SINT MAARTEN

EMERGENCY DEBRIS MANAGEMENT PROJECT
(P167347)

Installation of a Temporary Weighbridge and Reconstruction of the Access road to the MSW Site
Daily Management of the MSW Site Operations including Fire Suppression and Slope Recontouring

Environmental and Social Impact Assessment
(ESIA)

January 31st , 2023

Tables of Contents

Abbreviations and Acronyms 7

Executive Summary 9

1.0 Introduction 18

  1.1 Solid Waste Management in Sint Maarten 20

1.2 Description of the Municipal Solid Waste landfill: Collection and Management 21

  1.2.1 Operational practices 21

  1.2.2 Landfill Design and Construction 21

  1.2.3 Landfill Organizational Structure and Staffing - summary 22

  1.2.4 Waste Receiving Operations 23

  1.2.5 Daily Soil Cover 23

  1.2.6 Fire and Slope Stabilization at the MSW Site 24

  1.2.6.1 Subsurface Fires 24

  1.2.6.2 Slope stabilization 25

1.3 Environmental Matters and Recent Social Studies 27

  1.3.1 Community Resettlement 27

1.4 Description of the Project Activities 29

  1.4.1 Proposed Activities 30

  1.4.1.1 Installation of a Temporary Weighbridge, Supportive Infrastructure and Reconstruction of the Access Road to the MSW landfill 30

  1.4.1.2 Solid Waste and Landfill Management 31

  1.4.1.3 Irma debris disposal site rehabilitation, restoration and/or closure 34

  1.4.1.4 Fire Suppression 35

2.0 Legal, Regulatory and Policy Framework 36

  2.1 Great Salt Pond (National Monument) 37

  2.2. Environmental & Social Legislation and Regulations 37

  2.3 Permit Requirements 41

  2.4 Air Quality Guidelines and Standards 41

  2.5 Waste and Landfill Management System and Regulations 43

  2.6 Leachate Management and Surface Water Quality Standards 43

  2.7 Safe/Setback Distance for Landfills (relevant international dispositions) 44

  2.8 World Bank Requirements: Applicable Safeguards Policies 46

  2.8.1 The World Bank Group's Environmental, Health and Safety Guidelines (EHSGs) 47

  2.8.2 ESIA Process, Consultation, and Review Process 47

  2.8.3 Environmental and Social Management Capacities 48

3.0 Environmental and Social Baseline Information 50

3.1 Physical Environmental Data of Sint Maarten 50
3.1.1 Geology 50
3.1.2 Topography 50
3.1.2.1 Great Salt Pond 50
3.1.2.2 Pond Island........ 52
3.2 Soils 52
3.3 Climate and Meteorology 52
3.4 Ambient Air Quality 54
3.4.1 Air Quality at MSW/IDS Sites........ 54
3.4.2 Air Monitoring Study of Areas Surrounding MSW 56
3.4.3 Aerial Thermographic Infrared Surveys........ 57
3.5 Ambient and Receiving Water Quality 59
3.5.1 Ground Water Table Condition of the Study Area 60
3.6 Ambient Noise 61
3.7 Biological Environmental Data 61
3.7.1 Terrestrial Flora 61
3.7.1.1 Mangroves........ 62
3.8 Terrestrial Fauna 63
3.8.1 Nesting Terrestrial Birds 64
3.8.2 Migratory Birds 64
3.8.3 Seabirds 65
3.9 Aquatic Fauna and Flora 65
3.10 Species of Commercial Importance 66
3.11 Great Salt Pond Site: Baseline Environmental Assessment........ 66
3.11.1 Surface Soil and Vapor Testing 67
3.11.2 Surface Water Quality........ 69
3.13 Description of the Environment and Social Context 71
3.13.1 Economy of Sint Maarten........ 71
3.13.2 Demographics of the Project Affected Area 71
3.13.3 Existing Traffic Patterns........ 72
3.13.4 Community Social Baseline Yellow Zone........ 72
3.13.4.1 Community Census of the Resettlement Area of Impact........ 75
4.0 Assessment of Environmental and Social Impacts and Risks........ 77
4.1. Environmental and Social Impact Assessment 77
4.1.1 Community Resettlement 78
4.1.2 Air Emissions. Smoke/Fumes 80

4.1.3 Odor 80
4.1.4 Dust 81
4.1.5 Landfill Gases 81
4.1.6 Noise 81
4.1.7 Roads and Traffic 81
4.1.8 Geology and Soils. Slope Stability 81
4.1.9 Soil Impacts in the Blue Box Zone 81
4.1.10 Hydrogeology, Hydrology, and Surface Water Quality 82
4.1.11 Ecology 83
4.1.12 Worker Health and Safety 83
4.1.13 Public Health and Safety 84
4.1.14 Aesthetic Affects 84
4.1.15 Archaeological, Historic, and Cultural Heritage 85
4.1.16 Natural Disaster Risk 85
5.0 STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS PLAN 90
5.1 Objectives of Stakeholder Engagement 90
5.2 Stakeholder Engagement Plan 90
5.2.2 Stakeholder Engagement Methods and Materials 91
5.2.3 Communications Plan 91
5.2.4 Objectives 92
5.2.5 Communication Goals 92
5.2.6 Key Messages 92
5.2.7 Communication Methods 92
5.2.8 Informational Materials 92
5.2.9 Project Contact Vehicles 93
5.2.10 Stakeholder Point of Contact 93
5.2.11 Contact with Project Proponent 94
5.3 Consultation and Participation for RAP Process 94
5.3.1 Affected Persons Grievance Redress Management 96
6.0 Public Consultation Report 97
References 98

Figures

Figure 1.1: Road map of Sint Maarten 18
Figure 1.2 Aerial Photograph of Pond Island with MSW, and IDS Demographic Features .. 19
Figure 1.2.a. Pond island inland roads. Google image 2021 20

Figure 1.3 Topographic layout and a cross sections of the MSW landfill. 22
Figure 1.4 Unstable Slope Adjacent to a Populated Area as seen in 2018 26
Figure 1.5 No Work Zone on the MSW landfill 27
Figure 1.6 Red and Yellow Zones Identified in Threat Zone Document 28
Figure 1.7 Resettlement Area of Impact and surrounding 29
Figure 1.8 shows the existing security and scale house and old weighbridge scale location and future location of new weighbridge scale and the trace of the access road that will be reconstructed. 31
Figure 1.9 show details of the location of works related to the paving of the existing access road (Brine Drive) to the MSW landfill, the placement of a main gate, weighbridge scale and buildings... 31
Figure 1.10. Indicative detail of interim capping.. 32
Figure 3.1 – Bathymetric Readings for Great Salt Pond. Sint Maarten. 2019 51
Figure 3.2 – Great Salt Pond Inflow/Outflow Summary. 2019.. 51
Figure 3.3 - Average wind speed at a height of 50 m above the ground 53
Figure 3.4 - Wind frequency rose showing prevalence of easterly winds 53
Figure 3.5 sampling points by RIVM, 2019.. 56
Figure 3.6 June 2018 Aerial Infrared Thermal Survey of MSW Site.................................... 58
Figure 3.7 June 2018 Ground-based Infrared Thermal Survey of MSW Site)...................... 58
Figure 3.8 Aerial Infrared Thermal Survey of MSW/IDS Sites June 2019 59
Figure 3.10 Runoff Zone and drainage canal to Great Salt Pond 60
Figure 3.9 Runoff zones at MSW Site to Great Salt Pond 60
Figure 3.10 – Sea grape (Cocoloba uvifera) (right) and the Portia Tree Thespesia populnea (Left). 62
Figure 3.11 - Mangrove Thickets Surrounding Pond Island (Shown in Green) 63
Figure 3.12 – Nesting Terrestrial Birds. 64
Figure 3.13- Roseate Tern (Sterna dougallii dougallii) Pair, Brown Pelican (Pelecanus occidentalis) Nest on Pelican Key (source: NAFSXM).. 65
Figure 3.14 Soil Sampling Locations 67
Figure 3.15 Surface Water Sampling Locations 70
Figure 3.16 Yellow Zone Boundaries in the Terms of Reference for the Social Baseline Study 72
Figure 3.17 No Work Zone, as recommended by SCS Engineers April 22, 2020 74
Figure 3.18 The Blue Box Zone 75
Figure 3.19 The Resettlement Area of Impact... 76

Tables

Table 2.1. Summary of Environmental and Social legislation 41

Table 2.2 Summarize the air quality guidelines established by the WMNA.......................... 42

Table 2.3 Summarizes the air quality guidelines established by the World Health Organization. 43

Table 2.4. summarizes the WMNA water quality standards.. 44

Table 3.1: Summary of monthly climatological data for the period 1971-2000 at the Princess Juliana Airport, Sint Maarten (18°03'N 63°07'W) 54

Table 3.2: Typical Mangrove Zonation and Characteristics 63

Table 3.3: Birds Found Surrounding the Great Salt Pond with Limited Distribution 65

Table 3.4: Aquatic Flora and Fauna 66

Table 3.5 Endangered and Significant Fauna 66

Table 3.6 Summary of the Resettlement Area of Impact Census. Affected households and businesses (November, 2020) .... **Error! Bookmark not defined.**

Table 4.1 Environmental and Social Impact and Risk Assessment 86

Abbreviations and Acronyms

ADC	Alternate Daily Cover
CDC	Center for Disease Control and Prevention
CI	Conservation International
COD	Chemical Oxygen Demand
COCs	Constituents of Concern
COVID-19	SARS-CoV-2, the virus that causes coronavirus disease 2019
EEG	EE&G Disaster Response, LLC
EE&G	EE&G Disaster Response, LLC
EHS	Environmental, Health, and Safety
EHSGs	Environmental Health and Safety Guidelines
EDMP	Emergency Debris Management Project
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
EU	European Union
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
GBTS	Gallagher Bassett Technical Services
GDP	Gross Domestic Product
GIIP	Good International Industry Practice (
GRM	Grievance Redress Mechanism
GSP	Great Salt Pond
GPS	Global Positioning System
HSMWR	Hazardous Substance & Waste Management Research, Inc
IBAT	Integrated Biodiversity Assessment Tool
IDS	Irma Debris Site
ILO	International Labour Organization
ISDS	Integrated Safeguards Data Sheet
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
LFG	Landfill Gas
LEL	Lower Explosive Limit
MAC	Maximum Allowable Concentrations
MGA	Ministry of General Affairs
MPR	Maximum Permissible Risk
MSW	Municipal Solid Waste
NRPB	National Recovery Program Bureau
OEL	Occupational Exposure Levels
OCT	Overseas Countries and Territories
OHSAS	Occupational Health and Safety Standards
PAH	Polycyclic Aromatic Hydrocarbons
PAP	Project Affected Persons
PFAS	Perfluoroalkyl Substances
PIC	Person In Charge
PIU	Project Implementation Unit
PCB	Polychlorinated Biphenyls
PM 2.5	Respirable Particulates Matters

PPE	Personal Protective Equipment
RAI	Resettlement Area of Impact
RAP	Resettlement Action Plan
RBC	Risk-Based Criteria
RIVM	Dutch National Institute for Public Health and the Environment
SECP	Stakeholders Communication Plan
SDTF	Single Donor Trust Fund
SCTL	Soil Cleanup Target Levels
SSL	Site Screening Levels
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
VROMI	Ministry of Public Housing Spatial Planning Environment and Infrastructure
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
USD	United States Dollar
WB	World Bank
WBG	World Bank Group
WHO	World Health Organization
WMNA	Werkgroep Milieunormering Nederlandse Antillen

Executive Summary

- **Introduction**

In December 2018, the Government of Sint Maarten signed a Grant Agreement with the World Bank for the financing of the Emergency Debris Management Project (EDMP). project was developed to respond to Sint Maarten's urgent needs for removal and management of debris from hurricanes Irma and Maria in September 2017. During project preparation, a high number of surface and subsurface fires were reported at the waste and debris disposal sites on the northern part of Pond Island. This resulted in the inclusion of a stand-alone Fire Suppression activity to respond to this hazardous situation. The Fire Suppression Activity was identified a Category A Project under the World Bank's operational policies, with the potential for major impacts, complex environmental and social issues and need for significant mitigation and monitoring. Therefore an Environmental and Social Impact Assessment (ESIA) and related instruments – such as Environmental and Social Management Plan (ESMP) - were commissioned.

In May 2019, the National Recovery Program Bureau (NRPB) retained EE&G Disaster Response, LLC (EE&G) to perform the ESIA in support of the Fire Suppression Activity to be performed at the Municipal Solid Waste disposal site (MSW) and Irma Debris Site (IDS), both located on the northern portion of Pond Island in Sint. Maarten.

As time progressed VROMI (Ministry of Public Housing Spatial Planning Environment and Infrastructure) aggressively managed to prevent/control surface fires and significantly minimized subsurface fires. In January 2020, it was therefore decided that Fire Suppression as a standalone activity was no longer necessary and that the prevention and suppression of fires would be integrated as a subset activity to other normal and non emergency Landfill Operations to be implemented through EDMP.

The change in approach to interventions on Sint Maarten's waste and debris disposal sites resulted in the requirement to change the content of related safeguards instruments. As such, the NRPB was requested to redraft the existing ESIA and related ESMP to better reflect the change in scope of additional activities, related to daily management and rengineering of the sites. The activities that will be included for the purpose of this updated ESIA at the Municipal Solid Waste (MSW) Philipsburg Landfill and Irma Debris Site (IDS) are:

- The Installation of a Temporary Weighbridge and Reconstruction of the Access Road to the MSW Site
- Daily Management of the MSW Site Management Operations including Fire Suppression and Slope Recontouring
- Irma debris disposal site management, rehabilitation, restoration and/or closure

- **Baseline Conditions**

Pond Island is a man-made island on the southeast side of the Great Salt Pond in Philipsburg. Pond Island contains the MSW and IDS sites, populated areas with residences, government buildings, a university, a softball/ baseball field, festival village and various businesses.

The Great Salt Pond, is the largest permanent saltwater pond on the island which serves as a natural water catchment basin for much of the runoff water from surrounding hills. The majority of its shorelines have previously been cleared of their native mangroves and grasses. Part of the Great Salt Pond has been designated as a national monument based on its cultural and historical significance. Also, Birdlife International has designated the Great Salt Pond (IBA AN003) as an Important Bird Area for Sint Maarten. The Great Salt Pond is impacted by sewage runoff the from surrounding neighborhoods, and by runoff and seepage of uncontrolled leachate from the MSW/IDS Sites located on Pond Island, in the middle of Great Salt Pond. The ecological environment of the Great Salt Pond is under stress due to overdevelopment of the surrounding areas.

The Municipal Solid Waste (MSW) facility occupies approximately 14.9 hectares in the northwest portion of Pond Island in Philipsburg and is the final depository for MSW and non-hazardous wastes from the industrial sector on the Dutch side of the island. The MSW Site does not have a bottom liners system, neither a leachate collection system nor a gas collection system. The Great Salt Pond MSW Site was constructed in the early 1970s prior to more recent environmental directives/ guidelines, and to date has continued to be operated without any (strict) adherence to such.

The Irma Debris Site (IDS), measuring approximately 3.8 hectares, is located directly across from the MSW Site. The IDS was intended to be used as temporary storage site for hurricane Irma debris. However, due the large quantities of stockpiled material, it has evolved into an extension of the preexisting dumpsite located at the north end of the site. Estimated current volume of waste in the IDS is 214.136 cubic meters.

Surface and subsurface fires were reported to have been present at the MSW Site prior to Hurricane Irma. Shortly after placement of the initial debris from Hurricane Irma, an increase in the surface fires and evidence of subsurface smoldering fires were identified at the MSW Site. In addition, surface fires and evidence of subsurface smoldering fires were identified at the IDS in the months following the opening of the deposition site. VROMI took over the MSWS/IDS site and has aggressively managed to prevent/control surface fires and significantly minimize subsurface fires.

- **Project Description**

A series of past environmental evaluations and analyses for the area of the Great Salt Pond and Pond Island solid waste landfill have been done. These findings have indicated that the environment in the area is potentially negatively impacted due to pollution and contamination. This project and its activities are not conceived to address these existing impacts and risks issues. The activities that will be included for the purpose of this ESIA are described below.

- Installation of a Temporary Weighbridge, Supportive Infrastructure and Reconstruction of the Access Road to the MSW Site, including fencing. The current landfill entrance has no adequate entrance arrangements, no functional weighbridge and no supportive infrastructure for managing the site entrance and waste acceptance at the landfill. A landfill entrance road, gate, weighbridge, weighbridge house, office building, personnel building and storage room will be constructed in order to adequately manage the landfill

- Daily Management of the MSW Site Operations including Capping, Stormwater Management and Slope Recontouring. The landfill slopes will be re-contoured and regraded according to slope 3:1 (H:V), and concurrently compacted. A cement stabilized paved ring road will be constructed surrounding the landfill. Interim capping will be applied in re-countered parts. A drainage system to collect seeped water through the top soil and sub soil will be constructed along the periphery of the landfill. Water runoff will be directed to a sediment trap and further treated. For an optimized operation of the landfill, waste fill will take place with an optimized fill sequence plan. The waste that is placed daily will be covered with soil or alternative daily cover (ADC) materials. Interim and final cap cover will be installed over cells which will not receive additional solid waste. A passive landfill gas collection and flaring system, through vertical wells, will be installed in the landfill, partly while the area is still in operation followed by full installation in preparation of closing.

- Irma debris disposal site management, rehabilitation, restoration and/or closure. The site is expected to be rehabilitated as much as possible and operations should cease when rehabilitation is completed. The concept final closure plan for the Irma Debris Site is designed with criteria and features very similar to the main landfill. The design provides for the IDS to undergo a major reshaping and regrading to provide a final side slope of no more than 3:1. A drainage system to collect seeped water through the top soil and sub soil will be constructed along the periphery of the IDS. The southern end of the IDS will possibly be cleared from waste for future development (football field). Part of the IDS waste will go through a mining process in preparation of further treatment at the TDSR site. Rehabilitation efforts are anticipated to be part of the tasks of the contractor who takes over the management of the MSW Site.

- Fire suppression activities. Fire prevention and suppression will be integrated into the contract for daily management of the MSW Site. Fire suppression methods may include water and foam management, excavation of pockets of burning material, approaches for suppressing burning material using foam, quench pits, or use of suppression deck/lay-down areas, transfer of, handling, and final disposal of hazardous waste, and managing extinguished areas for safety. Excavating the burning material and dousing with water and or foam would be the preferred method for the MSWS and IDS sites.

- **Environmental & Social Impacts**

The Project activities have been assessed to determine any direct and indirect impacts between them and the nearby people, communities businesses and natural resources. The content and extent of the environmental and social impacts which needed to be addressed in this ESIA have been identified through research and scoping, meetings and consultations. The ESIA also predicts and quantifies to the extent possible the magnitude of impacts and risks. For this ESIA, magnitude of impacts and risks are based on the following considerations: • Type of impact (positive or negative); • Nature of the change (what is affected and how); • Size, scale, or intensity (low, moderate, significant); • Duration and/or frequency (e.g., temporary, short term, long term, permanent); • Cumulative (yes or no). In summary, this ESIA has identified forty (40) potential impacts; four (4) positive and thirty-six (36) negative; seven (7) significant, twenty-four (24) moderate and nine (9) of low importance; seven (7) are non-mitigable and thirty-three (33) are mitigable. Key findings are summarized below. An Environmental and Social Management Plan (ESMP) has been prepared to address and mitigate these potential impacts identified in this ESIA.

Community Safety Assessments & Zones Definition

Community safety assessments were conducted of the residential and commercial areas located in the vicinity of the MSW and IDS Sites. As further air monitoring and slope stability assessments were conducted, the specifics and locations of the safety zones evolved to reflect and address the health and safety of the surrounding communities. Below is a summary of the different actions that have led to identifying a Resettlement Area of Impact (RAI).

Assessments on fires and structural conditions of the MSW and IDS Sites were performed and two preliminary safety zones were designated. The Red Zone at 300 ft was established due the steepness of the slope located immediately to the west of the community and its anticipated proximity to fire suppression activities. The Yellow Zone or “notification zone” at 1000 ft was established whereby businesses and residences would be notified of the fire suppression activities and be prepared to evacuate if necessary.

The Red and Yellow Zones were further adjusted for easterly prevailing wind directions, and designated as the Fire Suppression Exclusion Zone (red area) and the Caution Zone (yellow area), as shown in the Figure.

A smaller portion of the Yellow or Caution Zone was identified as an area where resettlement would be required; this area was designated as the Blue Box Zone and later in the process as the Resettlement Area of Impact.

In 2018, it was observed that some of the side slopes of the MSW landfill were too steep, with slopes approaching 1:1 and potentially unstable. In addition, continuous subsurface fires had caused cracks or fissures which would further increase the risk potential. The Non-Work-Zone (NWZ) was established where specific works would not be allowed while resettlement was not completed. Works inside the NWZ could only begin after the community has been relocated.

<u>Community Resettlement Risks</u>

As described previously, a small area adjacent to the MSWS and IDS was identified as an area where resettlement would be required; as a result of the (i) potential risk of slope collapse; (ii) general health and safety risks due to waste management activities. This area is designated as the Resettlement Area of Impact (RAI).

This action will generate disruptions of existing daily activities on families and businesses (Project Affected People, PAPs) located within the resettlement area, focused to be within the RAI. Business owners, who are forced to resettle, will risk losing customers and operation hours. Residents within the RAI that make a livelihood working in the MSW and

IDS Sites, namely material salvagers (waste pickers) that gather recyclables, could potentially be forced to seek employment elsewhere.

Health & Safety of RAI Community Residents

- ✓ Surficial soils tested in the RAI contained detectable concentrations of heavy metals, PCB, TPHs and dioxins/furans. Elevated arsenic, copper and zinc were persistent in nearly all the analyzed soil samples at concentration levels above their commercial criteria and/or Dutch Target & Intervention Values, but without representing a major exposure concern. The source of these constituents was attributed to a combination of the MSWS/IDS and commercial operations. It does not appear that the RAI community is at risk with regard to the exposure concerns for the constituents tested with the exception of copper which may require further evaluation.
- ✓ The surface water tested within the Great Salt Pond contained detectable concentrations of aluminum, copper and iron. The surface water samples also revealed high levels of total coliform bacteria and *E. coli.* The source of heavy metals was attributed to a combination of the MSWS/IDS, car emissions and commercial operations. The general water quality appears to be poor and may have a negative impact on flora and fauna within the pond and poses a potential health risk for human recreational and/or consumptive use.
- ✓ Soil gas samples taken in various locations within the RAI for assessing whether landfill gases are migrating in the soils to off-site locations. The gas assessment did not identify significant landfill-type gases or any related risks to the RAI settlement.
- ✓ The stability of the slopes surrounding the MSW site, do not meet industry-accepted design criteria. Other factors, such as non-homogenous waste composition, compacting, presence of voids related to sub-surface fires, cracks, fissures or decomposition, may contribute to instabilities that cannot be detected. The southeast portion of the MSW Site presents a safety hazard to the adjacent RAI community and slopes recontouring or fire suppression activities may increase the landslide risk.
- ✓ Noise generated from landfilling activities as well as traffic has impacted the residential and commercial properties immediate adjacent to the MSW site for approximately 30 years. Much of the noise generated comes from the waste transport vehicles entering and leaving the MSW and IDS Sites, as well as onsite landfill equipment vehicles and machinery. The noise impact is not expected to significantly change as a result of the proposed works.

Health & Safety of MSWS Downwind Communities

A two-week air quality assessment by the Dutch RIVM in 2019, covering a broad area of communities established downwind the MSWS/IDS, was able to detect only a few substances of concern, in low concentrations. Based on these measurements, no conclusions were drawn about the possible substances that would be released in the event of an open fire or during the Fire Suppression Activity. Aluminum and PAHs concentrations exceeded the health-based guideline value for chronic exposure. The source of PAHs was attributed to a combination of the MSWS/IDS fires and car emissions, while for aluminum possible sources are not specified.

Health & Safety of MSWS/IDS Workers

The current MSW/IDS Site workers, material salvagers as well as future fire suppression workers and site visitors are at risk for exposure to hazardous air emissions. As the fire suppression activities commence onsite, there is potential for an increase in the amount of hazardous air emissions. Further, the non-homogenous nature of the waste and potential hot spots that may be encountered, could result in flare-ups at any time during the project.

Environmental Risks

The ecological environment of the Great Salt Pond is under stress due to overdevelopment, sewage runoff from the surrounding neighborhoods, stormwater runoff and leachate originating from the MSW/IDS Sites. This can have adverse impacts on existing flora and fauna. Fire suppression activities through excavation – which was the proposed preferred means in 2018 and is one of the most aggressive/ invasive means - have the potential to increase both airborne emissions and surface water discharges to the surrounding terrestrial and marine environments. In addition, COCs detected in the airborne environments can affect the terrestrial fauna, specifically: nesting birds, migratory birds, and seabirds, while the surface water discharges to the Great Salt Pond have the potential to materially impact the terrestrial and aquatic flora and fauna.

- **Environmental & Social Mitigation Measures and Instruments**

An Environmental and Social Management Plan (ESMP) has been prepared to address and resolve the potential impacts identified in this ESIA. The major mitigation instruments and implementation arrangements are summarized in the following paragraphs.

Community Resettlement

A census was conducted to gather the information necessary for an initial analysis of the social and economic conditions of PAPs who may be subject to a resettlement process. The World Bank policies also require the preparation of a Resettlement Action Plan (RAP[1]). The RAP encompasses the resettlement principles, valuation and compensation rates, and consultation mechanisms to be used for the entirety of the resettlement process.

A Stakeholder Engagement and Communications Plan (SECP) is prepared that sets out the approach that NRPB will follow in order to engage and communicate with stakeholders over the life of the Project. Consultation is undertaken in order to interact and incorporate the viewpoints of Affected Parties. Special consideration will be given to vulnerable groups. A

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[1] Refer to final RAP for the most up-to-date information on resettlement. The RAP can be found at: https://nrpbsxm.org/resettlement/

stakeholder engagement plan for resettlement was developed in the context of preparation of the RAP.

NRPB will establish a GRM as an integral element of the RAP to specifically serve the resettlement program, including specific procedures to record, register, analyse and resolve grievances arising from resettlement actions and policies

Solid Waste Management Framework

The Government of Sint Maarten will introduce an improved institutional and financial framework for managing the Solid Waste Sector. It is anticipated that an external entity will be established that will become responsible for solid waste management. This entity will coordinate and administrate all waste management activities, including financing. Until then, Government intends to outsource the management of the MSW/IDS to an external contractor. This contractor will take full management control over the disposal sites.

Health & Safety of RAI Community Residents

The slope considerations and the proximity of the subsurface fires on the southeast portion of the MSW Site present a potential safety hazard to the adjacent community works and fire suppression activities should not be performed until relocation of the PAPs has been completed. Works on the MSW Site will be performed in two phases accordingly:

- Phase 1 – to be performed in locations away from the community where it is anticipated that the works are not likely to create a deterioration of existing slope conditions and increase the risk of collapse.
- Phase 2 – to be performed in proximity to the community. These works will begin after the community has been relocated.

Health & Safety of MSWS/IDS Workers & RAI & Downwind Communities

Analytical area sampling and instantaneous read monitoring stations should be set up by Contractor for the purposes of evaluating emissions from the fire suppression and MSWS/IDS daily management activities. Fire suppression methods must be identified to minimize the magnitude of potential air emissions exposure scenarios. In daily management operations, fire prevention should be prioritized by the Contractor. In order to be protective of health and safety of the community members, consideration should be made to control access to Soualiga Road from the south end of the RAI to the north end of Pond Island in the event of calamities such as surface fires.

Implementation Arrangements & Capacity

NRPB will be responsible for the overall management and monitoring of the project. VROMI will act as the general Supervisor of the Contractor and will supervise and monitor the day to day landfill management activities under the contract.

The Contractor will need to prepare and implement a C-ESMP and engage qualified ESHS personnel. An independent Supervisor will be engaged for the supervision of the more technical components of the works related to the recontouring of the slopes, and any other site improvements such as installation of a landfill gas management system, stormwater management, and/or leachate management structures, as well as ESHS compliance.

NRPB will have to implement and monitor the Environmental and Social Management Plan (ESMP). For this purpose, the Safeguards team has assigned two Environmental Safeguards Specialists, one Social Safeguards Specialist and a Resettlement Specialist to EDMP. This team is supported by external consultants, where necessary. Where applicable, Safeguards staff from the NRPB will provide safeguards related support to government ministries. The consulting firm RINA was contracted by the NRPB to develop a Stakeholder Engagement Plan and a Resettlement Action Plan for resettlement of the community adjacent to the MSW/IDS Sites. Training is recommended for NRPB personnel and key government officials on the various aspects of the project related works and instruments.

- **Data Sources Used and Analytical Methods**

The following data sources and analytical methods were used for the preparation of this ESIA:

- The Terms of Reference (TORs) for the Fire Suppression Contractor and Supervisor.
- Available documentation regarding the environment and landfill operations, provided by NRPB and Sint Maarten Ministry of Public Housing, Spatial Planning, Envrironment and Infrastructure (VROMI) and Nature Foundation Sint Maarten.
- Studies performed by Hammer Consulting, EE&G, and SCS Engineers regarding risks to the community adjacent to the MSW/IDS due to slope and landfill fires. This included topographic maps, aerial surveys and infrared assessments to determine locations of ‘hot spots’ on the surface of the MSW and IDS to determine areas that may be vents for subsurface fires.
- Air testing performed by EE&G and Dutch National Institute for Public Health and the Environment (RIVM). EE&G performed testing of smoke fumes at cracks/fissures and collected samples from equipment operating at the IDS and MSW; RIVM collected air and dust wipe samples from locations 500 to 2,500 meters from the IDS and MSW.
- Soil testing performed within the community adjacent to the MSW/IDS and water testing from the Great Salt Pond. These assessments were performed by EE&G and the Nature Foundation.

The data was compiled and compared to applicable standards when available, in order to assess for environmental and social risks related to the proposed Acitivities. This included but was not limited to regulations and guidelines presented in Sint Maarten National Legislation, European Union, World Health Organization, United States Occupational Safety and Health Administration, United States Environmental Protection Agency and the State of Florida.
The ESIA is presented along with annexes, including are a series of baselines technical studies. These studies were previously conducted in the Great Salt Pond and Pond Island area.

1.0 Introduction

Sint Maarten is a constituent country of the Kingdom of the Netherlands. The island is located in the Northeastern Caribbean. Sint Maarten, The Dutch part of the island, comprises the southern half of the island while the French Collectivity of Saint Martin comprises the northern half. Sint Maarten is the most densely populated country in the Caribbean with a population of over 40,000. The island is a popular tourist destination known for its beaches and tropical weather. The island's port is also a popular port for cruise ships. Tourism is the largest industry on the island, and the majority of the workforce relies on the tourism industry for employment. Philipsburg is the capital of Sint Maarten, with the city center situated on a narrow stretch of land between Great Bay and the Great Salt Pond. See Figure 1.1.

Figure 1.1: Road map of Sint Maarten

The Great Salt Pond is a 2.25 square kilometer saltwater pond historically used for salt production. Pond Island is a man-made island on the southeast side of the Great Salt Pond, and was reportedly created using soil and rock from a nearby hillside and quarry beginning in the mid 1960's/early-1970s. A review of available aerial images from google earth revealed that the current configuration of Pond Island was established in approximately 2011 when the west-central portion of the island was filled in. The total area of Pond Island is approximately 48 hectares, and it is accessible via two land bridges on the southern and northern ends of the island. See Figure 1.2. The Municipal Solid Waste (MSW) Site occupies approximately 14.9 hectares in the northwest portion of Pond Island and is the final depository for MSW and non-hazardous wastes from the industrial sector on the Dutch side of the island. The MSW Site is composed of two areas, the western portion is near final grade and dormant, and active waste filling takes place at the eastern portion. Waste haul routes to the MSW use Soualiga Road, which is the only means of vehicle access to Pond Island Fig 1.2.a.

The remaining portions of Pond Island contain populated areas with residences, government buildings, a university, a softball/ baseball field, festival village and various businesses. Specifically, there is a residential and commercial area (car and heavy equipment storage, car repair businesses, a telecommunications office and a GEBE power company storage yard) directly south east of the MSW. (Figure 1.2) The close proximity of the residential and commercial community to the MSW Site is of concern.

Stormwater runoff, leachate, dust and fumes associated with traditional landfilling activities contribute to an environment where that population may be exposed to physical and chemical hazards.

There has been a series of environmental evaluations (see annexes B, D, K) and analyses of the area of the Great Salt Pond, Pond Island, and the MSW/IDS landfills. These findings have indicated that the area has been highly negatively impacted (soils and waters) from pollution and contamination, mainly by leaching from the Site. The most relevant of these reports and analyses are included in the section 3 of this Environmental and Social Impact Assessment (ESIA) as references. This project and its activities are not conceived to address these existing impacts and risks issues. The activities that will be included for the purpose of this Environmental and Social Impact Assessment (ESIA), at the Municipal Solid Waste (MSW) and Irma Debris Disposal sites are:

- The Installation of a Temporary Weighbridge and Reconstruction of the Access road and fencing to the MSW landfill
- Daily Management of the MSW Landfill Operations including Fire Suppression and Slope Recontouring
- Irma debris disposal site management, rehabilitation, restoration and/or closure

Figure 1.2 Aerial Photograph of Pond Island with MSW, and IDS Demographic Features

Figure 1.2.a. Pond island inland roads. Google image 2021

1.1 Solid Waste Management in Sint Maarten

Sint Maarten has over 43,200 permanent residents and 2.4 million visiting tourists per year resulting in a reported per-capita solid waste generation of 9.7 kilograms per day.[2]There are some National Ordinances aimed at protecting and preserving the environment from pollution and degradation in Sint Maarten. However, it appears that these ordinances are not fully enforced.

Solid Waste collection and sanitary landfill management are performed under the National Ordinance, known as Waste Ordinance AB 2013, GT No. 135. The Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI) manages solid waste collection and disposal services through a series of private sector contracts. No fee is charged for these services for residential properties whereas commercial properties typically hire private sector waste collection/removal services.[3] VROMI is also responsible for the processing and disposal of solid waste at the Great Salt Pond MSW and IDS Sites near Philipsburg.

All collected solid waste of Sint Maarten is disposed at the MSW Site.[4] The Great Salt Pond MSW Site was constructed in the early 1970s prior to these regulations, and thus without following any environmental directives/guidelines.

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[2] SER, 2016. Letter of Advice, Social Economic Council (SER) of Sint Maarten, Better Waste Management for Sint Maarten.

[3] Ministry Plan 2015 - 2018 – Ministry of Public Housing, Spatial Planning, Environment and Infrastructure, June 2015.

[4] Cocoon Interreg Europe, 2018. Landfill Management in the Netherlands. 107801/18-006.894.

Technical Reports have provided varying accounts regarding the end of the MSW's Site's viable lifespan, with most indicating that the end of the lifespan has been reached, however, it continues to be the only option available for the disposal of the country's wastes. Hurricanes such as Irma and Maria have compounded the issue as substantial amounts of debris collected from the island wide cleanup after the hurricanes were deposited at this MSW and IDS Sites.

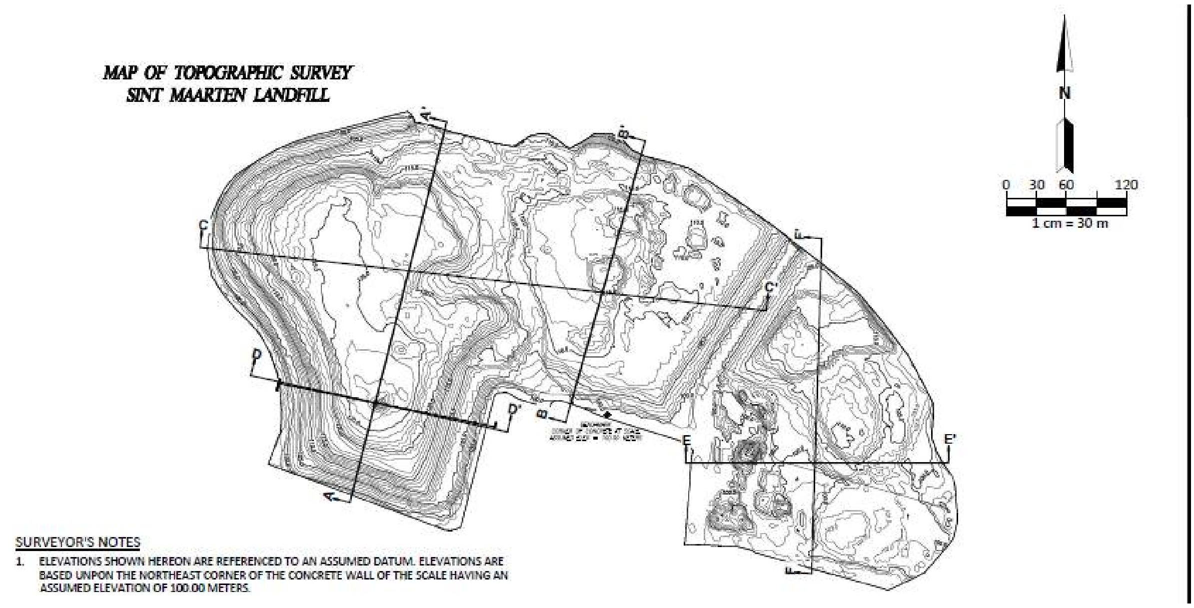
1.2 Description of the Municipal Solid Waste landfill: Collection and Management

1.2.1 Operational practices

The Ministry of Public Housing Spatial Planning Environment and Infrastructure (VROMI), provides regular residential waste collection services to residents of Sint Maarten. Several private waste hauling contractors hold contracts with VROMI to collect and haul the waste in different areas of Sint Maarten. Residential municipal solid waste is brought directly to the MSW/IDS sites for disposal. The island does not have transfer stations. Commercial waste collection services are provided by private haulers and the waste is disposed of at the MSW/IDS. There are no recycling services offered by VROMI and recyclable materials are comingled with municipal solid waste unless the material is recycled with a third party.

1.2.2 Landfill Design and Construction

There are no available construction plans, details, or cross sections from the construction of the MSW/IDS Sites. The MSW/IDS Sites do not have bottom liners system, neither a leachate collection system nor a gas collection system. The first lifts of waste were placed directly on the quarried material that comprised Pond Island. The absence of bottom liners system represents significant potential environmental concerns regarding potential groundwater impacts and surface water impacts to the Great Salt Pond. The topographic layout and a cross sections of the MSW/IDS Sites are presented in fig. 1.3. These show the approximate location of the bottom of the MSW/IDS Sites near the Great Salt Pond elevation. Some more details about the landfill are presented in annex A Cross Sections of MSW/IDS Sites.



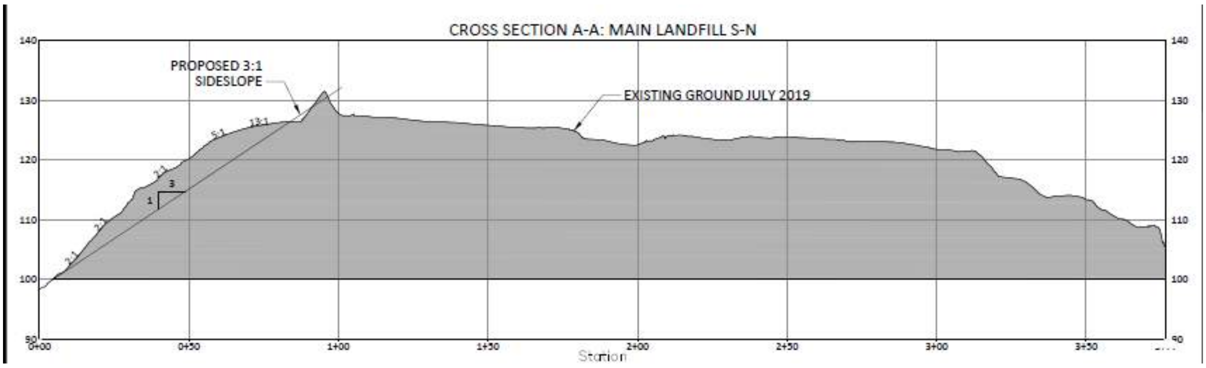


Figure 1.3 Topographic layout and a cross sections of the MSW landfill.

1.2.3 Landfill Organizational Structure and Staffing - summary

Presently VROMI manages and operates the MSW and IDS Sites, assisted by Heavy Equipment Contractors, in the past they have used contractors to manage the sites. There is no management plan in place.

At the moment, for effective management of the available space at the MSW and IDS, profiling of the area is crucial. Activities take place in the SW to NW side of the MSW. Reason being that the Wind Direction comes from the E- NE side. In addition, old sections are being reprofiled and compacted with new debris or waste followed by cover of soil or ADC.

At the MSW/IDS, there are 4 heavy equipment operators with heavy equipment working and 2 contractors are on standby in the event of emergencies. In addition, Government contracts a part-time operator to operate machinery owned by Government (a Front Loader, Bulldozer, Alternative Daily Cover equipment). In addition, there is a number of Government employees working on site. The following is a list of equipment and personnel involved in management operations.

Equipment (interchangeable between the two sites):
MSW
2 Excavators
2 Loaders
1 Compactor
Bulldozer
FORD F-350
IDS
2 Excavators

Personnel for both sites:
1 Supervisor
1 part time Contract Manager
2 persons security 24 hours per day 365 days a year at the MSW
2 persons security 24 hours per day 365 days a year at the IDS
1 Security Supervisor (mobile unit)
4 part time VROMI employees to operate the ADC Machinery

As there is no fencing or gate the both disposal sites are open from 6:00 A.M. to 6:00 P.M. daily. On Public holidays the sites are open for half a day. Trucks enter drive to the designated dumping area and dispose of their waste or debris. The machinery will level the waste and debris and compacts it. Once or twice a week the area is covered with an ADC cement compound. Selected areas are covered with ADC on a weekly basis. Other types of cover material, such as soil, is used when available.

More specifically, a Bulldozer is used to level and compact. A Loader moves the higher piles of waste to shorter piles and is used to transport fill from one location to the dump area. The Excavators keep re-profiling daily to create additional dumping space.

In case a subsurface fire is detected on one of the disposal sites, heavy equipment operators are called in and storage fill/dirt is used to cover the area. If required a Water pump is leased to soak the area for 96 hours minimum. Another mitigation strategy is the use of a VROMI water truck, which will source water from the Sewage Treatment Plant on A.T. Illidge Road.

In case of a surface fire, depending the emergency, Heavy Equipment Operators are called in and given specific tasks to combat the Surface fires. Mainly Fill/Dirt is trucked to the site to cover the surface fire. Depending on the situation, third party equipment is sourced, such as submersible pumps or additional heavy equipment. If needed the Fire Department is called in to assist.

1.2.4 Waste Receiving Operations

During an assessment made in 2018 it was found that the waste content monitoring procedures in place were minimal, and the actual content and quantity of the waste that was being received was unknown. Municipal trash and waste, including tires were accepted at the MSW Site and bulky debris, including vegetative debris, pallets, construction debris, white goods and other miscellaneous large items were accepted at the IDS. The survey was not made aware of a program for separating other wastes that may require special handling. The incoming waste was not weighed, tracked, or sorted, and the working face covered a relatively large area. Additionally, the waste was not properly compacted, an excavator was used to compact the waste. Improper compaction can result in large pockets of air which reduce space for future waste and can cause collapse of waste, especially combined with the subsurface fires.

Since the assessment, the Ministry of VROMI has taken over the management of the MSW and IDS and has been implementing some separation activities. On the MSW, only household waste is accepted on a daily basis. Tires are stored separately next to the MSW. Liquid waste is buried on request and asbestos is not accepted on either site. Furthermore, construction waste is stored separately. On the IDS, mainly pallets, wood, Bulk Waste, Garden Debris and White goods are accepted.

1.2.5 Daily Soil Cover

Sint Maarten does not have a source on the island for cover soil, therefore daily cover was not consistently used at the IDS and MSW Site. VROMI purchased dredged clay from St. Barths as well as excavated soil for use as daily cover and to extinguish surface fires at the MSW/IDS Sites. The lack of adequate daily cover can allow for oxygen to fuel subsurface fires and allow for excessive odors, dust and vectors. In 2019 VROMI, – with support of the EDMP procured a cement-based material to use as Alternate Daily Cover (ADC).

1.2.6 Fire and Slope Stabilization at the MSW/IDS Sites

Background

Hurricane Irma, a Category 5 plus hurricane, hit the island on September 6, 2017. Winds of more than 296 km per hour left a trail of devastation throughout the country. Irma was followed on September 19 by tropical storm conditions from Hurricane Maria, which further damaged Sint Maarten's infrastructure. Hurricane Irma caused extensive property damage, producing debris both from the damage itself and the subsequent demolition and reconstruction activities. This debris was collected and transported to Pond Island, and deposited as follows:

- The MSW was designated for commercial and household waste; however, it inevitably received waste co-mingled with hurricane debris during the recovery activities.
- The Irma Debris Site (IDS), measuring approximately 3.8 hectares is located east of Soualiga Road directly across from the MSW Site. It was placed on a piece of reclaimed land which was long-leased for the construction of a football and cricket stadium. In addition, condemned cells of the former dumpsite, closed in the 1990's, were used to temporarily store debris. The IDS was intended to be used as temporary storage site for hurricane Irma debris. However, due the large quantities of stockpiled material, it has evolved into an extension of the preexisting dumpsite located at the north end of the site.

The total area covered by both debris and solid waste landfills (IDS and MSW), was approximately 18.7 hectares.

Fires events at the MSW/IDS Solid Waste landfills

Surface and subsurface fires were reported to have been present at the MSW Site prior to Hurricane Irma. Shortly after placement of the initial debris from Hurricane Irma, an increase in the surface fires and evidence of subsurface smoldering fires were identified at the MSW Site. In addition, surface fires and evidence of subsurface smoldering fires were identified at the IDS in the months following the opening of the deposition site. The Ministry of VROMI attempted to extinguish fires by dousing them with water from the Great Salt Pond and covering them with layers of dirt/soil, up to approximately 30 to 140 cm thick. This technique was effective in extinguishing the surface fires, and the majority of subsurface fires. Although the efforts of VROMI appeared to have abated the surface fires, the proximity of the residences and commercial businesses to the MSW/IDS landfills was identified as a concern due to aforementioned potential exposure of people to harmful substances, (exacerbated by) fires and potentially unstable side slopes.

1.2.6.1 Subsurface Fires

Evidence of subsurface fires have been historically identified at MSW Site. Shortly after Hurricane Irma an increase in the surface fires and evidence of subsurface smoldering fires occurred at the MSW.

The high temperatures generated by the subsurface smoldering may result in air emissions that can potentially contain chemical compounds or constituents of concern, (COCs) from materials melted or combusted by the fire. Some of these are known to be harmful to humans at certain concentrations and exposure thresholds. These COCs could originate from combustion of the following waste materials: lead, tin, zinc, aluminum, tires, petroleum products, paint, plastics, PVC, other rubber, synthetic textiles and upholstery, Styrofoam or rigid foam, wood and paper. These emissions have the potential to be harmful to the population in the vicinity of the MSW/IDS Sites and those residing in areas which may be affected by smoke associated with landfill fires.

Air quality monitoring data that has been collected to date has demonstrated that there are no concentrations of COCs at levels that would warrant health concerns beyond the perimeter of the MSW/IDS. However, testing has not been performed during active surface fires where visible emissions (black smoke) would tend to indicate that a significant concern could exist in these specific conditions.

In January 2020, EE&G and Hammer Consulting, at the request of World Bank and the NRPB, performed a limited site visit to review the conditions at the MSW/IDS Sites. During the site reconnaissance, the following observations were made:

- Active surface fires were not observed.
- The southeast slope of the MSW Site in proximity to the residential area was re-contoured and terraced. The slopes were not observed to be as steep as noted in 2018, but still were greater than 3:1 in some areas.
- Evidence of active subsurface fires were observed on the northwest and southeast portions of the MSW Site. The subsurface fires observed on the northwest of the MSW Site were located approximately 600 feet northwest of the community, and the submerged fires located on the southeast were approximately 200 feet west of the community. Using available prevailing wind direction information, both were located generally downwind of the community. These locations are shown in Figure 1.4

The situation pertaining subsurface fires remains fluid as VROMI continuously addresses occurring hot spots when identified (see above).

1.2.6.2 Slope stabilization

In 2018, it was observed that some of the side slopes of the MSW landfill were too steep, with slopes approaching 1:1 and potentially unstable (A typical landfill side slope is graded at a slope of 3 meters horizontal (3H) to 1 meter vertical (1V). This is represented by the term 3:1.). In addition, continuous subsurface fires had caused cracks or fissures to form on the surfaces of the MSW landfill, which in turn can be related to subsurface instability. The proximity of a potentially unstable slope to the adjacent residential and commercial area is evident in Figure 1.4.

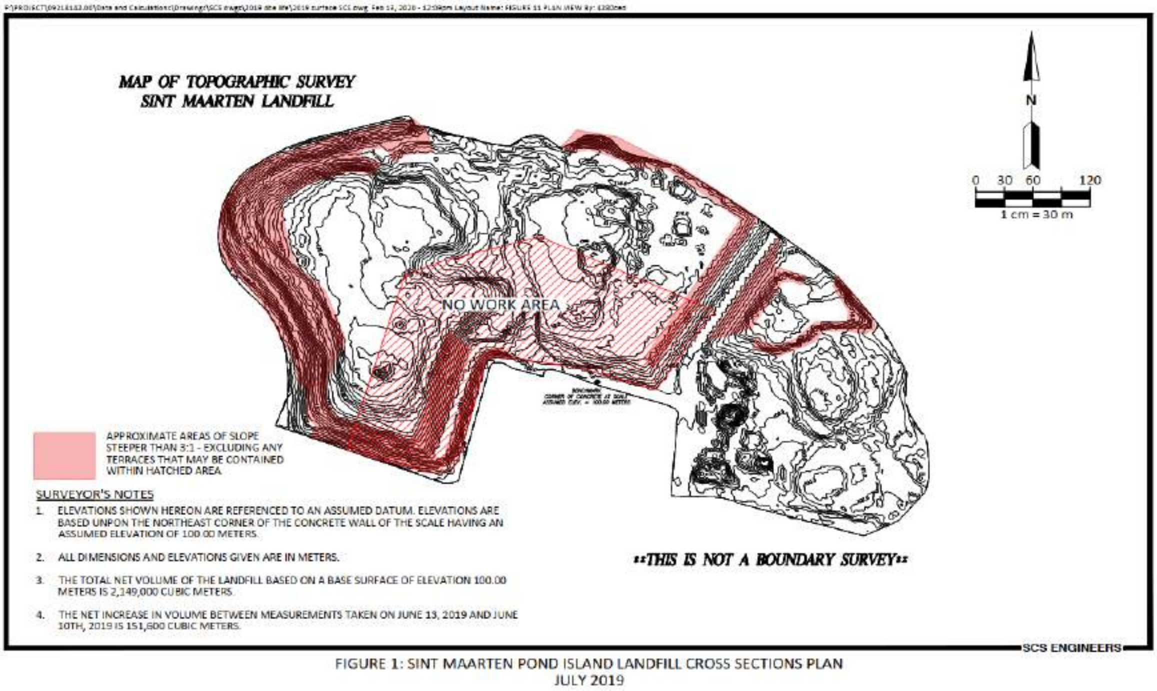
Figure 1.4 Unstable Slope Adjacent to a Populated Area as seen in 2018

Based on the findings, EE&G concluded that the slope considerations and the proximity of the subsurface fires on the southeast portion of the MSW Site presents a safety hazard to the adjacent community and the remaining fire suppression should not be performed until relocation of the PAPs has been completed. See Annex B for a copy of EE&G's January 2020 draft Summary of Limited Landfill Assessment.

During discussions regarding the Limited Landfill Assessment, the concept of performing Works on the MSW Site in two phases was conceived. These works would be performed accordingly:

- Phase 1 – to be performed in locations away from the community where it is anticipated that the works are not likely to create a deterioration of existing slope conditions and increase the risk of collapse. This work will be performed while the community is occupied and will include establishment of a "No Work Zone" (NWZ), delineating areas of the MSW where access is prohibited due to concerns of slope stability. The reconstruction of the access road and installation of a weighbridge are excluded from this NWZ, though the ESMP needs to address specific risk mitigation strategies. Also, the removal of tires to be transported to the future TDSR is excluded and can commence.
- Phase 2 – to be performed in the NWZ. These works will begin after the community has been relocated.

SCS Engineers was requested to perform a desk evaluation to establish the "No-Work Zone" discussed above, which was delivered in a report dated April 22, 2020. This document included a plan depicting the No Work Zone, which is shown in Figure 1.5. A copy of the No Work Zone document is included in Annex C. It should be noted that this determination was done through visual and desk assessments. No geotechnical study has been performed.



SURVEYOR'S NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERENCED TO AN ASSUMED DATUM. ELEVATIONS ARE BASED UNPON THE NORTHEAST CORNER OF THE CONCRETE WALL OF THE SCALE HAVING AN ASSUMED ELEVATION OF 100.00 METERS.
2. ALL DIMENSIONS AND ELEVATIONS GIVEN ARE IN METERS.
3. THE TOTAL NET VOLUME OF THE LANDFILL BASED ON A BASE SURFACE OF ELEVATION 100.00 METERS IS 2,149,000 CUBIC METERS.
4. THE NET INCREASE IN VOLUME BETWEEN MEASUREMENTS TAKEN ON JUNE 13, 2019 AND JUNE 10TH, 2019 IS 151,600 CUBIC METERS.

FIGURE 1: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS PLAN
JULY 2019

Figure 1.5 No Work Zone on the MSW landfill[5]

1.3 Environmental Matters and Recent Social Studies

1.3.1 Community Resettlement

Community assessments were conducted of the residential and commercial areas located in the vicinity of the MSW/IDS Sites. As further air monitoring and slope stability assessments were conducted, the specifics and locations of the safety zones evolved to reflect and address the health and safety of the surrounding communities. Below is a summary of the different actions that have led to identifying a Resettlement Area of Impact (RAI).

In August 2018, an assessment on fires and structural conditions of the MSW/IDS Sites was performed. Based on that assessment, a preliminary "Red Zone" and "Yellow Zone" of safety was designated: Red Zone at 300 ft, and Yellow Zone at 1000 ft. These zones were based off safety procedures used for landfill firefighting, slope stability at the MSW Site and the prevailing wind directions across Sint Maarten these zones are shown in Figure 1.6.

The Red Zone was established due the steepness of the slope located immediately to the west of the community and its anticipated proximity to fire suppression activities. The slope contained fissures at the top that were emanating smoke. This was viewed as a concern for slope failure and as a result, an imminent risk to life and health of the residents living at the toe of the MSW Site.

The Yellow Zone was described as a "notification zone", whereby businesses and residences would be notified of the fire suppression activities and be prepared to evacuate if necessary.

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[5] Note that the image does not show the access road neither the existing weighbridge infrastructure

Figure 1.6 Red and Yellow Zones Identified in Threat Zone Document

According to the 2019 census findings, this is the overall community situation: There were 266 Project-Affected Persons (PAP) in the Yellow Zone (195 residents; 71 non-resident workers); 98 households and 22 businesses. Of the 212 PAP for whom employment data was available, 41.51% worked outside the Yellow Zone; 26.42% worked in the Yellow Zone; 24.06% do not work and 7.08% were retirees. 20 people (14 men and 6 women), who provide income for 14 households, work in recycling related activities in the MSW Site. 2 of the businesses located in the Yellow Zone were engaged in recycling activities.

In June 2019 EE&G recommended that an expanded portion of the community adjacent to the MSW/IDS Sites be relocated, since it was downwind, or crosswind of areas known to have subsurface fires. This resulted in an expansion of the area where relocation should be conducted prior to the Fire Suppression Activity, which was termed the Blue Box Zone (Figure 1.7). Aside, international best practices also recommend to allocate a specific buffer area around landfilling activities where no people live (more below).

Based upon the initial assessment findings regarding the slope stability and presence of fires at the MSW/IDS Sites, the preparation of a Resettlement Action Plan (RAP) for people and business inside the Red and Yellow Zones was initiated. The Blue Box Zone includes the initial Red Zone and is a subset of the Yellow Zone.

The consulting firm (RINA) was retained by the NRPB to perform a census of the Yellow Zone. The Yellow Zone was defined in the TOR for the Social Baseline Study as an area, made up of the homes and businesses within a 1,000-foot radius of the area where fires at the MSW Site may be occurring. To develop the social baseline, RINA conducted a socioeconomic survey in the Yellow Zone to gather the information necessary for an initial analysis of the social and economic conditions of Project-Affected Persons (PAP) who may be subject to a resettlement process, and to provide information to develop the RAP Framework.

RINA's draft report, *titled Population Resettlement Project – Social Baseline for the Yellow Zone*, was provided to EE&G in August 2019. In total, 266 PAP were identified: 195 PAP are residents of the Yellow Zone, of whom 39 work in the Zone, and 71 non-residents were identified who work in the area. In addition, 98 households and 22 businesses (of which four were large businesses) were identified. A complete summary of the report is included in Section 3.13.

Continued assessment of the situation resulted in the identification of the RAI, which besides the Blue Box zone also included a corner within a 100 meter radios of the tip of the south-east slope at the MSW. This is depicted in figure 1.7, below.

Figure 1.7 Resettlement Area of Impact and surrounding

1.4 Description of the Project Activities

The main project objective is to support Sint Maarten's recovery through management of debris from the hurricane and reconstruction activities, to facilitate recovery and reduce risks, for this purpose, the project will focus on the following activities:

1.4.1 Proposed Activities

The activities for this Environmental and Social Impact Assessment (ESIA), at the Municipal Solid Waste (MSW) and IDS Philipsburg Landfill are:

- Installation of a Temporary Weighbridge and Reconstruction of the Access Road to the MSW landfill
- Daily Management of the MSW Landfill Operations including Fire Suppression and Slope Recontouring
- Irma debris disposal site rehabilitation, restoration and/or closure

1.4.1.1 Installation of a Temporary Weighbridge, Supportive Infrastructure and Reconstruction of the Access Road to the MSW landfill

The current landfill entrance has no adequate entrance arrangements, no functional weigh bridge and no supportive infrastructure for keeping under control the site entrance and waste acceptance to the landfill. A landfill entrance road, gate, weighbridge, weighbridge house, office building, personnel building and storage room will be constructed in order to adequately manage the landfill. Administration & Personnel Building will be designed and built for accommodating at least six (6) personnel. The contractor will purchase and install a deck and pitless type stationary weighbridge at the entrance of the MSWS Landfill. The contractor will design and build a weighbridge house operation of the weighbridge by personnel, a material storage and workshop building at the Landfill entrance, as well as a guardhouse.
This activity will also include the reconstruction and pavement of the access road to the MSW landfill, the demolition of the old weighbridge and the construction and installation of a new foundation to install a temporary weighbridge scale with a nominal capacity of 45 MT. In addition, fencing and the improvement of security monitoring infrastructure is required. These activities are located in the existing access road (Brine Dr.) that is adjacent to the NWZ in the Municipal Solid Waste Site (MSW) .

The remodeling works for Brine Dr., will involve the design of two-lane cement stabilized base (CSB) access road with an estimated paved surface of 900 m2 (150 m long, 6 m wide), demolition of an old weighbridge foundation and works for construction of a new weighbridge foundation by specifications and drawings and supervision to be provided by the Supplier of the weighbridge truck scale, at the Philipsburg Landfill. Road works include regrading of area to provide proper stormwater drainage.

A 6 m two-panel entrance gate will be installed for controlling the access to the MSWS.

The existing metal container facilities and other obsolete structures will be demolished and removed from site.

The road design will ensure entry of trucks to the weighbridge scale, exit and return point for large trucks. The nominal capacity of the weighbridge scale must be 45 metric tons. Works will include the installation of the electrical infrastructure suitable for the connection of the scale to power source and for reconditioning the existing metal container facilities as the scale operating office. The following figures 1.8 & 1.9 show the future location of the new weighbridge scale, existing scale house and the trace of the access road at the MSW landfill, which will be paved.

Figure 1.8 shows the existing security and scale house and old weighbridge scale location and future location of new weighbridge scale and the trace of the access road that will be reconstructed.

Figure 1.9 show details of the location of works related to the paving of the existing access road (Brine Drive) to the MSW landfill, the placement of a main gate, weighbridge scale and buildings.

1.4.1.2 Solid Waste and Landfill Management

The Solid Waste management falls under the responsibility VROMI. Through contractors, the Ministry provides regular residential waste collection services to residents of Sint Maarten. Several private waste hauling contractors hold contracts with VROMI to collect the waste in different areas of Sint Maarten and haul it to the MSW/IDS Sites. Residential municipal solid waste is brought directly to the MSW site for disposal. The island does not have transfer stations. Commercial waste collection services are provided by private haulers and the waste is disposed of at the MSW/IDS Sites. There are no recycling services offered by VROMI and recyclable materials are comingled with municipal solid waste unless the material is collected and recycled by a third party.

The Government of Sint Maarten will introduce an improved institutional and financial framework for managing the Solid Waste Sector. It is anticipated that an external entity will be established that will become responsible for solid waste management. This entity will coordinate and administrate all waste management activities, including financing. Until this is realized, Government intends to outsource the management of the MSW/IDS to an external contractor. This contractor will take full management control over the disposal sites.

- Slopes Regrading, Roads, Fencing and Stormwater Management

In view of the fact that the MSW Site lacks proper fill sequencing and final closure plans, and has to allow waste operations to continue. This activity will hire specialized services under contractors' terms to improve the daily management of the MSW landfill., there is a need to determine a final elevation guideline, as well as the need of implementing a regrading of existing slopes to be adjusted to 3:1 slope in most locations, and the need to construct and maintain the perimeter roads as well as the management of the storm water structures.

The landfill slopes will be re-contoured and regraded according to slope 3:1 (H:V), and concurrently compacted. Interim capping will be applied in re-countered parts. See below indicative Detail.

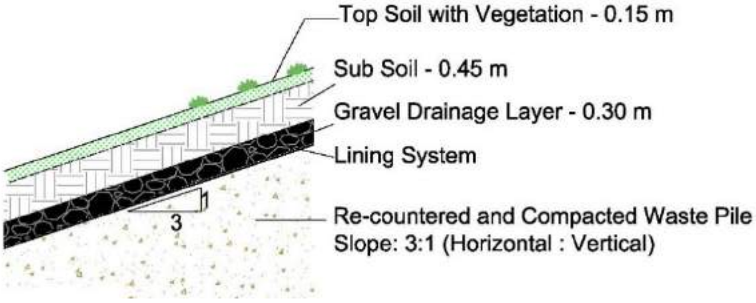

Figure 1.10. Indicative detail of interim capping

Before a contractor can take over the above activities, general daily management activities remain with the Ministry of VROMI, as described in paragraph 1.2.3 above. Until the RAI is cleared, such activities are restricted to the area outside the NWZ. Upon clearance of the RAI, daily waste disposal may be happening in a part of the NWZ, as soon as this is lifted.

A drainage system to collect seeped water through the top soil and sub soil will be constructed along the periphery of the landfill. The drainage system will consist of gravel, perforated corrugated HDPE pipe and will be covered by geotextile.

A cement stabilized paved ring road (approximately 4m in width) will be constructed surrounding the landfill, to provide easy access to the skirts of the landfill during improvement. This road will have concrete drainage ditches in either side, to collect and convey the run-off from rainfall to sediment trap basin.

A perimeter wall and fence will be erected on selected sections of the landfill perimeter to provide structural support, prevent entrance and littering. Height and other design characteristics will depend on location specifics and objectives.

A sediment trap basin and water treatment facility, wet-wells, and treated water reservoir, and etc. will be constructed at the entrance of the landfill in order to collect the storm water, run-off water and seeped water from the landfill drainage system. This water could be then used for daily landfill operations like dust suppression.

- Daily Waste Fill, Daily Cover, and Landfill Equipment

For an optimized operation of the landfill waste fill will be managed with an optimized fill sequence plan. When the first filling area is floored-out with a lift of waste, the filling will proceed back over the prior fill area with the second lift. This back and forth progression across the filling area will be continued until a waste height is reached in which the slope towards the next filling area is no more than 3:1.

Daily Disposal will be carried out with “Cell Method”, the amount of solid waste deposited during one operating period (one day) determines the size of each cell. Each cell will be an independent filling area covered with soil, in order to allow each cell to act as a firewall to minimize the spread of any underground landfill fires.

When pushing solid waste, waste will be spread thinly out in layers of about 30 to 50cm. The layer will be made as uniform as possible. Between each layer, the compacting equipment needs to make regular passes over the waste layer.

The waste that is placed daily will be covered. Soil resources are scarce on island, consequently alternative daily cover (ADC) materials for daily cover of the waste will be encouraged. Suitable ADCs include: Spray applied cementitious products, foam products or non-reusable geosynthetic fabric or panel materials. Inert pre-processed C&D waste fines mixed with non-contaminated sediment or dredge spoils or fine sand may be also used.

Equipment necessary for daily activities include a landfill compactor, bulldozer, back-hoe loader, dump trucks and a trommel screen. A grader and a hydro seeder will be needed for slopes reshaping and interim capping,

- Waste Reception

Pre-sorting of the municipal trash and waste, will be required in order to exclude materials such as tires and bulky debris, including vegetative debris, pallets, construction debris, white goods and other miscellaneous large items. Attention will also be paid to separating other wastes that may require special handling. The incoming waste will be weighed and recorded in tons per day. Excluded materials will be diverted to the TDSR site for further handling.

- Interim & Final Cap

A temporary final cover consisting of a soil layer will be installed over cells which will not receive additional solid waste. The temporary final cover will consist of a 45cm layer of soil. Vegetative cover will be placed on areas which have reached interim final grade. These areas will not receive additional waste.

When portions of the Facility are brought to design grades, final cover will be placed over those areas. The final cover system consists of a 60cm layer of cover soil, followed by a 30cm layer of gravel drainage and 40-mil LLDPE geomembrane / drainage geocomposite, tear protected by a 30cm compacted fine layer. Sod will be installed over all closed portions of the landfill.

- Landfill Gas Management

There is currently no Landfill Gas (LFG) collection system at the MSWs. LFG is a natural byproduct of the decomposition of organic material in landfills and contains methane, which is a potent greenhouse gas (GHG). A passive gasification system through vertical wells will be installed in the landfill, partly in operation time and fully during closing. Passive systems can be effectively used to control LFG migration. The pressure gradient created by gas generation within the landfill moves the gas toward a well, which then intercepts the gas and conducts it to the surface. The landfill gas will be treated in a high temperature flare to prevent release into the atmosphere. It is expected that LFG management systems will be designed to maintain 75 percent collection efficiency.

1.4.1.3 Irma debris disposal site rehabilitation, restoration and/or closure

As indicated above, the IDS location was put on a reclaimed piece of land that is in a long lease and is to be developed into a soccer/cricket field. The intention for this site is to, as much as possible, remediate the area to the condition prior Irma. If this is not feasible, the wish is to clear and close the site in such a manner that the intended sport field(s) can be constructed, possibly on elevated terrain. Debris on site will be recovered, separated and treated at the TDSR that is constructed and operated under EDMP.

- Landfill Closure and Final Cap

The concept final closure plan for the Irma Debris Site was designed with criteria and features very similar to the main landfill. The design provides for the landfill to undergo a major reshaping and regrading to provide a final side slope of no more than 3:1 (horizontal to vertical), a maximum vertical rise of 30 ft. (9 m) and a 20 ft. (6 m) wide bench (terrace) slope break.

When IDS is brought to design grades, cap cover will be placed over the area. The cap consists of a 60cm layer of cover soil, followed by a 30cm layer of gravel drainage and 40-mil LLDPE geomembrane / drainage geocomposite, tear protected by a 30cm compacted fine layer. Sod will be installed over all closed portions of the landfill.

A drainage system to collect seeped water through the top soil and sub soil will be constructed along the periphery of the landfill. The drainage system will consist of gravel, perforated corrugated HDPE pipe and will be covered by geotextile. Similar to the MSWS, a sediment trap and a water treatment plant will be installed for cleaning the water to acceptable standards for discharge. Alternatively, the collected stormwater will be directed to the equivalent facility of the MSW site.

- Football Field

The southern end of the Irma debris disposal site was promised in long lease to Sint Maarten's football association, who was going to develop a football field on that land. It is proposed that the land is prepared for future development of such a football field as was originally intended. To accomplish this, all disaster debris existing under the proposed footprint and out to a distance of 5 feet (1.5 m) should be removed.

- Debris Mining

The IDS reshaping and Soccer field area preparation works will result in considerable debris volume that needs to be managed. This debris will go through a mining process to prepare it for further treatment. Debris will be first excavated using excavator/bulldozer and loader. Following material screening through a trommel screen, the oversized materials - inert C&D waste fractions, wooden materials, metal scraps, scrap glass, plastics/PVC materials – will be hauled with dump trucks to the new TDSR handling area. Recovered soil and fines from this activity could be used as a substitute for daily cover in ongoing MSW landfill operation.

1.4.1.4 Fire Suppression

To date, solid wastes (mainly domestic) from the entire Dutch side are deposited at the MSW/IDS daily, the incoming waste is not weighed, tracked, or sorted, nor properly compacted. These facts can result in large pockets of air which reduce airspace for future waste and can cause collapse of waste, especially combined with the subsurface fires. The current conditions are anticipated to warrant small scale fire suppression activities to be performed under the context of normal landfill works.

In the past 2019 work was done pertaining to re-contouring and implemented fire suppression along the southeast slope of the MSW. That work involved removing some of the waste from this area, compacting the existing waste, performing limited fire suppression by covering, and installation of a clay layer on top of the materials that were compacted. The work also involved covering Hot Spots with fill, these hot spots are sporadic and temporary events, creating the need of emergency actions by the landfill managers and operators, affecting the normal activities of solid waste reception and disposal

During the aforementioned site inspection in January 2020, evidence was found of three remaining hotspots. This was a significant decrease in comparison to the situation in 2018 during preparation of EDMP. The decrease is a direct result of improved management of waste disposal operations, including compaction and covering of waste, implemented by VROMI. The improvement warranted to change focus in EDMP from Fire Suppression as a standalone activity to one where fire suppression and -prevention are an integrated part of improved waste disposal management and the re-engineering of the MSW and IDS. These responsibilities will be transferred to the external contractor taking over landfill management.

Understanding that for successful fire suppression methods there is a need for oxygen reduction as well as diminishing heat from the system, the contractor/operator will choose the adequate methodology and procedures to achieve the fire suppression and fire control. Knowing that any methodology applied could generate environmental and social risks and impacts, the contractor/operator of the fire suppression activity, will have to comply with an

Environmental and Social Management Plan (ESMP) which addresses fire suppression methodologies chosen to be implemented as well as a specific operational safety plan.

In general, fire suppression during the everyday operations and management of the solid waste landfill at MSW/IDS Sites could include but not be limited to: water and foam management, excavation of pockets of burning material, approaches for suppressing burning material using foam, quench pits, or use of suppression deck/lay-down areas, transfer of, handling, and final disposal of hazardous waste, and managing extinguished areas for safety.

It should also be recognized that while in one portion of the landfill a certain method may be applicable and successful, in another area of the landfill the method may not work due to different waste and site characteristics and conditions. Therefore, fire suppression methods at landfills may vary by location and may also evolve over time, depending on changing conditions. Like managing any other complex and dynamic environmental problem, the fire suppression team must be adaptable and timely in responding to unforeseen and changing conditions.

- Excavation with Water/Foam Dousing

When a landfill fire is near or at the ground surface, one method of suppression is to excavate the burning waste and douse it with water and/or foam. During this process, both hot and burning waste material must be carefully exhumed and spread out into thin layers for maximum exposure to the extinguishing agent. Water is typically used in combination with a surfactant to help overcome capillary forces that might otherwise limit its vertical penetration through the material. The extinguished waste must then be carefully inspected to ensure it no longer poses a risk of reigniting before being placed back into the landfill. Excavation and dousing with foam is the method recommended as the most effective to suppress the fires at the MSW and IDS landfills.

The excavation is generally limited to relatively shallow depths because a) exposure to oxygen can feed the fire, b) excavation can release health threatening gases and c) it can pose slope stability issues. A water source having adequate quantity and quality must be available. It is possible that the firefighting water could be obtained directly from the Great Salt Pond.

A drawback of this method is the generation of leachate and surface water runoff with the potential for additional contamination generation from the foaming agents/surfactants.

A very similar technique is the use of soil, instead of water/foam, for smothering a fire by covering the excavated burning material with soil and/or sand in order to starve the fire of oxygen. This technique is not very common in landfills and also requires a reliable source of soil/sand material.

2.0 Legal, Regulatory and Policy Framework

The island of Sint Maarten, an autonomous country within the Kingdom of the Netherlands, is located in the Caribbean Sea. Sint Maarten achieved country status and self-governing power through reforms in 2010.[6] The Kingdom of the Netherlands is a member of the

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[6] Government of Sint Maarten documents: www.sintmaartengov.org.

European Union (EU). However, Sint Maarten has the status of Overseas Countries and Territories (OCTs) and is not part of the EU. Accordingly, Sint Maarten is not directly subject to EU law, but it benefits from associate status given through the Lisbon Treaty.

2.1 Great Salt Pond (National Monument)

The Great Salt Pond (GSP), is located in south-central Sint Maarten and is bordered on all sides by Philipsburg and its suburbs. It is the largest permanent saltwater pond on the island which serves as a natural water catchment basin for much of the runoff water from surrounding hills. The majority of its shorelines have previously been cleared of their native mangroves and grasses. Part of the Great Salt Pond has been designated as a national monument based on its cultural and historical significance. Also, Birdlife International has designated the Great Salt Pond (IBA AN003) as an Important Bird Area for Sint Maarten. Because the Great Salt Pond is one of the few remaining wetlands on the island, it has been deemed a critical habitat for shorebirds and water birds as well as some fish, mollusks and small invertebrates.[7] Due to its size and connection to other ponds, the Great Salt Pond has been identified as one of the most ecologically important ponds at Sint Maarten.

A significant environmental threat to Great Salt Pond is the dumping of waste/debris, including sewage household trash, industrial waste, and trash from the MSW and IDS, into the pond. As large parts of the pond have been filled for development purposes and the influx of pollution of various types and sources continues resident and migratory birds are losing their important foraging, roosting, and nesting habitats.

The Great Salt Pond is impacted by sewage runoff the from surrounding neighborhoods, and by runoff and seepage of uncontrolled leachate from the MSW/IDS Sites located on Pond Island, in the middle of Great Salt Pond. The area is also under stress from development, and parts of the pond have been filled in with sand for possible future road construction.

The following section, presents the regulatory and legal framework issued by the government of Sint Maarten, the Netherlands, and European Union relevant to the management of waste. The World Bank Safeguards and other relevant International guidelines applicable to the project were also examined.

2.2. Environmental & Social Legislation and Regulations

The current legislation of Sint Maarten is adopted through National Ordinance from legislation of the former Netherlands Antilles and the former Island Territory of Sint Maarten.[8] Other legislative instruments also applicable to Sint Maarten include:

- The Charter for the Kingdom of the Netherlands
- The Constitution of Sint Maarten
- Treaties and agreements with other states and with international organizations
- National legislation, which has come into in effect for Sint Maarten since October 10, 2010

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[7] Bird Life International. (2008). Important Bird Areas in the Caribbean: Key sites for Conservation. Cambridge, UK: Bird Life International. (Bird Life Conservation Series No. 15).

[8] Ibid.

Sint Maarten is autonomous in matters of internal affairs and the environment. The governing body of Sint Maarten is comprised by a Council of Ministers, headed by a Prime Minister. The Parliament of Sint Maarten exercises control over Government's policies and plays a crucial role as co-legislator. A Governor is appointed by royal decree, represents the King on St. Maarten and functions as Head of State of St. Maarten. The Government of Sint Maarten carries the primary responsibility for nature and environmental policies and their implementation.

There are National Ordinances promulgated to protect and preserve the environment from pollution and degradation in Sint Maarten. However, some of this environmental legislation is not enforced or implemented.

Ordinances, policies and decrees related to environmental and social protection that are relevant to this Project are presented in the following Table.

General Environmental and Social Considerations	National Laws and Requirements	Gaps
Environmental and Social Assessment.	The National Ordinance Structure and Organization of National Government (AB 2010, GT no. 6 and AB 2014, no. 29). The Organization Decree Public Housing, Spatial Planning, Environment and Infrastructure (AB 2010, no. 8, AB 2013, GT no. 145 and AB 2014, no. 67).	
Labour and Working Conditions	Labour Legislation of St Maarten **National ordinance concerning safeguarding labor in enterprises a.k.a. Safety Ordinance** (AB 2013, GT no. 438). **Safety Decrees I-III** (AB 2013 GT no. 348; no. 280; no. 350) A National HIV and AIDS Workplace Policy (2012)	The current labor legislation covers the issues of minimum wages, employee dismissal, prohibition of child labor, occupational injury, holidays and special leaves etc; however, there is no specific section in the labor legislation which directly regulates vulnerable workers such as women, persons with disabilities. The labor legislation includes a specific ordinance on migrant workers, contracted workers, and community workers
Resource Efficiency and Pollution Prevention Management	**National Energy Policy (2014)** The current **Electricity Concessions Ordinance (AB 2013, GT no. 147)** and the Electricity Concession of N.V. GEBE **Waste Ordinance** (AB 2013, GT no. 135). National Ordinance Wastewater (AB 2013, GT no. 142) The National Ordinance for Nature Protection and Management (AB 2013, GT no. 809)	Policies and ordinances are in place to promote sustainable water and energy use. There are gaps with regard to pollution emission and discharges standards. The current Waste Ordinance does not address management, storage and transport of hazardous materials, chemicals and pesticides. There is not an adequate legal and regulatory framework to guide

	The National Ordinance for the Prevention of Pollution from Ships (AB 2013, GT No. 298) **National Ordinance Clearance of Ships and Wrecks** (AB 2013, GT no. 314) **Environmental Norms for Air & Sound, Water & Wastewater, Waste** **Article 28a of the Lrop (26 April, 2021)**	environmental and social impact assessments. There a limited number of elements that meet environmental and social assessment good practice.
Community Health and Safety	**Nuisance Regulation** (AB 2013, GT no. 139). **Hindrance Ordinance** and derivative regulations. (AB 2013 GT nr. 139 and AB 2013 GT nr. 140). **National Ordinance Public Health** (AB 2018, 20). **National Decree of the Governor of Sint Maarten Concerning Public Health Rules National Decree on Public Health** (AB 2017, GT No. 33).	There are no current regulations that require facilities to inform adjacent communities of potential risks and hazards including hazardous wastes, traffic safety, impacts of labor influx and issues associated with security personnel.
Land Acquisition, Restriction on Land Use and Involuntary Resettlement	St. Maarten adopted its own Planning and Zoning Ordinance in 1993 (Eilandsverordening Ruimtelijke Ontwikkelingsplanning St. Maarten,"EROP") and it is updated in 2013 which is the **National Ordinance Spatial Development Planning** (AB 2013, GT no. 144)**.** National ordinance, concerning Building- and Public Housing a.k.a. **Building Ordinance** (AB 2013, GT no. 136). There are **two National Decrees** for execution of **Article 19** (AB 2013, GT no. 146) and **Article 43** (AB 2013, GT no. 401) of the Building Ordinance. As per April 26, 2020 **Article 28a of the National Ordinance Spatial Development Planning** (**Lrop**) has recently come back into effect. **Article 28a**. regulates the requirements for a civil works permit, which will allow the Minister to review certain planned works prior to approval. This will ensure that the works will not cause undesirable and irreversible damage to the environment and are executed with concern to the environment and that the works fit within the Government Spatial Development Vision. In addition, the article allows the government to impose conditions on the	Currently, there are no requirements to address , nor assess economical and social impacts. There are no specific requirements that insure protection for all people affected including people who do not have full legal rights to land or assets.

	execution of the works. Approval by the Minister would be required for the following works: - The excavation, raising, leveling or explosion of land; - The construction of roads and other pavements; - Works and projects that impact the water management and the groundwater level; - The felling and clear-cutting of trees or other cultivation; - The demolition of structures; - The filling and/or dredging of water.	
Biodiversity Conservation and Sustainable Management of Living Natural Resources	**National ordinance, concerning management of nature and protection of the prevalent fauna and flora** (AB 2013, GT no. 809). **National Decree, entailing general measures, concerning management and protection of flora and fauna as well as nature parks** (AB 2013, GT no. 143). There are two relevant island policies that are not covered by legislation; **Beach Policy** (Public notice August 1994). **Hillside Policy** (Public notice No. 986/98). Temporary Fishing Prohibition Cartilage Fish Decree **(**AB 2011, no. 35). Fisheries Land Decree (AB 2013, GT no. 405). Fisheries Products National Decree (AB 2013, GT no. 354). **National Nature Conservation Ordinance – Ao2001, No. 41;** **Nature Conservation Ordinance St, Maarten- AB2003, No. 35** **St Maarten Proposed Land Parks Management Plan (2009);** **Sint Maarten Nature Policy** has been approved; in the process to be published..	Measures to protect, conserve, maintain and restore natural habitats and biodiversity have been proposed; however, have not been fully Implemented or are not enforced . Although there are laws regarding development activities impacting critical habitats and biodiversity, degradation continues because of the lack of enforcement. Incorporating ecosystem services into national capital is not required under current legal mandates.
Cultural Heritage.	The Philipsburg Declaration and Action Plan (2015) **National decree, entailing general measures of the execution of the Monuments ordinance** (AB 2013, GT no. 50).	Comprehensive regulation addressing potential adverse impacts on cultural property requires additional formulation.

	National decree indicating protected monuments (AB 2013, GT no. 46). **National decree monuments register** (AB 2013, GT no. 49).	Legal protection relating to commercial use of cultural heritage remains ambiguous.
Stakeholder Engagement and Information Disclosure.	There is no national law or regulation.	Stakeholder engagement and information disclosure are designed at the project level in related to project's stakeholders and their needs.

Table 2.1. Summary of Environmental and Social legislation

2.3 Permit Requirements

Permits for the proposed activities at the MSW/IDS Sites as described above, are:

- Hindrance Permit
- Infrastructure/Civil Works Permit
- Building Permit

2.4 Air Quality Guidelines and Standards

As mentioned previously, the current legislation of Sint Maarten is adopted through National Ordinance from legislation of the former Netherlands Antilles. The air quality standards for the islands of the Netherlands Antilles set by the Working Group on Environmental Standards Netherlands Antilles - *Milieunormering Nederlandse Antillen*, (WMNA) are the most relevant standards for air quality in Sint Maarten.[9] The WMNA includes air quality standards for dust, Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone (O_3), Methane (CH_4), Carbon Monoxide (CO), Lead (Pb), Chlorine (Cl), Volatile Organic Substances (VOS), and odor. Presented next is table 2.1 that summarizes the air quality guidelines established by the WMNA and could be relevant as air quality guidelines for Sint Maarten.

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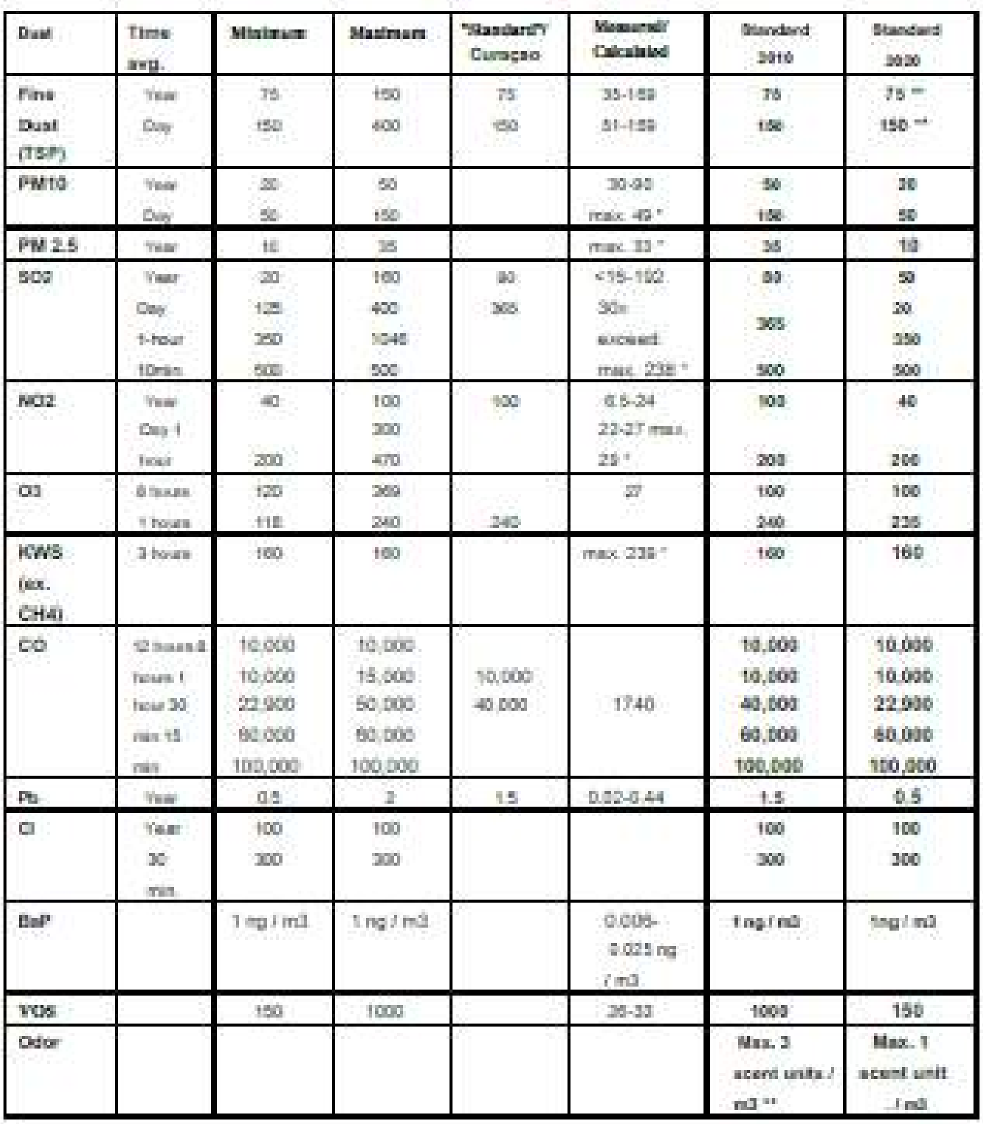
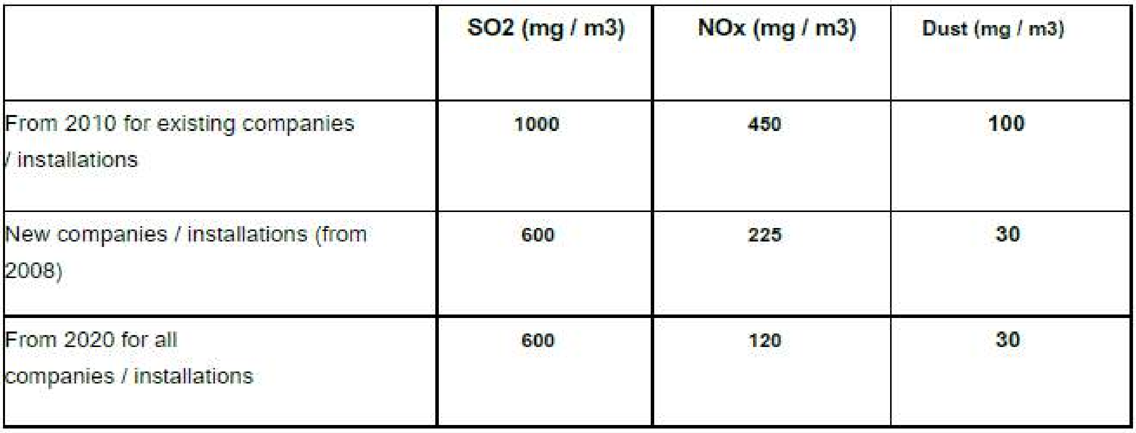
[9] Werkgroep Milieunormering Nederlandse Antillen, 2007, Eindrapport Milieunormen, Lucht & Geluid, Water & Afvalwater, Afval, Nederlandse Antillen.



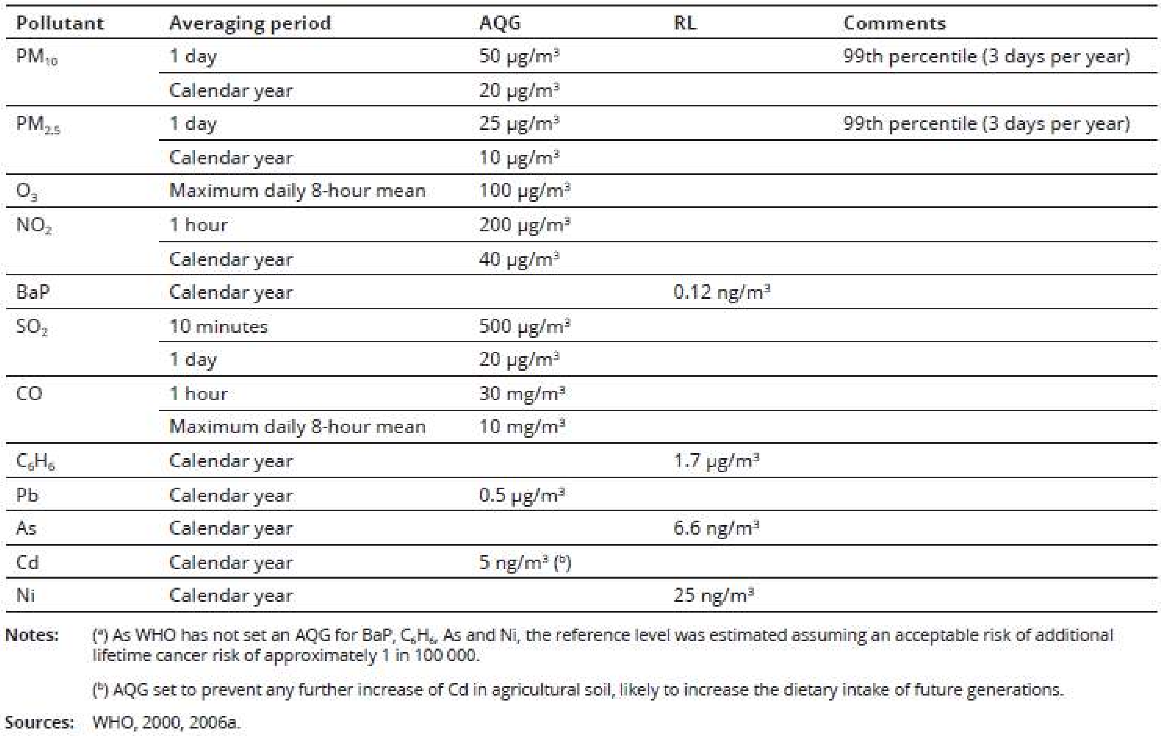
Dust	Time avg.	Minimum	Maximum	"Standard"/ Curaçao	Measured/ Calculated	Standard 2010	Standard 2020
Fine Dust (TSP)	Year Day	75 150	150 400	75 150	35-159 51-159	75 150	75 ** 150 **
PM10	Year Day	20 50	50 150		30-90 max. 49 *	50 150	20 50
PM 2.5	Year	10	35		max. 33 *	35	10
SO2	Year Day 1-hour 10min	20 125 350 500	160 400 1046 500	80 365	<15-192. 30x exceed. max. 238 *	80 365 500	50 20 350 500
NO2	Year Day 1 hour	40 200	100 300 470	100	6.5-24 22-27 max. 29 *	100 200	40 200
O3	8 hours 1 hours	120 110	269 240	240	27	100 240	100 235
KWS (ex. CH4)	3 hours	160	160		max. 236 *	160	160
CO	12 hours 8 hours 1 hour 30 min 15 min	10,000 10,000 22,900 60,000 100,000	10,000 15,000 50,000 60,000 100,000	10,000 40,000	1740	10,000 10,000 40,000 60,000 100,000	10,000 10,000 22,900 60,000 100,000
Pb	Year	0.5	2	1.5	0.02-0.44	1.5	0.5
Cl	Year 30 min	100 300	100 300			100 300	100 300
BaP		1 ng / m3	1 ng / m3		0.006-0.025 ng / m3	1 ng / m3	1ng / m3
VOS		150	1000		26-33	1000	150
Odor						Max. 3 scent units / m3 **	Max. 1 scent unit / m3



	SO2 (mg / m3)	NOx (mg / m3)	Dust (mg / m3)
From 2010 for existing companies / installations	1000	450	100
New companies / installations (from 2008)	600	225	30
From 2020 for all companies / installations	600	120	30

Table 2.2 Summarize the air quality guidelines established by the WMNA

The World Health Organization (WHO), has established Air Quality Guidelines that may be applicable to use in the air monitoring program, to be performed during the Fire Suppression Activities, and it is presented in table 2.2



Pollutant	Averaging period	AQG	RL	Comments
PM_{10}	1 day	50 µg/m^3		99th percentile (3 days per year)
	Calendar year	20 µg/m^3		
$PM_{2.5}$	1 day	25 µg/m^3		99th percentile (3 days per year)
	Calendar year	10 µg/m^3		
O_3	Maximum daily 8-hour mean	100 µg/m^3		
NO_2	1 hour	200 µg/m^3		
	Calendar year	40 µg/m^3		
BaP	Calendar year		0.12 ng/m^3	
SO_2	10 minutes	500 µg/m^3		
	1 day	20 µg/m^3		
CO	1 hour	30 mg/m^3		
	Maximum daily 8-hour mean	10 mg/m^3		
C_6H_6	Calendar year		1.7 µg/m^3	
Pb	Calendar year	0.5 µg/m^3		
As	Calendar year		6.6 ng/m^3	
Cd	Calendar year	5 ng/m^3 (b)		
Ni	Calendar year		25 ng/m^3	

Notes: (a) As WHO has not set an AQG for BaP, C_6H_6, As and Ni, the reference level was estimated assuming an acceptable risk of additional lifetime cancer risk of approximately 1 in 100 000.

(b) AQG set to prevent any further increase of Cd in agricultural soil, likely to increase the dietary intake of future generations.

Sources: WHO, 2000, 2006a.

Table 2.3 Summarizes the air quality guidelines established by the World Health Organization.

2.5 Waste and Landfill Management System and Regulations

A list of applicable legislation and regulations is provided in paragraph 2.2, above. At the moment, no fees are charged and waste management operations – from collection to disposal, are fully subsidized. Commercial properties generally use private sector waste collection/removal services.[10]

Table 2.3 lists environmental standards for waste in the form of waste policy targets for 2010 and 2020 proposed by the Working Group on Environmental Standards Netherlands Antilles (Werkgroep Milieunormering Nederlandse Antillen, WMNA).[11]

2.6 Leachate Management and Surface Water Quality Standards

The Wastewater Ordinance (AB 2013, GT No. 142) and WMNA, are in place to protect the environment by diminishing and preventing wastewater discharge into surface water. Due to a lack of municipal infrastructure and investment in sewage treatment systems, reported to be at 15% capacity in 2012,[12] a large portion of the population is still dependent on septic systems, which have led to degraded surface water quality at Sint Maarten. Likewise, due to the lack of implemented discharge standards, illegal and poorly maintained sewage system connections, dumping of wastewater, and runoff from road surfaces and the MSW/IDS

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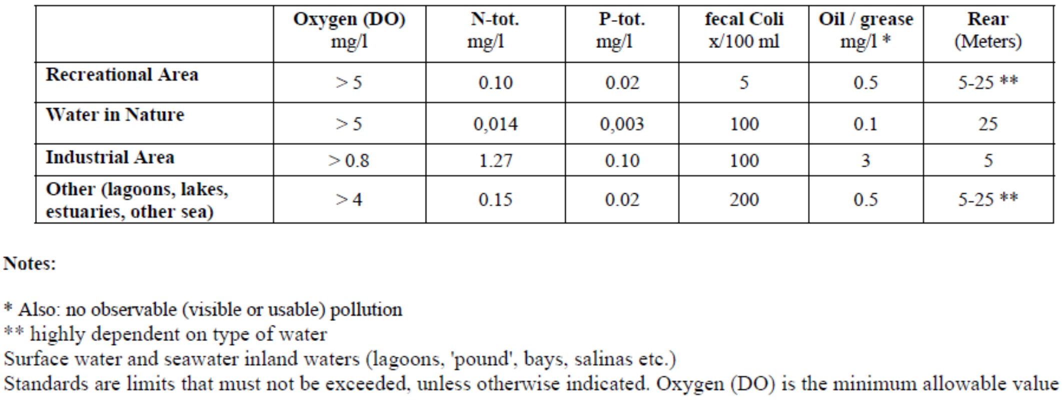
[10] Ministry Plan 2015 - 2018 – Ministry of Public Housing, Spatial Planning, Environment and Infrastructure, June 2015.

[11] Werkgroep Milieunormering Nederlandse Antillen, 2007, Eindrapport Milieunormen, Lucht & Geluid, Water & Afvalwater, Afval, Nederlandse Antillen.

[12] Fraser A, 2016. Risk Root Cause Analysis Paper for PEARL (Preparing for Extreme and Rare Events in Coastal Regions Project): St Maarten, Dutch Caribbean. Contested Development Working Paper Series Department of Geography, King's College London. Year 2016 Paper #74.

contributed to this degraded surface water quality. Site reconnaissance revealed observations of stormwater in contact with waste directly entering Great Salt Pond from the MSW/IDS landfills.

The water quality standards for the islands of the Netherlands Antilles set by the Working Group on Environmental Standards Netherlands Antilles *Werkgroep Milieunormering Nederlandse Antillen,* (WMNA) are the most relevant environmental standard for surface water quality in Sint Maarten.[13] The WMNA water quality standards are presented in table 2.3.



	Oxygen (DO) mg/l	N-tot. mg/l	P-tot. mg/l	fecal Coli x/100 ml	Oil / grease mg/l *	Rear (Meters)
Recreational Area	> 5	0.10	0.02	5	0.5	5-25 **
Water in Nature	> 5	0,014	0,003	100	0.1	25
Industrial Area	> 0.8	1.27	0.10	100	3	5
Other (lagoons, lakes, estuaries, other sea)	> 4	0.15	0.02	200	0.5	5-25 **

Notes:

* Also: no observable (visible or usable) pollution
** highly dependent on type of water
Surface water and seawater inland waters (lagoons, 'pound', bays, salinas etc.)
Standards are limits that must not be exceeded, unless otherwise indicated. Oxygen (DO) is the minimum allowable value

Table 2.4. summarizes the WMNA water quality standards

2.7 Safe/Setback Distance for Landfills (relevant international dispositions)

Although studies have been conducted, showing precise risks to health from landfill sites are hard to quantify. However, living in close proximity of a landfill or a dumpsite undoubtedly carries risks for human health and safety via exposure to emissions through different pathways such as inhalation of substances emitted from the site and contact with affected water or soil, directly or through the consumption of products or affected water. It has been reported by several studies that living near a landfill increases the risk of adverse health effects, which include low birth weight, birth defects, respiratory symptoms, certain types of cancers, and behavioral changes in children.[14] Although biases and confounding factors cannot be excluded as explanations for these findings, they may indicate real risks associated with residence near landfill sites.

Most landfill designs include setbacks that result in safe distance from the boundary of the landfill to residential areas in order to minimize potential environmental and public health risks. There is no buffer zone between the MSW/IDS Sites and the population residing in the community adjacent to it, the community extends to near to the toe of the MSW Site. Improving daily management, appropriate slope contouring and preventing subsurface and surface fires will minimize the risk of exposure to emissions from smoke, fumes and airborne

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[13] Werkgroep Milieunormering Nederlandse Antillen, 2007, Eindrapport Milieunormen, Lucht & Geluid, Water & Afvalwater, Afval, Nederlandse Antillen.

[14] Martine Vrijheid, 2000. Health Effects of Residence Near Hazardous Waste Landfill Sites: A Review of Epidemiologic Literature. Environmental Health Perspectives, Vol 108.

particulates. There is a need and a short-term objective to establish a more permanent buffer zone between populated areas and the MSW/IDS Sites.

The International Solid Waste Association (ISWA) issued Guidelines for the Design and Operation of Municipal Solid Waste Landfills in Tropical Climates in February 2013.[15] According to the report, landfill sites should not be located in the immediate proximity of occupied dwellings, waterways, or water bodies; and a minimum set back distance of 500 meters should be provided.

As relevant references, following is presented a summary of rules regarding setback distances of the European Union, United States and Canada. In the design of the project, it will be important to take into account the local context and emphasize the need on improved operation with least negative impact to surroundings.

European Union:
Annex I of Directive 1999/31/EC on the landfilling of waste specifies that the location of a landfill must be taken into consideration;[16] however, European legislation does not specify a required distance, but instead has general provisions leaving it to the discretion of Member States to decide considering site-specific conditions. A minimum buffer distance from residential areas of 0.5 kilometers in the case of municipal landfills and 2 kilometers from residential areas in the case of hazardous waste landfills were initially proposed for inclusion in the directive on landfilling of waste;[17] however, these minimum buffer distances were not adopted in the directive finalized in 1999.

United States:
Very few states in the U.S. have defined minimum setback distances from active landfills, which range between 300 feet and 1000 feet. However, it should be noted that the standard of care in developed countries for a Buffer Zone between closed (non-operational) landfills and residential communities is typically a minimum of 1,000 feet. This Buffer Zone requirement is contained within many of the county and municipal ordinances in the United States. Although the island state of Hawaii and island territories such as the U.S. Virgin Islands and Puerto Rico are required to conform to the location restriction,[18] they do not have defined minimum setback distances from active landfills.

Canada:
A review was conducted to determine the setback requirements and variance allowances within jurisdictions in Canada.[19] Most of the jurisdictions reviewed had setback provisions for the establishment of waste facilities. The setback distances varied among jurisdictions but were generally between 300 and 500 meters.

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[15] Guidelines for Design and Operation of Municipal Solid Waste Landfills in Tropical Climates, ISWA, February 2013

[16] OJ L 182, 16.7.1999.

[17] OJ C 156, 24.5.1997.

[18] Criteria for Municipal Solid Waste Landfills (§ 258, 40 U.S.C.)

[19] Landfill Development Setback Review Working Group, Report January 5, 2015, Alberta Environment and Sustainable Resource Development (ESRD).

Most standards recommend a set back distance between 1000 feet to 1500 feet. Based on a series of assessments regarding the subsurface fires incidents, prevailing wind directions, historic landfilling activities and slope stability of the MSW /IDS Sites, it has been proposed that a buffer zone of approximately 1000 feet is established and people residing in that zone are relocated.

2.8 World Bank Requirements: Applicable Safeguards Policies

This project has been classified as a Category A project, as documented in the ISDS. Based on early scoping of the project by World Bank environmental and social specialists, the following World Bank safeguards policies are triggered:

The World Bank Operational Policies triggered by this project are:

- Environmental Assessment (OP/BP 4.01)
- Natural Habitats (OP/BP 4.04)
- Pest Management (OP/BP 4.09)
- Physical Cultural Resources (OP/BP 4.11)
- Involuntary Resettlement (OP/BP 4.12)
- Projects on International Waterways (OP/BP 7.50)

Safeguard Policies
Environmental Assessment OP/BP 4.01 The project is rated Category A. The activities at the municipal waste disposal site that encompasses higher risks are related to: the fire suppression activities for subsurface fires. This is especially the case when excavation is required. In addition, recontouring of the MSW will involve excavation. In terms of the social aspects, temporary or permanent resettlement is likely needed to limit the exposure of households and businesses located near the disposal site. Risks include dust and noise pollution, smoke during firefighting activities and waste slope instability. The community of 100 to 300 households and businesses located near the disposal site also includes waste pickers. While waste-picking is not their full-time employment, many take large metal containers and equipment and other materials from the municipal disposal site, and extract what they require. A better enforced restriction of access of the waste pickers to disposal site may impact their livelihoods.
Natural Habitats OP/BP 4.04 This policy is triggered because waste/lixiviates and rain run-off from landfill to Great Salt Pond. The ESIA will assess any negative impact, and the ESMP will provide guidance to managing associated risks related to impacts on the natural habitat. According to the Integrated Biodiversity Assessment Tool (IBAT), supported by Conservation International (CI), International Union for Conservation of Nature (IUCN) and United Nations Environment Programme (UNEP)) Great Salt Pond is classified as an "*Important Bird and Biodiversity Area*" and hydrologically connected to Fresh Pond. Although these are not RAMSAR sites, (a wetlands location designated to be of international importance) they are important natural habitats, therefore OP 4.04 was triggered and an assessment should be performed to identify if the Solid Waste and Landfill Management, Fire Suppression during daily landfill will result in the degradation of natural habitats and fisheries, and propose mitigation measures if necessary.

Safeguard Policies
Pest Management OP/BP 4.09 This policy on pest management is triggered as the municipal disposal site management may require managing pests (e.g., flies, roaches, rodents as well as mosquitoes).
Physical Cultural Resources OP/BP 4.11 This Safeguard has been triggered as a precatory measure. Part of the Great Salt Pond is designated as a national monument and Pond Island has government buildings, a college, festival village, ball fields and the residential communities, located adjacent to the MSW and IDS. This policy addresses physical cultural resources which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Depending on the project approach and methods used, the activities described in this ESIA could result in limited or restricted access to some of these cultural resources.
Involuntary Resettlement OP/BP 4.12 Given the close proximity of a residential community to the MSW landfill, it is anticipated that involuntary resettlement will be necessary. Risks include potential exposure to fumes and dust as well as a potentially instable slope. Best practices on landfill operations also recommend a setback are to be established. To assess the impacts by the proposed activities, the project has conducted a social baseline study complementary to the ESIA to determine the number of households and businesses that may have to be displaced and relocated temporarily or permanently including the loss of livelihoods for the community in the proximity of the municipal disposal site.
Projects on International Waterways OP/BP 7.50 This policy is triggered as boat salvaging (sub-component 1d&e) will occur in Simpson Bay lagoon which is a body of water shared with the Collectivity of Saint Martin, which is part of France. This policy is not relevant for the sub-component 1b: “Reducing risks of operation, reorganization, rehabilitation, and upgrading of debris storage and municipal disposal sites”, examined under the current ESIA.

2.8.1 The World Bank Group’s Environmental, Health and Safety Guidelines (EHSGs)

The World Bank Group Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). EHS Guidelines are applied as required by their respective policies and standards. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Specific reference is made to the EHS guideline for Waste Management Facilities:

2.8.2 ESIA Process, Consultation, and Review Process

Several steps have been followed in the ESIA development, submissions and review. These are summarized below.

- A draft of the terms of reference for drafting the ESIA was reviewed by NRPB

- Various experts in Sint Maarten were solicited to provide inputs to the ESIA for data collection and inputs on: water quality, sediment, natural resources, flora and fauna
- Specialists across environment and social safeguards teamed with NRPB staff to contribute to the ESIA
- A first consultation for this ESIA was conducted in English on June 25th, 2019 and in Spanish on June 26th, 2019 at the University of Sint Maarten in Pond Island (see annex J)
- The ESIA was revised in line with the outcomes of the consultations and a water and soil sampling was added to the tasks of the ESIA
- Mid 2020, it was requested that the ESIA would include language on general landfill management and the construction of an access road and installation of the weighbridge
- The draft ESIA was completed and shared with World Bank on May 31st , 2021.
- The related ESMP was completed and published for consultation from May 19th, 2021 until May 28th, 2021.
- The ESMP was shared with World Bank on May 31st , 2021.
- The ESMP was revised according to comments from the World Bank

The following steps are still scheduled to take place:

- Clearance on the ESIA and ESMP from the World Bank
- Disclosure of the ESIA and ESMP by the NRPB

2.8.3 Environmental and Social Management Capacities

During project preparation in 2018, the overview of the capacity assessment indicated, that governance structure is not strong in the implementation of the related Safeguard Policies which could lead to lack of clarity in terms of the responsibilities to carry out the tasks as required in the corresponding ESMP for the project implementation activities. In 2021, the PIU's safeguards team consists of two Social Safeguards and three Environmental Safeguards personnel. In addition, there is a full-time Resettlement Specialist hired for EDMP. However, continued capacity building remains important for the implementation of the project and monitoring of the safeguard-related instruments, national legislation and policies described above.

It is recommended to train the Project Implementation Unit (PIU), the National Recovery Program Bureau (NRPB) personnel, on the application of the Environmental and Social World Bank Safeguard Policies, that is: procurement specialists, engineers and key government officials; Provide continued technical support to the PIU and government in designing of other construction and solid waste landfill activities to ensure the application of above related Safeguards instruments.

Also, the NRPB will have to implement and monitor the Environmental and Social Management Plans (ESMP). For this purpose, the Safeguards team has assigned two Environmental Safeguards Specialists, one Social Safeguards Specialist and a Resettlement Specialist to EDMP. This team is supported by external consultants, where necessary. Where applicable, Safeguards staff from the NRPB will provide safeguards related support for local government ministries.

The capacity building in environmental and social safeguards recommended will cover the following aspects.

- Project Safeguards Staffing: The tasks will include (i) participation in meetings that will be held at different stages throughout project effectiveness (ii) participation in the monitoring of safeguards instruments compliance, and (iii) being the local focal point for the grievance redress mechanism (GRM) and responsible for data entry into the GRM database on complaints and complaints resolution.
- Familiarization Meetings and Training: Based on this identified risk, two types of training programs on safeguards (environmental and social) will need to be developed:
    - Familiarization meetings to involved NRPB and Government personnel on the project's approach to management of environmental and social issues, the RAP, ESMP, and GRM.
    - A training for the contractors, builders and construction workers, which covers the same topics as the overall introduction, but with much more detail to make the participants fully conversant with the approach to management of environmental and social issues through the ESMP. Such training should be part of the C-ESMP provided by the Contractor.

3.0 Environmental and Social Baseline Information

3.1 Physical Environmental Data of Sint Maarten

3.1.1 Geology

The bedrocks of Sint Maarten consist primarily of andesite tuff and tuff breccia from Eocene volcanic events. These have been intruded by basalt, quartz diorite, and andesite. Later volcanic activity caused intrusions which have metamorphosed the rock and caused the tuff to tilt and fold. Limestone and marl were deposited on the eroded surfaces of these materials.[20]

At the end of the Pleistocene glaciation, ice melted and the sea level rose. The large, single island flooded and only the highest parts remained above sea level – forming the islands of St. Martin/St. Maarten, Anguilla and St. Barthélemy as they are known today. The tuffs form the Pointe Blanche formation, which is most visible at the southern end of the island. There are limestone caverns on Sint Maarten/St. Martin where the softer limestone was exposed.[21] The Simpson Bay Lagoon, Great Salt Pond, Great Bay and other bays and lagoons are drowned valleys. The plateau the neighboring islands sit on has a maximum depth of 36 m and is known as the Anguilla Bank.

3.1.2 Topography

The Island is hilly with scattered valleys. Some of the hills are sparsely wooded with a few areas of heavy vegetation. The highest point on the Island is located on the French side, is Pic Paradis at 1,391 ft (424 m); the highest peak on Dutch Sint Maarten is Mount Flagstaff at 383m, the lowest point is at sea level. The area to west of the Island around the airport is flatter, and contains the Dutch section of the Simpson Bay Lagoon. The Great Salt Pond lies to the north of Philipsburg. Several small islands lie off the coast, notably Cow and Calf, Hen and Chicks, Molly Beday, Pelican Key, and Guana Key. The Keys located in the Simpson Bay lagoon are Great Key and Little Key.

3.1.2.1 Great Salt Pond

A bathymetric assessment of the Great Salt Pond performed by the University of South Florida Water Institute in October 2019 is summarized below:

- Perimeter – 8,555 meters
- Area – 282.9 Acres (114.5 hectares)
- Mean depth – 0.77 meters
- Volume – 712.8 Acre-ft (232,267,344 gallons)
- Deepest point – 1.48 meters

A copy of the bathymetric assessment is presented below in Figure 3.1.

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[20] https://en.wikipedia.org/wiki/Geology_of_Sint_Maarten, after *"Geology of St. Bartholomew, St. Martin, and Anguilla, Lesser Antilles | GSA Bulletin". GeoScienceWorld.*

[21] https://www.academia.edu/34371438/Saint_Martin_Sint_Maarten_and_Saint_Barth%C3%A9lemy_from_Landscapes_and_Landforms_of_the_Lesser_Antilles_

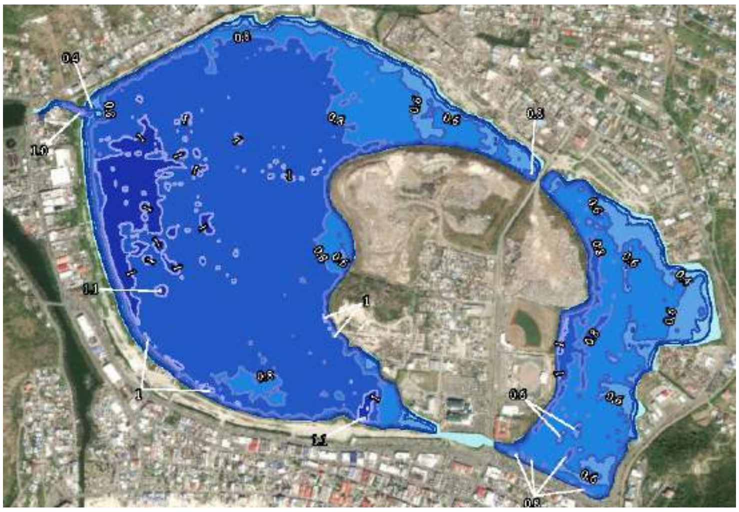

Figure 3.1 – Bathymetric Readings for Great Salt Pond. Sint Maarten. 2019

The same institute also performed an inflow/outflow assessment of the Great Salt Pond in October 2019. The assessment was performed to identify locations where water appeared to enter or leave the Great Salt Pond. Features were identified as the following:

- Green Box: Outfall to/from the GSP – main outfall is the control structure on the northwest edge of the GSP
- Green Circles: Culverts – observed as either a pipe, headwall, or hardened infrastructure
- Black Hexagons: Ditch outfalls were observed as open earthen or concrete linear constructed depressions. –
- Red Triangles: Pump house/station –
- Purple Pentagons: Swales were observed as runoff flow channels typically exchanging water with the surrounding ditch on the western edge.

Great Salt Pond accepts stormwater runoff from the MSW/IDS landfills as well as the surrounding areas, numerous inflow/outflow points were identified where water can intermingle with adjacent bodies of water. A copy of the inflow/outflow assessment of the Great Salt Pond is presented below in Figure 3.2

Figure 3.2 – Great Salt Pond Inflow/Outflow Summary. 2019

From the EE&G's ESIA draft report, 2020[22], the following environmental descriptions follows.

3.1.2.2 Pond Island

Pond Island is surrounded by the Great Salt Pond. The topography around the Great Salt Pond is hilly, with the pond acting as a catchment basin for storm water. Land use surrounding the Great Salt Pond is a mix of residential and commercial.

The topography immediately surrounding the MSW/IDS landfills is relatively flat. The topography beyond the Great Salt Pond is mountainous and therefore storm water management is necessary and the Great Salt Pond is a critical retention basin in that regard. Storm water flows from the MSW/IDS landfills directly to the Great Salt Pond or to drainage ditches that ultimately drain into the pond. There is a concrete wall around the perimeter of the informal settlement separating it from the MSW Landfill. There is a drainage trench along the southern part of the informal settlement which drains into the GSP. The Great Salt Pond also receives storm water runoff from surrounding neighborhoods and roadways as well as drainage and storm water from the Fresh Pond which drains into the Great Salt Pond. Water from the Great Salt Pond is periodically pumped into the Great Bay via the Rolandus Canal, which is located to the east of the Great Salt Pond that drains into the Great Bay to the south of Philipsburg. Great Bay has an active beach/recreational use area.

3.2 Soils

Based on the comparatively dry climate, which hampers the weathering of parent rocks, the soils of St. Maarten are in a young stage of development. This is demonstrated by the shallowness of the soils, the poor development of the subsoils and the presence of shell and rock material in the soils. The soils in the vicinity of Philipsburg fall into the category of the coastal low land soils. These soils are divided into two groups: well drained sandy soils and imperfectly and poorly drained mineral soils. Pond Island was created utilizing rock and soil excavated from Fort William Hill as fill, this was used as base material for the MSW landfill

3.3 Climate and Meteorology

The island of St. Maarten is characterized by a marine climate (classifies as "Am" on the classification scheme of Köppen) characterized by a relatively dry season (January-April) and a rainy season (August-December), with moderate to fresh east to north easterlies. Showers occur most of the time during the late afternoon. During summer, showers are limited and of light intensity. As autumn approaches, showers are moderate to heavy of character and can often be accompanied by thunderstorms. The island experiences tropical temperatures (averaging about 27 °C) with August being the warmest month. The seawater around the islands averages around 27.2 °C, and skies are in general mostly clear to partly cloudy.

Wind speed is prevailing from the east to northeast, with consistent monthly average of about 5 m/s at an elevation of 10 m above the ground. Figure 3.3 shows the wind speed at and around the island at a height of 50 m; Figure 3.4 shows the wind frequency rose, indicating robust persistence of easterly winds.

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[22] 2020, EE&G Disaster Response, LLC Environmental and Social Impact Assessment (ESIA/DRAFT) for Fire Suppression Activity, Pond Island Municipal Waste Landfill and Irma Debris Site. Emergency Debris Management Project. Sint Maarten National Recovery Program Bureau (NRPB).

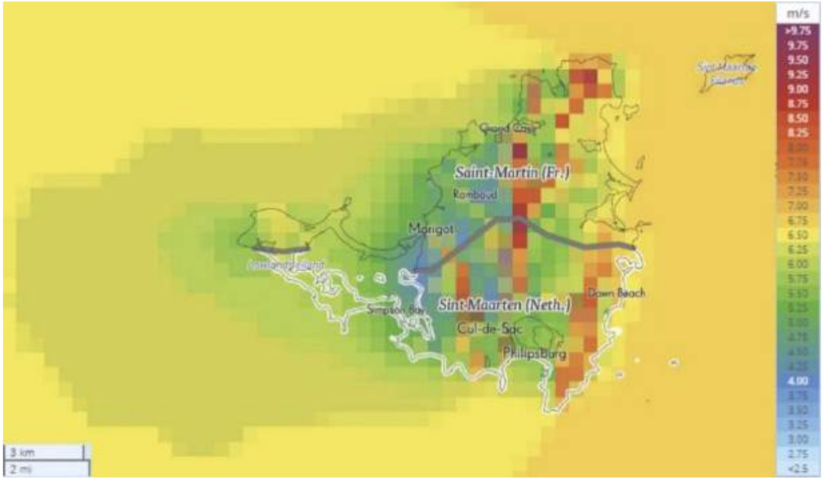

Figure 3.3 - Average wind speed at a height of 50 m above the ground

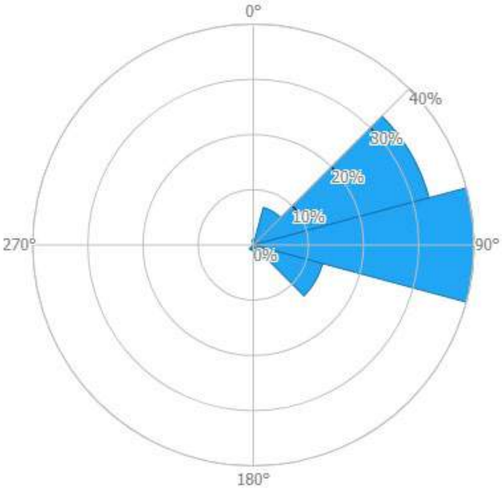

Figure 3.4 - Wind frequency rose showing prevalence of easterly winds

The hurricane season runs from June 1st to November 30th, with a peaked season from August through October. The island is situated within the Atlantic hurricane region. Climatic records show that during the period 1851-2009, 64 hurricanes passed within 120 nautical miles on either side of the island. These are shown below in Table 3.1.

Element	Unit	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Avg. Air Temperature	°C	25.5	25.4	25.7	26.5	27.4	28.2	28.3	28.6	28.5	28.2	27.3	26.1	27.2
Avg. Maximum Temperature	°C	28.6	28.7	29.2	29.8	30.4	31.3	31.6	31.7	31.6	31.2	30.2	29.2	30.3
Abs. Maximum Temperature	°C	32.7	31.6	32.6	33.6	33.5	33.9	34.2	35.1	34.8	34.3	33.9	32.1	35.1
Avg. Minimum Temperature	°C	23.2	23.1	23.5	24.1	25.1	25.2	26.1	26.2	26.0	25.7	24.9	23.9	24.8
Abs. Minimum Temperature	°C	18.6	19.2	19.5	19.3	20.2	22.3	22.1	21.4	22.0	22.1	21.2	20.0	18.6
Avg. Air Pressure (-1000)	hPa	16.9	17.0	16.4	15.6	15.7	17.0	17.1	15.9	14.5	13.8	13.9	15.7	15.8
Avg. Vapour Pressure	hPa	24.3	23.3	24.2	25.7	27.6	28.6	28.8	29.3	29.4	29.1	27.7	25.9	27.0
Avg. Relative Humidity	%	74.7	74.1	73.6	75.0	75.9	75.1	74.8	75.4	76.3	76.8	77.4	76.6	75.5
Avg. Dewpoint Temperature	°C	20.6	20.4	20.6	21.8	22.9	23.4	23.6	23.8	24.0	23.7	23.1	21.9	22.5

Element	Unit	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Avg. Daily Evaporation	mm	4.7	5.5	6.3	6.6	6.7	7.0	7.1	6.7	6.4	5.6	4.7	4.4	6.0
Avg. Monthly Rainfall	mm	66.0	50.7	45.2	64.0	93.3	61.8	71.6	98.8	139.6	113.0	149.3	93.8	1047.1
Avg. Hours with Rainfall	hours	62.3	50.0	45.2	42.6	54.1	35.4	60.8	65.4	62.5	77.0	81.5	68.3	705.1
Avg. Days with Rain > 1,0 mm	days	11.9	9.3	9.0	11.8	10.3	8.4	12.2	13.9	13.5	13.8	14.8	13.3	142.0
Highest Rainfall in 24 hours	mm	40.7	75.8	42.5	101.2	117.5	109.8	65.0	89.6	258.4	122.4	254.2	123.2	258.4
Avg. Days with Thunder	days	0.2	0.1	0.1	0.3	1.1	1.4	2.2	3.0	3.9	3.5	1.9	0.5	18.2
Avg. Cloud Coverage	%	37.3	39.6	37.8	41.1	49.0	47.3	46.1	45.3	47.5	45.7	44.0	40.7	43.4
Avg. Sunshine Duration	%	73.5	72.7	72.2	70.6	62.4	62.0	63.2	67.7	62.8	67.0	68.3	71.4	67.8
Avg. Sunshine Duration	hours	257.2	235.2	271.6	265.4	251.0	245.1	257.2	268.1	232.4	244.6	235.0	246.7	3009.4
Avg. Global Radiation	kWh/m^2	144.0	144.9	187.7	195.0	190.4	182.6	181.1	197.3	170.3	155.6	128.9	135.1	2013.7
Avg. Wind Direction	degrees	093	099	100	103	110	106	094	097	100	112	089	084	097
Avg. Wind Speed (at 10 m)	m/sec	4.9	4.9	4.8	4.8	4.8	5.2	5.3	5.0	4.6	4.2	4.5	4.7	4.8
Avg. Maximum Wind Speed	m/sec	11.6	11.5	11.1	10.6	10.6	11.8	12.7	11.8	11.2	10.1	11.3	11.2	11.3
Strongest Gust	m/sec	20.4	20.9	19.9	20.9	20.9	23.0	35.7	28.6	50.5	44.4	45.9	25.5	50.5
Persistency of the Wind	%	87.2	88.1	86.6	78.9	81.9	94.7	92.9	85.7	89.7	80.0	81.4	83.5	87.5

Table 3.1: Summary of monthly climatological data for the period 1971-2000 at the Princess Juliana Airport, Sint Maarten (18°03'N 63°07'W)

3.4 Ambient Air Quality

Ambient air quality data for the Island of Sint Maarten was not readily available. A preliminary screening of the smoke and fumes originating from the subsurface fires was conducted by the contracting company EE&G and Dutch National Institute for Public Health and the Environment (RIVM) in August 2018. These assessments are presented in the following paragraphs.

3.4.1 Air Quality at MSW/IDS Sites

EE&G performed a preliminary air quality screening of smoke and fumes from subsurface fires at the MSW/IDS Sites. This assessment identified risks and provided the foundation for addressing conditions of concern associated with the Fire Suppression Activity. A copy of the report is included in Annex D.

The air testing was performed over three consecutive days between August 28 and 30, 2018. Each day the testing was focused on a specific portion of the MSW/IDS Site. The objective of the screening activities was to obtain a general understanding of what constituents of concern (COCs) were present in the smoke and fumes emanating from cracks/fissures on the surfaces of the debris and disposal sites. The tests were performed in the following locations:

- Upwind of smoke plumes ("upwind" samples), to establish background levels of the COCs in the air prior to reaching the areas where smoke was visibly emanating.
- From the smoke vents ("smoke" samples), to obtain "worst-case" scenario levels of the COCs at their originating source.
- In the cabs of equipment performing normal operations at the active face of the MSW Site, that were reported to be part of a typical work day ("personnel" samples), to gauge COC levels relative to occupational limits.

Determination of the COCs to be tested was based upon a general knowledge of which byproducts of incineration can be found in a landfill setting and common components that make up landfill gasses, and the input of other World Bank consultants. The COCs that were tested for included the following:

- Landfill gases, which include methane (CH_4), carbon dioxide (CO_2), and carbon monoxide (CO). These gasses are produced when bacteria break down organic waste.
- Lower Explosive Limit (LEL), the concentration level at which gas has the potential to explode.
- Volatile Organic Compounds (VOCs), other gasses besides landfill gasses (listed above) that can be produced by the breaking down/decomposition of waste.
- Hydrogen sulfide (H_2S), a gas that can be the source of most landfill odors.
- Polycyclic aromatic hydrocarbons (PAHs), compounds found in coal and tar and produced by burning of organic matter.
- Respirable particulates (PM 2.5), solid particles generated by mechanical action or burning. Composition depends on the parent material. Can be non-organic (silica, asbestos, metals or plastics) or organic (cellulose, mold or bacteria). PM 2.5 are ‘fine’ or ‘tiny’ particles that are less than 2.5 micrometers in size.
- Ozone (O_3), a COC that may be formed by landfill gasses.
- Dioxins and Furans, byproducts of combustion of plastic waste and other materials, particularly those containing chlorine.
- Polychlorinated biphenyls (PCBs), man-made chemicals that can be released into the environment through burning of waste. PCBs typically are associated with electronics.
- Heavy metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver), environmental pollutants that can be released into the environment through burning of waste.
- Asbestos fibers, carcinogens associated with the disturbance or incineration of building materials

Identification of COCs were found to exceed occupational exposure levels (OELs) within smoke fumes emanating from fissures on the MSW at a height of 1,5 meters above the fissure, and particulate levels, exceeding OELs, were found in the cabs of equipment and upwind of smoke fumes.

The results and conclusions that were presented did not contain reference to or discussion of potential for offsite migration of COCs, or the potential for impacting surrounding populations. Perimeter air monitoring of the debris and disposal sites and potential impacts to the surrounding areas from emissions is recommended to be performed as part of the fire suppression activities to be protective of human health and the environment. This sampling and analysis event was performed to assess the “worse- case” exposure scenarios for workers (without excavating waste) that will be performing fire suppression and working within active combustion and smoke impacted areas. These data should not be used for other purposes, in particular speculation as to what offsite concerns may or may not be occurring.

Due to the limitations of the testing, it was not possible to determine potential exposure to PAPs, however the results illustrated that landfill workers, visitors and salvagers may be exposed to constituents of concern if there is a fire.

Furthermore, EE&G provided recommendations for an Air Monitoring Plan (AMP) to be used by the contractor and Government of St. Maarten during the fire suppression activities. The fire suppression activities may result in emissions from the site that represent potential inhalation and skin contact hazards to the fire suppression contractor employees, government and landfill contractor employees working at the MSW/IDS Sites, site visitors and the population in the surrounding communities. See Annex E for copy of the AMP.

3.4.2 Air Monitoring Study of Areas Surrounding MSW

The Environmental Incident Service (MOD) of the Dutch National Institute for Public Health and the Environment (RIVM) measured the air quality around the MSW/IDS Sites at Philipsburg, Sint Maarten for two weeks. The measurements were collected between January 24 and February 6, 2019. A copy of the report is included Annex G and a summary is below. The RIVM collected air samples and dust wipe samples at locations approximately 500 to 2,500 meters from the MSW/IDS Sites, figure 3.5

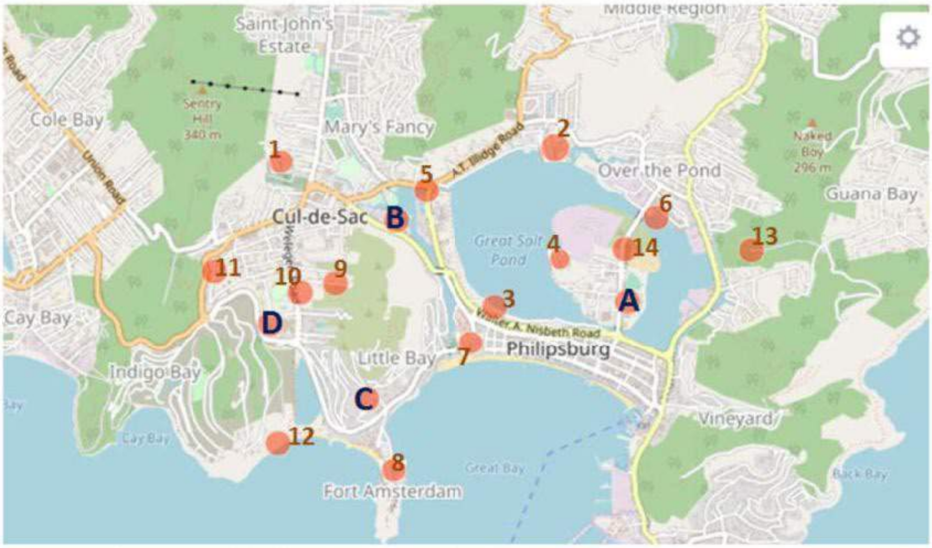

Figure 3.5 sampling points by RIVM, 2019

Figure 3.5 that shows the map of all sampling location: Sample locations (A-D) are fixed monitoring locations with 24/7 sampling equipment and Sample locations (1-14) are historical and instantaneous locations using other techniques.

The chosen sample locations provided insight into the possible exposure of the local population. Samples were collected upwind and downwind of the MSW/IDS Sites. The measurement techniques basically consisted of the following categories:

- Field detection that yields instantaneous (direct) information.
- Collecting gases for analyses. Examples are sample techniques such as canisters, 3MTM-badges, aldehyde cartridges, etc.
- Collecting particulate matter in the air for analysis in a laboratory. There were four Leckel 'base stations' where particulate matter (PM) in the air was collected 24/7. Field observations such as: "we smell an odor that seems to be related to the landfill" were noted for all samples.
- Collecting deposited (coarse) dust from smooth objects for a 'historical perspective' and collecting coarse dust from petri dishes for a 'two-week perspective'.

The following measurements were taken: particulate matter (PM10), inorganic gases, Volatile Organic Components (VOC), aldehydes, Polycyclic Aromatic Hydrocarbons (PAHs), dioxins and Polychlorinated Biphenyls (PCB). This is a broad "package" of substances that might be relevant in case of a fire. From the 206 samples taken, a selection of 90 samples was analyzed.

During the measurement period there were no open fires at the MSW/IDS Sites. As a result, the RIVM was unable to assess the potential health risks of substances released in the event of an open fire at the MSW/IDS Sites.

Based on these measurements, no conclusions were drawn about the possible substances that would be released in the event of an open fire or during the Fire Suppression Activity. The following conclusions were presented by RIVM based upon a ‘no open fire’ scenario:

- In the two weeks during which measurements were taken, only a few substances were found in low concentrations.
- For aluminum, some of the measured concentrations (specifically at the graveyard site – sample location 7) exceeded the health-based guideline value for chronic exposure. This did not derive from the landfill but is probably a result of traffic congestion and exhaust emitting from heavy traffic. It should be noted that the report stated that based upon 2008 Agency for Toxic Substances and Disease Registry report, the measured values of aluminum showed the same concentration range as found as a background in the Netherlands and the United States.
- In the unlikely case all chromium would be Cr (VI), some of the measured concentrations exceeded the health-based guideline value for chronic exposure. However, it is assumed that most chromium would be Cr (III) since that form is more stable in the environment. In that case, no health-based guideline values are exceeded.
- For PAHs, the concentrations found in dust wipe samples exceeded the health-based guideline value for lifelong daily intake. PAHs are emitted as a result of fires, but are also emitted through combustion gases of vehicles. Samples were often taken in areas with heavy traffic congestion, which may have been the main source of the PAH concentrations found.
- Odor was detected by the field technicians during the measurement period. Odor nuisance can be a source of health complaints by the population.
- RIVM had detailed information about background concentrations for different components in the Netherlands, but no information on the background concentrations for Sint Maarten. This study provided an initial insight into these background conditions.

3.4.3 Aerial Thermographic Infrared Surveys

An aerial thermal infrared survey conducted in June 2018 using an Unmanned Aerial Vehicle (UAV) and a high resolution FLIR thermal sensor visual camera captured elevated surface temperature and identified the locations of hot spots and potential subsurface fires (see Figure 3.6). The exact location of several hot spots and vents were identified using infrared thermography from ground level (see Figure 3.7).

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Figure 3.6 June 2018 Aerial Infrared Thermal Survey of MSW Site

Figure 3.7 June 2018 Ground-based Infrared Thermal Survey of MSW Site)

In June of 2019, a second Aerial Infrared Thermal Survey was conducted (See Figure 3.8). A comparison of the thermal data from August 2018 and June 2019 revealed the following: Areas of thermal anomalies or areas where there were higher heat signatures were generally in similar locations as identified in the previous survey. However, it is difficult to compare the temperature readings between the two maps, as surveys were conducted under different circumstances and different time of day. Further detail is discussed below:

- The 2018 map showed results using a color-coded range of values, with the maximum readings as between 106° and 147° C, these readings were collected while flying intermittently between 0800 and 1700 hours, therefore it is possible that solar reflection was a contributing factor to these results.
- The 2019 map results were also color coded however showed a maximum temperature of 67.2° C. These readings were collected after dark, eliminating the potential for solar reflection. However as mentioned in the above section, this does not rule out the potential for latent heat to contribute to the thermal results.

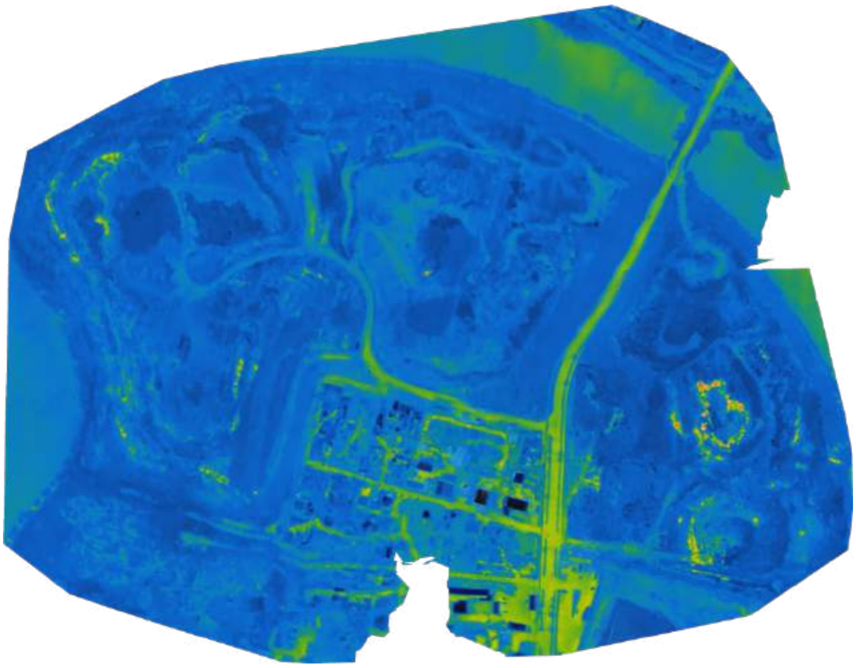


Figure 3.8 Aerial Infrared Thermal Survey of MSW/IDS Sites June 2019

The findings of the survey showed that the August 2018 and 2019 results had similar heat signatures, but not similar temperature ranges. Significant factors may have affected the diminished presence of heat sources or the time of day that the surveys were performed. Therefore, it was concluded that areas showing elevated heat signatures should be field verified to confirm that they are in fact related to subsurface fires and not some other factor. This has not happened.

Thermographic information may be used as a tool for identifying surface locations where elevated heat is present; and therefore, aid in the management of incoming waste activities and determining proximity of potential fire activity to nearby commercial and residential areas.

3.5 Ambient and Receiving Water Quality

A 2012 Water Testing Report was available for review on the Nature Foundation St. Maarten website. On July 22, 23 and 24, 2012, the St. Maarten Nature Foundation tested water quality at eight sites on the island. Tests were carried out in order to determine the quality of water for bathing (at swimming beaches) and for general water quality at various bodies of water throughout the island. Tests were carried out at the following locations: Cole Bay Lagoon, Simpson Bay Lagoon, Mullet Pond, Kim Sha Beach, Great Bay Beach, Belair Pond, Fresh Pond, and The Great Salt Pond. Water samples were tested for the following parameters: Nitrates, Phosphates, Nitrogen, Dissolved Oxygen, Alkalinity, and Temperature. Below is a summary of the findings:

- Simpson Bay Lagoon, Simpson Bay Beach, Mullet Pond, and Great Bay had medium levels of both phosphates and nitrates in samples tested. Elevated levels of nitrates and phosphates suggested that there was a presence of various types of pollutants and sewage which can cause algal blooms and mortality events (fish, turtle and crabs) in wetlands and coastal areas. The highest levels were recorded in the Great Salt Pond.

- Simpson Bay Lagoon, Simpson Bay Beach, Mullet Pond, and Great Bay showed low levels of Nitrogen. The highest level was recorded in the Great Salt Pond at 6 parts per million (ppm), which is a relatively high number; the presence of elevated nitrogen levels can pose a threat to aquatic organisms and can cause massive fish die-offs in wetlands and coastal areas.

Ambient and receiving water quality data for the Great Salt Pond was not readily available. The Great Salt Pond is a catchment basin for rain/storm water from the surrounding communities and Pond Island. This may include leachate and out flow from the MSW/IDS Sites.

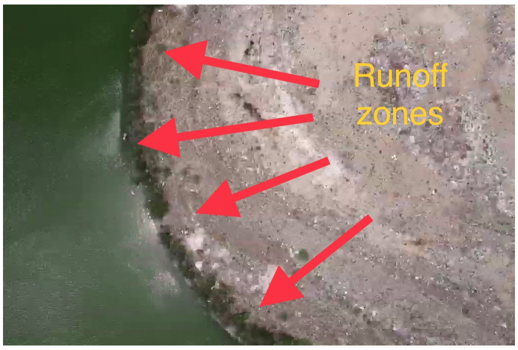
3.5.1 Ground Water Table Condition of the Study Area

The depth to the groundwater table on Pond Island varies in relation to the elevation around Pond Island; however, given that the island was manmade the depth to groundwater would correlate closely with the water elevation of Great Salt Pond. The MSW/IDS Sites w reported to not have been constructed with a liner system, leachate system, or storm water controls. It was reported that a collection system consisting of a lined trench was installed along the perimeter of the MSW, adjacent to the Great Salt Pond, the liner was reported to be no longer intact. In July 2019, a reconnaissance of the MSW Site was performed to note apparent locations of storm water runoff into the Great Salt Pond. Below is a summary of the findings:

- MSW – A drainage ditch located to the south of the MSW was observed that discharged to the Great Salt Pond and multiple locations of runoff into the pond were observed, there was evidence of trenching and what appeared to be a leachate management system along the perimeter. The below photos show locations of the runoff location.

Figure 3.9 Runoff zones at MSW Site to Great Salt Pond

Figure 3.10 Runoff Zone and drainage canal to Great Salt Pond



IDS - A drainage canal located to the south of the IDS was observed that discharged to the Great Salt Pond and three primary locations of runoff into the pond were observed. Storm water from the scrap metal/car decommissioning area located southwest of the IDS appeared to discharge to the drainage canal and ponding/pooling water was observed in the vicinity of stored debris. No apparent evidence of storm water or leachate management systems were in place

Because the MSW/IDS Sites do not have a liner system, the waste may come into direct contact with the underlying fill and potentially the groundwater. Rainfall that infiltrates into the MSW/IDS can filter through the waste, mobilizing constituents of concern present within the waste, potentially resulting in impacts to the groundwater. Because the MSW/IDS are located on an island, the groundwater on the island can seep directly into the surrounding body of water, the Great Salt Pond, and subsequently into Great Bay. In addition, fire suppression activities, which can include excavation followed by dousing with foam and/or water, will mobilize constituents of concern and subsequently negatively impact the surrounding surface water bodies and groundwater. Groundwater monitoring wells were not identified on or surrounding the MSW/IDS Sites .

3.6 Ambient Noise

The noise on Pond Island is affected by landfilling activities, businesses and bars and the festival village. Studies regarding ambient noise in areas surrounding the project location were not readily available.

3.7 Biological Environmental Data

The Great Salt Pond is located in south-central St. Maarten, north of Philipsburg. It is bordered by Philipsburg on the South side. It is the largest permanent saltwater pond on the island; it covers an area of 2.25 km^2 (225 hectares) and is up to 1,5 meters deep. The Great Salt Pond serves as a natural water catchment basin for much of the runoff water from the surrounding hills. Mangroves can be found around all of Sint Maarten's salt ponds and in particular the Great Salt Pond, which provides the necessary habitat for roosting, nesting and migrating birds. Despite the development of the surrounding area and subsequent stress to the ecosystem, the Great Salt Pond provides important foraging areas for many birds and the brackish and sometimes hypersaline conditions give rise to a unique wildlife community that includes several fish species, turtles, snails and insects.

There is periodic mechanically induced water exchange between the Great Salt Pond and the marine environment accessed through Great Bay. There is also constant exchange between each habitat for feeding and reproduction and continuous movement of water and animals between the deep waters surrounding St. Maarten, the coral reefs, seagrass and mangrove areas. As the waters around St. Maarten are relatively shallow, without much exchange between coastal and deep-water currents, corals and other organisms on reefs are exposed to any terrestrial influences including: freshwater runoff, sedimentation, nutrients, etc.

3.7.1 Terrestrial Flora

The 'littoral zone' refers to the coastal area of an ocean or sea, lagoon or salt pond where the transition from land to water offers a unique habitat for different vegetation types to exist. Along the shore of the Great Salt Pond vegetation types are found which have evolved due to a combination of varying environmental conditions i.e., low energy environments, saline water, and sandy soils. This type of vegetation is called Salina/ Saliña Mangrove Vegetation.

Salina vegetation includes plant species that are tolerant of saline waters and sandy soils and evolve on the banks of the Great Salt Pond where a low-energy wave environment prevails. The brackish or sometimes hypersaline nature of the Great Salt Pond is a result of its proximity to the sea, lack of rainfall, and high rates of evaporation. However, the salinity can fluctuate considerably; after heavy rains in the wet season for instance, the water will be more brackish than saline because of the diluting effect of the rainwater. These variable salinity conditions mean that only well adapted plants and animals can live in and around the ponds. A marked increase or decrease in salinity or oxygen parameters may result in not only water quality issues but also may result in fish die-off events, which has previously occurred within the Great Salt Pond.

Species diversity surrounding the MSW/IDS Sites and the Great Salt Pond is low and typically only one species will form the canopy. The communities consist mainly of Sea Grape (*Coccoloba uvifera*), Button Wood (*Conocarpus erecta*), Flambeau or Blactorch (*Erithalis fruticosa*) and the Portia Tree (*Thespesia populnea*) (Figure 3.10).

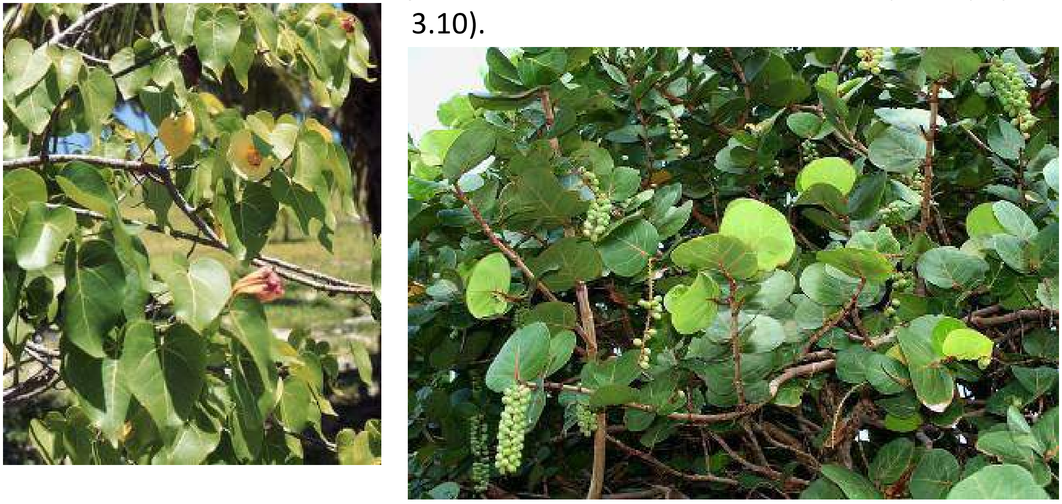


Figure 3.10 – Sea grape (Cocoloba uvifera) (right) and the Portia Tree Thespesia populnea (Left).

3.7.1.1 Mangroves

Mangroves are a different species of plants and shrubs that are highly tolerant of saline and muddy waters. Mangroves are found only in depositional environments where fine sediments, often with high organic content, collect in areas protected from high energy wave action. These areas are flooded daily by rising tides allowing the formation of large plant assemblages along inland water ways and sheltered coasts, collectively known as mangrove swamps or forests.

Around the Great Salt Pond four species of mangroves can be found; *Rhizophora mangle* (Red Mangrove), *Avicennia germinans* (Black Mangrove), *Laguncularia racemosa* (White Mangrove) and *Conocarpus erectus* (Buttonwood). See Table 3.2 for typical mangrove zonation and characteristics and Figure 3.11 for mangrove thicket locations around Pond Island.

A	Terrestrial Vegetation	Vegetation that grows on land and is intolerant of salty soil or water, such as Pepper Cinnamon (*Canella alba*), Black Loblolly (*Pisonia subcordata*), Choaky Berry (*Eugenia axillaris*), Buttonwood (*Conocarpus erectus*), and ferns.

B	White Mangrove Zone	The White Mangrove, *Laguncularia racemosa*, usually occupies the highest elevations farther upland than either the Red or Black Mangroves. Unlike its red or black counterparts, the White Mangrove has no visible aerial root systems. The easiest way to identify the White Mangrove is by the leaves. They are elliptical, light yellow green and have two distinguishing glands at the base of the leaf blade where the stem starts.
C	Black Mangrove Zone	The Black Mangrove, *Avicennia germinans,* usually occupies slightly higher elevations upland from the Red Mangrove. The Black Mangrove can be identified by numerous finger-like projections, called pneumatophores, which protrude from soil around the tree's trunk.
D	Red Mangrove Zone	The Red Mangrove, *Rhizophora mangle*, is probably the most well-known. It typically grows along the water's edge, especially around Simpson Bay. The Red Mangrove is easily identified by its tangled, reddish roots called 'prop roots'. The roots are usually exposed at low tide but covered at high tide.

Table 3.2: Typical Mangrove Zonation and Characteristics

Figure 3.11 - Mangrove Thickets Surrounding Pond Island (Shown in Green)

Mangroves are one of the most valuable natural resources on the island. Mangrove wetlands provide habitat and prime nesting and migratory sites for hundreds of bird species. Mangroves support extensive coastal food webs, provide shoreline stability and erosion prevention, and storm protection.

3.8 Terrestrial Fauna

St. Maarten, specifically the Great Salt Pond, is classified as an important breeding and nesting area for nesting birds, migratory birds, and seabirds. One hundred and seventy species of birds can be found in or around the Great Salt Pond, of which 47 are resident and nesting birds, and 123 are migrants and non-nesting visitors[23]. There are no endemic bird species on

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[23] Brown, A. C. & Collier, N. (2006). New bird records from Anguilla and St. Martin. Caribbean Journal of Ornithology

St. Maarten since birds can move easily between the islands, and there is a lack of habitat on St. Maarten, particularly undisturbed forest[24]. The following descriptions include common birds and birds of conservation interest specifically related to the Great Salt Pond.

3.8.1 Nesting Terrestrial Birds

The Green-throated Carib (*Eulampis holosericeus*), the Antillean Crested Hummingbird (*Orthorhyncus cristatus),* Lesser Antillean Bullfinch (*Loxigilla noctis ridgewayi*) and Bananaquit (*Coereba flaveola*) thrive in secondary habitats, and occasionally live close to residential areas. It is not uncommon to see these birds in backyards in sections adjacent to the MSW/IDS in areas slated for relocation. Yellow Warblers (*Dendroica petechia*) are a common species found in dry bushland and mangrove woodlands[25].

Figure 3.12 – Nesting Terrestrial Birds.

Clockwise from top left Antillean Crested Hummingbird (source: www.wbu.com), Green-throated Carib (Eulampis holosericeus) (source: www.kingsnake.com), Zenaida Dove Zenaida aurita aurita (source: www.greglasley.com), Blue-winged Teal (Anas bahamensis) (source: www.fazendavisconde.com.br), Yellow-crowned Night Heron (Nyctanassa violacea) (source: www.kingsnake.com), American Oystercatcher (Haematopus palliatus) (source: www.avesdelima.com).

Several water birds breed on the Great Salt Ponds including: White cheeked Pintail (*Anas bahamensis*), Common Moorhen (*Gallinula chloropus*),American Coot (*Fulica americana*), and the regionally endemic Caribbean Coot, all of which have been documented nesting in the Great Salt Pond [26] Yellow-crowned Night Heron (*Nyctanassa violacea*), Green Heron (*Butorides striatus*), Black-necked Stilt (*Himantopus himantopus*), Wilson's Plovers, Killdeer, and American Oystercatchers (*Haematopus palliatus*) also breed in the wetlands and mangrove areas.

3.8.2 Migratory Birds

The Great Salt Pond is an important resting place for migratory birds, where they are able to forage on their way south before traveling on. The habitat provides good food and resting

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[24] Brown, A. C. & Collier, N. (2004). New and rare bird records from St. Martin, West Indies. Cotinga. 25, 52-58.

[25] Brown, A. C. & Collier, N. (2003). Terrestrial Bird Studies on St. Martin: Winter of 2003. EPIC.

[26] Brown, A. C. & Collier, N. (2007). Terrestrial Bird Studies on St. Martin: Winter of 2007.

places for their journey. Among these migratory birds are several songbirds and many shorebirds from North America and Canada. The Great Salt Pond provides essential stopover habitat for migratory birds while they travel past the island. The migratory birds and winter guests include a number of birds of prey such as the Peregrine Falcons (*Falco peregrinus*), Northern Harriers (*Circus cyaneus*), Merlins (*Falco columbarius)* and Ospreys (*Pandion haliaetus*), all listed on CITES. The large groups of small waders passing through St. Maarten are a food source for the Merlin and the Peregrine Falcon. The survival of migrating birds of prey depends on them being able to find sufficiently large undisturbed hunting grounds and sufficient non-poisoned food.

3.8.3 Seabirds

Despite the challenges posed by the MSW/IDS Sites, several seabird species breeds surrounding the Great Salt Pond including the Brown Pelican, Roseate Tern, Sooty Tern, Bridled Tern, Least Tern, Red-billed Tropicbird, The Magnificent Frigate Bird and Laughing Gull.

Figure 3.13- Roseate Tern (Sterna dougallii dougallii) Pair, Brown Pelican (Pelecanus occidentalis) Nest on Pelican Key (source: NAFSXM)

The Least Terns (*Sterna albifrons antillarum*) nest on sandy areas surrounding the Great Salt Pond. The endangered Royal Tern (*Sterna maxima*) may breed in the area, as courtship behavior has been observed. Two other endangered Tern species, the Sandwich Tern (*Sterna sandwicensis)* and the Common Tern (*Sterna hirundo*) are seasonal visitors.

Common name	**Species**
Antillean Crested Hummingbird	*Orthorhyncus cristatus exilios*
Zenaida Dove	*Zenaida aurita aurita*
Common Ground Dove	*Columbigallina passerina nigrirostris*
Yellow Warbler	*Dendroica petechia bartholemica*
Bananquit	*Coereba flaveola bartholemica*
Caribbean Crackle	*Quiscalus lugubris guadeloupensis*

Table 3.3: Birds Found Surrounding the Great Salt Pond with Limited Distribution27

3.9 Aquatic Fauna and Flora

Very little is known about the composition, distribution and density of aquatic fauna and flora in the Great Salt Pond wetland. The invasive tilapia or Nile perch (O. niloticus) seems to be the dominant fish in the wetland followed by Mullet and Tarpon, respectively. The same goes for the possible presence of algae. Table 3.4 provides a list of aquatic flora and fauna observed during the initial assessments.

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[27] Rojer, A. (1997). Biological inventory of St Maarten, pp. http://www.mina.vomil.an/Pubs/RojerSXM-index.html. Carmabi Foundation, Curacao

Mollusca	
Flat mangrove oyster	*Isognomon alatus*
Echinodermata	
Cnidaria	
Upside-down jelly	*Casseopia xamachanna*
Porifera	
Pink mangrove sponge	*Ecteinascidia turbinata*
Black tunicate	*Ascidea nigra*
Fish	
Mojarra	*Gerres cinereus*
Juvenile schoolmaster	*Lutjannus apodus*
Juvenile barracuda	*Sphyraena barracuda*
Mangrove/grey snapper	*Lutjanus griseus*
Tilapia	*Oreochromis niloticus*
Tarpon	*Megalops atlanticus*

Table 3.4: Aquatic Flora and Fauna

Species	Common Name	Significance
Falco peregrinus	PERIGRINE FALCON	CITES Appendix I
Iguana iguana	GREEN IGUANA	CITES Appendix II
Falco sparverius caribaearum	AMERICAN KESTREL	CITES Appendix II
Larus atricilla	LAUGHING GULL	Great Salt Pond - Regionally significant stop-over site
Fulica caribaea	CARIBBEAN COOT	Great Salt Pond - Regionally significant, Near Threatened population
Circus cyaneus	NORTHERN HARRIER; HEN HARRIER	migratory stop over
Falco columbarius	MERLIN	migratory stop over

Table 3.5 Endangered and Significant Fauna

3.10 Species of Commercial Importance

No species of flora or fauna of commercial importance were identified in the Great Salt Pond. The consumption of fish, crabs or birds caught in the Great Salt Pond is discouraged by the Sint Maarten government. Signs prohibiting the consumption of fish were reported to have been placed at approaches to the Great Salt Pond.

3.11 Great Salt Pond Site: Baseline Environmental Assessment

Several baseline studies and environmental assessment have been performed in the Great Salt Pond area; some of the most relevant are included as annexes to this ESIA. These reports informs that the existing natural environs conditions of the Great Salt Pond (land and aquatic), are polluted and contaminated. In October 2019, Gallagher Bassett Technical Services (GBTS) performed the Baseline Environmental Site Assessment that included the following: a surface water assessment of the Great Salt Pond and surficial soil and vapor assessments of the area adjacent to the southeastern portion of the MSW (Blue Box Zone). EE&G was engaged to perform the assessment at the request of the NRPB based upon concerns presented during the first community consultation.

The purpose of this ESIA will only be the following activities: Design and Construction of an Access road for Weighbridge Truck Scale; Solid Waste and Landfill Management and Fire Suppression during landfill management

3.11.1 Surface Soil and Vapor Testing

The surface soil and vapor assessment was conducted within the "Blue Box" zone in Pond Island MWS/IDS (see Figure 3.14 below). The "Blue Box" zone was identified by GBTS as an area of probable PAP relocation. The scope of the preliminary surface soil and vapor assessment was prepared to meet the following objectives:

- To assess for landfill gas (LFG) that may have migrated laterally in the soils beneath the community. LFG, if present, could represent multiple risks to residents and businesses from potential explosive methane gas accumulation to the presence of Volatile Organic Compounds (VOCs) that may represent a potential exposure concern.
- To develop a preliminary baseline of soil quality in the community immediately adjacent to the MSW/IDS Sites prior to initiation of fire suppression activities.
- To preliminarily assess the soil quality and compare those data to available health-based criteria for residential and commercial exposure scenarios. This information may assist with decisions to be made regarding the potential relocation of the Project Affected Persons (PAP) located near the MSW/IDS Sites.

The sampling was performed as follows:

- LFG sampling – a total of 9 vapor wells were installed
- Soil sampling - Forty (40) soil samples were collected from a depth of 0 to 6 inches below the surface. This was considered to be the layer of soils that the public potentially could have contact with on a daily basis during normal activities. Two background soil samples also were collected in areas that were judged to represent the original fill material in the area (pre-MSW). These samples were collected from approximately 2 to 3 feet below land surface.

Figure 3.14 Soil Sampling Locations

Soil samples were sent to Pace Analytical Services in Pompano Beach, Florida for the following laboratory analyses:

- Total Arsenic, Barium, and Lead (42 samples)
- Total Zinc, Copper, Nickel, Iron and Cobalt (42 samples)
- Polynuclear Aromatic Hydrocarbons (PAHs) (42 samples)
- Polychlorinated Biphenyls (PCBs) (42 samples)
- Volatile Organic Compounds (VOCs) (42 samples)
- Total Petroleum Hydrocarbons (TPHs) (42 samples)

- Total Cadmium, Chromium, Mercury, Selenium and Silver (18 samples, from 8 residential locations, 8 commercial locations and 2 backgrounds)
- Dioxins/Furans (14 samples, from 6 residential locations, 6 commercial locations and 2 backgrounds).
- Organochlorine Pesticides (16 samples, from 7 residential locations, 7 commercial locations and 2 backgrounds)
- Organophosphorus Pesticides (16 samples, from 7 residential locations, 7 commercial locations and 2 backgrounds)
- Chlorinated Herbicides (16 samples, from 7 residential locations, 7 commercial locations and 2 backgrounds)
- TCLP Lead and SPLP Arsenic (extractions were collected from the 10 samples with highest concentrations of total lead and arsenic).

These parameters cover a wide variety of industrial-type contaminants associated with landfilling, metal recycling, auto motor work and include heavy metals, solvents, petroleum hydrocarbons, primary and secondary drinking water standards, and common elements.

Soil analytical results were compared to the Dutch Soil Remediation Circular 2009 which has established target values (D-TV) and intervention values (D-IV) for a limited number of compounds, along with Maximum Permissible Risk (MPR) values. In lieu of a defined set of cleanup criteria or any previously established Risk-Based Criteria (RBCs) for the EU or the Netherlands, the island of St. Maarten and/or the “Blue Box” Zone, EE&G has also included a comparison of soil cleanup criteria established by the Florida Department of Environmental Protection (FDEP) and the United States Environmental Protection Agency (USEPA). These criteria included the FDEP’s *Contaminant Cleanup Target Levels*, per Chapter 62- 777, Florida Administrative Code (FAC), which regulates Soil Cleanup Target Levels (SCTLs) for *residential-use direct exposure* (SCTL-R), *commercial-use direct exposure* (SCTL-C) and *leachability* (SCTL-L) concerns. The comparison criterion also included the USEPAs Regional Site Screening Levels (SSLs) established for residential (SSL-R) and commercial (SSL-C) use.

The findings and conclusions for the vapor assessment included the following:

- The vapor assessment did not identify significant landfill-type gases or VOCs in the vapor wells placed inside and outside the “Blue Box” Zone. Very low concentrations of carbon monoxide and Lower Explosive Limit (LEL) were noted in one sample location (VP-3) located in the center of the commercial portion of the “Blue Box” Zone. These results were likely from commercial activities such as automotive repair and salvaging in this area and do not appear to warrant further assessment or monitoring. Other vapor wells spread throughout the “Blue Box” Zone also had very low carbon monoxide readings, but these results did not warrant additional assessment.

The findings and conclusions for the surface soil assessment included the following:

- Surficial soils tested in the “Blue Box” Zone contained detectable concentrations of heavy metals, PCB, TPHs and dioxins/furans. The heavy metals identified above this assessments comparison criterion included arsenic, barium, cadmium, chromium, cobalt, chromium, copper, iron, lead and zinc. Of these heavy metals, elevated arsenic, copper and zinc were persistent in nearly all of the analyzed soil samples. Concentrations of heavy metals including arsenic, copper and zinc were noted in select samples above their commercial criteria and/or Dutch Target & Intervention Values.

- The source of these constituents was attributed to a combination of runoff & ash deposition from the MWS/IDS landfills, ongoing discharges from commercial activities ongoing in the "Blue Box" Zone (i.e., leaking oils/grease from stored/dumped vehicles & equipment, along with the storage and recycling of metals in the general assessment area), runoff from the adjoining Soualiga Road, the creation of the island using landfilled materials, and naturally occurring processes.
- The data was reviewed by a renowned toxicologist, Dr. Chris Teaf, Ph.D, President & Director of Toxicology of Hazardous Substance & Waste Management Research, Inc. (HSWMR), who concluded that the concentrations of arsenic, lead, PAHs, TPHs, and dioxins/furans detected in the surficial soils did not represent a major exposure concern for the existing residential and commercial uses ongoing in the "Blue Box" Zone.
- HSWMR concluded that the reported detections of copper in surface soils in the "Blue Box" Zone do not represent a major exposure concern for commercial/industrial use. However, further evaluation (e.g., residence type and location, receptor activity) may be appropriate for determining risk from copper in the residential area of the "Blue Box" Zone, although no imminent, widespread risk appeared to be evident.

Therefore, it does not appear that the PAPs are at risk with regard to the exposure concerns for the constituents tested with the exception of copper which may require further evaluation.

3.11.2 Surface Water Quality

The consulting firm EE&G performed surface water sampling of the Great Salt Pond in October 2019, which surrounds the locations that would be included in the proposed Fire Suppression Activity. The purpose of the surface water assessment was to establish baseline conditions in the Great Salt Pond prior to the initiation of activities aimed at suppressing the sub-surface fires at the MSW and Irma Debris Site.

The surface water analytical results were compared to the Maximum Allowable Concentrations (MACs) for pollutants regulated under the European Union's Environmental Quality Standards for Priority Substances under Annex I of Directive 2008/105/EC. The pollutant list within Annex I was considered limited; therefore, the results were also compared to the Florida Department of Environmental Protection (FDEP) Freshwater/Marine Surface Water Cleanup Target Level criteria (FWSWCTL/MSWCTL). This FDEP criterion was selected as the surface water within the Great Salt Pond would not be considered a potable source for drinking purposes. The criterion also was selected based on the proposed activities which may affect levels of existing contaminants. The assessment was not intended as current or potential exposure risk to individuals who use the Salt Pond for recreational purposes such as swimming or fishing.

In order to establish baseline water quality conditions within the Great Salt Pond prior to the initiation of fire suppression activities, a total of 18 samples were collected from 8 discrete locations (13 samples from the surface and 5 'deeper' samples collected from the bottom 18-inches of the pond's water column). At each sampling location, measurements of field parameters and representative water samples were collected from both the surface and the bottom of the water column. Of the 8 discrete sampling locations, 5 were located in the western portion of the Great Salt Pond and 3 background locations were located in Great Salt Pond. See Figure 3.15 for a map depicting the discrete sampling locations.

Figure 3.15 Surface Water Sampling Locations

The surface water samples generally followed the above-referenced sampling plan (there were minor modifications in some locations due to depth of water) and were analyzed for the following parameters which cover a wide variety of industrial-type contaminants associated with landfilling, metal recycling, auto motor work and include heavy metals, solvents, petroleum hydrocarbons, primary and secondary drinking water standards, and common elements:

- Perfluoroalkyl Substances (PFAS)
- Chemical Oxygen Demand (COD)
- Total Dissolved Solids (TDS)
- Volatile Organic Compounds (VOCs)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Pesticides
- Herbicides
- RCRA 8 Metals
- Aluminum, Iron, Nickel, Zinc
- Ammonia Nitrate
- Fluoride
- Chloride
- Sulfate

The surface water within the Great Salt Pond contained detectable concentrations of aluminum, copper and iron, along with Total Dissolved Solids (TDS) and chlorides. One sample also contained a detectable concentrations of PAH compounds. None of the analyzed samples were found to contain elevated values in excess of the few compounds listed in the EU's Maximum Allowable Concentrations (MACs) established in the Directive 2008/10/EC Annex 1, except for PAH compounds anthracene, fluoranthene and benzo(a)pyrene. However, the comparison criteria were limited; therefore, this result (concentrations), was also compared to the State of Florida FDEP Fresh and Marine Surface Water Cleanup Criteria, of which the aluminum, iron, copper, fluoranthene, TDS and chloride concentrations exceeded. The levels of elevated concentrations of chlorides and TDS do not appear to warrant significant concern given the saltwater/brackish environment and the amount of stormwater runoff directed into the pond. Further, a review of the field readings showed that there are typically low dissolved oxygen levels at just 1 m below surface. Given the levels of COD noted in the analytical results and the high turbidity at depths, the general water quality appears to be poor and likely the main influence in the fish kills observed during the site reconnaissance. The source of the aluminum, copper, iron and PAHs are likely the results of runoff from the MSW/IDS landfills and Soualiga Road, as well as the large metal recycling facility located east of the MSW, and also may be an indication of naturally-occurring processes.

The surface water samples also revealed high levels of total coliform bacteria and *E. coli* at levels too numerous/elevated for the laboratory to quantify. This suggests that sewage is being discharged into the Great Salt Pond.

Based upon the testing results, baseline conditions within the Great Salt Pond suggest that the water quality may have a negative impact on flora and fauna within the pond and poses a potential health risk for human recreational and/or consumptive use. Therefore fish, crabs, birds and other aquatic wildlife within and around the GSP should not be harvested or caught for human consumption.

3.13 Description of the Environment and Social Context

3.13.1 Economy of Sint Maarten

Sint Maarten is a high-income constituent country of the Kingdom of the Netherlands in the Caribbean. It occupies the southern half of an island shared with the French overseas Collectivity of Saint Martin. It is the most densely populated country in the Caribbean with a population of about 43,200 and a per capita gross domestic product (GDP) of US $25,381. The main industry of Sint Maarten is tourism with approximately 85% of the island workforce engaged in the tourism industry[28]. The restaurants, hotels, and other tourism-related sectors—including the wholesale and retail trade—the real estate, renting, and business sectors account for approximately 45 percent of Sint Maarten’s GDP. Activities in the transport, storage, and communication sector, 11 percent of GDP, are also related to the tourism sector. The tourism sector contributed 73 percent to the country’s total foreign exchange income in 2016. Sint Maarten’s harbor is a significant port for cruise tourism in the Caribbean, with 1.7 million cruise passengers visiting per year. The airport is an important hub for regional travel, with a large network of connecting flights across the Caribbean[29].

3.13.2 Demographics of the Project Affected Area

The southern half of Pond Island is comprised of residential areas, government buildings, a university, a baseball field, and various businesses. Specific businesses include but are not limited to the following: University of Sint Maarten, Sint Maarten Government Building/Census Office, Carnival Village, Telem Group, numerous bars/restaurants, scrap

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[28] https://en.wikipedia.org/wiki/CIA World Factbook

[29] Arrindell, R. (2019). Resettlement Action Plan, Red Zone, Philipsburg Landfill – draft report

yards, a pump house facility, GEBE electricity substation, Sint Maarten Festival Village Turning Point, Safe Haven, parking lots and residences.

3.13.3 Existing Traffic Patterns

Soualiga Road serves as the only access road for the MSW/IDS Sites. It runs in a north south direction across Pond Island separating the MSW and IDS. Entrances to the MSW Site from Soualiga Road are through a small narrow dirt road (Brine Drive) and an unnamed dirt road, respectively. There are no alternative roads that could be used during an emergency should Soualiga Road become unusable. Typically, the traffic laws/controls focus on adherence to the Traffic Ordinance. The traffic law restricts truck delivery of supplies from 6:30 AM to 8:30 AM and from 12:00 PM to 2:30 PM. The restriction applies every day except Sunday

3.13.4 Community Social Baseline Yellow Zone

The consulting firm RINA was contracted by the NRPB to conduct a MSW/IDS Sites neighboring communities census, (see annex H, RINA Socioeconomic survey of the Yellow Zone 2019), to be used as the social baseline and structuring the framework for the Resettlement Action Plan (RAP) for the population located in the area near the MSW/IDS Sites in the area defined as the Yellow Zone (figure 3.16). The Yellow zone is defined as a "notification zone" which may be subject to a resettlement process.

Figure 3.16 Yellow Zone Boundaries in the Terms of Reference for the Social Baseline Study

To develop the social baseline, RINA conducted a socioeconomic survey in the Yellow Zone to gather the information necessary for an initial analysis of the social and economic conditions of PAPs who may be subject to a resettlement process. The first census was conducted between May 31 and June 2, and the second between June 26 and July 2, 2019. According to the Social Baseline Study, the most significant findings from the census were:

- There were 266 Project-Affected Persons (PAP) in the Yellow Zone (195 residents; 71 non-resident workers); 98 households and 22 businesses.
- There were 18 people between 0 to 12 years old (six range from newborn to five years old).
- 13 businesses were located within residents' homes.
- 94.8% of the residences were comprised of three or fewer residents; 34.7% households had one member.
- 73.3% of the Yellow Zone population was Dominican.
- 64.10% of the residents (125) have lived in the yellow Zone more than five years.

- Spanish was the native language of 94.9% of the Yellow Zone's residents.
- Residents over six years of age indicated that they knew how to read; however, 10 of these residents indicated they did not know how to write.
- 13 people, residing in 11 households, were identified as having some level of disability.
- No formally elected or other leaders who represent the community were identified in the Yellow Zone.
- 48 of the 98 households own their home, and 50 rent.
- No minors were identified working in the Yellow Zone.

Of the 212 PAP for whom employment data was available, 41.51% worked outside the Yellow Zone; 26.42% worked in the Yellow Zone; 24.06% do not work and 7.08% were retirees.

- 20 people (14 men and 6 women), who provide income for 14 households, work in recycling related activities in the MSW Site
- 2 of the businesses located in the Yellow Zone were engaged in recycling activities.
- 80 of the 98 families (81.63%) said they would be willing to be resettled.

The Social Baseline Study gathered information regarding living conditions and human development profiles of the residents. Below is a summary of information presented in the report (an in-depth presentation of this information can be found in the report):

- Household size: The average number of residents per household was 1.98, with the majority having three or fewer residents.
- Electricity – Electricity was available to 93.88% of the residents.
- Potable Water – Access to a separate water connection was available in 69.39% of the residences and 24.49% share water supply with their neighbors.
- Sanitation – Sewer service was reported in 2.04% of homes and 96.94% were connected to septic tanks.
- Education – Of the residents over the age of 3 years, 7.85% had some level of post-secondary education, 41.36% had some level of secondary education and 29.32% had elementary education.
- Work Status - Of the 212 PAP for whom employment data was available, 41.51% worked outside the Yellow Zone; 26.42% worked in the Yellow Zone; 24.06% do not work and 7.08% were retirees.
- Economic Wellbeing - 50 of the 98 households have income below $850 USD/month, which is the World Bank reported minimum wage for Sint Maarten in 2017.

10 of the 98 households reported they have other homes; only two specified their location, both in Santo Domingo. 48 of the 98 households are owned, and 50 are rented.

In the Resettlement and Livelihoods Restoration Policy Framework prepared by NRPB (2021), informs that a visual assessment of the MSW landfill/dump in 2018, identified potential instability in the dump sites slopes that would require recontouring, representing a substantial risk to nearby communities. For this purpose, a specialized consulting firm evaluated the conditions and recommended the establishment of a No-Work Zone (see annex

C, and figure 3.17 bellow, and states: "…Based on the limited data available, SCS has estimated an area of concern where there should not be any recontouring efforts until additional investigations have been conducted or relocation of residents has been completed. Activities that should not be conducted include excavation of waste, placement of relocated waste, fire suppression that involves injection of water/grout, and placement of new waste (to name a few). The attached figures show the recommended area of concern and "No Work" zone."

Figure 3.17 No Work Zone, as recommended by SCS Engineers April 22, 2020

The 2018 assessment furthermore determined that a radius of 300 feet from subsurface fires should be identified as the most critically affected community in case fires would reach the surface

The preliminary results of the onsite evaluations, identified two potential risks to the nearby communities: i) **community health risks due to the smoke from the sub surface fires**. For this purpose, a specialized service was contracted with Dutch National Institute for Public Health and the Environment (RIVM) to do an Air Monitoring Study (2019) is presented in annex F. According to the survey contracted conclusion is:

"…on the basis of these measurements, no conclusions can be drawn about the possible substances released in the event of an open fire. The following conclusions are based on the "no open fire conditions" scenario:

- In the two weeks during which measurements were taken, only a few substances were found in low concentrations.
- For aluminum, some of the measured concentrations exceeded the health-based guideline value for chronic exposure.
- In the unlikely case all chromium would be Cr(VI), some of the measured concentrations exceeded the health-based guideline value for chronic exposure.

However it is assumed that most chromium would be Cr(III) since that form is more stable in the environment. In that case, no health-based guideline value are exceeded.

- Por PAHs, the concentrations found in the dust wipe samples exceeded the health-based guideline value for lifelong daily intake. PAHs are emitted as a result of fires, but are also emitted through combustion gases of vehicles.
- Odour was detected by the field team. Odour nuisances can be source of health complaints by the populations
- RIVM has detailed information about background concentrations for different components in the Netherlands, but no information on the background concentrations for Sint Maarten. This study provides an initial insight into these background conditions”

3.13.4.1 Community Census of the Resettlement Area of Impact

A smaller portion of the Yellow Zone was identified as an area where resettlement would be required; this area was designated as the Blue Box Zone and a later in the process the Resettlement Area of Impact.

Figure 3.18 The Blue Box Zone

Figure 3.19 The Resettlement Area of Impact

The World Bank policies require the preparation of a Resettlement Action Plan (RAP) for the Resettlement Area of Impact. As specified by the OP/BP 4.12, resettlement applies not only to cases of physical (locative) displacement of population but also to economic displacement when peoples´ livelihoods are significantly affected by a project. RINA and NRPB conducted a census and assets inventory in the Resettlement Area of Impact to collect information about affected households and businesses in November 2020, May 2021, and July-September 2021. The summarized field findings for the Resettlement Area of Impact is presented in table 3.6 below:

#	Item	Number
Affected populations		
1	Individuals	215
1a	- *Adults*	*179*
1b	- *Children*	*36*
2	Households	**123**
2a	- *Residential*	*97*
2b	- *Residential and commercial (mixed)*	*26*
3	Vulnerable households	47
Affected businesses & income		
4	Commercial units	32
4a	- *Businesses*	***6***
4b	- *Residential and commercial (mixed)*	*26*
5	Employees	13

#	Item	Number
6	Off-site landlords	**12**
7	Individuals with landfill-related income	34

Table 3.6 Summary of the Resettlement Area of Impact Census. Affected households and businesses

4.0 Assessment of Environmental and Social Impacts and Risks

In this section each of the project components and associated activities related to:

- Installation of a weighbridge, supportive infrastructure and access road to the MSW landfill for waste management
- Daily management of MSWS and IDS landfill operations including fire Suppression and Slope recontouring
- Final closing of MSWS and IDS landfills

Have been assessed for potential environmental and social impacts and risks.

These activities have been assessed to determine any direct and indirect impacts between them and the nearby environmental resources and people, communities and businesses. The ESIA also predicts and quantifies to the extent possible the magnitude of impacts and risks for each of the project activities. For this ESIA, magnitude of impacts and risks are based on the following considerations:

- Type of impact (positive or negative)
- Nature of the change (what is affected and how)
- Size, scale, or intensity (low, moderate, significant)
- Duration and/or frequency (e.g., temporary, short term, long term, permanent)
- Cumulative (yes or no)

The magnitude describes the actual change that is predicted to occur and in the case of adverse impacts is ranked from low, medium to high. It is also imperative to identify positive impacts. The Environmental and Social Impact and Risk Assessment is presented in Table 4.1

4.1. Environmental and Social Impact Assessment

The content and extent of the environmental and social impacts which needed to be addressed in this ESIA have been identified through research and scoping. This helps to ensure that the environmental information used for decision making provides a comprehensive picture of the effects of the project, including issues of particular concern to affected groups and individuals.

Meetings, special studies and consultations were carried out to ensure that comprehensive information was available on the involved stakeholders and their interests in the fire suppression planning. Particular attention was paid to the potential risks that the stakeholders' interests created for the planning, construction and management of a fire suppression project at the MSW/IDS Sites at Pond Island.

The potential environmental and social impacts and in another section the recommended mitigation measures will be addressed as well.

4.1.1 Community Resettlement[30]

Fire suppression and re-grading activities, conducted by VROMI in 2018 and 2019, resulted in a reduction in the number of subsurface fires and an apparent improvement of the slope stability. According to a 2020, EE&G and Hammer Consulting site survey and despite the re-grading activities performed by VROMI, the stability of the slopes surrounding the MSW site, do not meet industry-accepted design criteria. Other factors, such as non-homogenous waste composition, compacting, presence of voids related to sub-surface fires or decomposition, may contribute to instabilities that cannot be detected.

Based upon internationally accepted best practices and the social and environmental assessments of the MSW/IDS Sites and the surrounding communities, the implementation of a RAP, and the subsequent relocation of the community located adjacent to the southeastern portion of the MSW remains necessary. Where it was recommended to perform Works in two phases, as discussed in Section 1.2.6.2, following the establishment of a No Work Zone, and due to concerns regarding slope stability, activities within the No Work Zone should be prohibited until members of the community within the RAI have been relocated. Priority for relocation should be given to those residents and businesses located near the SE slope of the MSW.

This action will generate disruptions of existing daily activities on families and businesses located within the resettlement area, focused to be within the RAI. Business owners, who are forced to resettle, will risk losing customers and operation hours. Residents within the RAI that make a livelihood working in the MSW/IDS Sites namely material salvagers (waste pickers) that gather recyclables, could potentially be forced to seek employment elsewhere.

No safeguards policies relating to land acquisition and/or resettlement will be triggered for off-island processing of material and/or waste management. Off-site processing – or waste management facilities used by the Contractor, will be operating in accordance with applicable certifications. The Contractor will provide a letter confirming to the NRPB that there will be no land acquisition and/or resettlement impacts, as per OP4.12, at any of the sites where they will be operating or at any of the off-island sites where material will be transported to.

Economic displacement

The MSW and IDS landfills are operated by the Ministry of VROMI, based on the National Decree on the organization of the Ministry of VROMI. Certain companies have access because they are contracted for heavy equipment, concrete crushing and security services. Although there is no written access policy in place, the community is allowed to dispose waste during opening hours. No formal access is currently granted to individuals to conduct any waste picking activities and/or collecting

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[30] Refer to final RAP for the most up-to-date information on resettlement. The RAP can be found at: https://nrpbsxm.org/resettlement/

recyclables at either location, due to health and safety reasons. There is 24/7 security in place. However, it is expected that waste picking is currently taking place on an informal basis.

The Landfill project is associated with specific social impacts, such as the community resettlement described in the paragraph above and, furthermore, livelihood disruption of individuals involved in waste picking. Individuals that are currently residing in the RAI or outside the RAI involved in waste picking at the MSWS and/or IDS, , will be included in the RAP for the Landfill project and the Livelihood Restoration Plan.

Currently 34 persons in the RAI and 7 persons outside the RAI as identified in the waste pickers census carried out in October 2021 are generating income from waste picking/recycling. The impact on any other, currently unidentified, waste pickers residing outside the RAI, and associated mitigation measures, will be elaborated on in the Landfill ESMP.

The review of existing legislation and policies and drafting of policies regarding the operation of and access to the MSWS and IDS, fall outside the current scope of EDMP.

Potential specific social impacts as a result of the MSWS and IDS Landfill management project

- Resettlement

Impacts of relocation of individuals and mitigation measures are described and managed through the RAP, as described above in the section ‘community resettlement’.

- Potential livelihood disruption of waste pickers on the MSWS and IDS

- Waste pickers living in the RAI

Impacts and mitigation measures for potential livelihood disruption of residents of the RAI are described and managed through the RAP and LRP.
Individuals living in the RAI and outside the RAI, that are generating income from waste picking, are reflected in the RAP. The final version of the RAP indicates if, and which, persons living in the RAI are facing economic displacement due to the landfill project.

As per the waste pickers census carried out in October 2021, there are 34 individuals living inside the RAI and 7 individuals living outside the RAI that generate part of their income from recycling landfill materials, although they do not operate commercial businesses based on this activity. They include retirees and unemployed individuals, and other employed individuals who rely on this as a source of supplementary income.

As per socio-economic surveys caried out in November 2020 and field work in July-September 2021, it was determined that the income for landfill materials is only a supplementary income, individuals practice waste picking in their free time. Individuals who are practicing this activity do have other reliable sources of income, for example: providing cleaning services outside the RAI, construction services (or being construction workers), working for electrical equipment repair shops. Additionally, some PAPs make use of landfill materials for other purposes (e.g. salvaging parts from discarded electronic equipment for other uses) that are difficult to quantify.

As a result, the compensation to be paid to the individuals who rely on the landfill for all or part of their income will be standardized, according to the minimum wage of USD 4.9 per hour. Considering that the households will be compensated for a total loss of six months (160 hours of full-time work per month), the amount to be compensated per individual is USD 4704.00.

This compensation for six month is planned to cover the loss of supplementary incomes of these individuals. During this period of time they will be provided with the opportunity to participate in the livelihood restoration activities (vocational training) which will enable them to find other employment or job opportunities to cover for the loss of their supplementary income and restore their livelihood to pre-project level.

- Waste pickers living outside of the RAI

The current informal access policy to the MSWS and IDS, and enforcement thereof, might be impacted due to the start of the works and environmental, health and safety considerations. The entity managing the MSWS and IDS will be responsible for ensuring safety of persons on site.
Persons currently involved in waste picking or recycling, might face economic displacement, due to the changing of access policy (or enforcement thereof) of the MSWS and IDS and potential competition for waste materials. In principle, this is expected to be regulated by applicable legislation and policies. The responsible entity therefore, being VROMI and in the future (a) Contractor(s), will manage access to the MSWS and IDS. As such, the potential social impacts and/or ecconomic displacement on waste pickers residing outside of the RAI, will be described in the Landfill ESMP, the RAP and LRP.

4.1.2 Air Emissions. Smoke/Fumes

Based upon the findings of the initial air screening activities conducted in August 2018 as well as the prevailing easterly winds, the potential exists for the emissions from the existing subsurface fires to negatively impact the landfill employees in case of direct exposure.

The fire suppression activities may result in increased emissions from the site that represent potential inhalation and skin contact hazards to the fire suppression contractor employees, government and landfill contractor employees working at the MSW and IDS Site, visitors and the resident population in the surrounding communities. The fire suppression methods chosen to be implemented will impact the magnitude of potential air emissions exposure scenarios.

4.1.3 Odor

Site reconnaissance of the MSW and IDS Site and surrounding neighborhoods, conducted by EE&G in 2017, 2018, and 2019, revealed that the smoke associated with the MSW and IDS Site fires had a strong smell that can be described as acrid, or that of burnt rubber or plastic. Odors of this nature are often indicative of COCs or nuisance odors that could be annoying to residents, commercial businesses, and landfill employees living and working in the immediate vicinity of the SXM MSW and IDS Site. Odor nuisance can also be a source of health complaints by the population. Mitigation measures to minimize the impact of odor during fire suppression activities would mirror those measures implemented for smoke (see Section 7.2.1).

The concept of nuisance odor indicates that the human nose can detect odors at concentrations far below where a health exposure risk is present; therefore, the presence of odors downwind of the MSW and IDS Site does not correlate to a public health concern. The presence of an odor does not make exposure to a certain chemical a health risk; it is the concentration of the chemical in the air that makes the determination of whether it is a health risk or not. Nuisance odors may cause sensitivity reactions in susceptible individuals.

4.1.4 Dust

Site reconnaissance of the MSW and IDS Site, and surrounding neighborhoods, conducted by EE&G in 2017, 2018, and 2019, revealed that dust control practices were minimal. Dust was most visible at work/landfilling locations and on vehicular roadways. When regrading and waste movement/mining activities commence, an increase in vehicular traffic both on the MSW Site as well as Soualiga Road and Brine Road will result in the generation of additional dust particles in the air.

4.1.5 Landfill Gases

Landfill gas emissions are common from the decomposition of landfill waste, primarily in the form of methane, an odorless, explosive gas. In addition, other gases that are typically considered harmful at elevated concentrations may be released from the burning waste and contained within landfill gasses.

4.1.6 Noise

Noise generated from landfilling activities as well as traffic has impacted the residential and commercial properties immediate adjacent to the MSW site for approximately 30 years. Much of the noise generated comes from the waste transport vehicles entering and leaving the MSW and IDS Site, as well as onsite landfill equipment vehicles and machinery.

4.1.7 Roads and Traffic

Soualiga Road serves as the only access road for the MSW and IDS Site. It runs in a north south direction across Pond Island separating the MSW and IDS Site. Entrances to the MSW and IDS Site from Soualiga Road are through a small narrow dirt road (Brine Drive) and an unnamed dirt road, respectively. In order to be protective of health and safety of the community members, consideration should be made to control access to Soualiga Road from the south end of the RAI to the north end of Pond Island.

Typically, the traffic controls focus on adherence to the Traffic Ordinance. The traffic ordinance restricts truck delivery of supplies from 6:30 AM to 8:30 AM and from 12:00 PM to 2:30 PM. The restriction applies every day except Sunday.

4.1.8 Geology and Soils. Slope Stability

Due to the absence of significant slope stability testing and analysis, the consultants and engineers participating in this project will not be able to opine with confidence as to the stability or potential for the slopes to move or collapse. There simply are too many variables and unknowns regarding the composition of the waste, and the possibility for voids to have been created by subsurface fires or waste decomposition.

4.1.9 Soil Impacts in the Blue Box Zone

The community within the RAI is at greatest potential risk from soil impacts related to the slope stability of the MSW Site. In addition, the RAI also represents the area that has the greatest likelihood to have been impacted by historic landfilling activities and landfill fires in the IDS. Due to prevailing winds, impact from fires at the MSW on the RAI have been limited.

Data collected and summarized in Section 3.11 did not reveal the presence of significant concentrations of COCs in the soil samples collected within the Blue Box Zone, with the exception of copper, which may require further evaluation. In addition, an increase in the air emissions associated with the proposed activities would undoubtedly increase the amount of dust particles accumulating in the Blue Box Zone which in turn could result in soil impacts. Therefore, mitigation measures to minimize the soil impacts in RAI during any fire suppression activities will be the same measures described in Section 4.1.2 on Air Emissions.

4.1.10 Hydrogeology, Hydrology, and Surface Water Quality

The initial design of the MSW site did not include a liner system, leachate system or stormwater controls. Because the MSW does not have a liner system, the waste comes into direct contact with the underlying soil and therefore the groundwater. In addition, when hurricane debris was placed at the IDS following Hurricane Irma, no drainage systems were put in place.

Rainfall that infiltrates into the MSW and IDS Site is filtered through the waste and can mobilize chemicals that may be present within the waste, affecting the groundwater. Additionally, because the MSW and IDS Site is located on an island, the groundwater on the island eventually may migrate directly into the surrounding body of water, the Great Salt Pond.

In addition to groundwater discharge, the stormwater originating from the MSW and IDS Site also discharges directly to the Great Salt Pond. Site reconnaissance, conducted in 2019 identified several stormwater discharge points along the perimeter of the MSW and IDS Site directly into the Great Salt Pond.

During a landfill fire, because of the diversity and chemical composition of waste in general, hundreds or more compounds can be produced and released into the environment. In addition, firefighting activities such as the application of water and foam generate runoff that can mobilize and transport contaminants to sensitive receptors as well as generate more contamination. The dispersed contaminants, transported as leachate from soils, can have adverse impacts on humans, flora, and fauna.

Many common landfill waste materials can burn into incomplete combustion including polychlorinated dioxins and furans as well as other carcinogenic organic compounds (PAH) that remain in the soil after fires has been extinguished or burned out. These compounds may then leach into groundwater and/or discharge into surface water bodies, depending on how effectively surface runoff and landfill leachate discharges are controlled.

A common method for suppressing landfill fires is the application of firefighting foams. These foams come in a variety of forms that may contain Per- and Polyfluoroalkyl substances (PFAS), which have been identified in the United States as contaminants of emerging concern because they may pose potential environmental and/or public health risks.31 Even disregarding toxicity, foaming agents that discharge into surface water can have other adverse and even fatal impacts on aquatic species. The foaming agents decrease the oxygen content of water by forming a thin cover/layer on the water surface, limiting the potential of gas exchange.

Without proper control of runoff and leachate, rainwater has the potential to transport pollutants from the landfill to the Great Salt Pond and subsequently the Great Bay Area/ the ocean.

4.1.11 Ecology

The ecological environment of the Great Salt Pond is under stress due to overdevelopment of the surrounding areas. The Great Salt Pond is impacted by sewage runoff from the surrounding neighborhoods. In addition, stormwater runoff and groundwater, originating from the MSW and IDS Site, discharges directly into the surrounding Great Salt Pond. This can have adverse impacts on existing flora and fauna.

The proposed fire suppression activities have the potential to increase both airborne emissions and surface water discharges to the surrounding terrestrial and marine environments. In addition, COCs detected in the airborne environments can affect the terrestrial fauna, specifically: nesting birds, migratory birds, and seabirds, while the surface water discharges to the Great Salt Pond have the potential to materially impact the terrestrial and aquatic flora and fauna.

4.1.12 Worker Health and Safety

EE&G performed air testing at the MSW Site in August 2018 (a summary is presented in Annex G) to obtain a general understanding of what COCs were present in the smoke plumes emanating from the subsurface fires. The following COCs exceeded the exposure limits in at least one of the locations tested : Carbon Monoxide, PM2.5, VOCs – Benzene, Hydrogen Sulfide, PAH (All), Acenaphthylene, Benzo(a)pyrene, Ozone, and Dioxin/Furans (TCDD TEQ). The current MSW and IDS Site workers, material salvagers as well as future fire suppression, re-sloping, drilling workers and site visitors are at risk for exposure to hazardous air emissions. As the fire suppression activities commence onsite, there is potential for an increase in the amount of hazardous air emissions. Further, the non-homogenous nature of the waste and potential hot spots that may be encountered, could result in flare-ups at any time during the project.

In addition, the presence of landfill gases such as methane and other chemicals disposed of within the MSW and IDS Site could lead to explosions or spontaneous combustion, therefore putting not only the health and safety of site personnel at risk, but also the stability of the MSW and IDS Site. The burning subsurface fires increase landfill instability by increasing subsurface void spaces as material is consumed by the fire. The voids can cause surface settlement and cracks. These voids place landfill workers and fire suppression workers at risk should portions of the landfill fail.

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[31] https://www.nj.gov/dep/srp/emerging-contaminants/

An increase in vehicular traffic as fire suppression activities commence at the MSW and IDS Site sites will increase dust and the risk of potential accidents both at the MSW/IDS Sites and the surrounding roadways.

Fire suppression activities, specifically excavation and recontouring, have the potential for attracting pests at the MSW and IDS Site. In addition, in extreme cases, it is possible that the fires could cause pests such as rats to evacuate the site and seek shelter at nearby businesses and residences.

4.1.13 Public Health and Safety

Based upon EE&G's 2018 Air Screening Report, and subsequent site reconnaissance in 2019, EE&G took a conservative approach to neighborhood safety zone designation that minimizes the potential (to the extent reasonably feasible) for residents and businesses near to and adjacent to the MSW and IDS Site to be exposed to concentrations of COCs at levels that exceed applicable exposure criteria.

Based on a preliminary risk analysis, the Fire Suppression Exclusion Zone is defined as 300 feet and the Caution Zone as 1000 feet in any direction from the toes of both the MSW and IDS Site, along which it is assumed that fires may exist. The zones were further adjusted for easterly prevailing wind directions. In addition, as the proposed fire suppression activities commence onsite, there is potential for an increase in the amount of hazardous air emissions.

The burning subsurface fires increase landfill instability by increasing subsurface void spaces as material is consumed by the conflagration. The voids can cause surface settlement and cracks. These voids place the residences and businesses immediately adjacent to the MSW should portions slide slopes fail.

An increase in vehicular traffic as fire suppression activities commence at the MSW and IDS Site will increase dust and the risk of potential accidents both at the MSW and IDS Site and the surrounding roadways.

Based upon the recent studies (discussed in Section 4.2) as well as site reconnaissance, EE&G took a conservative approach with regard to public health and safety. The intent is to minimize the potential for residents and businesses in close proximity to the MSW and IDS Site to be exposed to concentrations of COCs at levels that exceed applicable exposure criteria, minimize the risk of public health impacts, traffic accidents, etc.

Also, the issues on COVID-19 Pandemic, with the impact that is obliged to implement all reasonable precautions to protect the health and safety of all workers. This applies also to subcontractors. For the purpose to address the Pandemic declared due to COVID-19, there are the following procedures to follow, in accordance with Center for Disease Control and Prevention (CDC): Guidance for Construction Workers: Construction COVID-19 Checklists for Employers and Employees. Construction COVID-19 Checklists for Employers and Employees | CDC, issued on January 26, 2021

4.1.14 Aesthetic Affects

There are no known objective methods to measure aesthetics; however, the impacts of the ongoing subsurface fires at the MSW and IDS Site sites cannot be understated and have negatively impacted the aesthetic nature of Philipsburg and the Great Salt Pond. The extinguishing of the subsurface fires at the MSW and IDS Site will be a significant aesthetic improvement to the island, the enhancement of which would greatly improve opportunities for tourism.

4.1.15 Archaeological, Historic, and Cultural Heritage

The Great Salt Pond was historically used for salt production, and much of the early development and of St. Maarten centered on the salt production and export industry. The suppression of the subsurface fires at the MSW and IDS Site could aid in the preservation of the historical and cultural significance of The Great Salt Pond.

4.1.16 Natural Disaster Risk

The extinguishing of the subsurface fires and stabilization of the landfill slopes at the MSW and IDS Site could mitigate a potential risk of slope collapse in the event of a significant wind and rain event that could result in the transport of debris and/or potential contaminants to the surrounding environment. The suppression of the subsurface fires and subsequent improved management of the MSW and IDS Site would allow for better disaster debris management.

Table 4.1 Environmental and Social Impact and Risk Assessment

Impact Category	Potential Impact	Type of impact (+) Positive (-) Negative	Scale Low=L Moderate= M Significant=S	Duration/ Frequency Short term= ST Long term = LT Permanent =P	Cumulative Yes No	Mitigation/ Management Necessary	Impacts		
							Before FS/SR[32] Activities	**During FS/SR Activities**	**After FS/SR Activities**
Community Resettlement	Impacts of land acquisition (RAP) on households	-	S	ST	N	yes	Significant	Significant	TBD
	Impacts of land acquisition (RAP) on local businesses	+	S	ST	N	yes	Significant	Significant	TBD
	Impacts on local social structure	+	S	ST	Y	yes	Significant	Significant	TBD
	Impacts on local employment	+	S	ST	Y	yes	Significant	Significant	TBD
Economic displacement	Impacts of landfill management on waste picking activities and livelihood of waste pickers	-	M	LT	N	yes	Slight or none	Moderate	TBD
Air Quality	Smoke impacts	-	M	LT	Y	yes	Moderate	Significant	Positive
	Odor impacts	-	M	LT	Y	yes	Moderate	Significant	Positive
	Dust impacts	-	M	LT	Y	yes	Moderate	Significant	Positive
	Landfill Gasses	-	M	LT	Y	yes	Moderate	Significant	Positive
Roads and Traffic	Existing traffic loading and traffic congestion	-	M	LT	Y	no	Moderate	Moderate	Moderate
	Increased traffic loading and traffic congestion during fire suppression activities	-	M	LT	Y	yes	Slight or None	Significant	Slight or None

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[32] FS = Fire Suppression/ SR = Slope Recontouring

Impact Category	Potential Impact	Type of impact (+) Positive (-) Negative	Scale Low=L Moderate= M Significant=S	Duration/ Frequency Short term= ST Long term = LT Permanent =P	Cumulative Yes No	Mitigation/ Management Necessary	Impacts		
							Before FS/SR[32] Activities	During FS/SR Activities	After FS/SR Activities
	Air quality impacts from vehicle emissions	-	L	LT	Y	yes	Slight or None	Moderate	Slight or None
	Traffic noise	-	M	LT	Y	yes	Moderate	Significant	Moderate
	Traffic Accidents	-	L	ST	N	yes	Slight or None	Moderate	Slight or None
	Littering and cleanliness during waste transit	-	M	LT	Y	yes	Moderate	Significant	Moderate
Noise	Noise arising from operation of IDS and MSW	-	M	LT	Y	no	Moderate	Moderate	Slight or None
	Noise from vehicle and equipment operations	-	M	LT	Y	yes	Moderate	Significant	Moderate
	Noise arising from fire suppression activities	-	L	ST	N	yes	Slight or None	Significant	Slight or None
Geology and Soils	Impacts from slope instability Soil	-	S	LT	Y	yes	Significant	Significant	Slight or None
	Impacts in Blue Box Zone	-	M	ST	Y	no	TBD	TBD	TBD
Hydrogeology, Hydrology, and Surface Water Quality	Existing runoff, leachate, and groundwater discharges to the Great Salt Pond from the MSW/IDS	-	M	LT	Y	no	Moderate	Moderate	Positive
	Increased runoff and leachate discharges to the Great Salt Pond from MSW/IDS Sites during fire suppression activities	-	L	LT	Y	yes	Slight or None	Significant	Slight or None

Impact Category	Potential Impact	Type of impact (+) Positive (-) Negative	Scale Low=L Moderate= M Significant=S	Duration/ Frequency Short term= ST Long term = LT Permanent =P	Cumulative Yes No	Mitigation/ Management Necessary	Impacts		
							Before FS/SR[32] Activities	**During FS/SR Activities**	**After FS/SR Activities**
	Increased suspended sediment loading and runoff post fire suppression activities	-	M	LT	Y	yes	Moderate	Significant	Slight or None
Ecology	Loss of biological habitats	-	M	LT	Y	yes	Moderate	Significant	Slight or None
	Extension of habitats (buffer zones)	-	L	LT	Y	no	Slight or None	Significant	Positive
	Creation of new habitats (post-fire suppression activities)	-	L	ST	Y	no	Slight or None	Slight or None	Positive
Worker health and safety	Direct exposure to hazardous material	-	M	LT	Y	yes	Moderate	Significant	Positive
	Exposure to smoke/dust emissions	-	M	ST	Y	yes	Moderate	Significant	Positive
	Accidents during fire suppression activities	-	L	ST	Y	yes	Slight or None	Significant	Slight or None
	Exposure to vermin acting as disease vectors	-	M	LT	Y	yes	Moderate	Significant	Positive
	Risk of traffic accidents	-	M	LT	Y	yes	Moderate	Significant	Slight or None
Public Health and Safety	Direct exposure to hazardous material	-	L	LT	Y	yes	Slight or None	Slight or None	Positive
	Slope instability and potential collapse	-	S	S	N	yes	Significant	Significant	Positive

Impact Category	Potential Impact	Type of impact (+) Positive (-) Negative	Scale Low=L Moderate= M Significant=S	Duration/ Frequency Short term= ST Long term = LT Permanent =P	Cumulative Yes No	Mitigation/ Management Necessary	Impacts		
							Before FS/SR[32] Activities	During FS/SR Activities	After FS/SR Activities
	Exposure to smoke/dust emissions	-	M	LT	Y	yes	Moderate	Significant	Positive
	Exposure to vermin acting as disease vectors	-	M	LT	Y	yes	Moderate	Significant	Positive
	Risk of traffic accidents	-	M	LT	Y	yes	Moderate	Moderate	Positive
	COVID 19 Pandemic	-	S	LT	Y	yes	Significant	Significant	Significant
Aesthetic	Current effects of subsurface fires and fire suppression activities at MSW/IDS Sites upon visual amenity	+	M	LT	Y	yes	Moderate	Significant	Positive
Archaeological, Historic, and Cultural Heritage	Neglect of the historical and cultural significance of The Great Salt Pond	-	L	LT	Y	no	Slight or None	Slight or None	Slight or None
Natural Disaster Risk	Additional instability of the landfill slopes in the event of a significant rain and wind event	-	M	ST	Y	no	Moderate	Moderate	Moderate

In summary, this ESIA has identified forty (40) potential impacts; four (4) positive and thirty-six (36) negative; seven (7) significant, twenty-four (24) moderate and nine (9) of low importance; seven (7) are non-mitigable and thirty-three (33) are mitigable. An Environmental and Social Management Plan (ESMP) is being prepared to address and resolve these potential impacts identified in this ESIA

5.0 STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS PLAN

Introduction

This Stakeholder Engagement and Communications Plan (SECP) sets out the approach that NRPB will follow in order to engage and communicate with stakeholders over the life of the Project. Consultation is undertaken in order to interact and incorporate the viewpoints of Affected Parties. Special consideration will be given to vulnerable groups. A stakeholder engagement plan for resettlement will be developed in the context of preparation of the RAP. Overall, stakeholder engagement is organized as follows:

5.1 Objectives of Stakeholder Engagement

The activities of engagement are guided by good international industry practice, as well as all applicable laws and regulations in Sint Maarten. The objectives of stakeholder engagement, outlined in this plan, are to:

- Promote the development of respectful and open relationships between stakeholders and the Project proponent and other relevant parties during project phases;
- Identify Project stakeholders and understand their interests, concerns and influence in relation to Project activities, particularly during the construction and operational phases;
- Provide stakeholders with timely information about the Project, in ways that are appropriate to their interests and needs, and also appropriate to the level of expected risk and potential adverse impacts;
- Support alignment with financing standards and guidelines for stakeholder engagement, as necessary in the pre-construction phase; and
- Record and resolve any grievances that may arise from Project-related activities through a Grievance Mechanism.

5.2 Stakeholder Engagement Plan

5.2.1 Stakeholder Analysis

Stakeholders and Affected Parties of the Project were identified based on the following information:

The consulting firm RINA was contracted by the NRPB to develop a Stakeholder Engagement Planand a Resettlement Action Plan for MSW/IDS Sites neighboring community resettlement. The following stakeholders were identified during the Stakeholder Engagement Plan development:

- Resettlement Project Affected Communities – Project Affected Persons within resettlement area of impact, Pond Island residents outside RAI, Host community (not yet identified)
- The executive branch of the Government of Sint Maarten – Sint Maarten Council of Ministers, Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI), Ministry of Public Health, Social Development and Labor (VSA), Ministry of Youth, Culture and Sport, Ministry of Tourism, Economic Affairs, Transport and Telecommunications, Ministry of Finance, Ministry of Justice
- The legislative branch of the Government of Sint Maarten – Parliament of Sint Maarten

- Project Proponents and Project Funders – World Bank, Government of the Netherlands, National Recovery program Bureau
- Civil society organization, NGOs
- Media
- Greater population of Sint Maarten (island-wide community)

Project Affected Persons within the resettlement area of impact were identified during the census and asset inventory in November 2020, May 2021, and July-September 2021. The census and asset inventory were carried out by the consulting firm RINA and NRPB.

5.2.2 Stakeholder Engagement Methods and Materials

The engagement process encourages meaningful participation by stakeholders. The Project Proponent will employ a range of methods and channels for disclosing information in order to tailor disclosure to the interests and needs of the various stakeholder groups and will also produce materials appropriate for specific stakeholders and types of engagement. This may include typical disclosure and engagement methods, such as:

- Local Newspaper Articles, Radio, Television Pieces, or Digital Media – Used to convey information to local audiences about proposed Project activities and progress (particularly relevant for any future offshore construction work).
- Internet/Website - Used to promote information or invite stakeholder queries and comments via email.
- Grievance Mechanism - Used by the public to obtain information, ask questions or report and get responses to grievances.
- Public Education, Outreach - use the general public and media outreach efforts as described in Section 4 to raise awareness on key issues of the Project, specifically.

The stakeholder engagement process includes two-way targeted engagement related to specific potential Project impacts. However, engagement activities will continue to be organized around specific topics of interest and known concerns of stakeholders.

Feedback mechanisms are adapted to suit the needs and preferences of different stakeholders and their physical locations. A Grievance Mechanism will be established to provide a dedicated mechanism for interested stakeholders to provide Project-related feedback

5.2.3 Communications Plan

The Communications Plan (CP), defines the communications goals and methods that the Project Proponent (the Government of Sint Maarten) and the selected construction and operations firm will pursue in order to communicate with stakeholders throughout the life of the Project. This plan sets out a framework to ensure consistent, efficient project communication throughout the Project planning and implementation process. In view that the construction firm has not yet been selected, some elements are not yet possible to define, thus the CP should be considered a 'living' document, and should be developed and refined progressively, with updates incorporated as the Project is further defined and implemented.

5.2.4 Objectives

It is important that communication with the public about the Project is consistent and easily understood by diverse audiences. Interest and knowledge levels will vary greatly – from highly-engaged individuals and organizations, to members of the general public that have limited familiarity and/or information about projects with impact on (social) environment. Regardless of the interest and knowledge level of any individual, the objective is to provide easily digestible and practical information for the public to augment a smooth Project implementation process.

5.2.5 Communication Goals

The specific goals of this CP are to provide a guide to:

- Proactively engage stakeholders with up-to-date information regarding Project development, construction timeline, and any changes in scope or delays
- Stress the Project's commitment to minimal disruptions to daily life in Sint Maarten and adherence to Project construction timeline
- Establish public trust through credible, consistent, and open communication
- Provide a variety of information tools and points of contact to satisfy a diverse public audience

5.2.6 Key Messages

This section will include key Project messages. Messages should address the following themes and/or categories:

- Project benefits for Sint Maarten and its future resilience
- Public involvement opportunities
- Key actors (VROMI, NRPB, Contractor(s) when identified)
- Other Stakeholders

Key messages should be developed internally and socialized with all Project staff as required for the audiences they might encounter such as upper management and Project Spokespersons, to construction site supervisors and social outreach team members.

5.2.7 Communication Methods

Communication methods should be developed to convey information to target audiences and the public at large, maintain consistent messaging, and provide the public with the opportunity to offer feedback. Potential platforms and materials include:

5.2.8 Informational Materials

Clear, accurate, and comprehensive informational materials for use with stakeholders during formal consultation events and informal interactions will be produced. These materials will be updated as the Project evolves and supplemented with additional materials and can include:

- Project fact sheet with infographics
- Frequently Asked Questions
- Advertisements for public meetings
- Project maps
- Handouts/flyers
- Physical signs near sites of Project components with visualizations and key information (purpose and dates for completion)

All materials should include a link to the project website where further information can be obtained as well as a point of contact for questions or concerns (as described below).

5.2.9 Project Contact Vehicles

To give stakeholders easy and convenient access to the Project, the following contact vehicles will be put in place:

- Toll-free number for general Project inquiries, the Project may wish to consider SMS capabilities to provide easier access;
- General e-mail address; and
- Mailing address and physical office location.

The contact vehicles will be monitored regularly and response protocols should be developed to ensure all inquiries are tracked for reporting purposes and that responses are provided. Monitoring will also allow for modifications or ramping up of certain contact vehicles should one method prove more effective than others.

5.2.10 Stakeholder Point of Contact

A community and social coordinator for the Project should be established as a single point of contact for stakeholders. This person will be tasked with providing information and responding to questions, or should they not be able to adequately address enquiries, forwarding the question to a relevant authority.

Information and Communications with Specific Stakeholders

As Project development advances and specific construction plans are in place, the community and social coordinator should be responsible for conducting specific outreach with key stakeholders. The primary purpose of this outreach is to share information, answer questions and obtain stakeholders input on issues and concerns that need to be addressed. These meetings will also help to identify any new stakeholders to include in future outreach activities. Meetings can take place in many formats, from one-on-one casual conversations to small focused industry-specific meetings.

Soualiga Road, is a key area of focus for this outreach, as it is the area that has the most human and traffic presence and will be moderately affected by construction of the new access road and weighbridge scale. The community and social coordinator will lead a process of conducting outreach in the area to give specific information to pertinent stakeholders and transportation providers regarding traffic rerouting, construction implements and closures. Particular attention should be given to conducting such outreach on multiple days to ensure contact with all transportation providers to inform them well in advance of when they will need to use the alternative routes and parking sites, expected duration and any other logistical information they may need to smoothly continue their operations during the construction period.

Public Information and Communications

Beyond specific stakeholders, the public at large should be informed of the Project, its purpose, and key information that may affect daily life. The key messages should always be reiterated during such efforts, in addition to addressing logistical project updates. Formats for public information and communications should include:

- Public Meetings
- Media engagements especially via most-used media sources (radio, local television, etc.)
- Presentations to key stakeholder groups
- Community event attendance—i.e., booth at local fairs or celebrations
- Project milestone press releases to local media
- Project website with up-to-date information
- Updated information on social media

5.2.11 Contact with Project Proponent

Feedback Process

Stakeholders will be able to contact the Project Proponent at any time by letter, phone, fax, or email. Contact information will be made available through a website and also on external publications and communications (including newspapers, reports, leaflets, letters, emails, etc.). Communications with the Project Proponent will be possible through all locally used languages.

Stakeholders are invited to provide feedback and report grievances about the Project, including those related the economic displacement. This will allow the Project Proponent to monitor how the Project is doing, and will help to identify areas of improvement. The Project Proponent will treat all types of feedback with professional consideration and respect, and base its responses on open and honest communication. Feedback and grievances, where appropriate and necessary, will be investigated and closed out, and stakeholders will be informed of resulting decisions.

5.3 Consultation and Participation for RAP Process

Before starting the vacation process of land and execution of project activities that generate population displacement, NRPB will design an Information and Participation Program covering the various stages of the resettlement process. This Program will address different groups:

- population of the area adjacent to the resettlement area of impact who will continue residing at the site,
- residents of the lands that will be required for the work, and
- the host community (if applicable).

Informed consultation and participation are permanent processes that start at the project preparation phase, continue during the whole process of RAP planning, and the execution and final evaluation of results. They have as their objectives providing accurate information on project activities, potential impacts, resettlement strategy, and other information of relevant importance for people to be displaced and resettled as well as fomenting direct active participation in the planning and implementation of resettlement.

Main Objectives of the Information and Participation Program are:

- Inform the population of the resettlement area of impact on the project on its potential characteristics, the technical stages involved in project design and

construction, the time schedules foreseen, the various players involved, and the agency responsible for the project.
- Report on the studies and procedures that will be carried out regarding the owners, holders of rights, and residents of the lands that will possibly be acquired.
- Reduce the stress and anxiety of the population potentially affected by the work.
- Show the project-linked benefits
- Prevent the interference of external agents with economic or political interests that impinge on public interests and the interest of the affected population.
- Introduce the persons responsible for social management and resettlement to the community.
- Establish effective and fast communication channels to respond in an ongoing manner to community concerns. To that end, a mutually agreed place and hours of attention to the community should be defined. Such a site should be located within the area affected and be readily accessible, to avoid transportation costs for the population.

The program will include encounters with the community, family units and business owners, printed information, media and other means aimed at transparent dissemination of project-related issues, impacts and management plans. Equally important, is the objective of fomenting participation by the affected persons in the decision-making process on issues that directly affect and/or interest them. A third objective is to obtain the preferences of the affected persons about alternative resettlement options offered. Finally, consultation should include a formal agreement with the affected persons accepting the draft RAP.

For the preparation of the RAP informed consultation is structured into four stages. Each may involve several meetings and other information exchange forms to secure the active involvement of PAPs all along the process. In each phase consultations with women will be conducted independently from those with men to allow expression of female views, concerns, needs, talents, and aspirations to be adequately reflected in the RAP.

First Phase. Orientation and dissemination of information about the project and the project-specific need to remove population from risk-prone areas. It explains the principal that the right to decide on resettlement alternatives and plans resides with the affected person, that the RAP provides for social, legal, and technical assistance in setting up new livelihoods, and it lays out the timetable for the proposed implementation. Finally, as a double-way communication process, initial consultation meetings invite questions, provide answers, set the basics rules of the resettlement process and the grounds for further collaborative work.

At this point the dates proposed for socioeconomic baseline data collection are announced, including the property inventory, which will occur in the second phase. It is especially important to announce the cut-off date being proposed after which no further persons will be eligible for resettlement, this so that affected people can make last minute adjustments (such as calling home household members who may have migrated for seasonal work but need to be counted as affected).

Second Phase. The household and business socioeconomic baseline data collection occurs at this point and the cut-off date is set when data collection is finished. The cut-off date must be announced throughout the affected area in various ways, such as by radio and in newspapers, distribution of printed fliers, public meetings, and receiving questions at local project offices. In addition, resettlement options being considered by the project are announced and described for the consideration of affected persons, including the provision of technical descriptions of each option and the timetable for affected people to take decisions regarding resettlement options in the third phase. Should affected people also have suggestions for alternatives not yet considered by the project, these can be tabled for technical and financial evaluation, designed if feasible, and included in the draft RAP.

Third Phase. Informed consultation in this phase is focused on assistance to households, individuals, businesses and other population clusters to make a definitive decision regarding resettlement strategies/options. At this point affected persons are asked to sign an agreement accepting the socioeconomic baseline, recording their preference for resettlement, and agreeing to the proposed timetable for implementation.

Fourth Phase. Present the affected persons the draft RAP and receive questions, comments, and ideas to improve it. Taking into account the questions, comments, and ideas, the RAP is then finalized and shared with the affected people for their signature indicating their agreement.

5.3.1 Affected Persons Grievance Redress Management

It is in the interest of NRPB and all involved parties to establish an accessible Grievance Redress Mechanism (GRM) to solve PAPs claims/disputes at the earliest possible time. The WB OP. 4.12 emphasizes that the PAPs should be heard and as such they must be fairly and fully represented. Further, the mechanism should implicitly discourage referring matters to the court system for resolution.

NRPB will establish a GRM as an integral element of the RAP to specifically serve the resettlement program, including specific procedures to record, register, analyse and resolve grievances arising from resettlement actions and policies. The grievance system should enable affected persons to register a complaint and receive a concrete response within a reasonable number of days. Such a system can operate out of a project community relations office to be established in the project area and staffed with social professionals with ample experience in community relations and grievance management the grievance system will include a procedure whereby complaints can be registered confidentially either in writing or verbally via a grievance box or a dedicated telephone line.

The responsible professionals will design and follow specific procedures/protocols for grievance classification on the basis of material or reputational risk, investigation of claims, evaluation of claims in terms of validity/legitimacy of the complaint, and formulation of corrective/reparatory actions jointly defined with parties involved in the claim. The GRM will define and disseminate among PAPs the number of days for grievance acknowledgement and response, signalling priority for addressing high-risk and urgent claims presented by displaced households/businessmen. Complainants will receive periodic updates on their claims: Once an answer is provided complainants will be encouraged to sign a grievance closure form stating satisfaction (or no satisfaction) with actions taken.

The GRM (section 6.6), will utilize standardized forms for grievance recording, investigation, resolution, and closure. NRPB will provide periodic summary reports to the WB on PAPs registered claims and resolutions. [33]

6.0 Public Consultation Report

The process, attendance and results of the first ESIA consultations are presented in annex J This report presents the details and findings of the First Public Consultation that was held at the University of Sint Maarten on June 25 (presented in English) and June 26, 2019 (presented in Spanish).

The purpose and objectives of this Public consultation were as follows:

- Notify the Public and area Stakeholders of the anticipated Fire Suppression Activity Project at the landfills.
- Conduct a limited community outreach in conjunction with RINA, the consultant retained by the NRPB to perform the census of the potentially impacted community and develop a Resettlement Action Plan.
- Gather Social Census data to be collected by RINA for consideration in the ESIA preparation.
- Make a technical presentation via PowerPoint of the anticipated Fire Suppression Activities and the components of the ESIA that will be performed for the project.
- Conduct the Public Consultation in English and Spanish to accommodate both communities that could be impacted.
- Facilitate in an open forum to the Public and Stakeholders a dialogue to freely and openly ask questions regarding the materials presented, and to encourage further inquiries.
- Answer as many questions as feasible during the Public Consultation.
- Gather the questions and concerns from the Stakeholders and Public and prepare written answers that can be published.
- Summarize the questions and answers into appropriate categories.
- Advise the Stakeholders and Public of the preliminary area of the community that is being considered for temporary relocation/evacuation (Exclusion Zone) and for Caution (or Notification) Zones that are being established for Public health and protection of nearby businesses.
- EE&G: First Consultation Report August, 2019
- Provide details regarding where the Public and Stakeholders can submit further questions or comments for consideration.
- Include the concerns and issues brought forth from the Public and Stakeholders into the preparation of the ESIA where appropriate.
- Summarize the Findings and Conclusions of the First Public Consultation and provide Recommendations for continuing the Public outreach and preparing for the second Public Consultation after a draft ESIA has been prepared and is ready to be released to the Public.

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[33] Final revised version of the GRM will be uploaded here, once cleared by the Bank: [Complaints Procedure – National Recovery Program Bureau (nrpbsxm.org)]

The various groups and entities that comprise the “Public and Stakeholders” are:

- The general public in Sint Maarten
- The community of residences and businesses located on Great Salt Pond Island.
- The National Recovery Program Bureau (NRPB)
- Sint Maarten Ministry of Public Housing, Spatial Planning, Environment, and Infrastructure
- (VROMI)
- Sint Maarten Ministry of Public Health, Social Development and Labor (VSA)
- The Government of Sint Maarten
- The World Bank Group
- RINA
- EE&G

References

2020, EE&G Disaster Response, LLC Environmental and Social Impact Assessment (ESIA/DRAFT) for Fire Suppression Activity, Pond Island Municipal Waste Landfill and Irma Debris Site. Emergency Debris Management Project. Sint Maarten National Recovery Program Bureau (NRPB). 139 pp and 12 annexes.

World Bank Group, Environmental, Health, and Safety (EHS) Guidelines; Main Web Page
https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

World Bank Group, Environmental, Health, and Safety (EHS) Guidelines; WASTE MANAGEMENT
https://www.ifc.org/wps/wcm/connect/456bbb17-b961-45b3-b0a7-c1bd1c7163e0/1-6%2BWaste%2BManagement.pdf?MOD=AJPERES&CVID=ls4XT4R

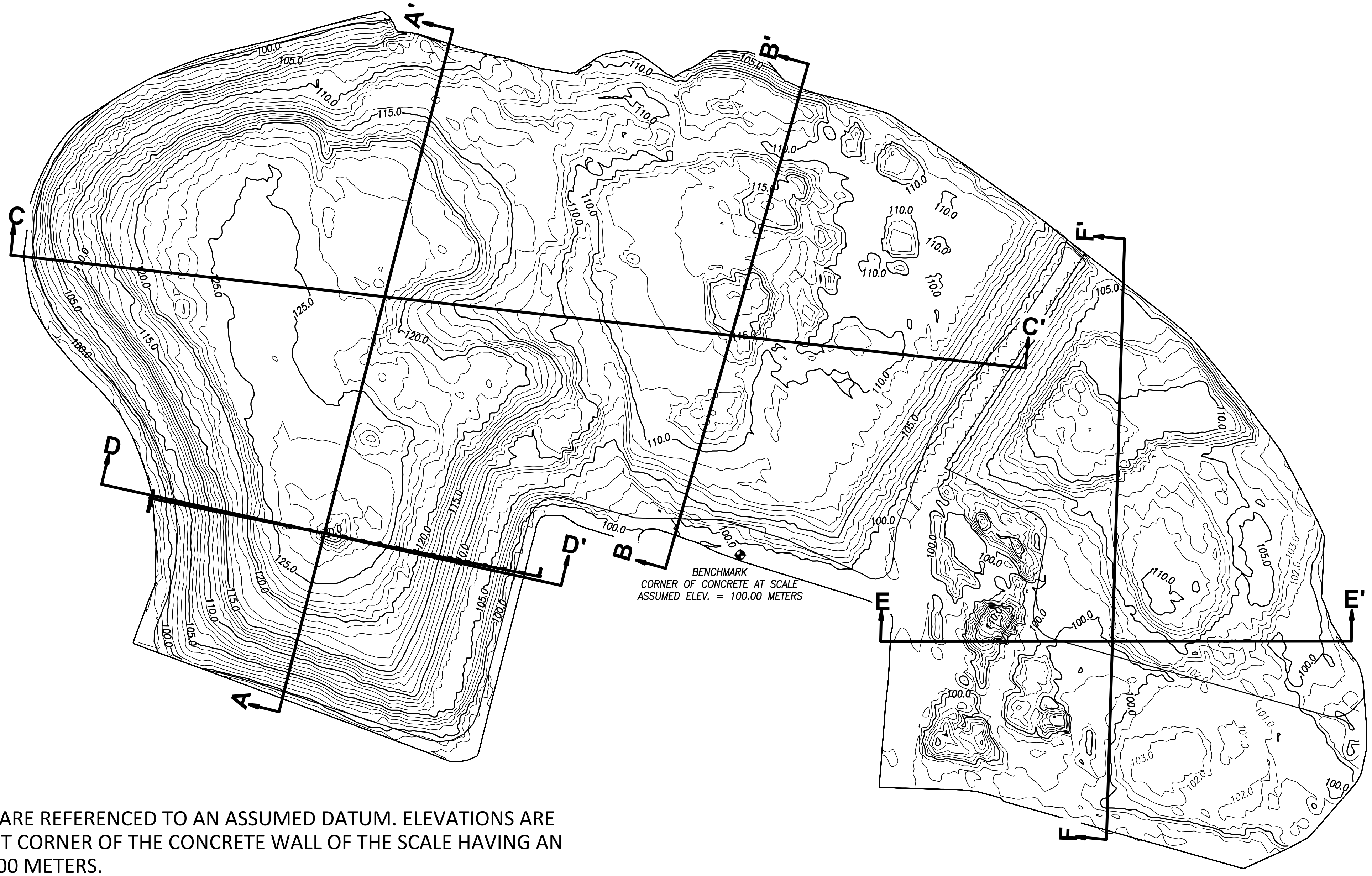
World Bank Group, Environmental, Health, and Safety (EHS) Guidelines; GENERAL EHS GUIDELINES: INTRODUCTION
https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

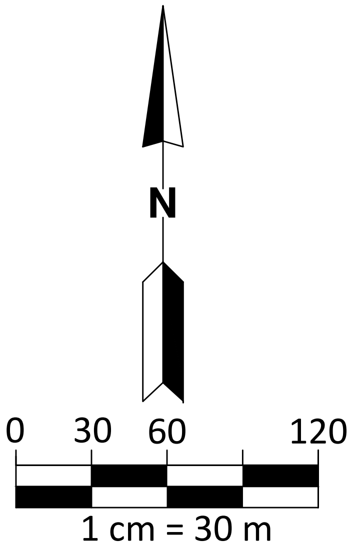
Annexes

Annex A- Cross Sections of MSW/IDS Sites
Annex B - Summary of Landfill Review Final
Annex C - No Work Zone (NWZ) document
Annex D - SXM Landfill Screening Report Final 2018.12.13
Annex E - EE&G Baseline Environmental Site Assessment (2019)
Annex F - SXM Landfill Fire Suppression Air Monitoring Plan (FINAL)
Annex G - RIVM 2019 air quality report
Annex H - SXM RAP RINA PR#2
Annex I - Draft Baseline ESA (2019-3249) - GSP St. Maarten - January 2020
Annex J - First Consultation Final

Annex A

MAP OF TOPOGRAPHIC SURVEY
SINT MAARTEN LANDFILL





SURVEYOR'S NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERENCED TO AN ASSUMED DATUM. ELEVATIONS ARE BASED UNPON THE NORTHEAST CORNER OF THE CONCRETE WALL OF THE SCALE HAVING AN ASSUMED ELEVATION OF 100.00 METERS.

2. ALL DIMENSIONS AND ELEVATIONS GIVEN ARE IN METERS.

3. THE TOTAL NET VOLUME OF THE LANDFILL BASED ON A BASE SURFACE OF ELEVATION 100.00 METERS IS 2,149,000 CUBIC METERS.

4. THE NET INCREASE IN VOLUME BETWEEN MEASUREMENTS TAKEN ON JUNE 13, 2019 AND JUNE 10TH, 2019 IS 151,600 CUBIC METERS.

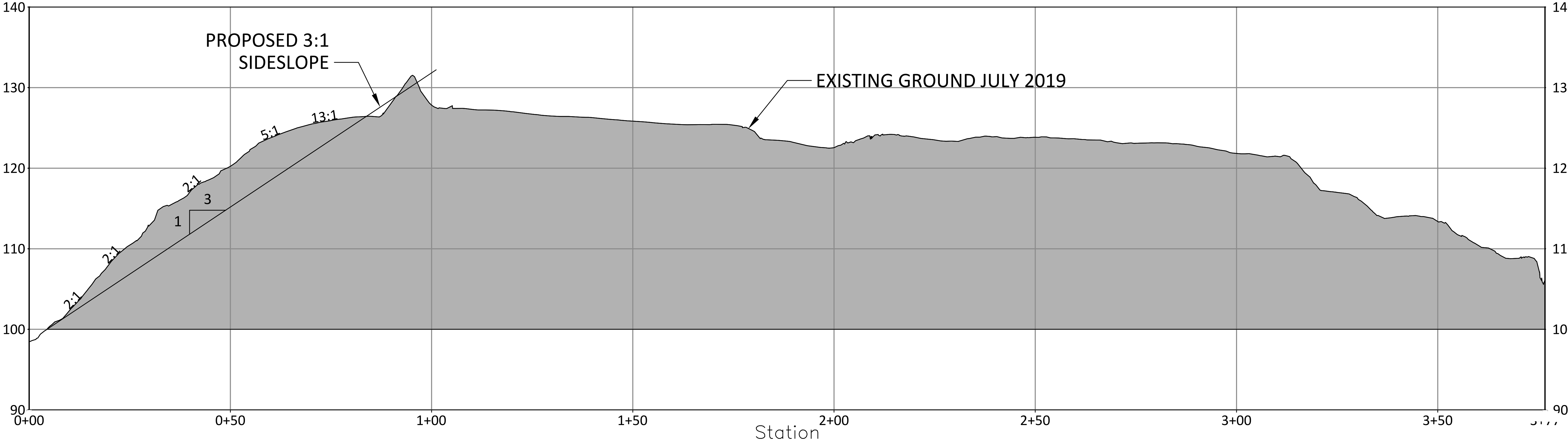
THIS IS NOT A BOUNDARY SURVEY*

SCS ENGINEERS

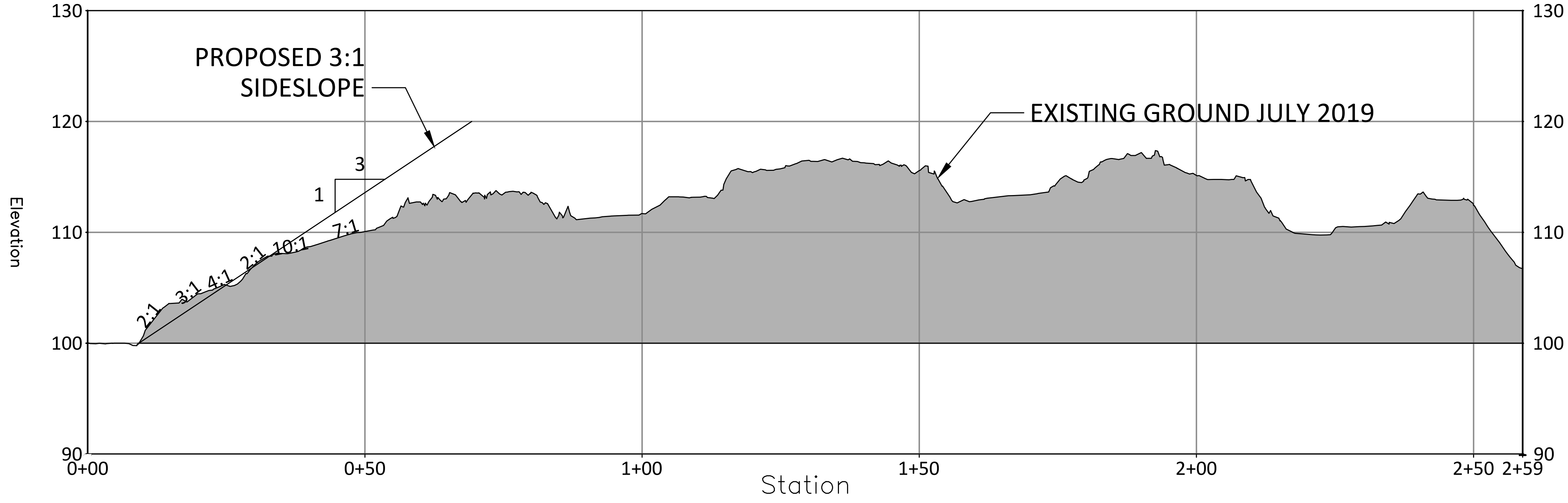
FIGURE 1: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS PLAN
JULY 2019

C:\Users\4382kkc\appdata\local\temp\AcPublish_14356\2019 surface SCS.dwg Aug 01, 2019 - 4:00pm Layout Name: FIGURE 2 CROSS SECTIONS By: 4382kkc

CROSS SECTION A-A: MAIN LANDFILL S-N



CROSS SECTION B-B: MAIN LANDFILL FILLING AREA S-N



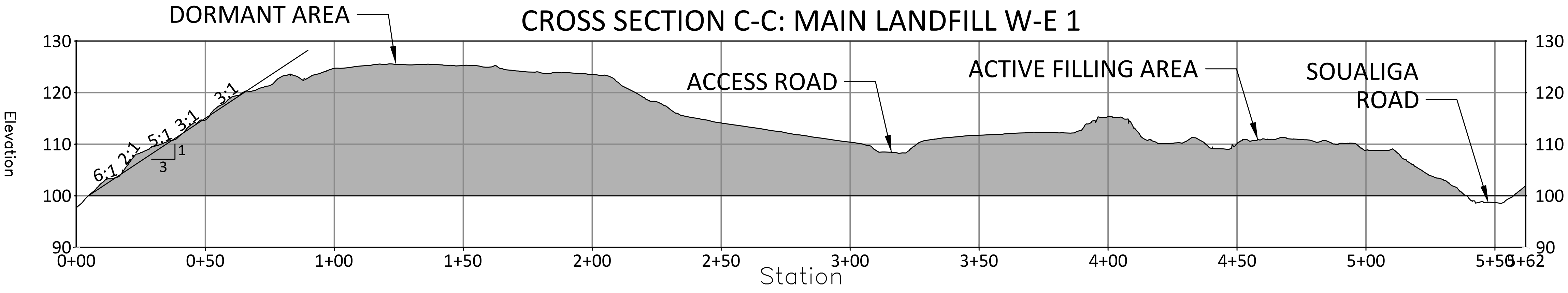
SCALE:
HORIZONTAL: 1 CENTIMETER = 10 METERS
VERTICAL: 1 CENTIMETER = 5 METERS

SCS ENGINEERS

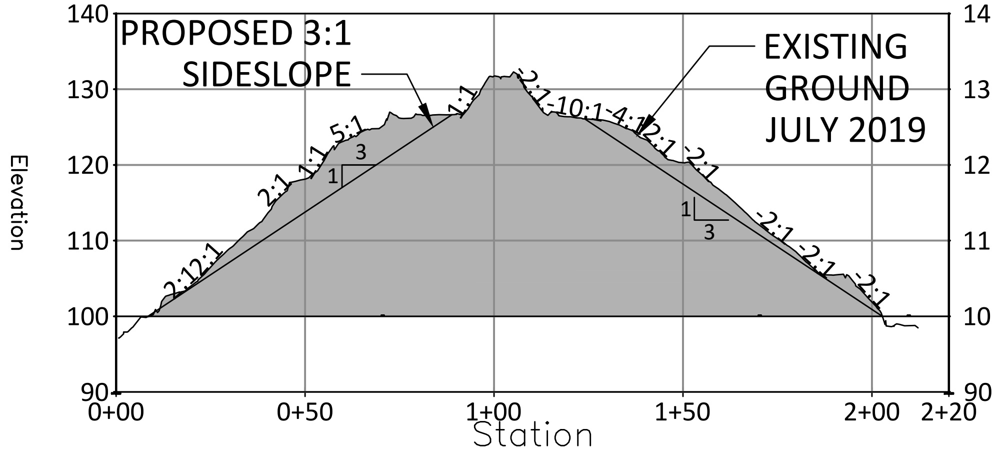
FIGURE 2: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS
JULY 2019

C:\Users\4382kkc\appdata\local\temp\AcPublish_14356\2019 surface SCS.dwg Aug 01, 2019 - 4:00pm Layout Name: FIGURE 3 CROSS SECTIONS By: 4382kkc

CROSS SECTION C-C: MAIN LANDFILL W-E 1



CROSS SECTION D-D: MAIN LANDFILL W-E 2



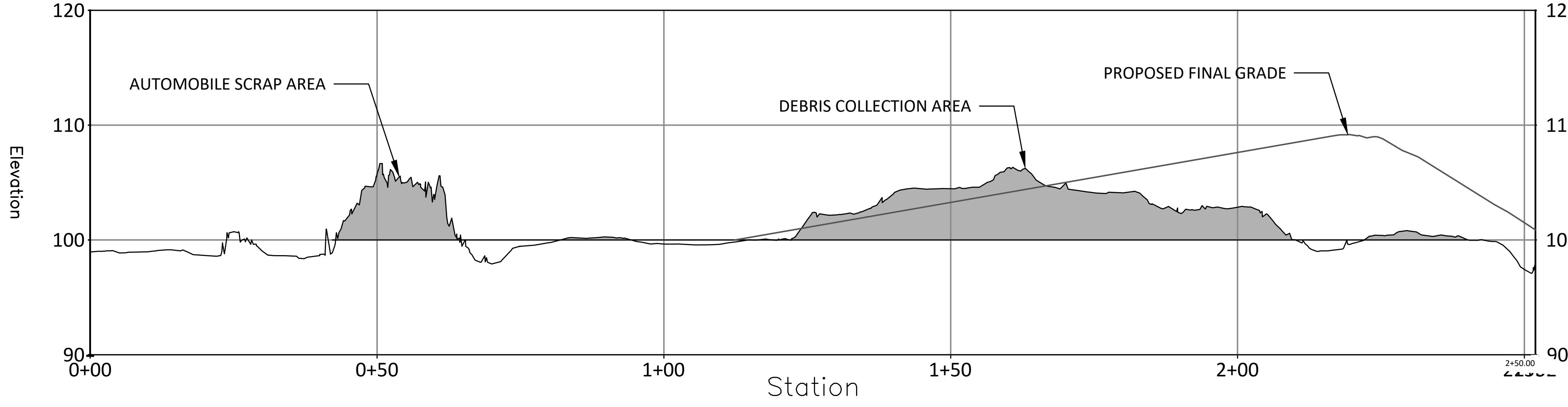
SCALE:
HORIZONTAL: 1 CENTIMETER = 20 METERS
VERTICAL: 1 CENTIMETER = 10 METERS

SCS ENGINEERS

FIGURE 3: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS
JULY 2019

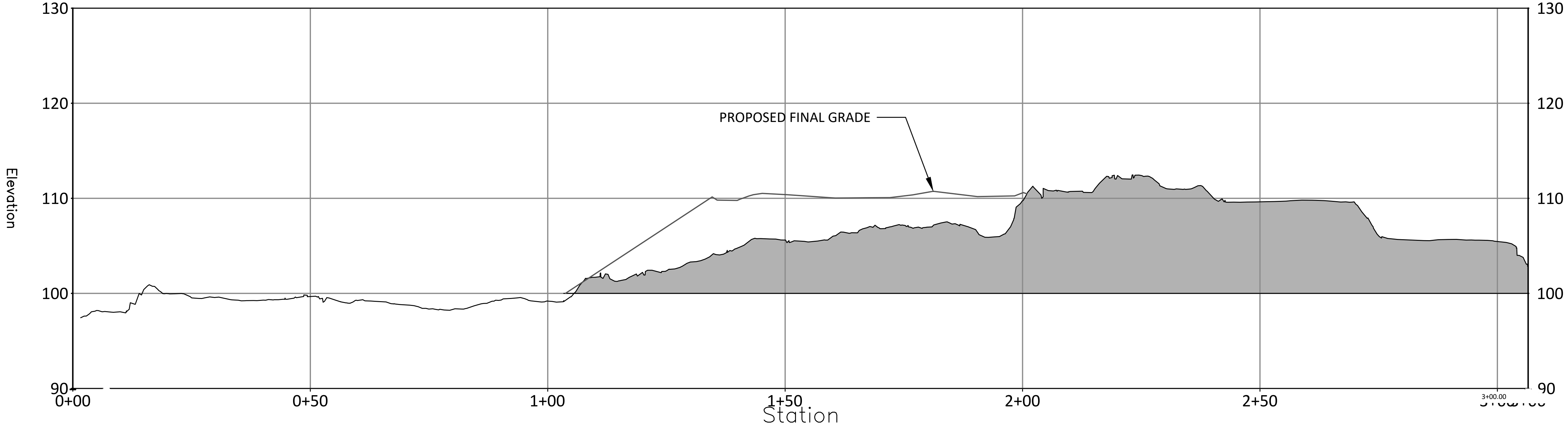
F:\PROJECT\09218142.00\Data and Calculations\Drawings\SCS dwgs\2019 site life\2019 surface SCS.dwg Aug 01, 2019 - 4:02pm Layout Name: FIGURE 4 CROSS SECTIONS By: 4382kkc

CROSS SECTION E-E: IDDS W-E



SCALE:
HORIZONTAL: 1 CENTIMETER = 10 METERS
VERTICAL: 1 CENTIMETER = 5 METERS

CROSS SECTION F-F: IDDS S-N



SCS ENGINEERS

FIGURE 4: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS
JULY 2019

Annex B

SUMMARY OF LIMITED LANDFILL ASSESSMENT - DRAFT
JANUARY 27, 2020

On January 27, 2020 representatives from Hammer Consulting, EE&G Disaster Response, Sint Maarten National Recovery Program Bureau and the Sint Maarten Department of Environment and Infrastructure (VROMI) performed a limited site visit at the Sint Maarten Municipal Solid Waste Landfill (MSW) and Irma Debris Site (IDS) located on Pond Island, in Sint Maarten.

The purpose of the limited site visit was to review current fire and slope conditions at the landfill and compare them to observations and information that was gathered in 2018 and 2019. The objective was to determine whether the approach, methods and scoping of the Fire Suppression Activity, needed to be modified to accommodate the reported change in conditions.

Background

Since 2018, multiple studies have been performed by EE&G, Hammer Consulting and others regarding the Conditions of the Landfill Sites. These assessments identified risks and provided the foundation for the establishment of a tender for a Fire Suppression Activity to address the conditions of concern. Below is a brief summary of these findings:

- A steep, potentially unstable slope and corresponding subsurface fires were identified adjacent to the community located southeast of the MSW. The slope was noted to have been very steep, approaching 1:1 and a potential collapse hazard. A final slope of 3:1 without a slope stability analysis is typically considered the industry maximum for most landfill designs.
- Surface and subsurface fires identified on the IDS and MSW.
- Identification of constituents of concern (COCs) found to exceed occupational exposure levels (OELs) within smoke fumes emanating from fissures on the IDS and MSW.
- Identification of particulate levels exceeding OELs in the cabs of equipment and upwind of smoke fumes.

Based upon these findings, Hammer Consulting and EE&G provided recommendations for the evacuation of certain portions of the community in order to mitigate risk and be protective of life and health, which were summarized in the following documents:

- Background document which indicated that the slope and presence of cracks/fissures along the southeast portion of the MSW presented a hazard to the adjacent community.
- Threat Zone document prepared by Hammer Consulting darted July 2018, which indicated that the community immediately adjacent to the southeast corner of the MSW were in immediate danger and should be evacuated. This created the concept of the Red and Yellow Zones. The Red Zone was an area that should be evacuated prior to the commencement of works to address the slope and/or fires, and the Yellow Zone, which was an area where the community would be notified of the hazard and may need to be evacuated if conditions deteriorated. The Red and Yellow Zones are shown in Figure 1.

- Position statement prepared by EE&G in June 2019, documenting the need for consideration of relocating an expanded portion of the community adjacent to the MSW, since it was downwind or crosswind of areas known to have surface or subsurface fires. This resulted in an expansion of the areas where temporary relocation should be performed during the Fire Suppression Activity, which was termed the Blue Box Area (Figure 1).

Figure 1 – Red Zone, Yellow Zone and Blue Box Area

Since the drafting of these documents, VROMI has:

- Performed re-contouring and fire suppression along the southeast slope of the MSW that was previous identified to be in the Red Zone. This was reported to include removing some of the waste from this area, compacting the existing waste, performing limited fire suppression by covering, and installation of a clay layer on top of the materials that were compacted.

- Performed fire suppression at the MSW, this was reported to include covering Hot Spots with unspecified fill.

- Conducted fire suppression at the IDS. This was reported to include dousing Hot Spots with water pumped from the pond and excavating extinguished material until the heat source was eliminated.

Other than indicated above, limited information has been provided about the methods, engineering, safeguards or monitoring that was utilized during these works, but they have resulted in a significant change in the condition of the Landfill Sites. Therefore, EE&G and Hammer

Consulting were asked by World Bank and the NRPB to perform a limited site visit to review the current conditions, compare them to previous findings and present them in a workshop on January 28, 2020. This document is not exhaustive and does not provide a complete summary of all of the data that has been collected, but provides an executive summary of key findings as they relate to the requested task.

Methodology

The findings of the 2020 walkthrough were compared to information obtained in 2018 and 2019. The following assessment methods were used during the January 2020 site visit:

- Walk the MSW and IDS (collectively referred to as the Landfill Sites) to visually assess for vents/fissures or locations of smoke fumes.

- Use of a FLIR E50 and E6 Infrared Cameras (IRC) to screen for Hot Spots and take temperature readings.

- Collect carbon monoxide readings using a ToxiRAE Pro Carbon Monoxide (CO) gas monitor. The device was set to continuously run, with an alarm set to go off at 35 ppm.

The observations were compared to a Fire Location Drawing that was developed in 2018 (Figure 2) and Topographic Map that was developed in 2019 (Figure 3). Additionally, the locations of the Hot Spots were compared to slope calculations for the southeast portion of the MSW, since this was identified as a concern these are shown on the 2019 Topographic Map (Figure 4) and a cross-section of the area (Figure 5)

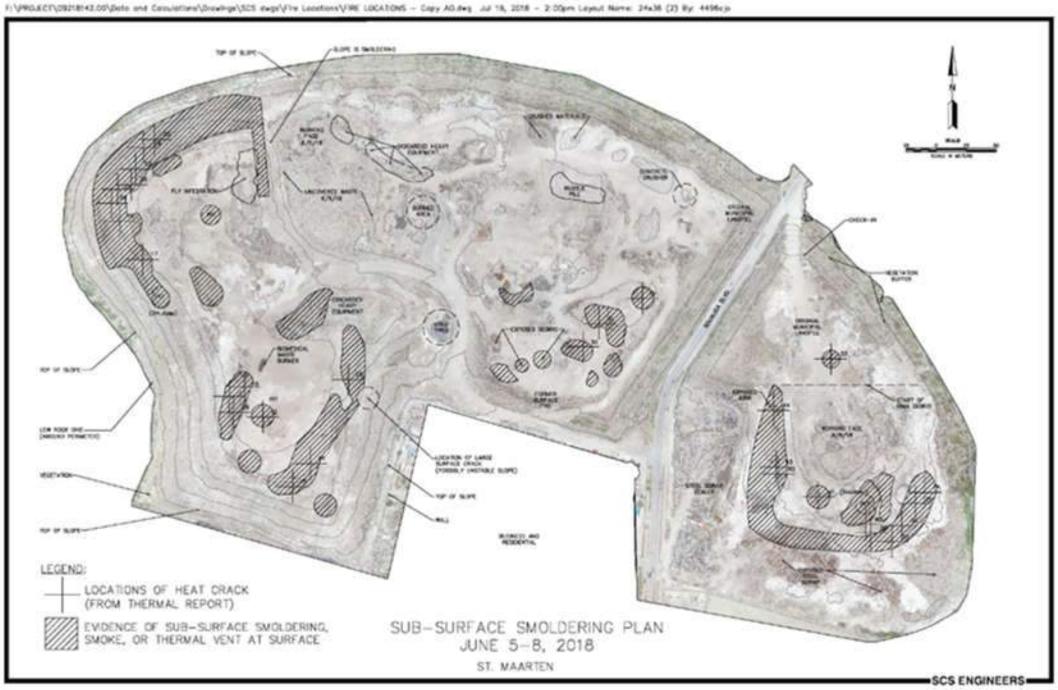
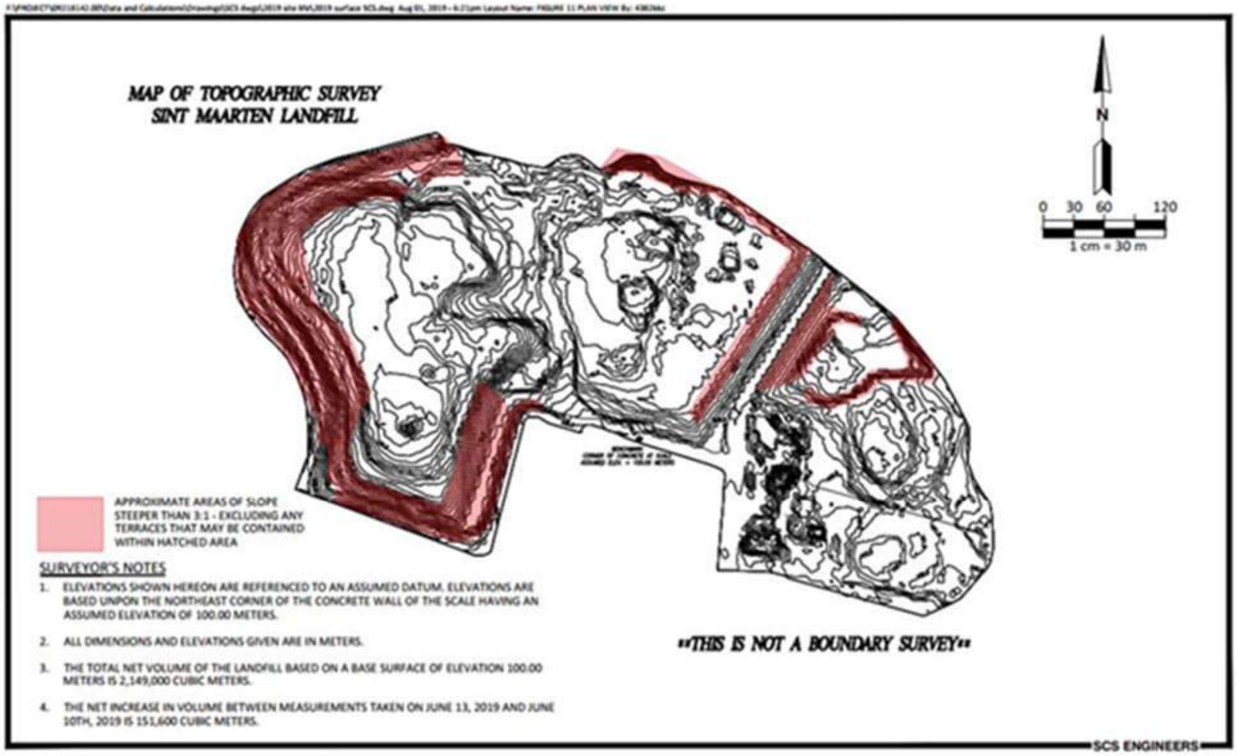


Figure 2 - 2018 Fire Locations

Figure 3 - 2019 Topographic Map



🟥 APPROXIMATE AREAS OF SLOPE STEEPER THAN 3:1 - EXCLUDING ANY TERRACES THAT MAY BE CONTAINED WITHIN HATCHED AREA

SURVEYOR'S NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERENCED TO AN ASSUMED DATUM. ELEVATIONS ARE BASED UNPON THE NORTHEAST CORNER OF THE CONCRETE WALL OF THE SCALE HAVING AN ASSUMED ELEVATION OF 100.00 METERS.
2. ALL DIMENSIONS AND ELEVATIONS GIVEN ARE IN METERS.
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4. THE NET INCREASE IN VOLUME BETWEEN MEASUREMENTS TAKEN ON JUNE 13, 2019 AND JUNE 10TH, 2019 IS 151,600 CUBIC METERS.

Figure 4 - 2019 Topographic Map Showing Areas with Slope Greater than 3:1

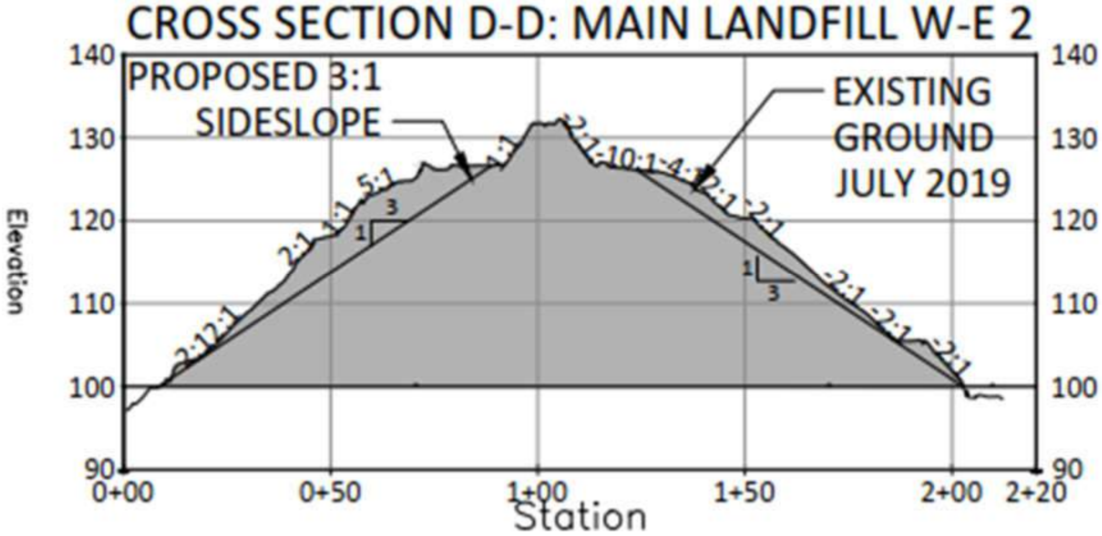

Figure 5 – Cross Section of Topographic Map Near Community

Findings

During the limited site visit, the following observations were made:

- Active surface fires were not observed.

- The southeast slope of the MSW in the former Red Zone was re-contoured and terraced. The slopes were not observed to be as steep as noted in 2018, but still were greater than 3:1 in some areas. Figure 4 shows where slopes of 2:1 were identified in the 2019 Topographic Survey.

- Evidence of active subsurface fires were observed on the northwest and southeast of the MSW. The hot spots observed on the northwest of the MSW were located approximately 600 feet northwest of the community; the hot spots located on the southeast were approximately 200 feet west of the community. Using available prevailing wind direction information, both were located generally downwind of the community.

- Evidence of subsurface fires were not observed on the IDS. However, excavation, sorting, relocation, and re-compacting of waste was observed to be actively occurring.

Other than the two locations mentioned above, the scanning of the surfaces of the Landfill Sites using the infrared camera did not show thermal 'Hot Spots' that suggested venting or presence of subsurface fires. Figures 6 through 9 show representative photos observed on the northwest and southeast portions of the MSW.

Figure 6 - Hot Spot on Northwest of MSW

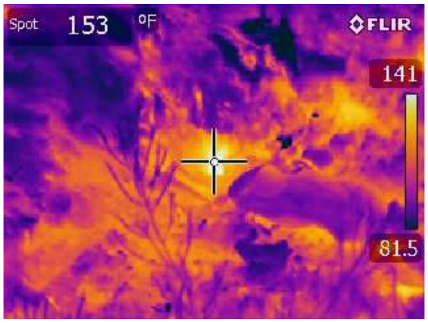

Figure 7 - Hot Spot on Northwest of MSW

Figure 8 - Hot Spot on Southeast of MSW

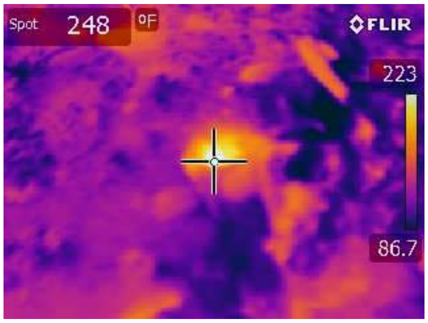

Figure 9 - Hot Spot on Southeast of MSW

The alarm of the CO monitor did not sound outside of the vicinity of the above-referenced locations, indicating that levels of this Constituent of Concern remained below the threshold setting of 35 ppm during the site visit. The CO monitor did confirm the presence of CO in both hot spot areas.

Figures 10 and 11, below show the locations of the Hot Spots on the 2018 Fire Location Map and the 2019 Topographic Map. Figure 12 shows the location of the southeast hot spots relative to the community.

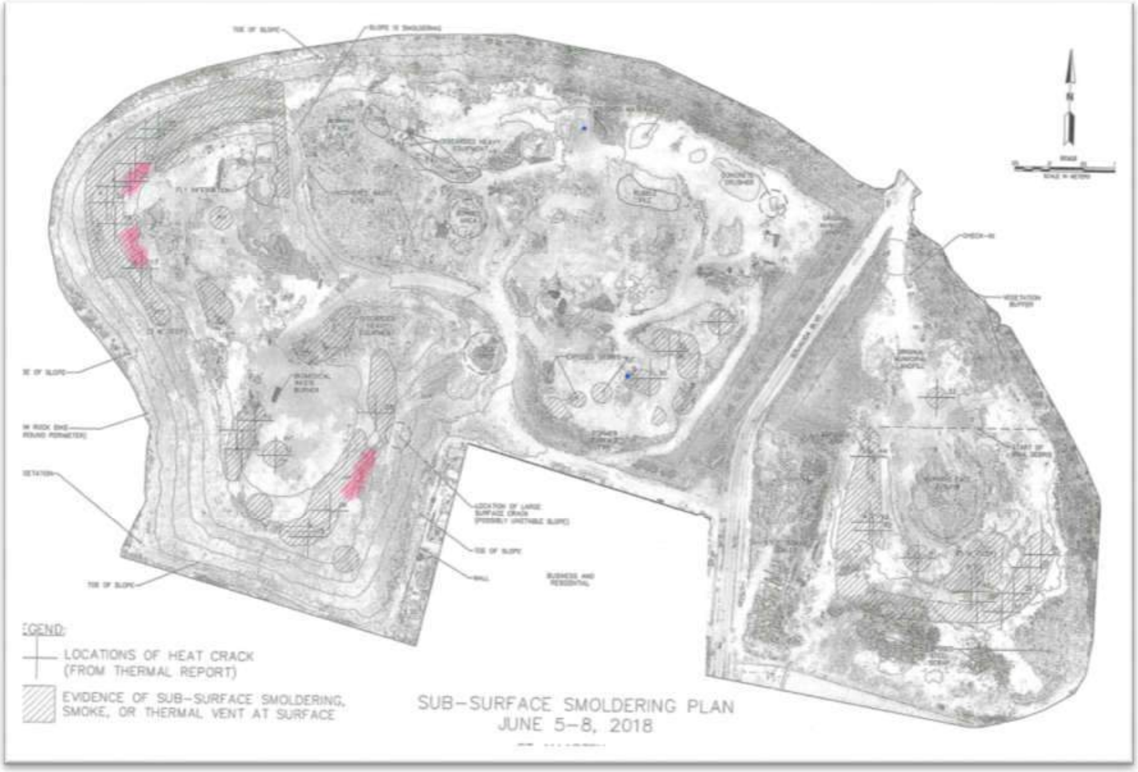

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Figure 10 - Locations of Hot Spots on 2018 Fire Location Map

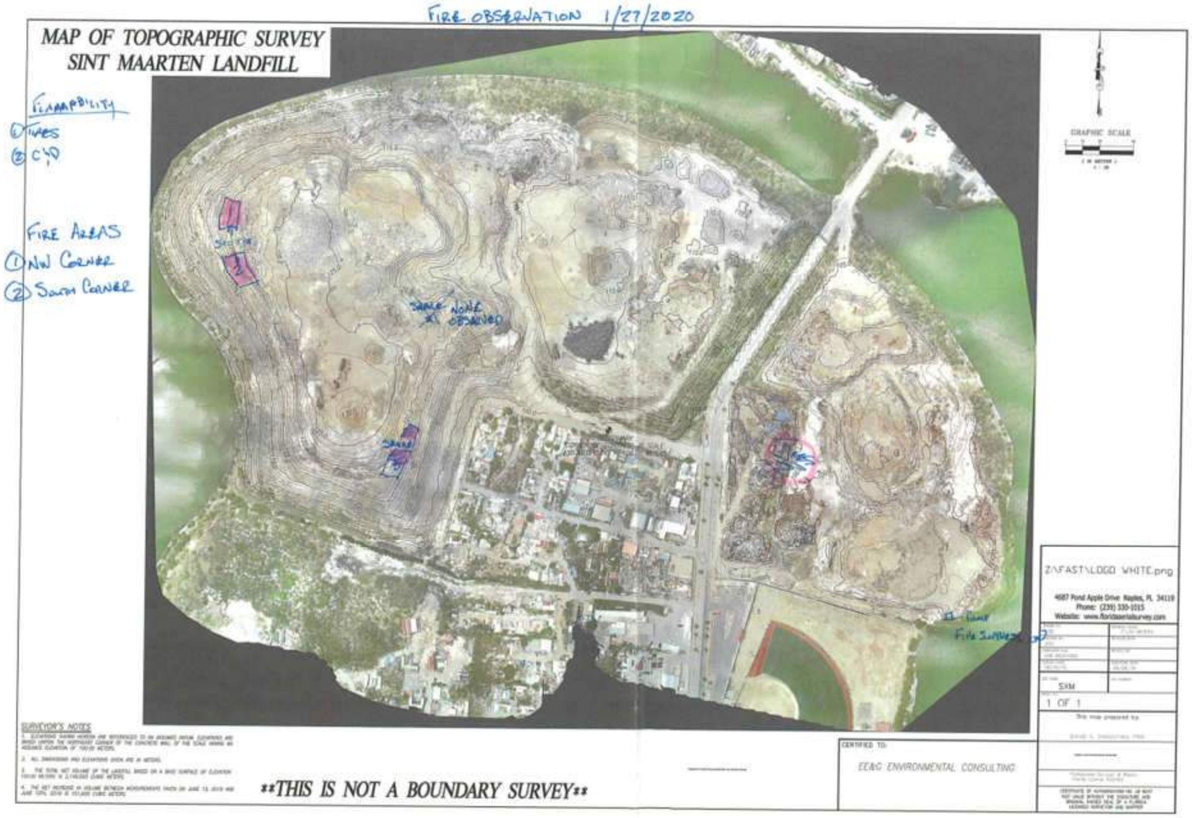


Figure 11 - Locations of Hot Spots on 2019 Topographic Map

Figure 12 - Location of Southeast Hot Spot Relative to Community

Discussion of Findings

The following table shows a comparison of key observations made in 2018, 2019 and 2020

	2018	**2019**	**2020**
MSW			
Surface Fires	Yes	No	No
Cracks, Fissures, Smoke Fumes	Yes	Yes	Yes
Locations of Fires/Smoke Upwind, Downwind or Crosswind of Community?	Downwind, Crosswind	Downwind Crosswind	Downwind
IDS			
Surface Fires	Yes	No	No
Cracks, Fissures, Smoke Fumes	Yes	Yes	No
Locations of Fires/Smoke Upwind, Downwind or Crosswind of Community?	Upwind	Upwind	N/A

This table shows the following:

- Observable evidence of surface and subsurface fires, on the Landfill Sites has significantly reduced since 2018.
- The remaining subsurface fires are now downwind of the community.

Conclusions

Based upon the observations made during the 2020 limited site visit, the following conclusions were made:

- The actions of VROMI have improved the condition of the Landfill Sites:
  - The status of the surface fires have evolved from an Emergency Situation that warranted immediate response and a specialized tender to address the fire concerns, to an Operational Situation, where through the course of normal operations the landfill manager should, if properly equipped and appropriately trained, be able to manage fires that may occur and suppress the remaining two hot spot areas.
  - The stability of the slopes surrounding the Landfill Sites, including the MSW adjacent to the community, do not meet industry-accepted design criteria. It appears that the actions of VROMI have improved the conditions along the southeast MSW, but additional re-contouring is warranted. Furthermore, it remains unclear if the works have effectively mitigated the potential for collapse. Other factors, such as non-homogenous waste composition, compacting, presence of voids related to sub-surface fires or decomposition, may contribute to instabilities that cannot be detected. No slope stability testing has been conducted to date. Additional testing is warranted to further evaluate slope stability conditions. The use of heavy equipment on the slopes for testing (i.e. drill rig) is not recommended unless precautionary measures are taken to protect workers and the population adjacent to the landfill.
  - Absent actual field data and slope stability testing and analysis whereby educated conclusions could be developed, the stability of the slopes in the vicinity of the adjacent landfill population remain a potentially significant life safety concern. Therefore, decisions should error on the side of caution as it relates to protection of the surrounding population.
- Relocation of the community located adjacent to the landfill may not be necessary to perform the remaining works, including fire suppression or re-contouring on the northwest portion of the MSW. However, the above slope considerations and the near proximity of the southeast Hot Spot to the community presents a hazard and those works should not be performed until relocation has been completed.
- Fire suppression of the IDS appeared to have been successfully completed. However, the works that were observed being performed at that site still can generate dust, airborne particulates and sediment that are of concern to the environment and downwind population.

Recommendations

Based upon the findings of the limited site visit, the following recommendations are presented:

- Provide VROMI with adequate personnel protective equipment, supplies and education/training that includes the various worker activity hazards that the landfill workers are exposed to: Excavation and sorting of previously combusted wastes, fire suppression, active face compaction, debris sorting, etc. A Site-Specific Health & Safety Plan with Activity Hazard Analysis should be prepared and implemented for Site Workers. Constituents of concern are present in the landfill gasses, soils/debris and smoke that could represent an exposure concern to landfill workers.

- Assessment of fires must remain an ongoing task. The conditions that were observed on Monday January 27, 2020 should not be considered the Final Condition by which all future plans are determined. The nature of subsurface smoldering wastes is such that new fires could start with the addition of air at any time. It is recommended that a formal Fire Monitoring Program be developed and implemented whereby a weekly assessment is performed with the proper equipment to routinely verify and document the location of any fires or signs of combustion, so that appropriate action can be taken.

- Absent subsurface fires, civil works may be performed in some locations of the Landfill Sites, in a manner that is protective of human health & environment without relocation of the Blue Box Area (Figure 13)

Figure 13 - Blue Box Area

- Engineering & institutional controls, coupled with air quality monitoring and storm water management can be performed in order to protect of the adjacent community and environment for most areas of the Landfill Sites while active Works proceed. The exception would be work on or near to the slopes on the SE portion of the MSW immediately adjacent to the community where a catastrophic collapse would put the western portion of the Blue Box zone community at risk.

- Consideration should be made to developing a “NO WORK” buffer zone on the MSW immediately west and north of the Blue Box community. Given the unknowns associated with the composition of the waste and its stability, this should be implemented regardless of the timing of the works to be performed and should apply to day to day works being performed by VROMI and potentially the transition contractor if retained.

- Absent significant slope stability testing and analysis, the consultants and engineers participating in this project will not be able to opine with confidence as to the stability or potential for the slopes to move or collapse. There simply are too many variables and unknowns regarding the composition of the waste, and the possibility for voids to have been created by subsurface fires or waste decomposition. Even with slope stability data in hand, there is no guarantee. With that in mind, as government considers the ultimate relocation of the adjacent residents, priority should be given to those residents located near to the SE slope of the MSW (Original Red Zone as defined in the Hammer Consulting Threat Assessment).

- Slope stability testing and analysis should be conducted to evaluate the risks to the population in the immediate vicinity of the landfill. Until this occurs, no heavy equipment or work activity should be performed on those slopes adjacent to the community, such that if slope failure occurred, loss of life of life could result.

- The following activities should be considered to safely manage future debris re-contouring, debris sorting/recycling, and fire suppression:

  - Active dust suppression (emissions control)
  - Fire monitoring program
  - Standby fire suppression capability
  - Worker training & education
  - Emergency and HazMat contingency plan
  - Continuous air monitoring of emissions
  - Erosion/sediment/storm water control
  - Develop a site-specific health & safety plan that includes ingress/egress control with designated work zones.
  - Fill sequence plan and final cover design

Annex C

SCS ENGINEERS Environmental Consulting & Contracting

April 22, 2020
Project No. 092318146.03

Mr. D. Kirk Smith
Vice President /Tampa Office Director
EE&G
5005 W. Laurel Street, Suite 110
Tampa, FL 33607

Subject: Establishment of "No-Work"
Sint Maarten Landfill
Philipsburg, St. Maarten

Dear Kirk:

At the request of EE&G, SCS Engineers (SCS) has prepared this letter to assist in the establishment of a no-work zone at the Sint Maarten Landfill (Landfill).

BACKGROUND

The government of Sint Maarten (Government) operates a Landfill on the Dutch side of the Island of St. Maarten. The Landfill is the only solid waste facility in Sint Maarten and is located on Pond Island in Phillipsburg, the capitol city of Sint Maarten. Pond Island is located within the Great Salt Pond, a 2.25 square kilometer saline lagoon saltwater pond historically used for salt production. Pond Island is a man-made island on the east side of the Great Salt Pond, created sometime in the mid to late 1900's. The total area of Pond Island is approximately 48 hectares. The Landfill, with a total area of approximately 22 hectares, occupies the northern half of Pond Island.

The Landfill consists of a municipal solid waste facility (MSW) located to the west of Soualiga Road and the Irma Debris Site (IDS), the area where debris from Hurricane Irma was placed following the storm and during recovery efforts. The IDS was situated east of Soualiga Road. Various studies have been performed at the Landfill since 2018. Reports prepared by EE&G and Hammer Consulting identified steep, potentially unstable slopes at the Landfill. Of particular concern were locations of the MSW that were adjacent to a nearby community. These reports recommended that businesses and residents within this community be relocated prior to the commencement of fire suppression and works on the MSW.

A two-phase works project is being planned at the MSW. Among other things, the project will include re-contouring the side slopes. The project is anticipated to be performed in 2 phases:

- Phase 1 – to be performed in locations away from the community where it is anticipated that the works are not likely to create a deterioration of existing slope conditions and increase the risk of collapse. This work will be performed while the community is occupied and will include establishment of a "No Work Zone" (NWZ), delineating areas of the MSW where landfilling and recontouring activity is prohibited due to concerns of slope stability.

- Phase 2 – to be performed in the NWZ. These works will begin after the community has been relocated.

The World Bank and St. Maarten National Recovery Program Bureau have requested an engineering evaluation of the Landfill to establish the NWZ. At the request of EE&G, SCS Engineers (SCS) has agreed to perform this evaluation. A summary of the findings of this evaluation follow.

NO-WORK AREA

SLOPE STABILITY EVALUATION

There is limited data available for the project site such as types and compaction of waste, potential voids from subsurface combustion, underlying soils, and surrounding geology. Due to the limited data, general site information and failures at similar landfills were used to estimate the area of concern. SCS is also concerned with the methods of regrading. Uncontrolled excavation and compaction could result in a sideslope failure.

In general, landfill sideslope failures occur by two methods, block and circular. The block failure results in the surface of the waste sliding down the slope, similar to a mudslide. The circular failure involves the base of the landfill not being able to support the weight of the waste resulting in the underlying soils rotating up and outside the landfill limits. In each scenario, the impacted area is downslope and perpendicular to the sideslope.

ESTIMATE “NO WORK ZONE”

Based on the limited data available, SCS has estimated an area of concern where there should not be any recontouring efforts until additional investigations have been conducted or relocation of residents has been completed. Activities that should not be conducted include excavation of waste, placement of relocated waste, fire suppression that involves injection of water/grout, and placement of new waste (to name a few). The attached figures show the recommended area of concern and “No Work” zone.

As discussed, this is an estimate based on the limited data and failures at other landfills. There is limited technical analysis and based on the potential direction of slope failure. This “No Work” zone was developed to be conservatively protective of human health and essentially includes the slopes of the MSW landfill that are immediately adjacent (to the north and west) to the community that has been defined in past documents as the “Blue Box Zone”. Although there is no guarantee that implementation of this “No Work” Zone will prevent a slope failure, implementation of such a zone should significantly reduce the potential for catastrophic collapse induced by landfilling activities. SCS recommends a waste recontouring management plan be developed and implemented in order to consider possible failures and safely regrade the Landfill.

Light traffic may be allowed on the existing landfill access roads within the NWZ. Compaction through use may have a stabilizing effect on the road surfaces, but work on top of adjacent slopes may create instability in those areas. However, work around the road should be limited due to lack of data. These areas lie within the NWZ, therefore there exists some level of risk of collapse due to steep slopes that surround them.

Please contact us at 813-804-0800, if you have any questions or require additional information.

Sincerely,

Robert Curtis, P.E.
Sr. Project Manager
SCS Engineers

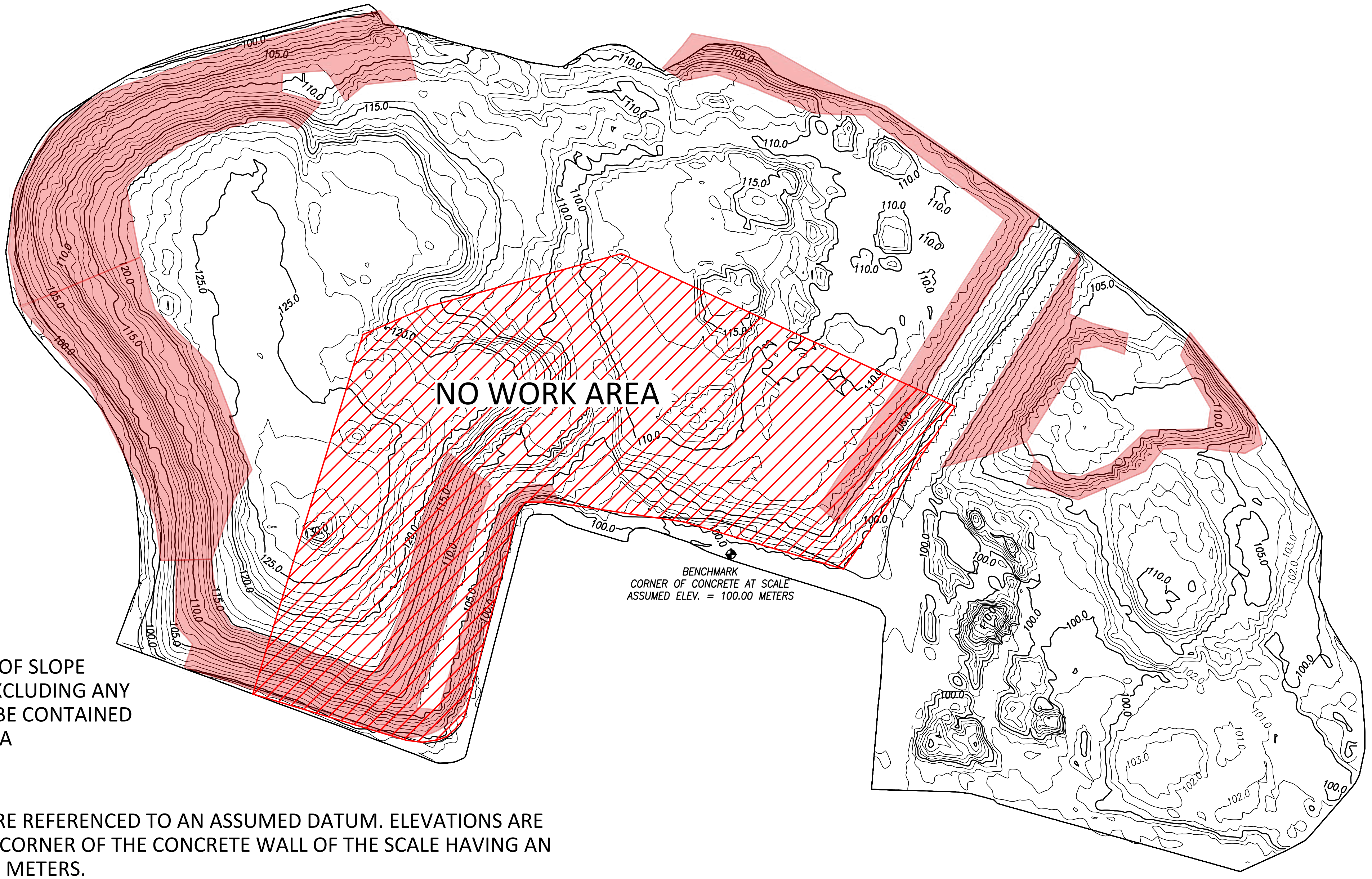
Shane Fischer. P.E.
Project Director
SCS Engineers

Attachments

RBC/SRF:rbc

F:\PROJECT\09218142.00\Data and Calculations\Drawings\SCS dwgs\2019 site life\2019 surface SCS.dwg Feb 13, 2020 - 12:09pm Layout Name: FIGURE 11 PLAN VIEW By: 4280ced

MAP OF TOPOGRAPHIC SURVEY
SINT MAARTEN LANDFILL



🟥 APPROXIMATE AREAS OF SLOPE STEEPER THAN 3:1 - EXCLUDING ANY TERRACES THAT MAY BE CONTAINED WITHIN HATCHED AREA

SURVEYOR'S NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERENCED TO AN ASSUMED DATUM. ELEVATIONS ARE BASED UNPON THE NORTHEAST CORNER OF THE CONCRETE WALL OF THE SCALE HAVING AN ASSUMED ELEVATION OF 100.00 METERS.

2. ALL DIMENSIONS AND ELEVATIONS GIVEN ARE IN METERS.

3. THE TOTAL NET VOLUME OF THE LANDFILL BASED ON A BASE SURFACE OF ELEVATION 100.00 METERS IS 2,149,000 CUBIC METERS.

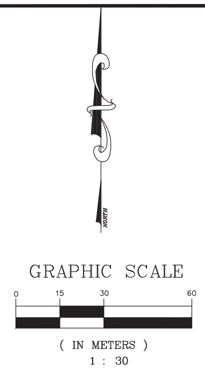
4. THE NET INCREASE IN VOLUME BETWEEN MEASUREMENTS TAKEN ON JUNE 13, 2019 AND JUNE 10TH, 2019 IS 151,600 CUBIC METERS.

THIS IS NOT A BOUNDARY SURVEY

SCS ENGINEERS

FIGURE 1: SINT MAARTEN POND ISLAND LANDFILL CROSS SECTIONS PLAN
JULY 2019

MAP OF TOPOGRAPHIC SURVEY
SINT MAARTEN LANDFILL



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****THIS IS NOT A BOUNDARY SURVEY****

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CERTIFIED TO:

EE&G ENVIRONMENTAL CONSULTING

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4687 Pond Apple Drive Naples, FL 34119
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DRAWN BY: DSD	DRAWING SCALE: 1"=30 METERS
CHECKED BY: DSD	REVISION DATE:
COMPUTER FILE: SXM MESH.DWG	REVISED BY:
SURVEY DATE: 06/10/19	SIGNATURE DATE: 06/26/19
JOB NAME: SXM	JOB NUMBER:

SHEET NO.: 1 OF 1

This map prepared by:

DAVID S. DAGOSTINO, PSM

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Professional Surveyor & Mapper
Florida License No5762

CERTIFICATE OF AUTHORIZATION NO. LB 8247
NOT VALID WITHOUT THE SIGNATURE AND
ORIGINAL RAISED SEAL OF A FLORIDA
LICENSED SURVEYOR AND MAPPER

Annex D

EE&G Disaster Response, LLC

DRAFT - Air Screening Results

For

Pond Island Municipal Waste Disposal Site and Temporary Debris Site International Advisory Support for Debris Management and Short Term Solid Waste Priorities for the Hurricane Irma Reconstruction, Recovery and Resilience Program

Sint Maarten

World Bank Contract: 7187552

Presented to

World Bank Group
1818 H. Street, NW
Washington DC, 20443

Presented by

EE&G
Disaster Response, LLC
5751 Miami Lakes Drive
Miami Lakes, FL 33014
(305) 374-8300
www.eeandg.com

December 13, 2018
EE&G Project Number: 2018-4191

CONTENTS

Section **Page**

EXECUTIVE SUMMARY 1

SECTION 1.0 – INTRODUCTION 5

1.1 INTRODUCTION 5
1.2 LIMITATIONS 6

SECTION 2.0 – METHODS 7

2.1 SAMPLE COLLECTION..7
2.2 CONSTITUENTS OF CONCERN 9
2.3 DETERMINATION OF INTERPRETIVE CRITERIA 9
2.4 SAMPLING METHODS, DEVICES AND MEDIA..10
2.5 COC COMPARISON CRITERIA..11

SECTION 3.0 – FINDINGS 19

3.1 SCREENING RESULTS 19
3.2 DATA INTERPRETATION 27

SECTION 4.0 – CONCLUSIONS..31

4.1 SMOKE SAMPLING 31
4.2 UPWIND SAMPLING..32
4.3 PERSONNEL SAMPLING 33

SECTION 5.0 – RECOMMENDATIONS 34

TABLES

Table 2 – Instantaneous Testing Results
Table 3 – Landfill Gas Testing Results
Table 4 – Particulate (PM 2.5) Results
Table 5 – VOC Analytical Testing Results
Table 6 – H2S Analytical Testing Results
Table 7 – PAH Testing Results
Table 8 – Ozone (O_3) Testing Results
Tables 9a, 9b and 9c – Dioxin/Furan Testing Results
Table 10 – Heavy Metal Testing Results

FIGURES

Figure 1 – Site Sampling Plan
Figure 2 – Locations of CO Analytical Sampling Results
Figure 3 – Locations of Instantaneous Particulate (PM 2.5) Results
Figure 4 – Locations of Benzene Sampling Results
Figure 5 – Locations of H_2S Sampling Results
Figure 6 – Locations of Acenaphthylene Sampling Results
Figure 7 – Locations of Benzo(a)pyrene Sampling Results
Figure 8 – Locations of Ozone Sample Results
Figure 9 – Locations of Dioxin and Furan Results
Figure 10A – Locations with Results Above COCs – Northwest Municipal Waste Disposal Site

Figure 10B – Locations with Results Above COCs – South Municipal Waste Disposal Site
Figure 10C – Locations with Results Above COCs – Temporary Debris Site

ATTACHMENTS

Attachment A – Photo Pages
Attachment B – COCs and NIOSH Links
Attachment C – Laboratory Results, Landfill Gases (CH_4, CO_2, and CO)
Attachment D – Laboratory Results, Volatile Organic Compounds (VOCs)
Attachment E – Laboratory Results, Hydrogen Sulfide (H_2S)
Attachment F – Laboratory Results, PAHs
Attachment G – Laboratory Results, Ozone (O_3)
Attachment H – Laboratory Results, Dioxins and Furans
Attachment I – Laboratory Results, Polychlorinated Biphenyls (PCBs)
Attachment J – Laboratory Results, Heavy Metals
Attachment K – Laboratory Results, Asbestos Fibers

EXECUTIVE SUMMARY

EE&G Disaster Response, LLC (EE&G) has been retained by the World Bank (the “Client”) to perform a preliminary screening of smoke from subsurface fires at the Pond Island municipal waste disposal site and temporary debris site (collectively referred to as the “debris and disposal sites”), in support of the Hurricane Irma Restoration, Recovery and Resilience Program in Sint Maarten.

The intent of this screening was to provide information that can be used in scoping activities for World Bank financing, in particular related to the general types and scale of activities to be included in the proposed fire suppression at the municipal waste disposal site and temporary debris site.

EE&G performed air testing at the debris and disposal sites over three consecutive days between August 28 and 30, 2018. Each day the testing was focused on a specific portion of the debris and disposal sites, testing locations were as follows:

- Day 01 (August 28, 2018) – The northwest portion of the municipal waste disposal site.
- Day 02 (August 29, 2018) – The south portion of municipal waste disposal site, located to the northwest of the settlement.
- Day 03 (August 30, 2018) – The southeast portion of the temporary debris site.

The objective of the screening activities was to obtain a general understanding of what chemicals (or ‘constituents’) of concern (COCs) were present in the smoke plumes emanating from cracks/fissures on the surfaces of the debris and disposal sites. The tests were performed in the following locations:

- Upwind of smoke plumes (“upwind” samples), to establish background levels of the COCs in the air prior to reaching the areas where smoke was visibly emanating.
- From the smoke plumes (“smoke” samples), to obtain “worst-case” scenario levels of the COCs at their originating source.
- In the cabs of equipment performing normal operations at the active face of the municipal waste disposal site (MWDS) and on the temporary disposal site (TDS) that were reported to be part of a typical work day (“personnel” samples), to gauge COC levels relative to occupational limits.

Four samples were collected from the smoke plumes and one upwind sample was collected each day. Personnel samples were collected on days 2 and 3.

Determination of the COCs to be tested was based upon a general knowledge of which byproducts of incineration can be found in a landfill setting and common components that make up landfill gasses, and the input of other World Bank consultants. The COCs that were tested for included the following:

- Landfill gases, which include methane (CH_4), carbon dioxide (CO_2), and carbon monoxide (CO). These gasses are produced when bacteria break down organic waste.

- Lower Explosive Limit (LEL), the concentration level at which gas has the potential to explode.

- Volatile Organic Compounds (VOCs), other gasses besides landfill gasses (listed above) that can be produced by the breaking down/decomposition of waste.

- Hydrogen sulfide (H_2S), a gas that can be the source of most landfill odors.

- Polycyclic aromatic hydrocarbons (PAHs), compounds found in coal and tar and produced by burning of organic matter.

- Respirable particulates (PM 2.5), solid particles generated by mechanical action or burning. Composition depends on the parent material. Can be non-organic (silica, asbestos, metals or plastics) or organic (cellulose, mold or bacteria). PM 2.5 are 'fine' or 'tiny' particles that are less than 2.5 micrometers in size.

- Ozone (O_3), a COC that may be formed by landfill gasses.

- Dioxins and Furans, byproducts of combustion of plastic waste and other materials, particularly those containing chlorine.

- Polychlorinated biphenyls (PCBs), man-made chemicals that can be released into the environment through burning of waste. PCBs typically are associated with electronics.

- Heavy metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver), environmental pollutants that can be released into the environment through burning of waste.

- Asbestos fibers, carcinogens associated with the disturbance or incineration of building materials

The air testing results were compared to the most stringent of the threshold levels established by the American Council of Governmental Industrial Hygienists (ACGIH), the European Union (EU) Occupational Exposure Levels (OELs), United States (US) Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) or the US National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs).

Prior to discussing the testing results, it is important to note that monitoring data collected directly from the smoke plumes, near the ground surface does not accurately reflect the levels of airborne concentrations at which the general public or workers at the site will be exposed. However, these data provide a preliminary understanding of what exposure risks may be anticipated during fire suppression activities. Air quality testing that will be performed during fire suppression activities can be focused on "indicator" parameters based on what was detected in the smoke samples.
The below table shows locations where concentrations of COCs exceeded exposure limits.

COC	Smoke - Northwest Municipal Waste Disposal Site	Smoke - South Municipal Waste Disposal Site	Smoke - Temporary Disposal Site	Upwind	Personnel
Carbon Monoxide	X	X	X	-	-
Respirable Particulates (PM 2.5)	X	X	X	X	X
Volatile Organic Compounds - Benzene	X	X	X	-	-
Hydrogen Sulfide	X	-	-	-	-
PAH (All)	X	X	X	-	-
Acenapthylene	-	X	X	-	-
Benzo(a)pyrene	X	X	-	-	-
Ozone	X	X	-	-	-
Dioxin/Furans (TCDD TEQ)	X	X	X	-	-

X – Denotes locations with results that exceed the exposure limits
- Denotes concentrations not exceeding exposure limits

The above table shows that concentrations of the COCs were highest within the smoke plumes this was supported by the number of locations where results were above exposure limits. Exceptions were respirable particulates which were found in upwind and personnel samples.

Although there were some similarities in the test results collected from the debris and disposal sites, the findings showed that more COCs were at concentrations greater than threshold levels in the samples collected at the municipal waste disposal site than the temporary debris site. This may be due to the age and thickness of debris of the municipal waste disposal site, reported duration of the fires at the municipal waste disposal site or different mix of debris types at the two locations.

Results of the upwind and personnel samples showed significantly lower concentrations of the COCs when compared to the smoke samples and exceedances were not found in these samples, with the exception of respirable particulates. This suggested that the COCs identified in the samples were primarily associated with the smoke/vapor sources and likely did not originate from other offsite sources.

Potential routes of exposure to COCs resulting from the smoke would primarily be through inhalation. However, exposure through skin contact or ingestion from residues around smoke sources (fissures) or around/near active or inactive areas of smoldering or burning may also be possible. Risks of potential exposure may likely be increased during fire suppression activities, when the fires are excavated and burning waste is exposed.

Based upon the findings and conclusions of the air testing, EE&G has developed an air monitoring plan and provided recommendations for training, personal protective equipment, safe work practices, and decontamination which are described in the Recommendations section of this document. The air monitoring plan will be delivered under separate cover.

These results and conclusions presented in this report do not contain reference to or discussion of potential for offsite migration of COCs, or the potential for impacting surrounding populations. Perimeter air monitoring of the debris and disposal sites and potential impacts to the surrounding areas from emissions is recommended to be performed as part of the fire suppression activities to be protective of human health and the environment. This sampling and analysis event was performed to assess the "worse case" exposure scenarios for workers (without excavating waste) that will be performing fire suppression and working within active combustion and smoke impacted areas. These data should not be used for other purposes, in particular speculation as to what offsite concerns may or may not be occurring.

SECTION 1.0 – INTRODUCTION

1.1 INTRODUCTION

EE&G Disaster Response, LLC (EE&G) has been retained by the World Bank (the “Client”) to perform a preliminary screening of smoke from subsurface fires at the Pond Island municipal waste disposal site and temporary debris site (collectively referred to as the “debris and disposal sites”), in support of the Hurricane Irma Restoration, Recovery and Resilience Program in Sint Maarten. EE&G’s testing services described herein was provided in accordance with EE&G’s Technical Proposal Contract 7187552, Modification “B”, issued by the World Bank on August 22, 2018 (hereafter referred to as “the Contract”).

The objectives of EE&G’s advisory services were as follows:

- To perform a preliminary screening for chemical constituents of concern (COCs) identified by EE&G and other third party consultants retained by the Client, that may be in the smoke emanating from smoldering waste and debris through fissures at the debris and disposal sites. The purpose of the screening was to assess for COCs that may be present during upcoming fire suppression activities.

- To develop an air monitoring plan to be followed during upcoming fire suppression activities. This plan will be based upon the results of the preliminary screening activities summarized in this document and will be provided as a separate document.

- To make recommendations for the appropriate level of respiratory protection for landfill workers and fire suppression workers based on the data collected.

The intent of this screening was to provide information that can be used in scoping activities for World Bank financing, in particular related to the general types and scale of activities to be included in the proposed fire suppression at the municipal waste disposal site and temporary debris site. It can be used by Government of Sint Maarten as a reference in the development and implementation of these activities; however, the results are strictly advisory, and the contents are not ready or endorsed for use under World Bank financing.

Any recommendations are provided by EE&G to the World Bank as advice and do not represent the views of the World Bank, and its Executive Directors or the Government of Sint Maarten. While every reasonable effort was made to ensure the information is accurate, any use of the information by third parties is not the responsibility of the World Bank, the Government of Sint Maarten or EE&G and should be done by professionals qualified in the field and in the context of the time, method and scope of the analysis with due consideration of any limitations it may present.

The Government of Sint Maarten is responsible for doing the necessary analysis to comply with environmental and social safeguards policies of the World Bank and local regulations, develop an associated documentation and the mitigation measures therein and for obtaining World Bank clearance and approval for those activities financed under World Bank administered financing as per World Bank Policies and the terms of the associated financing.

1.2 LIMITATIONS

The intent of this work is to provide advice in helping scoping activities for World Bank financing. The work is strictly advisory, and the contents do not represent an endorsement for financing or implementation.

This report has been prepared by EE&G in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, expressed or implied, is made. EE&G's interpretations and recommendations are based upon the results of sample analyses, as well as investigative work conducted on August 28, 29 and 30, 2018. Other conditions elsewhere at the site may differ from those in the sampled locations and such conditions are unknown, may change over time and have not been considered.

Adverse weather, consisting of intermittent rainstorms and strong wind gusts were experienced during the testing. In some cases these conditions resulted in sample stations being washed out or knocked over, damage to sample media and equipment and shortened sampling intervals. The affect that these conditions had on the results was unclear, as the laboratory was able to read the majority of the samples. It is possible that data collected during favorable weather may show slightly different results that those presented in this report.

EE&G and the World Bank will not be responsible for the interpretation or use by others of data developed pursuant to the compilation of this report. This report reflects conditions, operations, and practices as observed on the dates and times of the site testing. The interpretations and recommendations, stated in this report, are based on previous environmental studies and research conclusions. EE&G and the World Bank do not warrant the use of segregated portions of this report.

EE&G and the World Bank will not be responsible for the interpretation or use by others of data developed pursuant to the compilation of this report. It is recommended that any implementing party should have a qualified industrial hygienist interpret the applicability of the information for implementation. Furthermore, a qualified occupational physician should interpret the information in this report before any clinical conclusions are drawn.

SECTION 2.0 – METHODS

The primary objective of the air testing was to screen for COCs that may be associated with smoke and vapor emission plumes at the points of emanation from surface fissures located on the debris and disposal sites. Data was also collected upwind of the smoke samples and within two heavy equipment cabs that were operating at the debris and disposal sites.

2.1 SAMPLE COLLECTION

The sampling was accomplished by collecting instantaneous and analytical air samples. These methods are described below:

- Instantaneous samples were collected using direct read meters that provide real time data in the field.

- Analytical air samples were collected using various types of filtration cassettes and media which were shipped off-island to laboratories for analysis. Analytical air samples were collected by setting up sampling stations, each with multiple vacuum pumps drawing air through various different forms of test media, including evacuated grab sampling canisters.

Instantaneous and analytical samples were collected at fixed locations on the debris and disposal sites. The locations were designated as smoke, upwind and personnel, which are defined below:

- Smoke sampling – Smoke samples were collected to screen for COCs at the emissions points at the surface of the debris and dump sites. The points of air intake of the sampling media, meters and grab canisters were positioned within approximately one foot above the ground directly in visible smoke plumes emanating from surface fissures on the debris and disposal sites. It was widely reported to and also observed by EE&G that the winds in the area blow consistently from the eastward direction to the west, making the flow of smoke from the ground fissures across the sampling media reasonably predictable.

- Upwind sampling – Upwind samples were placed in locations where smoke and other visible emissions were not observed, to evaluate the analytical air entering into the subject site for the tested COCs prior to mixing with the smoke sources. The points of air intake of the sampling media, meters and grab canisters were positioned within approximately one foot above the ground upwind of the smoke samples described above. It was reported to and also observed by EE&G that the winds in the area blow consistently from the eastward direction to the west. The wind direction was visually confirmed by EE&G prior to placing the sampling equipment.

- Personnel sampling – Personnel samples were placed in track hoes while operators performed activities that were reported to be typical of a work day managing incoming municipal solid waste and hurricane related debris. Test stations were set up in the cabs of heavy equipment behind the operator's chair, with the intakes of the sampling media drawing air from head levels near the breathing zone (approximately one foot from the operator's face). Instantaneous readings were not collected as part of the personnel sampling.

The air testing was performed over a period of three days from August 28 through August 30, 2018. The testing was conducted on a different general area of debris and disposal sites each day. A summary of the sample areas are as follows:

- Day 01 (August 28, 2018) – Smoke and upwind were collected from the northwest portion of the municipal waste disposal site. Personnel sampling was not collected this day.
- Day 02 (August 29, 2018) – Smoke and upwind were collected from the south portion of municipal waste disposal site, in the vicinity of fissures associated with the unstable slope located to the northwest of the settlement. Personnel samples were collected from heavy equipment operating in the active face of the municipal waste disposal site and Temporary debris site.
- Day 03 (August 30, 2018) – Smoke and upwind were collected from the southeast portion of the temporary debris site. Personnel samples also collected from heavy equipment operating in the active face of the municipal waste disposal site and on the temporary debris site.

Instantaneous and analytical test locations were designated using a project specific identification system where each location was marked with a 5-digit number. The first two numbers noted the day the sampling was performed (Days 01-03, corresponding to dates of August 28-30, 2018), followed by the last three numbers that noted the testing station (location) at the site. For example, sample #02-005 was collected on Day 2 (August 29, 2018) at sampling location 005, and each different COC tested for may have a sample numbered 02-005.

Samples were collected from fixed locations each day; which are shown on the sample location diagram that is provided in Figure 1. Below is a summary of the sampling activities:

- Smoke sampling – Instantaneous and analytical testing was performed at a total of 12 locations, with sampling performed at locations 001-004 each day.
- Upwind sampling – Instantaneous and analytical testing was performed at a total of 3 locations, with sampling performed at location 005 each day.
- Personnel sampling – Analytical testing was performed on August 29 and 30, 2018 (days 02 and 03). A total of 4 personnel samples were collected over the two days, with 1 sample collected from the track hoe working on the active face of the municipal waste disposal site (sample 006) and 1 sample collected from the track hoe working on the temporary debris site (sample 007) each day.

Representative photographs of the sampling stations and test locations are included in Attachment A.

2.2 CONSTITUENTS OF CONCERN

Determination of which COCs to be tested for was based upon a general knowledge of which byproducts of waste burning or incineration are typically found in a landfill setting, observations of types of waste at the debris and disposal sites, common components contained within landfill gasses, and the input of other World Bank consultants. The COCs that were tested for included the following:

- Landfill gases[1], specifically methane (CH_4), carbon dioxide (CO_2), and carbon monoxide (CO)
- Lower Explosive Limit (LEL)
- Volatile Organic Compounds[1] (VOCs)
- Hydrogen sulfide[1] (H_2S)
- Polycyclic aromatic hydrocarbons[1] (PAHs)
- Respirable particulates[2] (PM 2.5)
- Ozone[2] (O_3)
- Dioxins and Furans[2]
- Polychlorinated biphenyls[2] (PCBs)
- Heavy metals[2] (arsenic, barium, cadmium, chromium, lead, selenium, and silver)
- Asbestos fibers[2]

[1] The COCs were sampled both by methods requiring lab analysis and to the greatest extent feasible by direct read meters, which provide instantaneous results.

[2] The COCs were sampled only by methods requiring lab analysis and sampling with direct read meters was not feasible.

Attachment B contains a list of the above COCs that contains a link to NIOSH website that contains information regarding each chemical, including types of hazard, acute symptoms, routes of exposure and occupational exposure limits.

2.3 DETERMINATION OF INTERPRETIVE CRITERIA

In 2008, the UN Economic & Social Council published the following remark: "A number of environmental health rules and regulations are in place in the Netherlands Antilles but they are insufficient, a fact which is recognized by the Government. Environmental standards have been drawn up for priority areas (refineries, utility companies, waste-disposal companies) but have not yet come into force, pending the entry into force of the National Ordinance on Environmental Principles. In addition, a number of general island ordinances (e.g. the Waste Ordinance, Pollution Ordinance and the Police Ordinance), which allow the island authorities to act when there is a threat to public health or the environment, are already in force.

The former Netherlands Antilles had reportedly begun the process of establishing environmental norms and standards, but this was never concluded prior to establishing of the new countries within the Dutch Kingdom, including St. Maarten. Because of this, it was not clear which norms and standards would apply to the interpretation of the air testing data. The Environmental Legislation of Bonaire, Saba and Statia was proposed as an applicable reference standard, https://zoek.officielebekendmakingen.nl/kst-32473-3.html however it does not address air testing (Section 2.2 Environment and Environmental Regulations, Part d Other Environmental Issues – "*The air quality also deserves attention. At the moment there is no regulation in this* *area yet"*). Given that there are no specific guidelines for environmental air testing established by the Government of St. Maarten, there can be some flexibility in determination of applicable standards. For the purpose of the screening activities, the following standards were used to evaluate the data that was collected, when different values were found for a COC, the most stringent or lowest value was used.

- American Council of Governmental Industrial Hygienists (ACGIH) time weighted average (TWA) - threshold limit values (TLVs) as required by The World Bank Group, International Finance Corporation Environmental Health and Safety Guidelines for Occupational Health and Safety dated April 30, 2007.

- European Union (EU) Occupational Exposure Limits (OELs) – since the subject site was located in Sint Maarten, a country that is part of the Kingdom of the Netherlands, the data collected was compared to regulatory exposure limits applicable to the Netherlands or the European Union when possible. In Europe, there are two types of occupational exposure limits for chemical agents: EU community exposure limits and national exposure limits. The community limits are set by the European Agency for Safety and Health at Work. The EU Member States are required to establish national occupational exposure limit values for listed chemical agents, taking into account the community values. National exposure limit values may be different from the community values. Exposure limits that are specific to The Netherlands are noted with "NL".

- US Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) – these are the legal limits in the United States for employee exposures to chemical substances or physical agents. PELs are typically expressed as an 8-hour time weighted average (TWA) concentration.

- US National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs) – these are occupational exposure limits that have been recommended to OSHA for adoption as regulatory PELs. RELs are generally considered as recommended updates to the OSHA exposure regulations.

2.4 SAMPLING METHODS, DEVICES AND MEDIA

The methods used for instantaneous, smoke and personnel sampling are described in Table 1 below. The collection periods for the samples described in Table 1 varied depending on circumstances at the site and may have been longer or shorter than the intended run time. Site conditions may have dictated that deviations to the below sampling methods were necessary. In these situations the condition and associated change in collection methodology will be discussed in the Findings Section of this report.

Table 1: Sampling Methods, Devices and Media Used for Suspected COCs.

Constituents of Concern	**Sampling Materials and Media** (†smoke/personnel samples, *direct read/instantaneous meters):	**Lab Analyses:**	**Approximate Sample Collection Periods, Flow Rates and Total Volume (liters [L] and liters per minute [LPM]):**
Landfill gas (CH_4, CO_2, CO) plus VOCs	Evacuated summa canister†	EPA TO-15 Method with Methane via TO-3 plus CO2 and CO via CMS Method	8-hour draw period
	GEM 2000 meter (CH4 and CO2) and ppbRAE 3000 Photo-ionizing Detector (TVOCs)*	--	n/a
H_2S	Coconut shell solid sorbent tubes†	NIOSH 6013 Method	2.5 hours at flow rate of 0.25 LPM for a total of 37.5 L
	GEM 2000 meter (H_2S)*	--	n/a
CO, O_2, LEL, H_2S	Multi-RAE 6228 multi-gas meter*	--	n/a
PAH's (semi-VOCs)	XAD-2 sorbent tubes with PTFE pre-filter†	NIOSH 5506 Method (samples were wrapped in aluminum foil and shipped to lab on ice)	8 hours at flow rate of 2 LPM for a total of 960L
	ppbRAE 3000 Photo-ionizing Detector*	--	n/a
PM 2.5 (Respirable Particulates)	Dust-Trak 2 (data logging)†	--	n/a
	TSI Sidepack AM 520 (data logging)†	--	n/a
Ozone (O_3)	Nitrate-impregnated glass fiber filter†	OSHA ID214 Method	2.5 hours at flow rate of 0.25 LPM for a total of 37.5 L
Dioxins and Furans	Polyurethane foam tube†	Method TO-9A modified (samples were shipped to lab on ice)	8 hours at flow rate of 5 LPM for a total of 2400 L
PCBs	Florisil sorbent tube with glass fiber Swinnex pre-filter†	NIOSH 5503 modified Method	2.5 hours at flow rate of 0.25 LPM for a total of 37.5 L
Heavy Metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver)	5.0 pre-weighed PVC filter cassette†	RCRA 8 NIOSH 7300 modified Method	6 hours at flow rate of 4 LPM for a total of 1440L
Asbestos	TEM CEM cassette†	NIOSH 7402 Method (TEM)	100 minutes at flow rate of 4 LPM for a total of 400L

2.5 COC COMPARISON CRITERIA

The results of the smoke, upwind and personnel testing were compared to the criteria of comparison presented in this section.

Landfill Gases – Methane (CH_4), Carbon Dioxide (CO_2), and Carbon Monoxide (CO)

Instantaneous and analytical air testing were performed to screen for Methane, CO_2 and CO. The analytical results were compared to the exposure limits shown below (the "criteria for comparison"). The values given are for 8-hour time weighted average exposures.

Constituent	EU OEL (Netherlands)	OSHA PEL	NIOSH REL	ACGIH TLV
Methane	N/A	N/A	N/A	1,800 mg/m^3 (1,000 ppm)
Carbon dioxide	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)
Carbon monoxide	29 mg/m^3 (25 ppm)	55 mg/m^3 (50 ppm)	40 mg/m^3 (35 ppm)	29 mg/m^3 (25 ppm)

Lower Explosive Level (LEL)

Instantaneous testing was performed to screen for LEL. Results were compared to the OSHA action level of 10%. Analytical sampling for LEL was not performed.

Oxygen (O_2)

Instantaneous testing was performed to screen for O_2. Results were compared to OSHA minimum levels of 195,000 ppm, or 19.5%. Analytical sampling for O_2 was not performed.

Respirable Particulates (PM 2.5)

Instantaneous testing was performed to screen for particles of less than 2.5 micrometers in size ("respirable particles"). Results were reported in milligrams per cubic meter (mg/m^3) and compared to the EU OEL of 5 mg/m^3 (France) and OSHA PEL of 5 mg/m^3 based upon 8-hour time weighted average exposures. NIOSH and ACGIH have not established RELs or TLVs for respirable particulates.

Constituent	EU OEL	OSHA PEL	NIOSH REL	ACGIH TLV
Respirable Particulates (PM 2.5)	5 mg/m^3 (France)	5 mg/m^3 (20 ppm)	N/A	N/A

Volatile Organic Compounds (VOCs)

Instantaneous and analytical testing was performed to screen for VOCs, results were interpreted accordingly:

- Instantaneous testing - A screening was performed using a photoionization detector (PID) to assess for the presence of total VOCs (TVOCs), to support the analytical sampling described below. The use of a PID allowed for the collection of multiple readings from different locations over the sampling periods. This analysis did not provide the composition of the gases that were being measured.

- Analytical sampling - Results were compared to the exposure limits shown in the below table (the “criteria for comparison). The values given are for 8-hour time weighted average exposures.

VOC Constituent	EU OEL	OSHA PEL	NIOSH REL	ACGIH TLV
Propylene	*N/A	240 mg/m^3 (100 ppm)	N/A	1,190 mg/m^3 (500 ppm)
Chloromethane	268 mg/m^3 (130 ppm)	207 mg/m^3 (100 ppm)	**LFC	104 mg/m^3 (50 ppm)
n-Butane	N/A	N/A	1,900 mg/m^3 (800 ppm)	2,400 mg/m^3 (1,000 ppm)
1,3-Butadiene	4.6 mg/m^3 (2 ppm)	2.2 mg/m^3 (1 ppm)	LFC	4.4 mg/m^3 (2 ppm)
Chloroethane	268 mg/m^3 (100 ppm)	2,600 mg/m^3 (1,000 ppm)	LFC	264 mg/m^3 (100 ppm)
Ethanol	260 mg/m^3 (500 ppm)	1,900 mg/m^3 (1,000 ppm)	1,900 mg/m^3 (1,000 ppm)	1,900 mg/m^3 (1,000 ppm)
Isopropyl alcohol	N/A	980 mg/m3 (400 ppm)	980 mg/m3 (400 ppm)	490 mg/m^3 (200 ppm)
Acetone	1,210 mg/m^3 (505 ppm)	2,400 mg/m^3 (1,000 ppm)	590 mg/m^3 (250 ppm)	1,200 mg/m^3 (500 ppm)
Acetonitrile	34 mg/m^3 (20 ppm)	68 mg/m^3 (40 ppm)	34 mg/m^3 (20 ppm)	34 mg/m^3 (20 ppm)
Acrylonitrile	N/A	4.4 mg/m^3 (2 ppm)	2.2 mg/m^3 (1 ppm)	4.4 mg/m^3 (2 ppm)

VOC Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
n-Hexane	72 mg/m^3 (20 ppm)	1,800 mg/m^3 (500 ppm)	180 mg/m^3 (50 ppm)	180 mg/m^3 (50 ppm)
2-Butanone	N/A	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)
Ethyl acetate	N/A	1,400 mg/m^3 (400 ppm)	1,400 mg/m^3 (400 ppm)	1,400 mg/m^3 (400 ppm)
Tetrahydrofuran	300 mg/m^3 (101 ppm)	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)	150 mg/m^3 (50 ppm)
Cyclohexane	700 mg/m^3 (200 ppm)	1,050 mg/m^3 (300 ppm)	1,050 mg/m^3 (300 ppm)	350 mg/m^3 (100 ppm)
n-Heptane	1,200 mg/m^3 (300 ppm)	2,000 mg/m^3 (500 ppm)	350 mg/m^3 (85 ppm)	1,600 mg/m^3 (400 ppm)
Benzene	3.2 mg/m^3 (1 ppm)	3.2 mg/m^3 (1 ppm)	0.3 mg/m^3 (0.1 ppm)	1.6 mg/m^3 (0.5 ppm)
Methyl Methacrylate	205 mg/m^3 (50 ppm)	410 mg/m^3 (100 ppm)	410 mg/m^3 (100 ppm)	205 mg/m^3 (50 ppm)
1,4-Dioxane	20 mg/m^3 (5 ppm)	360 mg/m^3 (100 ppm)	3.6 mg/m^3 (1 ppm)	72 mg/m^3 (20 ppm)
4-Methyl-2-pentanone	104 mg/m^3 (25 ppm)	410 mg/m^3 (100 ppm)	200 mg/m^3 (50 ppm)	200 mg/m^3 (50 ppm)
Toluene	150 mg/m^3 (40 ppm)	750 mg/m^3 (200 ppm)	375 mg/m^3 (100 ppm)	190 mg/m3 (50 ppm)
2-Hexanone	N/A	410 mg/m^3 (100 ppm)	4.1 mg/m^3 (1 ppm)	21 mg/m^3 (5 ppm)
Chlorobenzene	23 mg/m^3 (5 ppm)	350 mg/m^3 (75 ppm)	N/A	45 mg/m3 (10 ppm)
Ethylbenzene	215 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)
Xylene (p,m)	210 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)

VOC Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Xylene (Ortho)	210 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)
Styrene	N/A	430 mg/m^3 (100 ppm)	210 mg/m^3 (50 ppm)	86 mg/m^3 (20 ppm)
Isopropylbenzene (cumene)	100 mg/m^3 (25 ppm)	250 mg/m^3 (50 ppm)	250 mg/m^3 (50 ppm)	250 mg/m^3 (50 ppm)
4-Ethyltoluene	N/A	N/A	N/A	N/A
1,3,5-Trimethylbenzene	100 mg/m^3 (21 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)
1,2,4-Trimethylbenzene	100 mg/m^3 (21 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)
Naphthalene	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)

*N/A – Not Applicable
**LFC – Lowest Feasible Concentration

Hydrogen Sulfide (H_2S)

Instantaneous and analytical sampling was performed to screen for H_2S. Results were compared to the following exposure limits (the "criteria for comparison"). The values given are for 8-hour time weighted average exposures unless otherwise noted:

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
H_2S	1.65 ppm	28 mg/m^3 (20 ppm) 10-minute ceiling	14 mg/m^3 (10 ppm) 10-minute ceiling	1.4 mg/m^3 (1 ppm)

Polycyclic Aromatic Hydrocarbons (PAHs)

Analytical sampling was performed to screen for PAHs. The PAH sampling results were compared to the regulatory and recommended exposure limits summarized in the table below (the "criteria for comparison"). Only criteria for comparison of constituents that were identified above detectable levels are listed. The values given are for 8-hour time weighted average exposures.

PAH Constituent	**EU OEL (NL)**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Naphthalene	50 mg/m^3	50 mg/m^3	50 mg/m^3	50 mg/m^3
Acenaphthylene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Acenaphthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Fluorene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Phenanthrene	800 (Latvia)	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Anthracene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Pyrene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Chrysene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(e)pyrene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(b)fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(k)fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(a)pyrene	0.00055 mg/m^3 (Netherlands)	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3

Ozone (O_3)

Analytical sampling was performed to screen for O_3. Results were compared to the following exposure limits (the "criteria for comparison"). The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Ozone	0.12 mg/m^3 (0.05 ppm)	0.2 mg/m^3 (0.1 ppm)	0.2 mg/m^3 (0.1 ppm)	0.2 mg/m^3 (0.1 ppm)

Dioxins and Furans

Analytical sampling was performed to screen for dioxins/furans. Results were reported in picograms per cubic meter of air (pg/m^3), which were given for 8-hour time weighed average exposures. The results were normalized by toxicity equivalence factors to a toxicity equivalence (TEQ) value based on the dioxin compound tetra-chloro-dibenzo-dioxin (TCDD).

The TEQ was calculated by the laboratory as prediction of the potency of the mixture of dioxins and furans present in a sample and expressed as a concentration of 2,3,7,8 Tetrachlorodibenzo-*p*-dioxin or TCDD alone. TCDD is commonly regarded as the most toxic compound (congener) in the dioxin group of chemicals and is used as a general measure of dioxin toxicity for the samples.

The TEQ was compared to exposure limits (the "criteria for comparison") presented below:

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
TCDD	10 pg/m^3 (Germany)	*LFC	LFC	LFC

*LFC – Lowest Feasible Concentration

Polychlorinated Biphenyls (PCB's)

Analytical sampling was performed to screen for PCBs. Results were compared to the following exposure limits (the "criteria for comparison"). The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
PCB's	0.01 mg/m^3 (Denmark)	0.5 mg/m^3 (skin)	0.001 mg/m^3	0.5 mg/m^3 (skin)

Heavy Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)

Analytical sampling was performed to screen for the following heavy metals: arsenic, barium, cadmium, chromium, lead, selenium and silver. Results were reported in mg/m^3 and compared to the following exposure limits (the “criteria for comparison”). The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Arsenic (As)	0.2 mg/m^3 (Israel)	0.01 mg/m^3	N/A	0.01 mg/m^3
Lead (Pb)	0.15 mg/m^3 (EU)	0.05 mg/m^3	0.05 mg/m^3	0.05 mg/m^3
Barium (Ba)	0.5 mg/m^3 (Finland)	0.5 mg/m^3	0.5 mg/m^3	0.5 mg/m^3
Chromium (Cr)	2.0 mg/m^3 (EU)	0.5 mg/m^3	0.5 mg/m^3	0.5 mg/m^3
Cadmium (Cd)	0.004 mg/m^3 (Finland)	0.005 mg/m^3	*LFC	0.002 mg/m^3
Silver (Ag)	0.01 mg/m^3 (Germany)	0.01 mg/m^3	0.01 mg/m^3	0.1 mg/m^3
Selenium (Se)	0.1 mg/m^3 (Finland)	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3

*N/A – Not Applicable

**LFC – Lowest Feasible Concentration

Asbestos Fibers

Analytical sampling was performed to screen for airborne asbestos fibers. Asbestos sample results were reported in Structures per square millimeter (S/mm^2). The TEM analytical method allows for identification of asbestos fibers. Therefore the interpretive criteria for this constituent were based upon the presence/absence of asbestos fibers in the samples, with detectable concentrations being deemed significant.

SECTION 3.0 – FINDINGS

3.1 SCREENING RESULTS

Instantaneous and analytical samples were collected from upwind, smoke and personnel locations shown on sample location diagram that is provided in Figure 1.

- Instantaneous sampling was performed at the smoke and upwind locations. The readings were observed to fluctuate with changes in wind speed, wind direction and in the density of the smoke plumes. The data was collected from 13 test locations (11 smoke and 2 upwind control samples) and shown in Table 2 which is attached to this report. The values for CO, H_2S, and particulates were higher when sampling equipment was placed directly in the smoke plumes. The instantaneous meters typically displayed no readings (zeroes) or near zeroes for the above COCs when not placed in visible smoke plumes which also are associated with landfill gasses. One exception was $O_{2,}$ which did not show zero readings outside of the smoke plumes.

- Analytical sampling consisted of 12 smoke, 3 upwind and 4 personnel samples.

This Section contains a summary of the data collected during the testing. Results will be presented by constituent and grouped by test location (smoke, upwind and personnel). Instantaneous and analytical sampling was not performed for each constituent; only information was provided for the testing performed.

Landfill Gases – Methane (CH_4), Carbon Dioxide (CO_2), and Carbon Monoxide (CO)

A summary of testing for landfill gasses, which include Methane, Carbon Dioxide and Carbon Monoxide is presented below.

Methane

Methane screening results were compared to 1,000 ppm. Instantaneous testing results are shown on Table 2 and analytical testing results are provided in Table 3 and Attachment C. A summary of findings is presented below:

Smoke Sampling

Analytical sampling results were below the limit values presented in the comparison criteria of 1,000 ppm, with smoke and upwind control samples ranging from 8.7 to 160 ppm.

Instantaneous readings ranged from 0 to 28,000 ppm. The locations with the highest values were limited to the temporary debris site, which was sampled on Day 3. Detectable concentrations of methane were not identified in the other test locations.

Upwind Sampling

The results of the analytical sampling were below the comparison criteria of 1,000 ppm. Analytical sampling results showed that methane was not detected in the test locations with reported concentrations ranging from 2.6 to 5.0 ppm.

Personnel Sampling

The analytical sampling showed that methane was not detected in the test locations, with reported concentrations ranging from 2.6 to 5.0 ppm.

Carbon Dioxide

Carbon dioxide instantaneous testing results are shown on Table 2 and analytical testing results are provided in Table 3 and Attachment C. Analytical readings were compared to 5,000 ppm.

Smoke Sampling

Analytical CO_2 results were below the limit values presented in the comparison criteria of 5,000 ppm, with results ranging from 480 to 1,900 ppm.

Instantaneous CO_2 readings ranged from 1,000 to 6,000 ppm.

Upwind Sampling

Analytical CO_2 readings were below the criteria for comparison of 5,000 ppm. Instantaneous results ranged from 0 to 1,000 ppm and analytical results ranged from 550 to 600 ppm.

Personnel Sampling

The results of the analytical sampling were below the comparison criteria of 5,000 ppm with results ranging from 650 to 1,500 ppm.

Carbon Monoxide

Carbon monoxide analytical testing results are shown on Table 3 and Figure 2 with laboratory reports provided in Attachment C. Analytical readings were compared to 25 ppm. Instantaneous testing results are shown on Table 2.

Smoke Sampling

Analytical CO results exceeded comparison criteria of 25 ppm in 4 of 12 smoke samples (1 on northwest municipal waste disposal site, 2 on south municipal waste disposal site and 1 on the temporary debris site), with results ranging from below detection limits (BDL) to 130 ppm.

Instantaneous CO readings ranged from 5 to 500 ppm.

Upwind Sampling

CO was not detected in the analytical samples. Instantaneous CO readings were 0 and 24 ppm.

Personnel Sampling

CO was not detected in the personnel samples.

Lower Explosive Limit

Instantaneous testing for LEL was performed. The results were compared to an action level of 10%. A summary of LEL readings is presented in Table 2.

Smoke Sampling

Explosive environment testing or LEL did not exceed the 10% action level. Results ranged from 0 to 9%, with 2 samples collected from the south municipal waste disposal site that were just below the action level of 10% with readings of 9%.

Upwind Sampling

Explosive environment testing or LEL did not exceed the 10% action level. Results in the test locations were 0%.

Personnel Sampling

LEL testing was not performed in these locations.

Oxygen (O_2)

Instantaneous testing was performed for O_2. Readings were compared to OSHA minimum levels of 195,000 ppm or 19.5%. A summary of O_2 readings is presented in Table 2.

Smoke Sampling

Oxygen gas readings exceeded the minimum levels in the smoke samples with results ranging from 196,000 to 209,000 ppm (19.5-20.9%).

Upwind Sampling

Oxygen gas readings exceeded the minimum levels in the upwind samples with results of 204,000 to 209,000 ppm (20.4-20.9%).

Personnel Sampling

Oxygen gas testing was not performed in these locations.

Respirable Particulates (PM 2.5)

Instantaneous testing was performed to screen for particles of less than 2.5 micrometers in size ("respirable particles"). The sampling was performed over approximate 8-hour periods; averages of the particulate concentrations and peak concentrations at the types of test locations (smoke, personnel and upwind control) for respirable particulate readings were recorded and compared to 5 mg/m^3. A summary of the results is presented in Table 4 and Figure 3.

Smoke Sampling

Average results of the instantaneous smoke tests exceeded the 5.0 mg/m^3 criteria for comparison in 9 of 12 sample locations (3 on northwest municipal waste disposal site, 3 on south municipal waste disposal site and 3 on the temporary debris site). Averages at the test locations ranged from 0 to 161 mg/m^3 and peaks ranged from 15 to 400 mg/m^3.

Upwind Sampling

Average results of instantaneous tests of upwind control locations exceeded the 5.0 mg/m^3 criteria for comparison in 2 of 3 samples (1 on northwest municipal waste disposal site and 1 on south municipal waste disposal site). Averages at the test locations ranged from 05 to 78 mg/m^3 and peaks ranged from 31 to 218 mg/m^3.

Personnel Sampling

Average results of the instantaneous tests of personnel sample locations exceeded the 5.0 mg/m^3 criteria for comparison in all four samples. Averages at the test locations ranged from 12 to 43 mg/m^3 and peaks ranged from 77 to 428 mg/m^3.

Volatile Organic Compounds (VOCs) –

Instantaneous testing was performed for total TVOCs and the results were used to determine the presence of these constituents at the test locations. The analytical testing allowed for analysis for specific compounds and results were compared to the lowest exposure limit presented in the criteria for comparison. Instantaneous testing results are shown on Table 2 and analytical testing results are shown on Table 5 and Figure 4 (Benzene only) with laboratory reports provided in Attachment D.

Smoke Sampling

Instantaneous TVOC results showed the presence of these constituents at the test locations (3 on northwest municipal waste disposal site, 4 on south municipal waste disposal site and 4 on the temporary debris site), with results ranging from 0 to 850 ppm.

Analytical sample results were as follows:

- Benzene exceeded the criteria for comparison of 0.3 mg/m^3 (NIOSH REL) in 11 of 12 smoke samples (4 on northwest municipal waste disposal site, 4 on south municipal waste disposal site and 3 on the temporary debris site), with results ranging from 0.2 to 13.0 mg/m^3.

- Concentrations of other VOCs were either below the criteria for comparison or BDL.

Upwind Sampling

Instantaneous TVOC results showed the presence of these constituents at the upwind test locations on the south municipal waste disposal site and the temporary debris site, with results of 100 and 7,000 ppm.

Analytical sample results showed that concentrations of VOCs, including Benzene were either below the criteria for comparison or BDL.

Personnel Sampling

VOC and Benzene concentrations were below the criteria for comparison or BDL.

Hydrogen Sulfide (H_2S) –

Hydrogen Sulfide readings were compared to 1 ppm. Instantaneous testing results are shown on Table 2 and analytical testing results are shown on Table 6 and Figure 5 with laboratory reports provided in Attachment E.

Smoke Sampling

Analytical H_2S results showed concentrations that exceeded the 1 ppm criteria for comparison (ACGIH TLV) in one smoke sample collected from the northwest municipal waste disposal site. Twelve smoke samples were collected with results ranging from BDL to 3.1 ppm.

Instantaneous H_2S readings ranged from 0 to 8.8 ppm.

Upwind Sampling

Instantaneous H_2S readings were 0 ppm and analytical testing results were either BDL or below exposure limits.

Personnel Sampling

H_2S levels in personnel samples were either BDL or below exposure limits.

Polycyclic Aromatic Hydrocarbons (PAHs) –

The analytical testing provided analysis for specific PAH compounds. Results were compared to the lowest exposure limit presented in the criteria for comparison for each constituent. Results are shown on Table 7 and laboratory reports are provided in Attachment F.

The following is a summary of the PAH sampling results:

Smoke Sampling

Acenaphthylene were found above the NIOSH REL of 0.1 mg/m^3 in 3 of 12 smoke samples (2 on south municipal waste disposal site and 1 on the temporary debris site), with results ranging from BDL to 0.6 mg/m^3. The sample locations and results are shown on Figure 6.

Benzo(a)pyrene were found above the EU OEL (NL) of 0.00055 mg/m^3 in 3 of 12 (1 on northwest municipal waste disposal site and 2 on south municipal waste disposal site) smoke samples, with results ranging from BDL to 0.0044 mg/m^3. The sample locations and results are shown on Figure 7.

Concentrations of other PAHs were either BDL or below the criteria for comparison.

Upwind Sampling

Concentrations of PAHs, including Acenaphthylene and Benzo(a)pyrene were either BDL or below the criteria for comparison.

Personnel Sampling

Concentrations of PAHs, including Acenaphthylene and Benzo(a)pyrene were either BDL or below the criteria for comparison.

Ozone (O_3) –

Ozone readings were compared to 0.12 mg/m^3. Results are shown on Table 8 and Figure 8 with laboratory reports are provided in Attachment G.

The limit of detection for the O_3 samples ranged from 0.20 to 0.31 mg/m^3, which is at or above the criteria for comparison. This was because the samples were collected at a lower volume than recommended in the standard. Although the lower sample collection volume resulted in a higher limit of detection on the laboratory results, useful data was obtained. Some sample results were reported by the laboratory above the limits of detection and above the criteria for comparison. These data were useful in concluding that this constituent has the potential to cause overexposures and should be monitored during the fire suppression activities.

Smoke Sampling

Three of 14 smoke samples showed O_3 levels at or above the 0.12 mg/m^3 criteria of comparison (EU OEL, NL), with results of 0.91 on the northwest municipal waste disposal site and 0.26 and 0.20 mg/m^3 on the south municipal waste disposal site. O_3 was not detected in the remaining smoke samples.

Only 3 smoke samples were collected on Day 3, at the temporary debris site. The O_3 sampling media was damaged due to weather impacts (location #001).

Upwind Sampling

O_3 was not detected in the upwind samples. An upwind sample was not collected during the testing of the temporary debris site, the sampling station

Personnel Sampling

O_3 was not detected in the personnel samples.

Dioxins and Furans –

Dioxin results were compared to the TCDD TEQ of 10 pg/m^3. Results are shown on Table 9 and Figure 9, with laboratory reports provided in Attachment H.

Smoke Sampling

Concentrations of dioxin/furan constituents were above the TCDD TEQ of 10 pg/m^3 in 9 of 11 smoke samples (2 on northwest municipal waste disposal site, 4 on south municipal waste disposal site and 3 on the temporary debris site). TCDD TEQ of the samples values ranged from 1.0 to 590 pg/m^3.

Only 3 smoke samples were collected on Day 3, at the temporary debris site, the sampling media was reported by the laboratory to be damaged and not analyzed

Upwind Sampling

TCDD TEQ values were below the comparison criteria of 10 pg/m^3, with results ranging from 1.1 to 4.4 pg/m^3.

Personnel Sampling

TCDD TEQ values were below the comparison criteria of 10 pg/m^3 and ranged from 0.0016 to 0.33 pq/m^3.

Polychlorinated Biphenyls (PCBs) –

Polychlorinated Biphenyl results were compared to 0.001 mg/m^3. The laboratory report is provided in Attachment I.

Smoke Sampling

Detectable concentrations of PCBs were not found within the smoke samples.

Upwind Sampling

Detectable concentrations of PCBs were not found within the upwind samples.

Personnel Sampling

Detectable concentrations of PCBs were not found within the personnel samples.

The limit of detection, or minimum concentration detectable by the analytical method used, was reported by the laboratory as ranging from 0.0028 – 0.00062 mg/m^3, which was above the criteria for comparison, but less than other exposure limits (EU OEL – 0.01 mg/m^3, OSHA PEL – 0.5 mg/m^3 and ACGIH TLV of 0.5 mg/m^3). Since detectable concentrations of PCBs were not identified and the results were significantly lower than other exposure limits this should not pose a significant concern.

The samples were collected at a flowrate of 0.25 liters per minute, which is slightly higher than the flowrate 0.20 liters per minute, which is recommended in the NIOSH 5503 Method. It is the opinion of EE&G that this difference did not have a significant impact on the validity or usefulness of the results.

Heavy Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)

Heavy metal samples were compared to the lowest established exposure limit for each constituent. The results are presented in Table 10 and the laboratory results are provided in Attachment J.

Smoke Sampling

The following metals were identified in smoke test samples at concentrations above the limits of detection reported by the laboratory:

- Arsenic was not found in concentrations above the 0.2 mg/m^3 criteria for comparison in the samples, with results ranging from 0.000073 to 0.0013 mg/m^3.
- Barium was not detected in the samples.
- Lead was not found in concentrations above the 0.15 mg/m^3 criteria for comparison in the samples, with results ranging from 0.000038 to 0.0023 mg/m^3.
- Chromium was not found in concentrations above the 2.0 mg/m^3 criteria for comparison in the samples, with results ranging from 0.00068 to 0.00083 mg/m^3.
- Cadmium was detected in 1 of 15 smoke samples (1 on south municipal waste disposal site) and not found in upwind control or personnel samples. The result was 0.000071 mg/m^3, which is below the EU OEL (Finland) of 0.004 mg/m^3 and OSHA PEL of 0.005 mg/m^3, but above the NIOSH REL of lowest feasible concentration. It is the opinion of EE&G that a result at this concentration is not statistically significant.
- Selenium was not found in concentrations above the 0.1 mg/m^3 criteria for comparison in the samples, with results ranging from 0.000047 to 0.00014 mg/m^3.
- Silver was not detected in the samples.

Upwind Sampling

Metals were not detected in the upwind samples, with exception of a 0.00073 mg/m^3 concentration of chromium identified in sample 01-005, which was collected on the south municipal waste site. This result was below the comparison criteria of 2.0 mg/m^3.

Personnel Sampling

Metals were not detected in the personnel samples, with exception of a 0.00083 mg/m^3 concentration of chromium identified in sample 02-007, which was collected from the track hoe working on the temporary debris site. This result was below the comparison criteria of 2.0 mg/m^3.

Asbestos Fibers –

Asbestos fiber samples were compared to 70 S/mm^2, laboratory results are provided in Attachment K. Below is a summary of the asbestos sampling results:

Smoke Sampling

Asbestos fibers were not detected in the smoke samples. Sample 02-001, collected from the south municipal waste disposal site was not analyzed by the laboratory and was reported to be too heavily loaded with particulates.

Upwind Sampling

Asbestos fibers were not detected in the upwind samples.

Personnel Sampling

Asbestos fibers were not detected in the personnel samples.

3.2 DATA INTERPRETATION

Below is a discussion of significant findings of sampling data described in the above section. Upwind and personnel sampling did not identify COCs that were not also found in the smoke samples. Therefore, the information presented in this Section will focus on the COCs that were found to have concentrations above exposure limits in the smoke and compare them to the results of the upwind and personnel samples.

Smoke Sampling

Constituents of concern were found above exposure limits in the smoke testing. Below is a table showing these COCs, the number of samples, their average concentration, range, comparison value and number of exceedances.

COC	Number of Samples	Average	Range	Exposure Limit	Number of Exceedances
Carbon Monoxide (Analytical)	12	31 ppm	<5.6 – 130 ppm	25 ppm	4
Respirable Particulates (PM 2.5)	12	45 mg/m^3	0.0 – 161 mg/m^3	5 mg/m^3	9
Volatile Organic Compounds - Benzene	12	4.2 mg/m^3	0.2 – 13.0 mg/^{3}	0.3 mg/m^3	11
Hydrogen Sulfide (Analytical)	12	0.51 ppm	<0.24 – 3.1 ppm	1 ppm	1
Acenapthylene (Analytical)	12	0.1 mg/m^3	BDL – 0.6 mg/m^3	0.1 mg/m^3	3
Benzo(a)pyrene (Analytical)	12	0.00061 mg/m^3	BDL – 0.0044 mg/m^3	0.00055 mg/m^3	3
Ozone (Analytical)	12	0.11 mg/m^3	BDL – 0.91 mg/m^3	0.12 mg/m^3	3

COC	Number of Samples	Average	Range	Exposure Limit	Number of Exceedances
Dioxin/Furans (TCDD TEQ) (Analytical)	11	149 pg/m^3	1 – 590 pg/m^3	10 pg/m^3	9

Upwind Sampling

Below is a table showing the COCs, the number of samples, their average concentration, range, comparison value and number of exceedances for upwind samples.

COC	Number of Samples	Average	Range	Exposure Limit	Number of Exceedances
Carbon Monoxide (Analytical)	3	6 ppm	<5 – <6 ppm	25 ppm	0
Respirable Particulates (PM 2.5)	3	32 mg/m^3	5 – 78 mg/m^3	5 mg/m^3	2
Volatile Organic Compounds - Benzene	3	0.04 mg/m^3	0.02 – 0.08 mg/^{3}	0.3 mg/m^3	0
Hydrogen Sulfide (Analytical)	3	0.29 ppm (Not Detected)	<0.25 – <0.35 ppm	1 ppm	0
Acenapthylene (Analytical)	3	0.004 mg/m^3	BDL – 0.005 mg/m^3	0.1 mg/m^3	0
Benzo(a)pyrene (Analytical)	3	0.00033 mg/m^3 (Not Detected)	<0.31 - <0.35 mg/m^3	0.00055 mg/m^3	0
Ozone (Analytical)	3	0.21 mg/m^3 (Not Detected)	<.020 – <0.23 mg/m^3	0.12 mg/m^3	0 (Not Detected)
Dioxin/Furans (TCDD TEQ) (Analytical)	3	1.8 pg/m^3	0 – 4.4 pg/m^3	10 pg/m^3	0

Detectable concentrations (below exposure limits) of other COCs were identified in the upwind samples, which included:

- Carbon Dioxide
- Carbon Monoxide
- VOCs
- PAHs
- Dioxin/Furans
- Metals

Personnel Sampling

Below is a table showing COCs, the number of samples, their average concentration, range, comparison value and number of exceedances for personnel samples.

COC	Number of Samples	Average	Range	Exposure Limit	Number of Exceedances
Carbon Monoxide (Analytical)	4	6 ppm	<5 – <6 ppm	25 ppm	0
Respirable Particulates (PM 2.5)	4	22 mg/m^3	12 – 43 mg/m^3	5 mg/m^3	4
Volatile Organic Compounds - Benzene	4	0.05 mg/m^3	0.02 – 0.08 mg/^{3}	0.3 mg/m^3	0
Hydrogen Sulfide (Analytical)	4	0.40 ppm	<0.24 – 0.81 ppm	1 ppm	0
Acenapthylene (Analytical)	4	0.002 mg/m^3	BDL – 0.004 mg/m^3	0.1 mg/m^3	0
Benzo(a)pyrene (Analytical)	4	0.00034 mg/m^3 (Not Detected)	<0.31 - <0.35 mg/m^3	0.00055 mg/m^3	0
Ozone (Analytical)	4	0.24 mg/m^3 (Not Detected)	<.020 – <0.31 mg/m^3	0.12 mg/m^3	0 (Not Detected)
Dioxin/Furans (TCDD TEQ) (Analytical)	4	0.1 pg/m^3	0.00 – 0.33 pg/m^3	10 pg/m^3	0

Detectable concentrations (below exposure limits) of other COCs were identified in the personnel samples, which included:

- Hydrogen Sulfide Gas
- VOCs
- PAHs
- Dioxin/Furans
- Metals

The above information shows the following:

- Smoke samples contained more COCs, with higher peak and average concentrations than the upwind and personnel samples.
- Respirable Particulates were found to exceed exposure limits in smoke, upwind and personnel samples.

- TVOCs were found in smoke and upwind samples. Personnel sampling was not performed, so the possibility exists that VOCs also may be a concern for operators.

- COC exceedances were not found in upwind and personnel samples that were not also found in the smoke samples. However concentrations of several COCs were found at the debris sites, outside of the smoke plumes.

SECTION 4.0 – CONCLUSIONS

Based on the findings of the preliminary screening activities, EE&G presents the following specific conclusions related to the air sampling data.

4.1 SMOKE SAMPLING

The smoke samples showed that concentrations of the following COCs were found to be at or above exposure limits. Figures 10a, 10b and 10c show locations of these samples for the northwest municipal waste disposal site, south municipal waste disposal site and the temporary debris site respectively:

COC	Smoke - Northwest Municipal Waste Disposal Site	Smoke - South Municipal Waste Disposal Site	Smoke - Temporary Disposal Site
Carbon Monoxide	X	X	X
Respirable Particulates (PM 2.5)	X	X	X
Volatile Organic Compounds - Benzene	X	X	X
Hydrogen Sulfide	X	-	-
PAH (all)	X	X	X
Acenapthylene	-	X	X
Benzo(a)pyrene	X	X	-
Ozone	X	X	-
Dioxin/Furans (TCDD TEQ)	X	X	X

X – Denotes location where concentrations exceeded exposure limits.

Given the location of the samples (collected from within the smoke plumes, within 1 foot of the surfaces of the debris and disposal sites), these results do not necessarily mean that the debris and disposal site employees or the general public are being exposed to these COCs at these concentrations. The results support that these COCs were present and that personnel performing work directly in the smoke at the debris and disposal sites have potential for exposure to these constituents at some level.

The instantaneous instrument testing supported the conclusion that the concentrations of the COCs were greater near the fissures/smoke sources. The potential exists that some COCs may originate from different locations other than where smoke was observed or in soils surrounding the fissures/smoke sources. Testing in these areas was outside of the scope of this screening.

The municipal waste disposal site had exceedances for 3 more COCs than the temporary debris site. This supported the understanding that the trash and waste smoldering beneath the surface at the sites may have different chemical compositions at different times. Also, fires have been burning deeper within the waste and for many more years at the municipal waste disposal site versus the more recently developed temporary debris site. The fact that several of COCs with exceedances were found at both sites suggested that there were some similarities in the smoke composition, with similar potential for exposure to firefighting crews and employees at the site.

The potential routes of exposure would primarily be through inhalation. However, exposure through dermal contact or ingestion from precipitated residues around smoke sources (fissures) or around/near active or inactive areas of smoldering or burning may also be possible. The risk of potential exposure may likely be increased once the fires are excavated and burning waste is exposed.

4.2 UPWIND SAMPLING

The results of the upwind control samples showed significantly lower concentrations of the COCs tested for when compared to the smoke test samples and with the exception of respirable particulates, showed no exceedances. This suggested that the COCs identified in the test samples primarily originated from the smoke/vapor sources evaluated at the site and likely did not originate from other offsite sources.

Detectable concentrations (below exposure limits) of other COCs were identified in the upwind samples, which included:

- Carbon Dioxide
- Carbon Monoxide
- VOCs
- PAHs
- Dioxin/Furans
- Metals

These results support that these COCs were present and that personnel working at the debris and disposal sites have potential for exposure to these constituents at some level, even when not working in visible smoke.

Particulate sample results were above the criteria for comparison in the upwind samples. These results were not likely due to the smoke, but to the lack of dust control at the debris and disposal sites.

4.3 PERSONNEL SAMPLING

The results of the personnel sampling performed in the equipment cabs did not identify concentrations of COCs above the referenced exposure limits, with the exception of particulates. Detectable concentrations (below exposure limits) of other COCs were identified in the personnel samples, which included:

- Hydrogen Sulfide Gas
- VOCs
- PAHs
- Dioxin/Furans
- Metals

These results support that these COCs were present and that there is potential for exposure to these constituents at some level.

The particulate sampling results were significant for the following reasons:

- Some COCs can bind to dust particles which can be inhaled, ingested or contaminate clothing.

- The results support the need for implementation of dust control at the debris and disposal sites.

The equipment operators were performing normal solid waste landfilling activities near the active face and temporary debris site; therefore, these data are not representative of what the conditions may be for operators performing fire suppression activities, who will presumably be within close proximity to active fire and associated smoke and landfill gas vapors.

SECTION 5.0 – RECOMMENDATIONS

This Section contains recommendations for the purpose of scoping the fire suppression activity. The implementation of the recommendations presented herein will need to be considered by the fire suppression contractor and other on-site operators. This will need to be confirmed at the time of mobilization and included in a final environmental and social safeguards instrument, duly cleared by the relevant authorities and in the case of World Bank financing, the World Bank. These recommendations should be revisited after the fires are suppressed and normal municipal waste disposal site activities are resumed.

EE&G's recommendations are based upon the understanding that the following personnel may be at the debris and disposal sites during fire suppression activities:

- Fire suppression crews and related staff – personnel that are expected to be working in the immediate vicinity of the fires.
- Landfill workers and contractors – personnel that are expected to spend the majority of their shifts working at the debris and disposal sites, but not in the immediate vicinity of the fires.
- Government employees, site visitors and waste haulers – personnel that are expected to spend a limited amount of time at the debris and disposal sites, but not in the immediate vicinity of the fires.
- Salvagers – individuals that are not employees of the Government, landfill operator or Government-authorized contractor. Salvagers work on the debris and disposal sites removing metal and other items of scrap value from waste that has been discarded.

EE&G's recommendations are presented below:

- The Government, authorized contractors and fire suppression contractors that work at the debris and disposal sites should have a health and safety plan developed that is specific to their on-site activities. Among other things, these plans should address hazard communication, use of personal protective equipment and smoke/fire safety.
- All personnel should be instructed to avoid working near fissures and downwind of smoke or areas where pungent landfill gas odors are observed. Workers operating directly in the visible smoke sources or in areas where smoke migration may be anticipated at the site should employ respiratory protection consisting of atmosphere supplying respirators (airline, self-contained breathing apparatus, or combination of the two). Air purifying respirators should not be allowed for such work. In addition to this level of respiratory protection, additional personal protection for high heat, fire and hot surfaces may also be required, depending on the nature of the work near the smoke sources.
- All personnel working on the debris and disposal sites should be provided with respiratory protection, at a minimum consisting of half-face respirators equipped with high efficiency particulate air (P100)/multi-gas/organic vapor cartridges. Prior

to being outfitted with a negative pressure respirator, employees should pass a basic physical. The physical should be performed by an occupational physician or equivalent health care professional and may include a medical history review, spirometry to assess lung capacity and any other assessment deemed necessary by the health care professional to determine fitness to wear a respirator. Furthermore, fit testing and respiratory use training should be conducted before any person is outfitted and asked to work/salvage on the debris and disposal sites.

- Consideration should be made to improve site security to reduce potential for unauthorized site visitors to access areas near fissures, smoke sources, fires or fire suppression exclusion zones. Unauthorized personnel should not be allowed inside fire suppression exclusion or contamination reduction zones.

- Fire suppression and government employees working on the debris and disposal sites, should be equipped with direct-read monitors to test for the presence of CO, H_2S, LEL, O_2, Hydrogen Cyanide (HCN), VOCs and other potentially harmful landfill gas components. These monitoring devices should be set to sound an alarm when the concentrations of the COCs reach the PEL, and workers instructed to immediately vacate any area where the alarm activates and move upwind. Equipment cabs should also be outfitted with these monitors. In addition, periodic analytical sampling for the original list of target COCs (at a minimum) referenced in Section 2.2 should be performed during fire suppression activities to monitor for changes in concentration and presence of airborne hazards. Work practices and personal protective equipment should be modified accordingly based on the results of this testing.

- Authorized visitors and salvagers, should be equipped with CO monitors as an indicator of the presence of CO, H_2S, VOCs and other potentially harmful landfill gas components. These monitoring devices should be set to sound an alarm when the concentrations of CO reach 1 ppm.

- Employees and salvagers working on the debris and disposal sites should be provided with disposable suits to wear over their work clothes, or alternatively, be provided uniforms, that are donned when reporting to work and removed following completion of their shift and laundered professionally. Employees should have a decontamination area with showers and lockers where uniforms are donned and doffed each day. The residue from the smoke was observed to contain oils and particulates that should not be taken back in personal vehicles to worker's/salvager's homes where exposure to children and others is possible in a residential scenario.

- Employees/Salvagers should be outfitted with rubber boots than can be decontaminated and are not taken to their house. Foot wear used on the debris and disposal sites also will potentially be impacted with oils and particulates that may represent a concern in a residential exposure scenario.

- Employees/Salvagers should be provided awareness training about the COCs and associated landfill gasses, monitoring devices, personal protective equipment use and decontamination processes. An 8 hour mini "HAZWOPER" type awareness training is recommended by a qualified company, with certificates issued to document the training.

These results and conclusions contained herein DO NOT contain reference to or discussion of potential for offsite migration of COCs, or the potential for impacting surrounding populations. Perimeter air monitoring of the debris and disposal sites and potential impacts to the surrounding areas from emissions is recommended to be performed as part of the fire suppression activities to be protective of human health and the environment. This sampling and analysis event was performed to assess the “worse case” exposure scenarios for workers (without excavating waste) that will be performing fire suppression and working within active combustion and smoke impacted areas. These data should not be used for other purposes, in particular speculation as to what offsite concerns may or may not be occurring.

TABLES

Table 2 – Instantaneous Testing Results
Table 3 – Landfill Gas Testing Results
Table 4 – Particulate (PM 2.5) Results
Table 5 – VOC Analytical Testing Results
Table 6 – H2S Analytical Testing Results
Table 7 – PAH Testing Results
Table 8 – Ozone (O_3) Testing Results
Tables 9a, 9b and 9c – Dioxin/Furan Testing Results
Table 10 – Heavy Metal Testing Results

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site

Table 2 - Instantaneous Testing Results

			Constituents of Concern							
Zone	Sample Type	Sample ID (Day-Location)	CO_2 (ppm)	CO (ppm)	H_2S (ppm)	LEL (%)	O_2 (ppm) - Minimum	CH_4 (ppm)	TVOC Range (ppm)	
									Low	High
Northwest - MWDS	Smoke	01-001	5,000	136	1.7	ND	20,100	ND	160	200
		01-002	6,000	9.0	ND	ND	20,900	ND	30	40
		01-003	6,000	5.0	ND	ND	20,900	ND	16	17
		01-004	--	--	--	--	--	--	--	--
	Upwind	01-005	--	--	--	--	--	--	--	--
South - MWDS	Smoke	02-001	1,000	499	9.0	9.0	20,400	ND	300	600
		02-002	1,000	19	2.5	4.0	20,100	ND	150	250
		02-003	1,000	500	8.8	4.0	20,100	ND	250	350
		02-004	1,000	11	ND	ND	20,300	ND	250	350
	Upwind	02-005	1,000	24	ND	ND	20,400	ND	ND	7000
	Personnel	02-006	--	--	--	--	--	--	--	--
		02-007	--	--	--	--	--	--	--	--
Temporary Debris Site	Smoke	03-001	ND	499	2.5	ND	20,500	ND	750	850
		03-002	6,000	500	7.0	ND	19,600	ND	250	300
		03-003	5,000	200	2.5	2.0	19,800	28,000	350	400
		03-004	3,000	40	1.2	ND	20,900	1,000	200	300
	Upwind	03-005	ND	ND	ND	ND	20,900	ND	ND	100
	Personnel	03-006	--	--	--	--	--	--	--	--
		03-007	--	--	--	--	--	--	--	--
Comparison Criteria		EU OEL	--	--	--	10	--	--	--	--
		OSHA PEL	--	--	--	10	--	--	--	--
		NIOSH REL	--	--	--	10	195,000	--	--	--
		ACGIH TLV	--	--	--	--	180,000	--	--	--

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria (Except O_2)

ppm: parts per million

ND: None Detected

--: Data not available

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site

Table 3 - Landfill Gas Testing Results

Zone	Sample Type	Sample ID (Day-Location)	Constituents of Concern (ppm)					
			Methane *		Carbon dioxide		Carbon monoxide	
			Detection Limit	Sample Result	Detection Limit	Sample Result	Detection Limit	Sample Result
Northwest - MWDS	Smoke	01-001	1,000	22	260	760	6.6	**26**
		01-002	1,000	13	200	560	5.0	6.7
		01-003	1,000	16	250	680	6.2	13
		01-004	1,000	35	300	740	7.5	18
	Upwind	01-005	1,000	4.0	220	600	5.6	<5.6
South - MWDS	Smoke	02-001	1,000	160	210	1,400	5.4	**92**
		02-002	1,000	69	240	870	6.0	**130**
		02-003	1,000	8.7	250	730	6.2	9.5
		02-004	1,000	39	240	1,900	6.0	15
	Upwind	02-005	1,000	2.6	250	550	6.2	<6.2
	Personnel	02-006 (P)	1,000	3.0	270	1,100	6.6	<6.6
		02-007 (P)	1,000	2.7	220	650	5.6	<5.6
Temporary Debris Site	Smoke	03-001	1,000	12	400	480	10	**26**
		03-002	1,000	7.9	210	710	5.4	15
		03-003	1,000	4.3	220	670	5.6	<5.6
		03-004	1,000	13	590	810	15	18
	Upwind	03-005	1,000	2.6	210	600	5.3	<5.3
	Personnel	03-006 (P)	1,000	3.1	260	1,500	6.4	<6.4
		03-007 (P)	1,000	3.7	270	650	6.8	<6.8
Comparison Criteria		EU OEL	--		5,000 ppm (NL)		25 ppm (NL)	
		OSHA PEL	--		5,000 ppm		50 ppm	
		NIOSH REL	--		5,000 ppm		35 ppm	
		ACGIH TLV	1,000 ppm		5,000 ppm		25 ppm	

* Methane was compared to the ACGIH TLV of 1,000 ppm.

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

ppm: parts per million

NL: Netherlands Specific

--: Data not avalaible

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site

Table 4 - Particulate (PM 2.5) Testing Results

Zone	Sample Type	Sampling ID (Day-Location)	Average (mg/m^3)	Minimum (mg/m^3)	Maximum (mg/m^3)
Northwest - MWDS	Smoke	01-001	0.14	0.04	0.76
		01-002	**16.81**	0.01	46.00
		01-003	**45.70**	0.81	97.30
		01-004	**40.30**	4.37	97.00
	Upwind	01-005	**13.10**	1.82	30.80
South - MWDS	Smoke	02-001	0.04	0.01	0.13
		02-002	**112.00**	2.96	349.00
		02-003	**161.00**	1.24	400.00
		02-004	**19.60**	0.61	176.00
	Upwind	02-005	**78.30**	8.47	218.00
	Personnel	02-006	**11.61**	0.04	76.67
		02-007	**16.70**	3.78	134.82
Temporary Debris Site	Smoke	03-001	0.01	0.01	0.02
		03-002	**44.90**	6.96	153.00
		03-003	**97.40**	0.04	356.00
		03-004	**6.72**	0.05	39.70
	Upwind	03-005	4.81	0.99	14.50
	Personnel	03-006	**42.77**	0.00	427.64
		03-007	**15.36**	2.54	105.99
Comparison Criteria	EU OEL		5.00 mg/m^3 (France)		
	OSHA PEL		5.00 mg/m^3		
	NIOSH REL		--		
	ACGIH TLV		--		

Bold - Indicates that value was equal to or greater than one or more of the Comparison Criteria

mg/m^3: Milligrams per cubic meter of air

--: Data not avaliable

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site
Table 5 - VOC Testing Results

	Sample Types						Comparison Criteria			
Constituent of Concern	Smoke Sample Range (mg/m^3)		Upwind Samples (mg/m^3)		Personnel Samples (mg/m^3)		EU OEL (mg/m^3)	OSHA PEL (mg/m^3)	NIOSH REL (mg/m^3)	ACGIH TLV (mg/m^3)
	Low	High	Low	High	Low	High				
Propylene	0.12	4.4	ND	0.026	0.029	0.04	--	240	--	1,190
Chloromethane	0.11	1.7	ND	0.024	0.017	0.025	268 (NL)	210	LFC	104
n-Butane	ND	ND	ND	ND	0.026	0.076	--	1,900	1,900	2,400
1,3-Butadiene	0.012	0.31	ND	ND	ND	ND	46.2 (NL)	2.2	LFC	4.4
Chloroethane	0.022	0.077	ND	ND	ND	ND	268 (NL)	2,600	LFC	264
Ethanol	0.087	40	0.35	2.2	0.57	10	260 (NL)	1,900	1,900	1,900
Isopropyl alcohol	0.015	0.072	ND	0.013	0.021	0.026	--	980	980	490
Acetone	0.26	4.3	0.015	0.03	0.021	0.081	1,210 (NL)	2,400	590	1,200
Acetonitrile	0.038	1.1	ND	ND	ND	ND	34 (NL)	67	34	34
Acrylonitrile	0.013	0.018	ND	ND	ND	ND	--	4.3	2.2	4.4
n-Hexane	ND	1	ND	ND	ND	ND	72	1,800	180	180
2-Butanone	0.065	1.4	ND	ND	0.02	ND	--	590	590	590
Ethyl acetate	0.019	0.068	ND	0.018	0.022	0.026	--	1,400	1,400	1,400
Tetrahydrofuran	0.022	0.72	ND	ND	ND	ND	300 (NL)	590	590	150
Cyclohexane	0.019	0.025	ND	ND	ND	ND	700 (NL)	1,000	1,000	350
n-Heptane	0.05	0.75	ND	ND	ND	ND	1,200 (NL)	2,000	350	1,600
Benzene	0.21	**13**	0.025	0.075	0.052	0.076	3.25 (NL)	3.2	0.32	1.6
Methyl Methacrylate	ND	0.083	ND	-	ND	ND	205 (NL)	410	410	205
1,4-Dioxane	0.021	0.6	ND	-	ND	ND	20 (NL)	360	3.6	72
4-Methyl-2-pentanone	0.024	0.041	ND	-	ND	ND	104 (NL)	410	200	200
Toluene	0.11	7.1	ND	0.033	0.028	0.085	150 (NL)	750	380	190
2-Hexanone	0.049	0.17	ND	ND	ND	ND	--	410	4.1	21
Chlorobenzene	0.025	0.048	ND	ND	ND	ND	23 (NL)	350	--	45
Ethylbenzene	0.077	7.2	ND	0.035	0.023	0.045	215 (NL)	430	430	435
Xylene (p,m)	0.058	1.0	ND	ND	ND	0.064	210 (NL)	430	430	435
Xylene (Ortho)	0.035	0.74	ND	ND	ND	0.025	221	430	430	435
Styrene	0.023	1.6	ND	0.023	ND	ND	--	430	210	86
Isopropylbenzene	0.094	2.1	ND	ND	ND	ND	100 (NL)	250	250	250
4-Ethyltoluene	0.029	0.39	ND	ND	ND	ND	--	--	--	--
1,3,5-Trimethylbenzene	0.03	0.38	ND	ND	ND	ND	100 (NL)	120	120	120
1,2,4-Trimethylbenzene	0.03	0.27	ND	ND	ND	ND	100 (NL)	120	120	120
Naphthalene	0.026	0.62	ND	ND	ND	ND	50 (NL)	52	52	50

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

--: Data Not Available

LFC: Lowest Feasible Concentration

ND: None Detected

mg/m^3: Milligrams per cubic meter of air

NL: Netherlands Specific

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDP) and Temporary Debris Site

Table 6 - H_2S Testing Results

Zone	Sample Type	Sample ID (Day-Location)	Reporting Limit (µg/tube)	Result (µg/tube)	Result (ppm)
Northwest - MWDS	Smoke	01-001	14	**170**	**3.1**
		01-002	14	<14	<0.28
		01-003	14	<14	<0.30
		01-004	14	<14	<0.33
	Upwind	01-005	14	<14	<0.35
South - MWDS	Smoke	02-001	14	<14	<0.24
		02-002	14	<14	<0.24
		02-003	14	<14	<0.24
		02-004	14	<14	<0.25
	Upwind	02-005	14	<14	<0.25
	Personnel	02-006	14	<14	<0.24
		02-007	14	<14	<0.25
Temporary Debris Site	Smoke	03-001	14	<14	<0.26
		03-002	14	<14	<0.27
		03-003	14	<14	<0.27
		03-004	14	<14	<0.28
	Upwind	03-005	14	<14	<0.26
	Personnel	03-006	14	<14	<0.28
		03-007	14	38	0.81
Comparison Criteria		EU OEL		--	1.65 ppm
		OSHA PEL (10 minute Ceiling)		--	20.00 ppm
		NIOSH REL (10 minute Ceiling)		--	10.00 ppm
		ACGIH TLV		--	1.00 ppm

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

µg: micrograms

ppm: parts per million

--: data not available

NL: Netherlands Specific

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site

Table 7 - PAH Testing Results

			Constituent of Concern (mg/m^3)												
Zone	Sample Type	Sample ID (Day-Location)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo (e) pyrene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene
Northwest - MWDS	Smoke	01-001	0.029	0.083	0.02	0.013	0.0048	0.0028	0.0021	0.0033	ND	ND	ND	ND	**0.00056**
		01-002	ND	0.025	ND	0.013	0.017	ND	0.0035	0.0045	ND	ND	ND	ND	0.00044
		01-003	0.009	0.027	ND	0.003	ND	ND	0.0054	0.00037	ND	ND	ND	ND	0.00039
		01-004	0.012	0.028	0.0026	ND	ND	ND	ND	ND	0.013	0.0068	0.00073	0.00063	ND
	Upwind	01-005	ND	0.0048	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
South - MWDS	Smoke	02-001	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		02-002	ND	**0.21**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00053	**0.0015**
		02-003	ND	0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		02-004	ND	**0.55**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.0044**
	Upwind	02-005	ND	0.00093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Personnel	02-006	0.002	0.0044	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		02-007	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Temporary Debris Site	Smoke	03-001	ND	**0.169**	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
		03-002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		03-003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		03-004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Upwind	03-005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Personnel	03-006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		03-007	ND	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Comparison Criteria		EU OEL	50 (NL)	--	--	--	0.8 (Latvia)	--	--	--	--	--	--	--	0.00055 (NL)
		OSHA PEL	50	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
		NIOSH REL	50	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
		ACGIH TLV	50	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

mg/m^3: milligrams per cubic meter of air

ND: None Detected

--: Data not available

NL: Netherlands Specific

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site

Table 8 - Ozone (O3) Testing Results

Zone	Sample type	Sample ID (Day-Location)	Results (mg/m3)
Northwest - MWDS	Smoke	01-001	**0.91**
		01-002	ND
		01-003	ND
		01-004	ND
	Upwind	01-005	ND
South - MWDS	Smoke	02-001	ND
		02-002	**0.26**
		02-003	ND
		02-004	**0.20**
	Upwind	02-005	ND
	Personnel	02-006	ND
		02-007	ND
Temporary Debris Site	Smoke	03-002	ND
		03-003	ND
	Upwind	03-005	ND
	Personnel	03-006	ND
		03-007	ND
Comparison Criteria		EU OEL	0.12 (NL)
		OSHA PEL	0.20
		NIOSH REL	0.20
		ACGIH TLV	0.20

Bold - Value was equal to or greater than one or more of the Comparison Criteria

ND: None Detected (possible from reduced volume of air collected)

mg/m^3: Milligrams per cubic meter of air

NL: Netherlands Specific

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Wast Disposal Site (MWDS) and Temporary Debris Site
Table 9a - Dioxin/Furan Testing Results

Constituent of Concern		Northwest - MWDS						
		Smoke (pg/m^3)				Upwind (pg/m^3)	Personnel (pg/m^3)	
		01-001	01-002	01-003	01-004	01-005	--	--
2,3,7,8-TCDF		ND	ND	1.6	79	ND	--	--
Total TCDF		11,000	200	120	5,600	160	--	--
2,3,7,8-TCDD		16	ND	ND	35	ND	--	--
Total TCDD		3,900	150	83	11,000	310	--	--
1,2,3,7,8-PeCDF		110	1.5	1.0	ND	1.4	--	--
2,3,4,7,8-PeCDF		130	3.8	1.5	8.4	ND	--	--
Total PeCDF		2,000	36	19	1,500	40	--	--
1,2,3,7,8-PeCDD		33	2.0	ND	96	4.2	--	--
Total PeCDD		2,000	47	17	6,100	120	--	--
1,2,3,4,7,8-HxCDF		30	ND	ND	39	ND	--	--
1,2,3,6,7,8-HxCDF		62	1.6	ND	47	ND	--	--
2,3,4,6,7,8-HxCDF		75	ND	ND	ND	ND	--	--
1,2,3,7,8,9-HxCDF		13	1.2	ND	ND	ND	--	--
Total HxCDF		720	16	4.1	410	2.4	--	--
1,2,3,4,7,8-HxCDD		23	ND	ND	58	ND	--	--
1,2,3,6,7,8-HxCDD		39	1.1	ND	100	3.7	--	--
1,2,3,7,8,9-HxCDD		27	ND	ND	96	2.8	--	--
Total HxCDD		1,500	45	20	3,200	63	--	--
1,2,3,4,6,7,8-HpCDF		94	3.4	-----	43	ND	--	--
1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	--	--
Total HpCDF		94	3.4	ND	43	ND	--	--
1,2,3,4,6,7,8-HpCDD		120	6.6	ND	280	ND	--	--
Total HpCDD		500	22	ND	830	9.3	--	--
OCDF		ND	ND	ND	36	ND	--	--
OCDD		53	13	3.4	230	ND	--	--
Total 2,3,7,8-TCDD Equivalence:		**150**	3.9	1.00	**140**	4.4	--	--
Comparison Criteria	EU OEL	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	--	--
	OSHA PEL	LFC	LFC	LFC	LFC	LFC	--	--
	NIOSH REL	LFC	LFC	LFC	LFC	LFC	--	--
	ACGIH TLV	LFC	LFC	LFC	LFC	LFC	--	--

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

pg/m^3: picograms per cubic meter of air

ND: None Detected

--: Data not available

LFC: Lowest Feasible Concentration

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste Disposal Site (MWDS) and Temporary Debris Site
Table 9b - Dioxin/Furan Testing Results

Constituent of Concern		South - MWDS						
		Smoke (pg/m^3)				Upwind (pg/m3)	Personnel (pg/m3)	
		02-001	02-002	02-003	02-004	02-005	02-006	02-007
2,3,7,8-TCDF		27	79	28	ND	ND	ND	ND
Total TCDF		1700	3700	2100	17000	110	16	9.2
2,3,7,8-TCDD		7.2	15	5.2	150	ND	ND	ND
Total TCDD		1100	820	990	25000	280	34	11
1,2,3,7,8-PeCDF		27	ND	23	170	ND	ND	ND
2,3,4,7,8-PeCDF		ND	18	28	280	ND	ND	ND
Total PeCDF		450	410	620	4000	22	6.2	1.9
1,2,3,7,8-PeCDD		7.2	9.7	10	270	ND	ND	ND
Total PeCDD		300	220	430	9300	110	13	ND
1,2,3,4,7,8-HxCDF		7.7	ND	16	120	0.56	ND	ND
1,2,3,6,7,8-HxCDF		ND	ND	16	150	ND	ND	ND
2,3,4,6,7,8-HxCDF		ND	ND	18	ND	0.49	ND	ND
1,2,3,7,8,9-HxCDF		ND	ND	3.7	19	ND	ND	ND
Total HxCDF		63	26	200	1400	2.4	1.1	ND
1,2,3,4,7,8-HxCDD		ND	ND	6.0	140	ND	ND	ND
1,2,3,6,7,8-HxCDD		5.2	ND	8.2	300	1.4	ND	ND
1,2,3,7,8,9-HxCDD		6.3	ND	6.6	240	0.87	ND	ND
Total HxCDD		160	160	210	5700	64	9.9	1.7
1,2,3,4,6,7,8-HpCDF		5.7	ND	23	400	ND	0.65	ND
1,2,3,4,7,8,9-HpCDF		ND	ND	ND	17	ND	ND	ND
Total HpCDF		5.7	ND	23	510	ND	0.65	ND
1,2,3,4,6,7,8-HpCDD		17	16	22	720	2.8	ND	ND
Total HpCDD		38	40	61	2200	8.0	2.6	ND
OCDF		ND	ND	ND	27	ND	ND	ND
OCDD		ND	22	34	480	ND	3.0	1.6
Total 2,3,7,8-TCDD Equivalence:		**23**	**40**	**36**	**590**	1.1	0.021	0.0016
Comparison Criteria	EU OEL	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)
	OSHA PEL	LFC	LFC	LFC	LFC	LFC	LFC	LFC
	NIOSH REL	LFC	LFC	LFC	LFC	LFC	LFC	LFC
	ACGIH TLV	LFC	LFC	LFC	LFC	LFC	LFC	LFC

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

pg/m^3: picograms per cubic meter of air

ND: None Detected

--: Data not available

LFC: Lowest Feasible Concentration

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Wast Disposal Site (MWDS) and Temporary Debris Site
Table 9c - Dioxin/Furan Testing Results

Constituent of Concern		Temporary Debris Site					
		Smoke (pg/m^3)			Upwind (pg/m3)	Personnel (pg/m3)	
		03-001	03-003	03-004	03-005	03-006	03-007
2,3,7,8-TCDF		ND	33	ND	ND	ND	ND
Total TCDF		42,000	1,900	2,500	0.97	14	19
2,3,7,8-TCDD		180	15	15	ND	ND	ND
Total TCDD		54,000	4,400	3,300	ND	19	28
1,2,3,7,8-PeCDF		200	15	19	ND	ND	ND
2,3,4,7,8-PeCDF		300	23	34	ND	ND	ND
Total PeCDF		6,700	580	740	ND	ND	2
1,2,3,7,8-PeCDD		200	24	23	ND	ND	ND
Total PeCDD		21,000	2,400	1,300	ND	ND	10
1,2,3,4,7,8-HxCDF		82	6.3	14	ND	ND	ND
1,2,3,6,7,8-HxCDF		75	6.1	13	ND	ND	ND
2,3,4,6,7,8-HxCDF		90	6.7	13	ND	ND	ND
1,2,3,7,8,9-HxCDF		10	ND	ND	ND	ND	ND
Total HxCDF		1,100	58	150	ND	ND	ND
1,2,3,4,7,8-HxCDD		76	7.3	12	ND	ND	ND
1,2,3,6,7,8-HxCDD		130	13	17	ND	ND	ND
1,2,3,7,8,9-HxCDD		100	12	15	ND	ND	ND
Total HxCDD		8,700	780	620	ND	5.8	7.8
1,2,3,4,6,7,8-HpCDF		64	5.0	19	ND	3.1	ND
1,2,3,4,7,8,9-HpCDF		ND	ND	ND	ND	ND	ND
Total HpCDF		64	5.0	19	ND	8.4	ND
1,2,3,4,6,7,8-HpCDD		200	17	43	ND	12	ND
Total HpCDD		790	87	210	ND	24	1.8
OCDF		ND	ND	ND	ND	9.3	ND
OCDD		54	ND	43	ND	160	1.6
Total 2,3,7,8-TCDD Equivalence:		**550**	**48**	**58**	0.00	0.33	0.0016
Comparison Criteria	EU OEL	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)	10 (Germany)
	OSHA PEL	LFC	LFC	LFC	LFC	LFC	LFC
	NIOSH REL	LFC	LFC	LFC	LFC	LFC	LFC
	ACGIH TLV	LFC	LFC	LFC	LFC	LFC	LFC

Bold: Indicates that value was equal to or greater than one or more of the Comparison Criteria

pg/m^3: picograms per cubic meter of air

ND: None Detected

--: Data not available

LFC: Lowest Feasible Concentration

EU OEL: European Union Occupational Exposure Limit

OSHA PEL: Occupational Safety and Health Administration Permissible Exposure Limit

NIOSH REL: National Institute for Occupational Safety and Health Recommended Exposure Limit

ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value

Environmental Air Sampling Results - Pond Island Municipal Waste and Disposal Site (MWDS) and Temporary Debris Site

Table 10 - Heavy Metal Testing Results

Zone	Sample Type	Sample ID (Day-Location)	Arsenic (mg/m3)	Barium (mg/m3)	Cadmium (mg/m3)	Chromium (mg/m3)	Lead (mg/m3)	Selenium (mg/m3)	Silver (mg/m3)
Northwest - MWDS	Smoke	01-001	0.000077	ND	ND	ND	ND	ND	ND
		01-002	0.00016	ND	ND	ND	0.000088	ND	ND
		01-003	0.00018	ND	ND	0.00076	0.000047	ND	ND
		01-004	ND	ND	ND	ND	ND	ND	ND
	Upwind	01-005	ND	ND	ND	0.00073	ND	ND	ND
South - MWDS	Smoke	02-001	0.000073	ND	ND	ND	ND	ND	ND
		02-002	0.00020	ND	ND	ND	ND	ND	ND
		02-003	0.00016	ND	ND	0.00068	0.000038	ND	ND
		02-004	0.00050	ND	0.000071	ND	0.0017	0.000047	ND
	Upwind	02-005	ND	ND	ND	ND	ND	ND	ND
	Personnel	02-006	ND	ND	ND	ND	ND	ND	ND
		02-007	ND	ND	ND	0.00083	ND	ND	ND
Temporary Debris Site	Smoke	03-001	0.00065	ND	ND	ND	0.0023	0.00014	ND
		03-002	0.00015	ND	ND	0.00080	ND	ND	ND
		03-003	0.00018	ND	ND	0.00070	ND	ND	ND
		03-004	0.0013	ND	ND	ND	ND	0.00014	ND
	Upwind	03-005	ND	ND	ND	ND	ND	ND	ND
	Personnel	03-006	ND	ND	ND	ND	ND	ND	ND
		03-007	ND	ND	ND	ND	ND	ND	ND
Comparison Criteria		EU OEL	0.2 (Israel)	0.5 (Finland)	0.004 (Finland)	2.0 (EU)	0.15 (EU)	0.1 (Finland)	0.01 (Germany AGS)
		OSHA PEL	0.5	0.5	0.005	0.5	0.05	0.2	0.01
		NIOSH REL	--	0.5	LFC	0.5	0.05	0.2	0.01
		ACGIH TLV	0.01	0.5	0.002	0.5	0.05	0.2	0.1

Bold - Indicates that value was equal to or greater than one or more of the Comparison Criteria

mg/m^3: Milligrams per cubic meter of air

--: Data not avaliable

ND: None Detected

LFC: Lowest Feasible Concentration

EU OEL: Occupational Exposure Limit

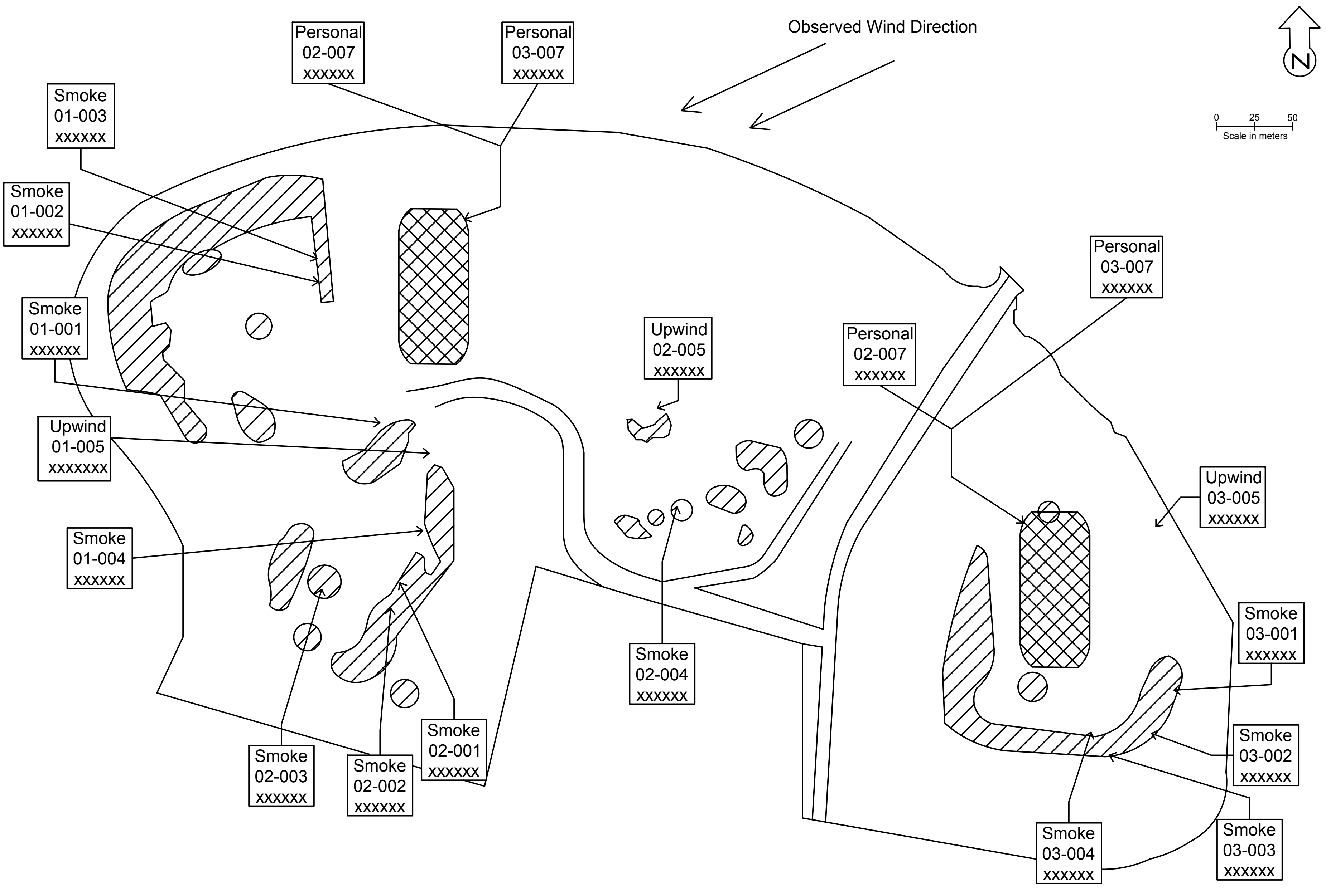
OSHA PEL: Permissible Exposure Limit

NIOSH REL: Recommended Exposure Limit

ACGIH TLV: Threshold Limit Value

FIGURES

Figure 1 – Site Sampling Plan
Figure 2 – Locations of CO Analytical Sampling Results
Figure 3 – Locations of Instantaneous Particulate (PM 2.5) Results
Figure 4 – Locations of Benzene Sampling Results
Figure 5 – Locations of H_2S Sampling Results
Figure 6 – Locations of Acenaphthylene Sampling Results
Figure 7 – Locations of Benzo(a)pyrene Sampling Results
Figure 8 – Locations of Ozone Sample Results
Figure 9 – Locations of Dioxin and Furan Results
Figure 10A – Locations with Results Above COCs – NW Municipal Waste Disposal Site
Figure 10B – Locations with Results Above COCs – South Municipal Waste Disposal Site
Figure 10C – Locations with Results Above COCs – Temporary Debris Site



EE&G

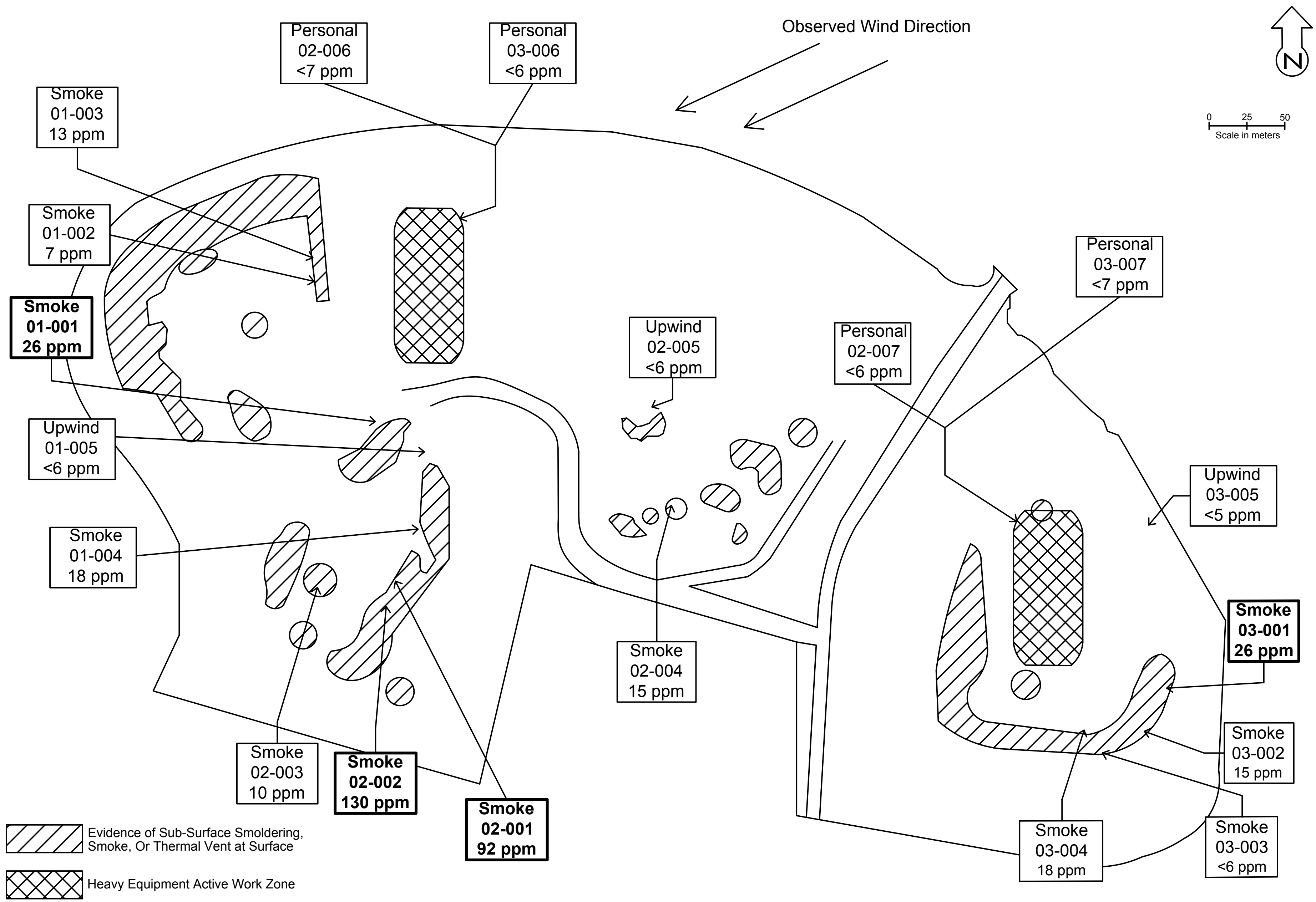
▨ Evidence of Sub-Surface Smoldering, Smoke, Or Thermal Vent at Surface

▩ Heavy Equipment Active Work Zone

Site Sampling Plan

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 1
Dwg. Scale: As Noted

FIGURE 1



EE&G

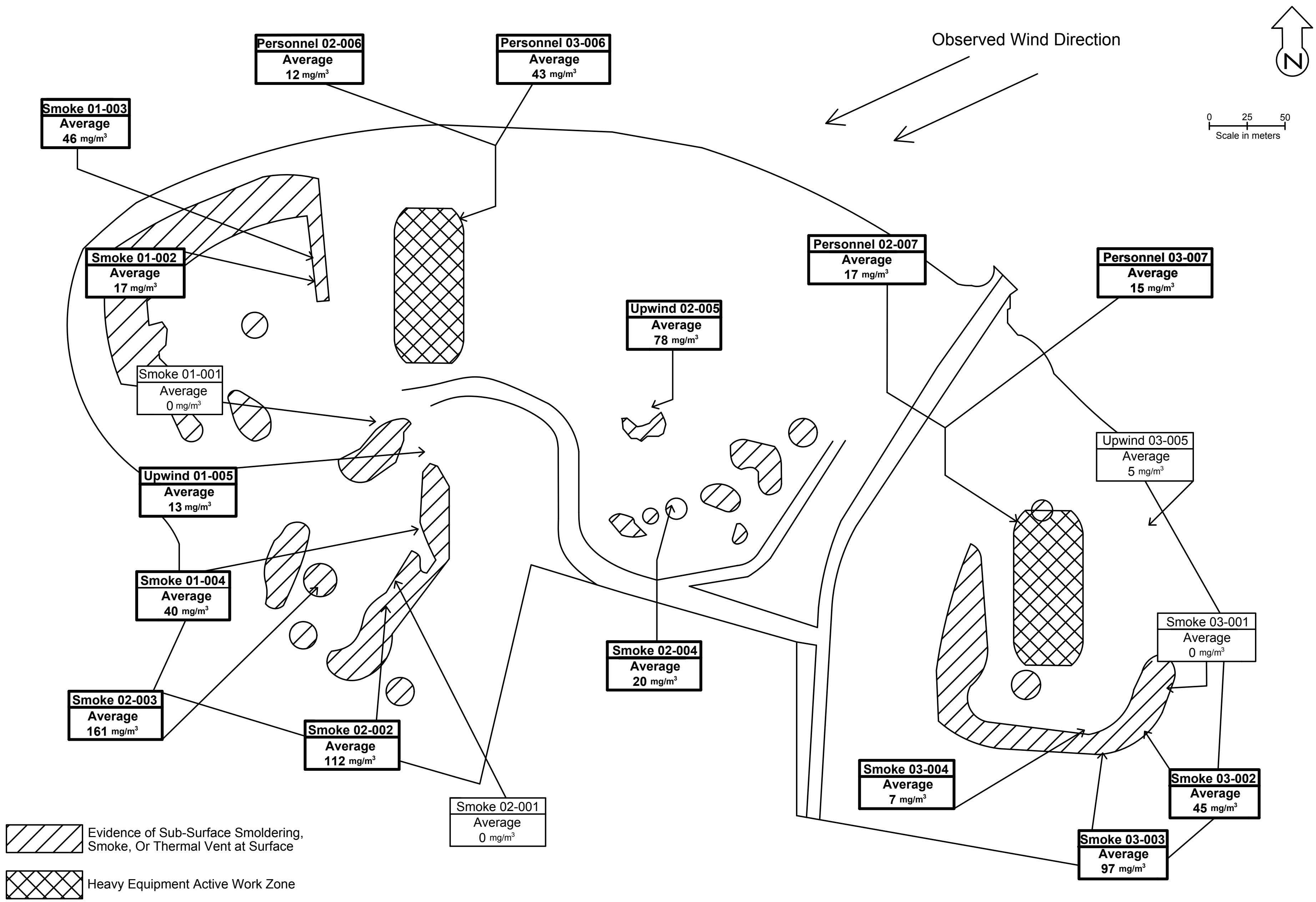
Occupational Exposure Limits = 25 ppm
Occupational Safety & Health Administration = 50 ppm
National Institute of Occupational Safety & Health = 35 ppm
American Conference of Governmental Industrial Hygienists = 25 ppm

NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

LOCATIONS OF CO ANALYTICAL RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 5
Dwg. Scale: As Noted

FIGURE 2



EE&G

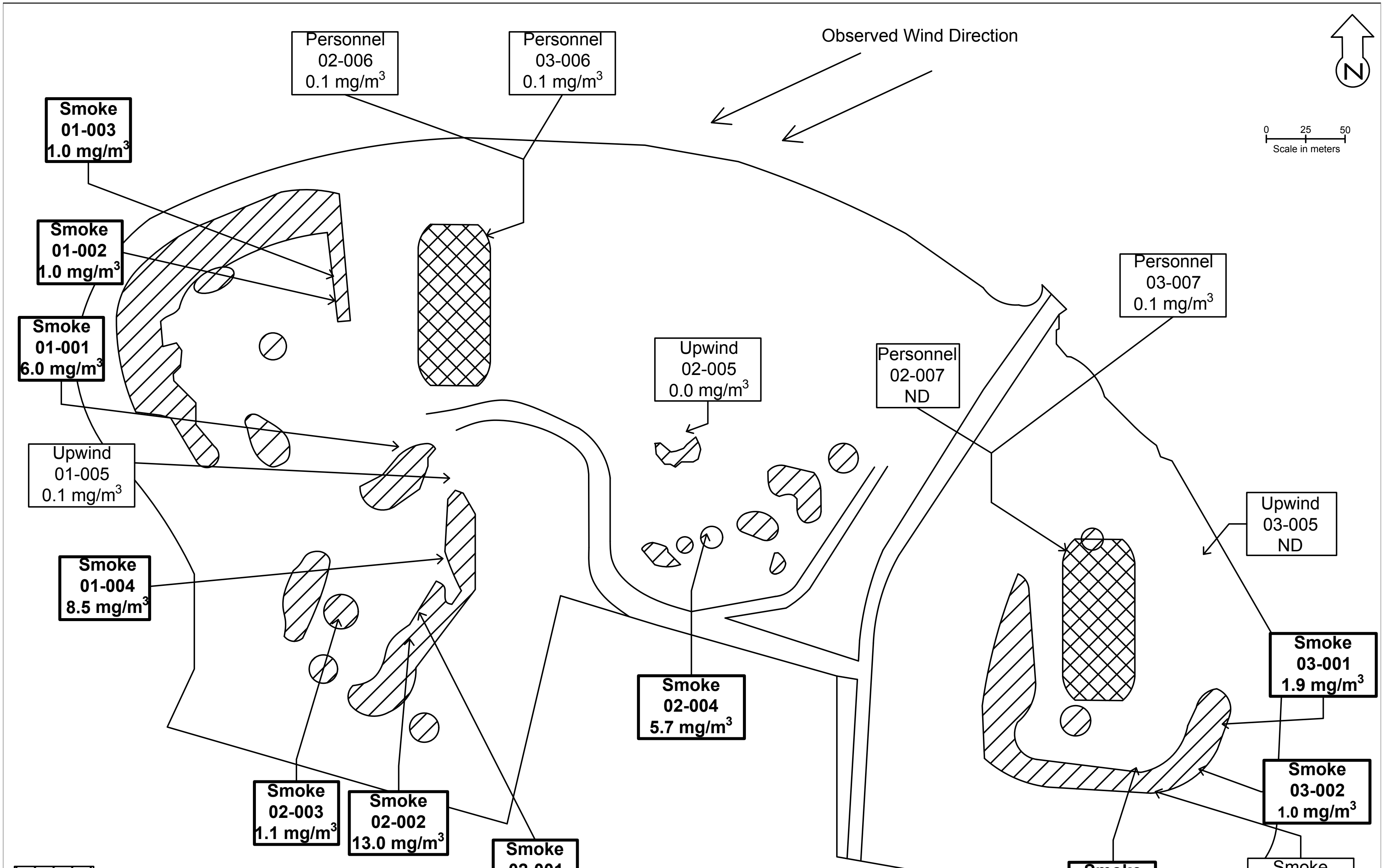
Occupational Exposure Limits (FRA) = 5 mg/m3
Occupational Safety & Health Administration = 5 mg/m3
National Institute of Occupational Safety & Health = Not Available
American Conference of Governmental Industrial Hygienists = Not Available

NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

LOCATIONS OF RESPIRABLE PARTICULATE TESTING RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 6
Dwg. Scale: As Noted

FIGURE 3



▨ Evidence of Sub-Surface Smoldering, Smoke, Or Thermal Vent at Surface

☒ Heavy Equipment Active Work Zone

EE&G

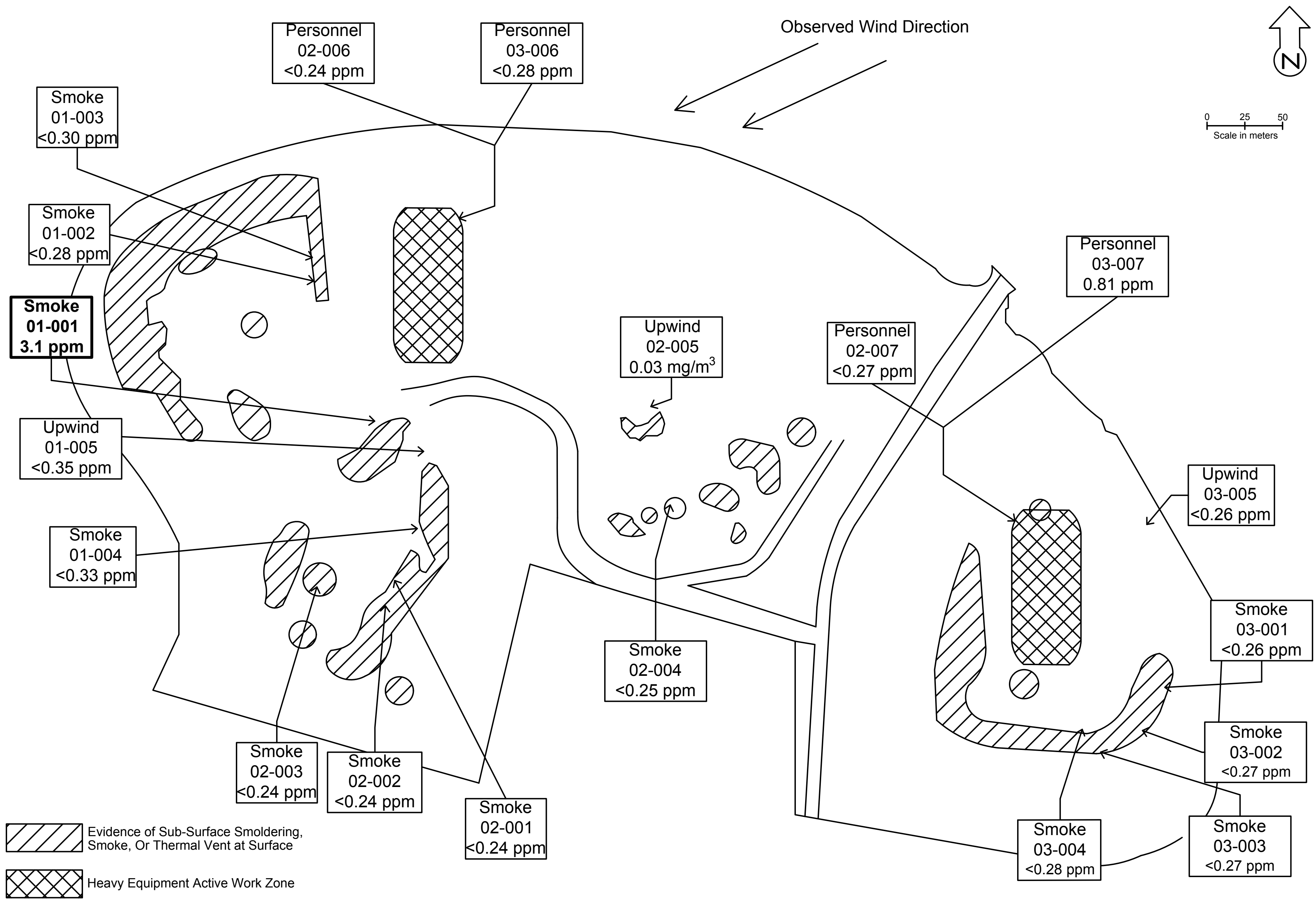
Occupational Exposure Limits = 3.2 mg/m3
Occupational Safety & Health Administration = 3.2 mg/m3
National Institute of Occupational Safety & Health = 0.3 mg/m3
American Conference of Governmental Industrial Hygienists = 1.6 mg/m3

NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

LOCATIONS OF BENZENE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 8
Dwg. Scale: As Noted

FIGURE
4



EE&G

Occupational Exposure Limits = 1.65 ppm

Occupational Safety & Health Administration = 20 ppm

National Institute of Occupational Safety & Health = 10 ppm

American Conference of Governmental Industrial Hygienists = 1 ppm

NR = No Reading

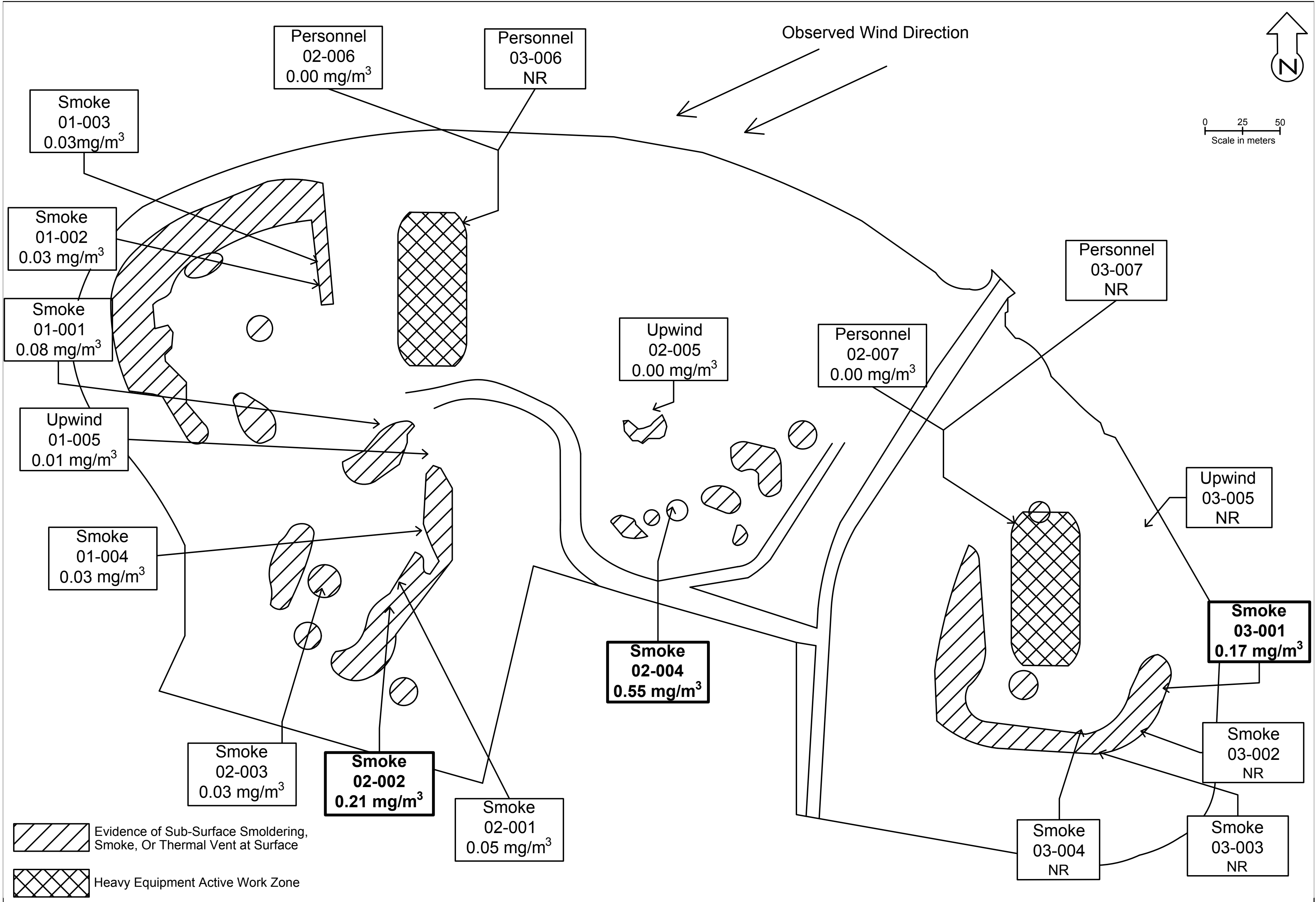
ND = Not Detected

BOLD = Exceeds Criteria

LOCATIONS OF H_2S RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 10
Dwg. Scale: As Noted

FIGURE
5



EE&G

Occupational Exposure Limits = Not Available

Occupational Safety & Health Administration = 0.20 mg/m3

National Institute of Occupational Safety & Health = 0.10 mg/m3

American Conference of Governmental Industrial Hygienists = 0.20 mg/m3

NR = No Reading

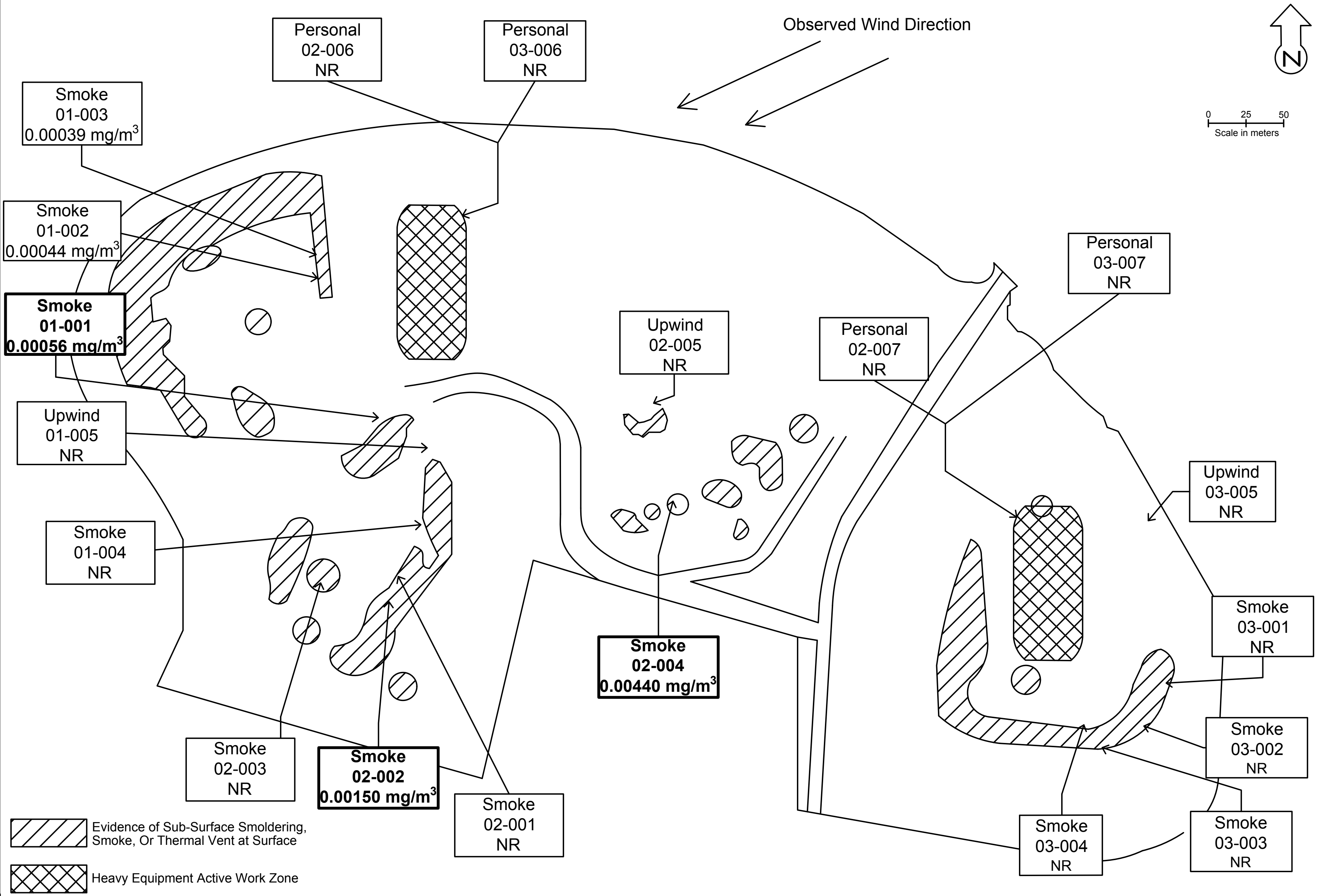
ND = Not Detected

BOLD = Exceeds Criteria

LOCATIONS OF ACENAPHTHYLENE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 11
Dwg. Scale: As Noted

FIGURE 6



EE&G

Occupational Exposure Limits (NED) = 0.00055 mg/m3

Occupational Safety & Health Administration = 0.2 mg/m3

National Institute of Occupational Safety & Health = 0.1 mg/m3

American Conference of Governmental Industrial Hygienists = 0.2 mg/m3

NR = No Reading

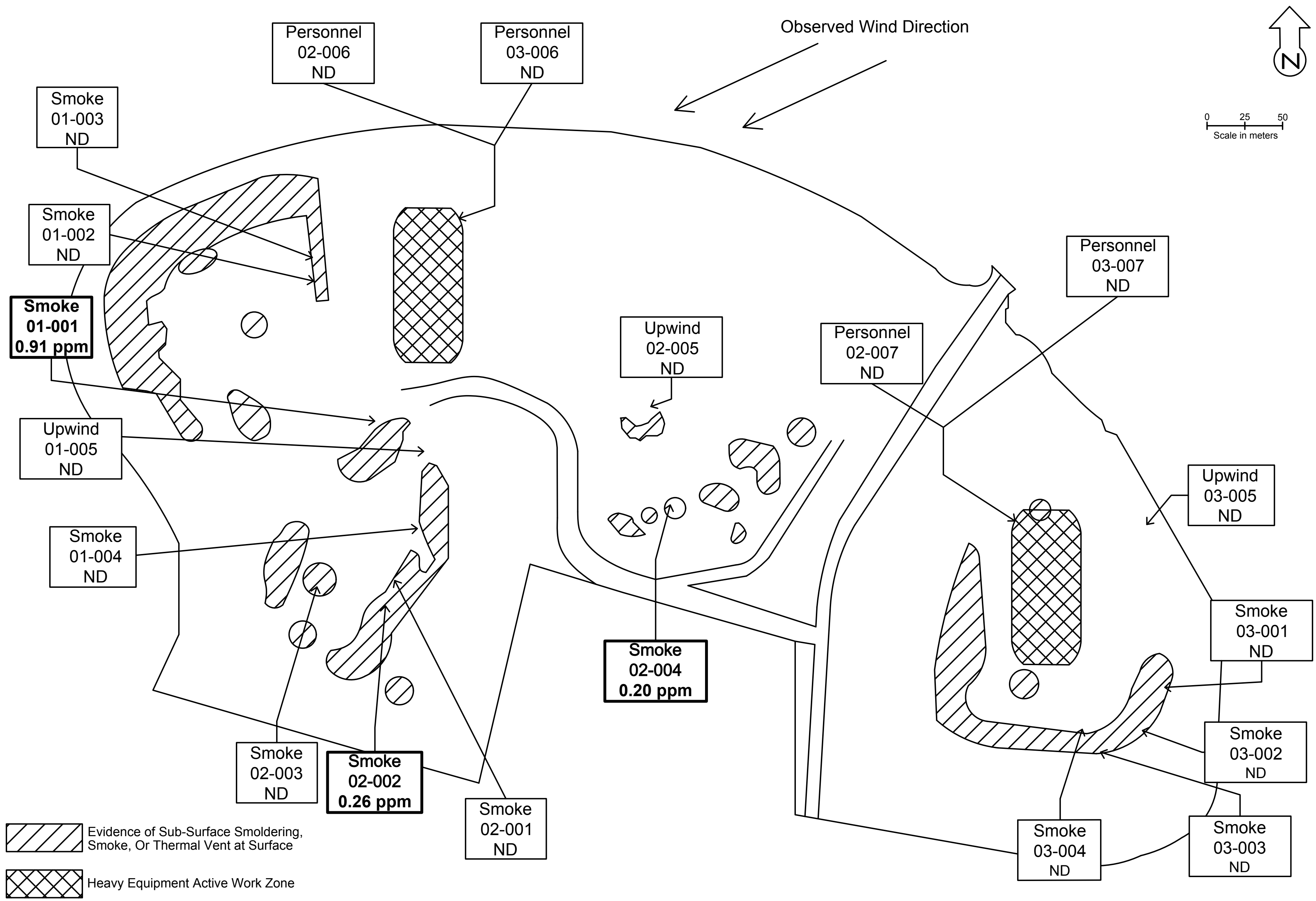
ND = Not Detected

BOLD = Exceeds Criteria

LOCATIONS OF BENZO(A)PYRENE EQUIVALENT RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 12
Dwg. Scale: As Noted

FIGURE 7



EE&G

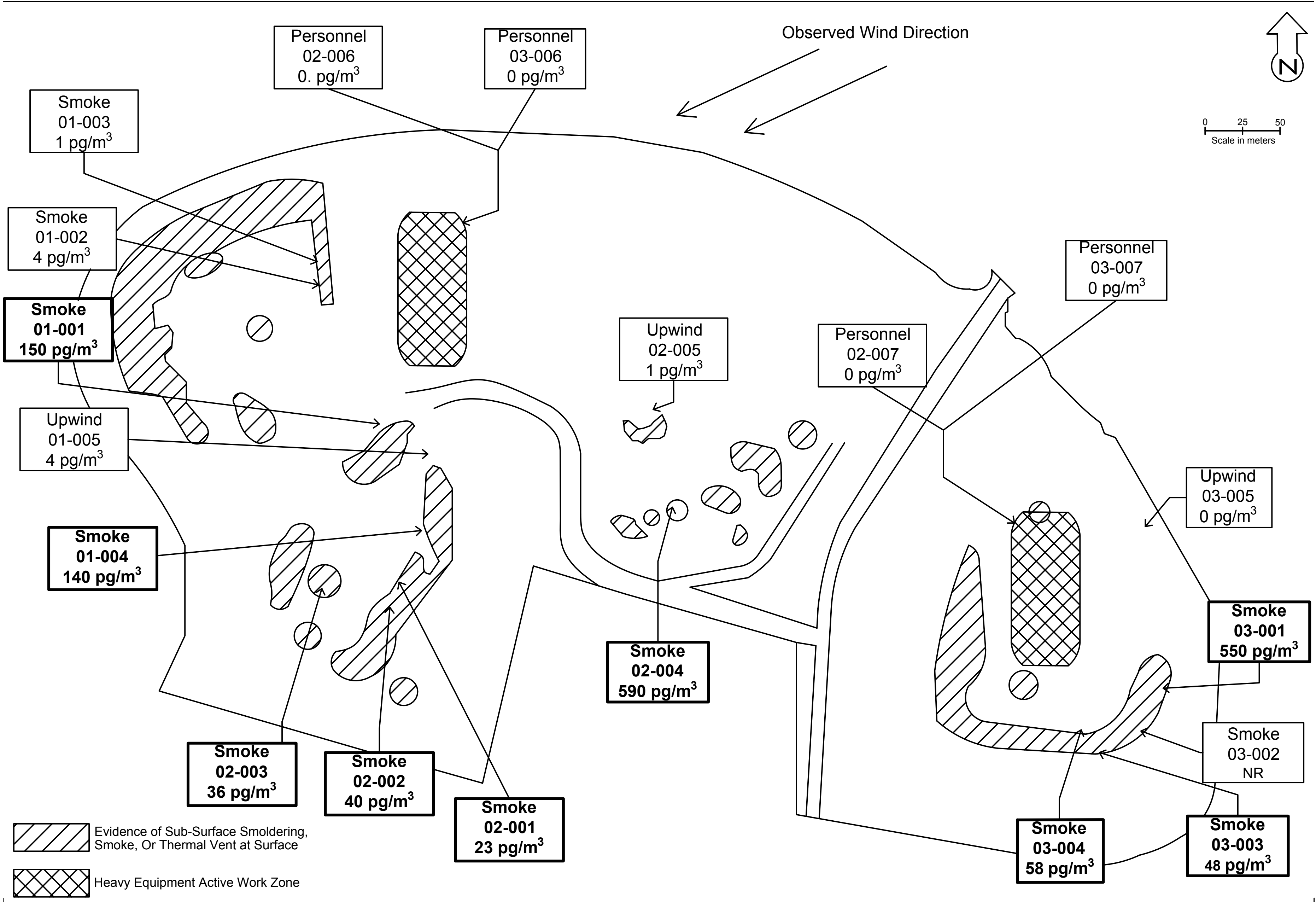
Occupational Exposure Limits = 0.05 ppm
Occupational Safety & Health Administration = 0.1 ppm
National Institute of Occupational Safety & Health = 0.1 ppm
American Conference of Governmental Industrial Hygienists = 0.1 ppm

NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

LOCATIONS OF OZONE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 13
Dwg. Scale: As Noted

FIGURE
8



Occupational Exposure Limits (GER) = 10 pg/m3
Occupational Safety & Health Administration = Not Available
National Institute of Occupational Safety & Health = Not Available
American Conference of Governmental Industrial Hygienists = Not Available

NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

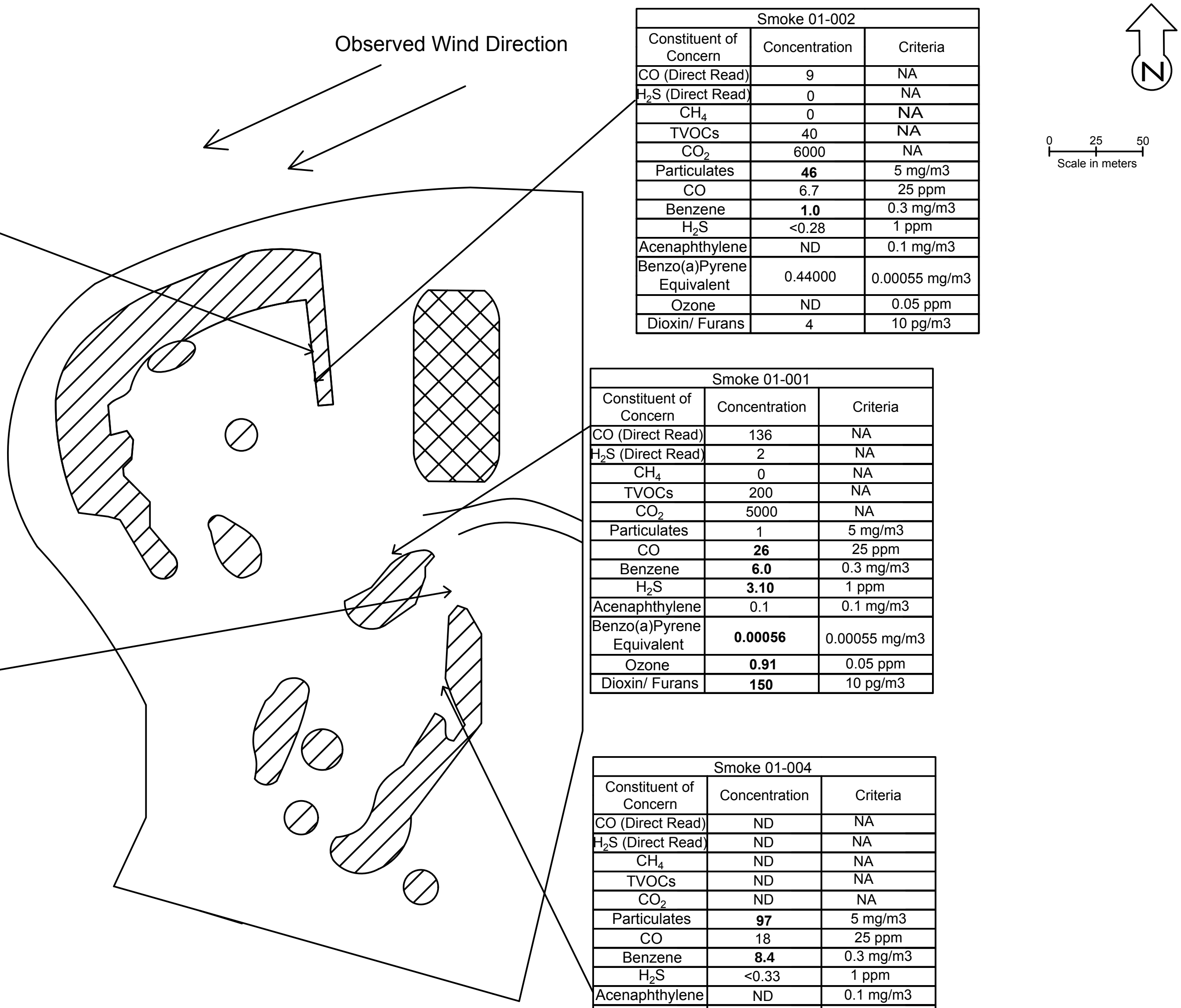
LOCATIONS OF TOTAL 2,3,7,8-TCDD EQUIVALENCE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 13
Dwg. Scale: As Noted

FIGURE 9

Smoke 01-003		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	5	NA
H_2S (Direct Read)	0	NA
CH_4	0	NA
TVOCs	17	NA
CO_2	6000	NA
Particulates	97	5 mg/m3
CO	13	25 ppm
Benzene	**1.0**	0.3 mg/m3
H_2S	<0.30	1 ppm
Acenaphthylene	ND	0.1 mg/m3
Benzo(a)Pyrene Equivalent	0.00039	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	1	10 pg/m3

Smoke 01-002		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	9	NA
H_2S (Direct Read)	0	NA
CH_4	0	NA
TVOCs	40	NA
CO_2	6000	NA
Particulates	**46**	5 mg/m3
CO	6.7	25 ppm
Benzene	**1.0**	0.3 mg/m3
H_2S	<0.28	1 ppm
Acenaphthylene	ND	0.1 mg/m3
Benzo(a)Pyrene Equivalent	0.44000	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	4	10 pg/m3



Smoke 01-001		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	136	NA
H_2S (Direct Read)	2	NA
CH_4	0	NA
TVOCs	200	NA
CO_2	5000	NA
Particulates	1	5 mg/m3
CO	**26**	25 ppm
Benzene	**6.0**	0.3 mg/m3
H_2S	**3.10**	1 ppm
Acenaphthylene	0.1	0.1 mg/m3
Benzo(a)Pyrene Equivalent	**0.00056**	0.00055 mg/m3
Ozone	**0.91**	0.05 ppm
Dioxin/ Furans	**150**	10 pg/m3

Upwind 01-005		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	ND	NA
H_2S (Direct Read)	ND	NA
CH_4	ND	NA
TVOCs	ND	NA
CO_2	ND	NA
Particulates	**31**	5 mg/m3
CO	<6	25 ppm
Benzene	0.1	0.3 mg/m3
H_2S	<0.35	1 ppm
Acenaphthylene	ND	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	4	10 pg/m3

Smoke 01-004		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	ND	NA
H_2S (Direct Read)	ND	NA
CH_4	ND	NA
TVOCs	ND	NA
CO_2	ND	NA
Particulates	**97**	5 mg/m3
CO	18	25 ppm
Benzene	**8.4**	0.3 mg/m3
H_2S	<0.33	1 ppm
Acenaphthylene	ND	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	**140**	10 pg/m3

EE&G

▨ Evidence of Sub-Surface Smoldering, Smoke, Or Thermal Vent at Surface

▦ Heavy Equipment Active Work Zone

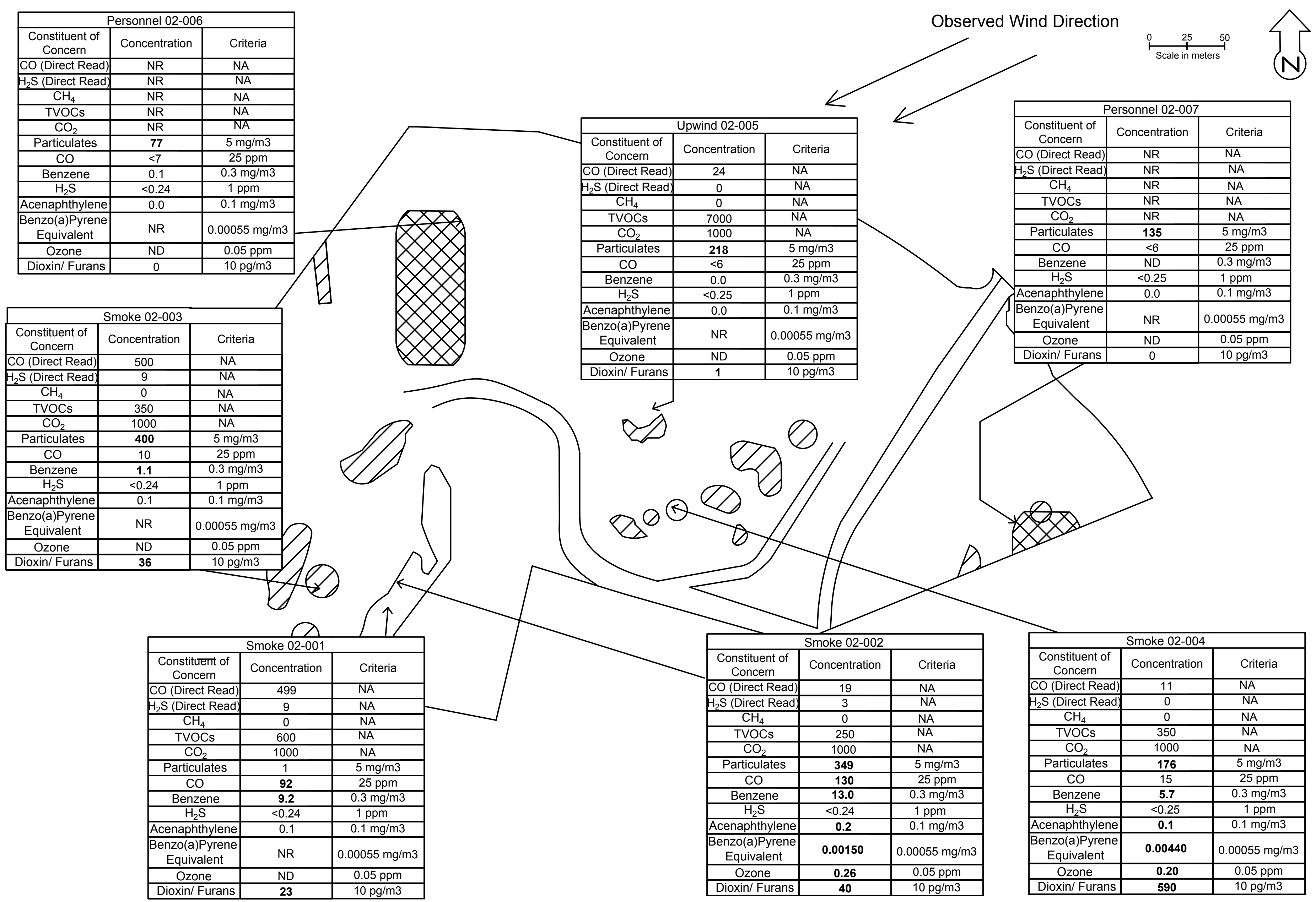
NR = No Reading
NA = Not Applicable
ND = Not Detected
BOLD = Exceeds Criteria

NW MUNICIPAL WASTE DISPOSAL SITE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 15A
Dwg. Scale: As Noted

FIGURE 10A

NR = No Reading



Personnel 02-006		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	NR	NA
H_2S (Direct Read)	NR	NA
CH_4	NR	NA
TVOCs	NR	NA
CO_2	NR	NA
Particulates	**77**	5 mg/m3
CO	<7	25 ppm
Benzene	0.1	0.3 mg/m3
H_2S	<0.24	1 ppm
Acenaphthylene	0.0	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	0	10 pg/m3

Upwind 02-005		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	24	NA
H_2S (Direct Read)	0	NA
CH_4	0	NA
TVOCs	7000	NA
CO_2	1000	NA
Particulates	**218**	5 mg/m3
CO	<6	25 ppm
Benzene	0.0	0.3 mg/m3
H_2S	<0.25	1 ppm
Acenaphthylene	0.0	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	**1**	10 pg/m3

Personnel 02-007		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	NR	NA
H_2S (Direct Read)	NR	NA
CH_4	NR	NA
TVOCs	NR	NA
CO_2	NR	NA
Particulates	**135**	5 mg/m3
CO	<6	25 ppm
Benzene	ND	0.3 mg/m3
H_2S	<0.25	1 ppm
Acenaphthylene	0.0	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	0	10 pg/m3

Smoke 02-003		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	500	NA
H_2S (Direct Read)	9	NA
CH_4	0	NA
TVOCs	350	NA
CO_2	1000	NA
Particulates	**400**	5 mg/m3
CO	10	25 ppm
Benzene	**1.1**	0.3 mg/m3
H_2S	<0.24	1 ppm
Acenaphthylene	0.1	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	**36**	10 pg/m3

Smoke 02-001		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	499	NA
H_2S (Direct Read)	9	NA
CH_4	0	NA
TVOCs	600	NA
CO_2	1000	NA
Particulates	1	5 mg/m3
CO	**92**	25 ppm
Benzene	**9.2**	0.3 mg/m3
H_2S	<0.24	1 ppm
Acenaphthylene	0.1	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	**23**	10 pg/m3

Smoke 02-002		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	19	NA
H_2S (Direct Read)	3	NA
CH_4	0	NA
TVOCs	250	NA
CO_2	1000	NA
Particulates	**349**	5 mg/m3
CO	**130**	25 ppm
Benzene	**13.0**	0.3 mg/m3
H_2S	<0.24	1 ppm
Acenaphthylene	**0.2**	0.1 mg/m3
Benzo(a)Pyrene Equivalent	**0.00150**	0.00055 mg/m3
Ozone	**0.26**	0.05 ppm
Dioxin/ Furans	**40**	10 pg/m3

Smoke 02-004		
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	11	NA
H_2S (Direct Read)	0	NA
CH_4	0	NA
TVOCs	350	NA
CO_2	1000	NA
Particulates	**176**	5 mg/m3
CO	15	25 ppm
Benzene	**5.7**	0.3 mg/m3
H_2S	<0.25	1 ppm
Acenaphthylene	**0.1**	0.1 mg/m3
Benzo(a)Pyrene Equivalent	**0.00440**	0.00055 mg/m3
Ozone	**0.20**	0.05 ppm
Dioxin/ Furans	**590**	10 pg/m3

EE&G

▨ Evidence of Sub-Surface Smoldering, Smoke, Or Thermal Vent at Surface

▦ Heavy Equipment Active Work Zone

NA = Not Applicable
NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

SOUTH MUNICIPAL DISPOSAL SITE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 15B
Dwg. Scale: As Noted

FIGURE 10B

Personnel 03-006

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	NR	NA
H_2S (Direct Read)	NR	NA
CH_4	NR	NA
TVOCs	NR	NA
CO_2	NR	NA
Particulates	**428**	5 mg/m3
CO	<6	25 ppm
Benzene	0.1	0.3 mg/m3
H_2S	<0.28	1 ppm
Acenaphthylene	NR	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	0	10 pg/m3

Personnel 03-007

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	NR	NA
H_2S (Direct Read)	NR	NA
CH_4	NR	NA
TVOCs	NR	NA
CO_2	NR	NA
Particulates	**106**	5 mg/m3
CO	<6.8	25 ppm
Benzene	0.1	0.3 mg/m3
H_2S	0.81	1 ppm
Acenaphthylene	0.0	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	0	10 pg/m3

Upwind 03-005

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	0	NA
H_2S (Direct Read)	0	NA
CH_4	0	NA
TVOCs	100	NA
CO_2	0	NA
Particulates	**15**	5 mg/m3
CO	<5	25 ppm
Benzene	ND	0.3 mg/m3
H_2S	<0.26	1 ppm
Acenaphthylene	NR	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	0	10 pg/m3

Smoke 03-001

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	499	NA
H_2S (Direct Read)	2.5	NA
CH_4	0	NA
TVOCs	850	NA
CO_2	0	NA
Particulates	0	5 mg/m3
CO	**26**	25 ppm
Benzene	**1.9**	0.3 mg/m3
H_2S	<0.26	1 ppm
Acenaphthylene	**0.2**	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	NR	0.05 ppm
Dioxin/ Furans	**550**	10 pg/m3

Smoke 03-002

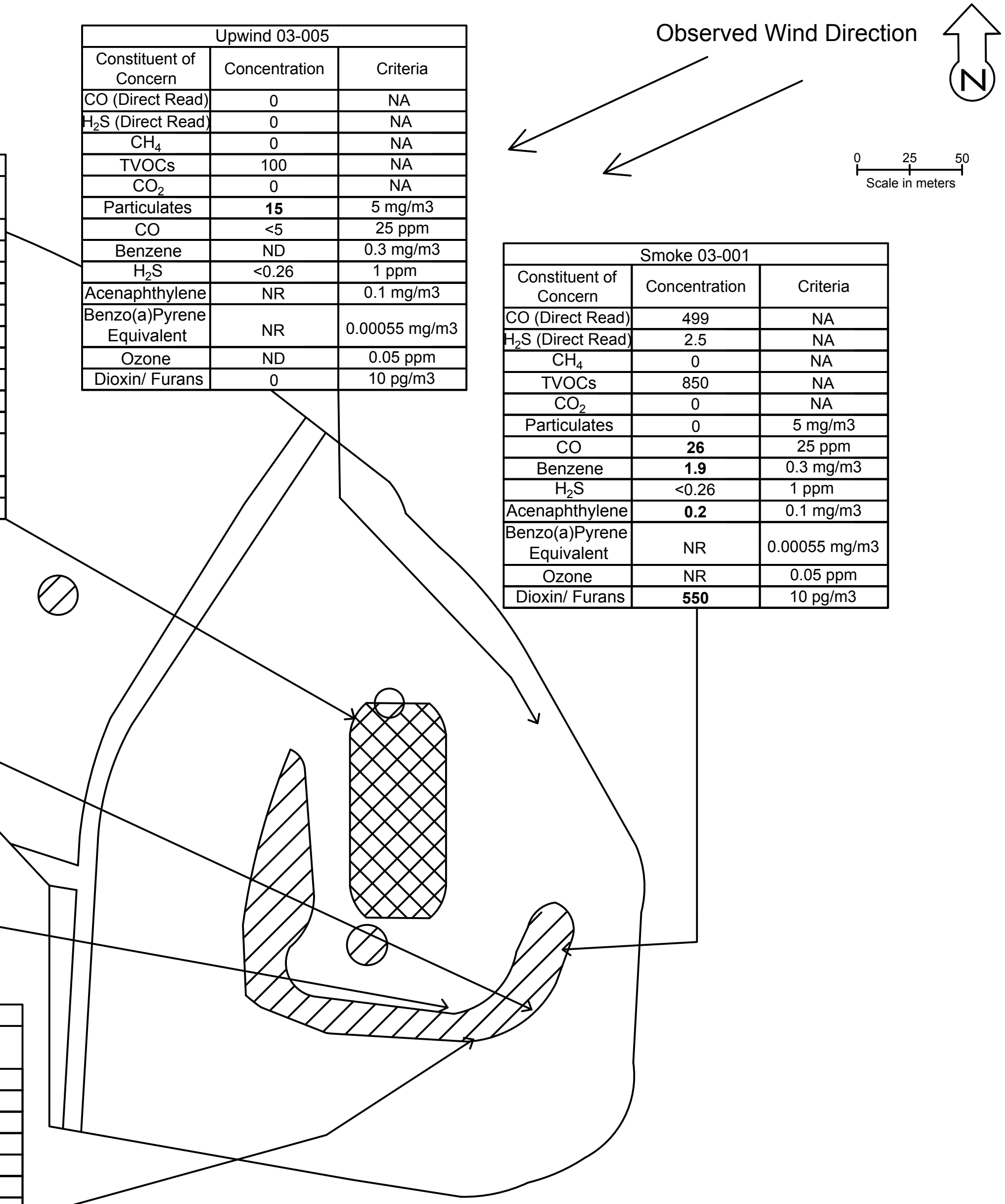
Constituent of Concern	Concentration	Criteria
CO (Direct Read)	500	NA
H_2S (Direct Read)	7	NA
CH_4	0	NA
TVOCs	300	NA
CO_2	6000	NA
Particulates	**153**	5 mg/m3
CO	15	25 ppm
Benzene	**1.0**	0.3 mg/m3
H_2S	<0.27	1 ppm
Acenaphthylene	NR	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	NR	10 pg/m3

Smoke 03-004

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	40	NA
H_2S (Direct Read)	1	NA
CH_4	1000	NA
TVOCs	300	NA
CO_2	3000	NA
Particulates	**40**	5 mg/m3
CO	18	25 ppm
Benzene	**1.6**	0.3 mg/m3
H_2S	<0.28	1 ppm
Acenaphthylene	NR	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	NR	0.05 ppm
Dioxin/ Furans	**58**	10 pg/m3

Smoke 03-003

Constituent of Concern	Concentration	Criteria
CO (Direct Read)	200	NA
H_2S (Direct Read)	3	NA
CH_4	28000	NA
TVOCs	400	NA
CO_2	5000	NA
Particulates	356	5 mg/m3
CO	<6	25 ppm
Benzene	0.2	0.3 mg/m3
H_2S	<0.27	1 ppm
Acenaphthylene	NR	0.1 mg/m3
Benzo(a)Pyrene Equivalent	NR	0.00055 mg/m3
Ozone	ND	0.05 ppm
Dioxin/ Furans	**48**	10 pg/m3



EE&G

▨ Evidence of Sub-Surface Smoldering, Smoke, Or Thermal Vent at Surface

▦ Heavy Equipment Active Work Zone

NA = Not Applicable
NR = No Reading
ND = Not Detected
BOLD = Exceeds Criteria

TEMPORARY DEBRIS SITE RESULTS

Date: 11/16/2018
Project # 2018-4191
Drawn by: MD
Cad File: Fig 15C
Dwg. Scale: As Noted

FIGURE 10C

ATTACHMENT A

PHOTO PAGES

Photo 1 – Typical Area Sampling Station Placement

Photo 2 – Typical Area Sampling Station Placement

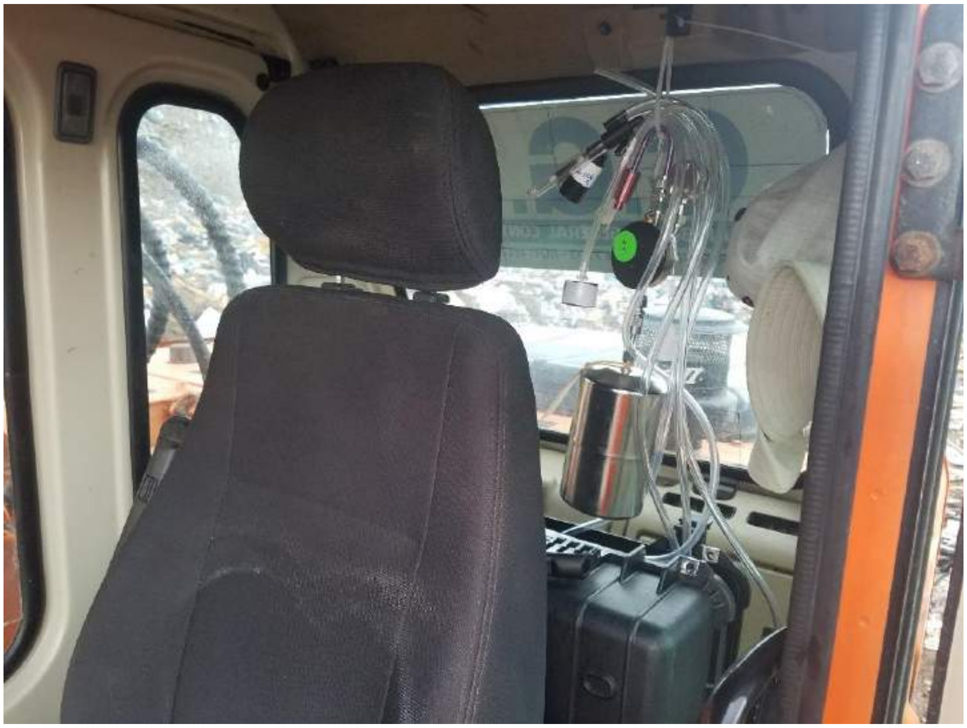


Photo 3 – Typical Personnel Sample Placement

Photo 4 - Typical Personnel Sample Placement

ATTACHMENT B

COCS AND NIOSH LINKS

Methane

https://www.cdc.gov/niosh/ipcsneng/neng0291.html

Carbon Dioxide

https://www.cdc.gov/niosh/ipcsneng/neng0021.html

Carbon Monoxide

https://www.cdc.gov/niosh/ipcsneng/neng0023.html

Propylene

https://www.cdc.gov/niosh/ipcsneng/neng0559.html

Chloromethane

https://www.cdc.gov/niosh/ipcsneng/neng0419.html

n-Butane

https://www.cdc.gov/niosh/ipcsneng/neng0232.html

1,3-Butadiene

https://www.cdc.gov/niosh/ipcsneng/neng0017.html

Chloroethane

https://www.cdc.gov/niosh/ipcsneng/neng0132.html

Ethanol

https://www.cdc.gov/niosh/ipcsneng/neng0044.html

Isopropyl alcohol

https://www.cdc.gov/niosh/ipcsneng/neng0554.html

Acetone

https://www.cdc.gov/niosh/ipcsneng/neng0087.html

Acetonitrile

https://www.cdc.gov/niosh/ipcsneng/neng0088.html

Acrylonitrile

https://www.cdc.gov/niosh/ipcsneng/neng0092.html

n-Hexane

https://www.cdc.gov/niosh/ipcsneng/neng0279.html

2-Butanone

https://www.cdc.gov/niosh/ipcsneng/neng0179.html

Ethyl acetate

https://www.cdc.gov/niosh/ipcsneng/neng0367.html

Tetrahydrofuran

https://www.cdc.gov/niosh/ipcsneng/neng0578.html

Cyclohexane

https://www.cdc.gov/niosh/ipcsneng/neng0242.html

n-Heptane

https://www.cdc.gov/niosh/ipcsneng/neng0657.html

Benzene

https://www.cdc.gov/niosh/ipcsneng/neng0015.html

Methyl Methacrylate

https://www.cdc.gov/niosh/ipcsneng/neng0300.html

1,4-Dioxane

https://www.cdc.gov/niosh/ipcsneng/neng0041.html

4-Methyl-2-pentanone

https://www.cdc.gov/niosh/ipcsneng/neng0511.html

Toluene

https://www.cdc.gov/niosh/ipcsneng/neng0078.html

2-Hexanone

https://www.cdc.gov/niosh/ipcsneng/neng0489.html

Chlorobenzene

https://www.cdc.gov/niosh/ipcsneng/neng0642.html

Ethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng0268.html

Xylene (p,m)

https://www.cdc.gov/niosh/ipcsneng/neng0086.html

https://www.cdc.gov/niosh/ipcsneng/neng0085.html

Xylene (Ortho)

https://www.cdc.gov/niosh/ipcsneng/neng0084.html

Styrene

https://www.cdc.gov/niosh/ipcsneng/neng0073.html

Isopropylbenzene (cumene)

https://www.cdc.gov/niosh/ipcsneng/neng0170.html

4-Ethyltoluene

1,3,5-Trimethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng1155.html

1,2,4-Trimethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng1433.html

Naphthalene

https://www.cdc.gov/niosh/ipcsneng/neng0667.html

Hydrogen Sulfide

https://www.cdc.gov/niosh/ipcsneng/neng0165.html

Acenaphthylene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Acenaphthene

https://www.cdc.gov/niosh/ipcsneng/neng1674.html

Fluorene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Phenanthrene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Anthracene

https://www.cdc.gov/niosh/ipcsneng/neng0825.html

Fluoranthene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Pyrene

https://www.cdc.gov/niosh/ipcsneng/neng1474.html

Chrysene

https://www.cdc.gov/niosh/ipcsneng/neng1672.html

Benzo(e)pyrene

https://www.cdc.gov/niosh/ipcsneng/neng0104.html

Benzo(b)fluoranthene

https://www.cdc.gov/niosh/ipcsneng/neng0720.html

Benzo(k)fluoranthene

https://www.cdc.gov/niosh/ipcsneng/neng0721.html

Benzo(a)pyrene

https://www.cdc.gov/niosh/ipcsneng/neng0104.html

Respirable Particulates

Ozone

https://www.cdc.gov/niosh/ipcsneng/neng0068.html

2,3,7,8 Tetrachlorodibenzo-*p*-dioxin

https://www.cdc.gov/niosh/ipcsneng/neng1467.html

PCBs

https://www.cdc.gov/niosh/ipcsneng/neng0939.html

Arsenic (As)

https://www.cdc.gov/niosh/ipcsneng/neng0013.html

Lead (Pb)

https://www.cdc.gov/niosh/ipcsneng/neng0052.html

Barium (Ba)

https://www.cdc.gov/niosh/ipcsneng/neng1052.html

Chromium (Cr)

https://www.cdc.gov/niosh/ipcsneng/neng0029.html

Cadmium (Cd)

https://www.cdc.gov/niosh/ipcsneng/neng0020.html

Silver (Ag)

https://www.cdc.gov/niosh/ipcsneng/neng0810.html

Selenium (Se)

https://www.cdc.gov/niosh/ipcsneng/neng0072.html

Asbestos

https://www.atsdr.cdc.gov/asbestos/

Hydrogen Cyanide

https://www.cdc.gov/niosh/ipcsneng/neng0492.html

https://www.cdc.gov/niosh/npg/npgd0333.html

ATTACHMENT C

LABORATORY RESULTS, LANDFILL GASES (CH_4, CO_2, AND CO)

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

USEPA TO-3 Modified
Laboratory Report- Sample Summary

EMSL Sample ID.	Client Sample ID.	Start Sampling Date	Start Sampling Time
491800829-0001	03-006 (P)	8/30/2018	9:25 AM
491800829-0002	01-005	8/28/2018	10:00 AM
491800829-0003	03-002	8/30/2018	8:50 AM
491800829-0004	03-003	8/30/2018	8:55 AM
491800829-0005	03-005	8/30/2018	9:05 AM
491800829-0006	03-004	8/30/2018	9:00 AM
491800829-0007	02-003	8/29/2018	8:25 AM
491800829-0008	02-005	8/29/2018	8:44 AM
491800829-0009	03-001	8/30/2018	8:45 AM
491800829-0010	02-001	8/29/2018	8:15 AM
491800829-0011	01-003	8/28/2018	9:45 AM
491800829-0012	03-007 (P)	8/30/2018	9:45 AM
491800829-0013	02-007 (P)	8/29/2018	9:15 AM
491800829-0014	02-004	8/29/2018	8:37 AM
491800829-0015	02-006 (P)	8/29/2018	8:55 AM
491800829-0016	01-002	8/28/2018	9:30 AM
491800829-0017	02-002	8/29/2018	8:20 AM
491800829-0018	01-001	8/28/2018	9:15 AM
491800829-0019	01-004	8/28/2018	10:00 AM

If "Preliminary Report" is displayed in the signature box; this indicates that there are samples that have not yet been analyzed, that are in a preliminary state, or that analysis is in progress but not completed at the time of report issue.

Report Date:	Report Revision	Revision Comments
9/12/2018	R0	Initial Report
10/2/2018	R1	Wrong results reported for Sample 2.

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The results are not blank corrected unless otherwise noted. Interpretation and use of test results are the responsibility of the client. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Case Narrative

Method Reference
USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

Column
Varian CP-Sil 5 CB, 50m x 0.53mm ID x 5um

Concentrator Traps:
0.4cc Loop

Gas Standards:
Certified Gas standards were used for all analyses.

Sample Volumes:
Sample volume aliquots for this procedure is 0.4cc by loop injection. Other volumes for sample dilutions are reflected on each result page.

Holding Times:
Standard holding times of 30 days (Summa Canister) and 72 hours (Tedlar Bag) were met for all samples.

Sampling Pressures:
All samples (Summa Canister) were received at acceptable pressure/vacuum unless listed below.

Sample Dilutions:
Diluitions reported are designated by the sample # with a "DL" suffix resulting from initial analysis having compounds exceeding calibration as reported with an "E" qualifier.

Methane for 491800829-10 was reported with an E qualifier. A dilution could not be run due to instrument failure.

QA/QC criteria outside method specifications are listed below (if applicable).

Initial Calibration
All Initial Calibratiion criteria met method specification.

Initial Calibration Verification Standard (ICVS)- Second Source
ICVS met method specification with 70-130% recovery for 100% of compounds.

Laboratory Control Sample (LCS)
LCS met method specification with 70-130% recovery for 100% of compounds.*(If the LCS does not meet criteria but any compounds which have recoveries >130% are not found in the samples, samples may be reported)*

Continuing Calibration Verification Standard (CCVS)
CCVS met method specification with all compounds within 30% deviation.

Ending Calibration Verification Standard (ECVS)
ECVS met method specification with all compounds within 30% deviation.

Method Blanks (MB)
Method Blank met method specification.

Sample Duplicate (DUP)
Sample Duplicate met method specification with all hits within 25% Relative Standard Deviation (RPD).

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Case Narrative

Manual Integration *: -Listed below if applicable. Before and after documentation provided in extended deliverable packages.*

The following data qualifiers that may have been reported with the data,

ND- Non Detect. This notation would be used in the results column in lieu of a "U" qualifier.

U- Compound was analyzed for but not detected at a listed and appropriately adjusted reporting level.

J- Estimated value reported below adjusted reporting limit for target compounds or estimating a concentration for TICs where a 1:1 response is assumed

B- Compound found in associated method blank as well as in the sample.

E- Estimated value exceeding upper calibration range of instrument. Ethanol and isopropyl alcohol are not specifically targeted to dilute within calibration range.

D- Compound reported from additional diluted analysis.

N- indicates presumptive evidence of a compound based on library search match.

EMSL Analytical, Inc. certifies that this data package is in compliance with the terms and conditions of this contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer –readable data submitted on diskette has been authorized by the laboratory manager or his/her designee, as verified by the following signature.

Report Date	Report Revision	Revision Comments
07/18/2018	R0	Initial Report

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-1**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1494.D	HD0183	1 cc	1.29

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**3.1**	2.6		**2.1**	1.7	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-2**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1496.D**	**HD2155**	**1 cc**	**1.11**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**4.0**	2.2		**2.6**	1.5	

Qualifier Definitions

B = Compound also found in method blank. **ND = Non Detect**
E= Estimated concentration exceeding upper calibration range.
D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-3**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1497.D	HD2275	1 cc	1.07

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**7.9**	2.1		**5.2**	1.4	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-4**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1498.D	HD2282	1 cc	1.12

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**4.3**	2.2		**2.8**	1.5	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-5**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1499.D	HD2291	1 cc	1.06

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**2.6**	2.1		**1.7**	1.4	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-6**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1500.D	HD2298	1 cc	2.94

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**13**	5.9		**8.5**	3.9	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-7**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1501.D**	**HD2300**	**1 cc**	**1.23**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**8.7**	2.5		**5.7**	1.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-8**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1502.D**	**HD2303**	**1 cc**	**1.23**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**2.6**	2.5		**1.7**	1.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-9**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1503.D	HD2702	1 cc	2.01

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**12**	4.0		**7.8**	2.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-10**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1505.D	HD2705	1 cc	1.07

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**160**	2.1	E	**100**	1.4	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #:	**491800829**
EMSL Sample #:	**491800829-11**
Customer ID:	**EEG50**
Customer PO:	**20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone:	**305-374-8300**
Fax:	**305-374-8301**
Date Collected:	**8/28/2018**
Date Received:	**9/4/2018**

Project: **SXM Debris**

Sample ID: 01-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1506.D**	**HD2727**	**1 cc**	**1.23**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**16**	2.5		**11**	1.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-12**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1507.D	HD2733	1 cc	1.36

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	3.7	2.7		2.4	1.8	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-13**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1508.D**	**HD2743**	**1 cc**	**1.12**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**2.7**	2.2		**1.8**	1.5	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

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EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-14**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1509.D**	**HD2752**	**1 cc**	**1.2**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**39**	2.4		**26**	1.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-15**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1510.D	HD2768	1 cc	1.33

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**3.0**	2.7		**2.0**	1.7	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-16**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1511.D**	**HD2786**	**1 cc**	**1**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**13**	2.0		**8.3**	1.3	

Qualifier Definitions

B = Compound also found in method blank. **ND = Non Detect**

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-17**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/06/2018**	**TP**	**F1512.D**	**HD2787**	**1 cc**	**1.24**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**69**	2.5		**46**	1.6	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-18**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1513.D	HD2802	1 cc	1.31

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	22	2.6		15	1.7	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #:	**491800829**
EMSL Sample #:	**491800829-19**
Customer ID:	**EEG50**
Customer PO:	**20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/06/2018	TP	F1514.D	HD2831	1 cc	1.5

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppmv	RL ppmv	Q	Result mg/m3	RL mg/m3	Comments
Methane	74-82-8	16.04	**35**	3.0		**23**	2.0	

Qualifier Definitions

B = Compound also found in method blank.

ND = Non Detect

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Threshold References

Analyte	Typical Atmospheric Background Levels	Typical Indoor Air Background Levels	OSHA PEL	Hazard
Methane	1.8 ppm	2-5 ppm	n/a	Simple asphyxiant, flammable

Agency Definitions

OSHA= Occupational Safety and Health Administration

Exposure Limit Definitions

PEL= Permissable Exposure Limit

Method Reference

USEPA TO-3 Modified, Method for the Determination of Volatile Organic Compounds in Ambient Air using Gas Chromatography with Flame Ionization Detector. Rev 1.0, April 1984

NJDEP Certification #: 03036

USEPA TO-15
External Chain of Custody/ Field Test Data Sheet

EMSL ANALYTICAL, INC.

EMSL Order Number (Lab Use Only): -491800829

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ph. (800) 220-3675
Fax (856) 786-0327

Report To Contact Name:		Bill To Company:		Sampled By (Sign):	
Company Name:		Attention To:		Sampled By (Name):	
Address 1:		Address 1:		Total # of Samples:	
Address 2:		Address 2:		Date Shipped:	
Phone No. :	Fax :	Phone No.:	Fax :	Sample Collection Zip Code:	
Email Results To:		Project Name:		Purchase Order:	

Turnaround Time (In Business Days): ☐ 10 Day Standard ☐ 5 Day ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other - 1-WEEK

Reporting Format: ☐ Results Only (Standard Lab Report) ☐ Full Deliverables (Surcharge may apply) ☐ Other

EMSL Sample Identifier	Client Field Sample Identification	Field Use - All Information Required! Sampling Start Information Barometric Pres. ("Hg): Start Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Sampling Stop Information Barometric Pres. ("Hg): Stop Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Lab Use Only Canister Information Canister ID	Size (L)	Can Cert Batch ID	Outgoing Pressure ("Hg)	Incoming Pressure ("Hg)	Flow Contoller Reg. ID	Cal Flow (ml/min)	Analysis USEPA TO-15	NJDEP LLTO-15	LIBRARY SEARCH	Other (Specify)	Matrix Indoor/ Ambient Air	Soil Gas	Landfill/ Vent
	01-003	8/28	9:45	-29"		8/28	17:53	-5"		HD2727	1.4	H0470	-30.0	-6.5	5992*	2.4	X		X				X
	03-007 (P)	8/30	9:45	-31"		8/30	17:15	-9"		↓ 2733	↓	↓	↓	-9.5	5994	↓	X		X				
	02-007 (P)	8/29	9:15	-30"		8/29	17:22	-1"		↓ 2743	↓	↓	↓	-4.0	7391	↓	X		X				↓
	02-004	8/29	8:37	-29"		8/29	17:05	-1"		↓ 2752	↓	↓	↓	-6.0	7874*	↓	X		X				↓
	02-006 (P)	8/29	8:55	-30"		8/29	16:20	-1"		↓ 2768	↓	↓	↓	-9.0	7881	↓	X		X				↓
	01-002	8/28	9:30	-30"		8/28	17:29	-4.5"		↓ 2786	↓	↓	↓	-5.0	7926	↓	X		X				↓
	02-002	8/29	8:20	-29.5"		8/29	16:30	-1"		↓ 2787	↓	↓	↓	-7.0	7928*	↓	X		X				↓
	01-001	8/28	09:15	-30"		8/28	17:20	-7"		↓ 2802	↓	↓	↓	-8.5	7934*	↓	X		X				↓
	01-004	8/28	10:00	-31"		8/28	17:40	-10"		↓ 2831	↓	↓	↓	-12.0	8068*	↓	X		X				↓

Comments:

Lab Canister Certification
Analyst Signature (TO-15):

Relinquished by:	Date/ Time	Received by:	Date/ Time	Seal #/Intact	Reason for Exchange (circle appropriate)
Carly Peters	8.16.18 1527			580-581	[✓ Shipping] Courier Receiving Sampling Other:
		Alex Mavrelis	8/27/2018 ~4:00pm		Shipping Courier [✓ Receiving] [✓ Sampling] Other:
Alex Mavrelis	8/31/2018 10:00A	(Fedex)			[✓ Shipping] Courier Receiving Sampling Other:
			9/5/18/0832		Shipping Courier Receiving Sampling [✓ Other:]
					Shipping Courier Receiving Sampling Other:

* 9/5/18 really dirty regs from
0E47

EMSL ANALYTICAL, INC.

USEPA TO-15

External Chain of Custody/ Field Test Data Sheet

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ph. (800) 220-3675
Fax (856) 786-0327

EMSL Order Number (Lab Use Only): -491800829

Report To Contact Name: Alex Mavrelis	Bill To Company: SAME		Sampled By (Sign):
Company Name: EE+G Environmental	Attention To: Alex Mavrelis		Sampled By (Name): Alex Mavrelis
Address 1: 5751 Miami Lakes Drive	Address 1:		Total # of Samples: 19
Address 2: Miami Lakes, FL 33014	Address 2:		Date Shipped: 8/31/2018
Phone No.: (305) 984-3218 Fax:	Phone No.:	Fax:	Sample Collection Zip Code:
Email Results To: amavrelis@eeandg.com	Project Name: SXM Debris		Purchase Order: 2018-4191.DEBRIS.Task10

Turnaround Time (in Business Days): ☐ 10 Day Standard ☐ 5 Day ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other 1-WEEK

Reporting Format: ☒ Results Only (Standard Lab Report) ☐ Full Deliverables (Surcharge may apply) ☐ Other

HO183

EMSL Sample Identifier	Client Field Sample Identification	Field Use - All Information Required! Sampling Start Information Barometric Pres. ("Hg): Start Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Sampling Stop Information Barometric Pres. ("Hg): Stop Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Lab Use Only Canister Information LLO 9/5/18 HO183 Canister ID	Size (L)	Can Cert Batch ID	Outgoing Pressure ("Hg)	Incoming Pressure ("Hg)	Flow Contoller Reg. ID	Cal Flow (ml/min)	Analysis USEPA TO-15	NJDEP LLTO-15	LIBRARY SEARCH	Other (Specify)	Matrix Indoor/ Ambient Air	Soil Gas	Landfill/ Vent
	03-006 (P)	8/30	9:25	-31"		8/30	17:20	-8"		~~HO2185~~	1.4	HO470	-30.0	-8.0	3583	2.4	X		X				X
	01-005	8/28	10:10	-29"		8/28	17:42	-0.5		2155				-3.0	3595		X		X				
	03-002	8/30	8:50	-31"		8/30	16:50	-5"		2275				-15	3644		X		X				
	03-003	8/30	8:55	-31"		8/30	16:55	-3"		2282				-4.0	3689		X		X				
	03-005	8/30	9:05	-29"		8/30	16:50	0"		2291				-1.0	3715		X		X				
	03-004	8/30	9:00	-31"		8/30	14:17	UNK		2298				-24.0	4344		X		X				
	02-003	8/29	8:25	-29"		8/29	16:35	-2"		2300				-6.5	6957		X		X				
	02-005	8/29	8:44	-30"		8/29	17:06	-4.5"		2303				-7.0	5974		X		X				
	03-001	8/30	8:45	-31"		8/30	14:15	UNK		2702				-18.0	5979		X		X				
	02-001	8/29	8:15	-30"		8/29	16:31	-1"		2705				-1.5	5989	*	X		X				

Comments: Samples 03-001 and 03-004 have unknown end pressures, please analyze based on incoming pressure at the lab and assume no intake leaks since testing.

Lab Canister Certification
Analyst Signature (TO-15):

Relinquished by:	Date/ Time	Received by:	Date/ Time	Seal #/Intact	Reason for Exchange (circle appropriate)
Carly Peters	8.16.18 1527			580-581	[✓ Shipping] Courier Receiving Sampling Other:
		Alex Mavrelis	8/27/2018 ~4:00pm		Shipping Courier [✓ Receiving] [✓ Sampling] Other:
Alex Mavrelis	8/31/2018 10:00A	(Fedex)	9/4/18 930		[✓ Shipping] Courier Receiving Sampling Other:
	9/4/18 330P		9/5/18 / 0837		Shipping Courier Receiving Sampling [✓ Other:]
					Shipping Courier Receiving Sampling Other:

Controlled Document - COC-50 TO-15 Cinnaminson R7.1 2017.07.26

Page 1 of 2

* 9/5/18 really dirty Regs. Rod 0847

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Fixed Gas Analysis by Using The Draeger CMS (Chip Measurement System)
Laboratory Report- Sample Summary

EMSL Sample ID.	Client Sample ID.	Compound	Detection Limit (ppmV)	Sample Result (ppmV)
491800829-0001	03-006 (P)	Carbon dioxide	260	1500
491800829-0002	01-005	Carbon dioxide	220	600
491800829-0003	03-002	Carbon dioxide	210	710
491800829-0004	03-003	Carbon dioxide	220	670
491800829-0005	03-005	Carbon dioxide	210	600
491800829-0006	03-004	Carbon dioxide	590	810
491800829-0007	02-003	Carbon dioxide	250	730
491800829-0008	02-005	Carbon dioxide	250	550
491800829-0009	03-001	Carbon dioxide	400	480
491800829-0010	02-001	Carbon dioxide	210	1400
491800829-0011	01-003	Carbon dioxide	250	680
491800829-0012	03-007 (P)	Carbon dioxide	270	650
491800829-0013	02-007 (P)	Carbon dioxide	220	650
491800829-0014	02-004	Carbon dioxide	240	1900
491800829-0015	02-006 (P)	Carbon dioxide	270	1100
491800829-0016	01-002	Carbon dioxide	200	560
491800829-0017	02-002	Carbon dioxide	240	870
491800829-0018	01-001	Carbon dioxide	260	760
491800829-0019	01-004	Carbon dioxide	300	740

If "Preliminary Report" is displayed in the signature box; this indicates that there are samples that have not yet been analyzed, that are in a preliminary state, or that analysis is in progress but not completed at the time of report issue.

Report Date:	Report Revision	Revision Comments
9/12/2018	R0	Initial Report

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The results are not blank corrected unless otherwise noted. Interpretation and use of test results are the responsibility of the client. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Fixed Gas Analysis by Using The Draeger CMS (Chip Measurement System)
Laboratory Report- Sample Summary

EMSL Sample ID.	Client Sample ID.	Compound	Detection Limit (ppmV)	Sample Result (ppmV)
491800829-0001	03-006 (P)	Carbon monoxide	6.4	<6.4
491800829-0002	01-005	Carbon monoxide	5.6	<5.6
491800829-0003	03-002	Carbon monoxide	5.4	15
491800829-0004	03-003	Carbon monoxide	5.6	<5.6
491800829-0005	03-005	Carbon monoxide	5.3	<5.3
491800829-0006	03-004	Carbon monoxide	15	18
491800829-0007	02-003	Carbon monoxide	6.2	9.5
491800829-0008	02-005	Carbon monoxide	6.2	<6.2
491800829-0009	03-001	Carbon monoxide	10	26
491800829-0010	02-001	Carbon monoxide	5.4	92
491800829-0011	01-003	Carbon monoxide	6.2	13
491800829-0012	03-007 (P)	Carbon monoxide	6.8	<6.8
491800829-0013	02-007 (P)	Carbon monoxide	5.6	<5.6
491800829-0014	02-004	Carbon monoxide	6.0	15
491800829-0015	02-006 (P)	Carbon monoxide	6.6	<6.6
491800829-0016	01-002	Carbon monoxide	5.0	6.7
491800829-0017	02-002	Carbon monoxide	6.0	130
491800829-0018	01-001	Carbon monoxide	6.6	26
491800829-0019	01-004	Carbon monoxide	7.5	18

If "Preliminary Report" is displayed in the signature box; this indicates that there are samples that have not yet been analyzed, that are in a preliminary state, or that analysis is in progress but not completed at the time of report issue.

Report Date:	Report Revision	Revision Comments
9/12/2018	R0	Initial Report

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.

ATTACHMENT D

LABORATORY RESULTS, VOLATILE ORGANIC COMPOUNDS (VOCS)

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com   to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Laboratory Report- Sample Summary

EMSL Sample ID.	Client Sample ID.	Start Sampling Date	Start Sampling Time
491800829-0001	03-006 (P)	8/30/2018	9:25 AM
491800829-0002	01-005	8/28/2018	10:00 AM
491800829-0003	03-002	8/30/2018	8:50 AM
491800829-0004	03-003	8/30/2018	8:55 AM
491800829-0005	03-005	8/30/2018	9:05 AM
491800829-0006	03-004	8/30/2018	9:00 AM
491800829-0007	02-003	8/29/2018	8:25 AM
491800829-0008	02-005	8/29/2018	8:44 AM
491800829-0009	03-001	8/30/2018	8:45 AM
491800829-0010	02-001	8/29/2018	8:15 AM
491800829-0011	01-003	8/28/2018	9:45 AM
491800829-0012	03-007 (P)	8/30/2018	9:45 AM
491800829-0013	02-007 (P)	8/29/2018	9:15 AM
491800829-0014	02-004	8/29/2018	8:37 AM
491800829-0015	02-006 (P)	8/29/2018	8:55 AM
491800829-0016	01-002	8/28/2018	9:30 AM
491800829-0017	02-002	8/29/2018	8:20 AM
491800829-0018	01-001	8/28/2018	9:15 AM
491800829-0019	01-004	8/28/2018	10:00 AM

If "Preliminary Report" is displayed in the signature box; this indicates that there are samples that have not yet been analyzed, that are in a preliminary state, or that analysis is in progress but not completed at the time of report issue.

Report Date	Report Revision	Revision Comments
9/12/2018	R0	Initial Report

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.
NJDEP Certification #: 03036

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Case Narrative

Method Reference
USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

Column
Restek RTX-502.2, 60m, 0.25mm ID, 1.4um

Concentrator Traps:
Entech Dual Cold Traps: (1) 1/8” No Packing, (2) 1/8” Tenax.

Gas Standards:
Certified Gas standards were used for all analyses.

Sample Volumes:
Sample volume aliquots for this procedure are 250cc for indoor/ ambient air and 25cc for soil gas. Other volumes for sample dilutions are reflected on each result page.

Holding Times:
Standard holding times of 30 days were met for all samples.

Sampling Pressures:
All samples were received at acceptable pressure/vacuum unless listed below.

Sample Dilutions:
Diluitions reported are designated by the sample # with a "DL" suffix resulting from initial analysis having compounds exceeding calibration as reported with an "E" qualifier. Ethanol and Isopropanol are not diluted for and may be reported with an "E" qualifier on the final result.

QA/QC criteria outside method specifications are listed below (if applicable).

Initial Calibration
All Initial Calibratiion criteria met method specification.

Initial Calibration Verification Standard (ICVS)- Second Source
ICVS met method specification with 70-130% recovery for 100% of compounds.

Laboratory Control Sample (LCS)
LCS met method specification with 70-130% recovery for 100% of compounds.*(If the LCS does not meet criteria but any compounds which have recoveries >130% are not found in the samples, samples may be reported)*

Continuing Calibration Verification Standard (CCVS)
CCVS met method specification with all compounds within 30% deviation.

Ending Calibration Verification Standard (ECVS)
ECVS met method specification with all compounds within 30% deviation.

Method Blanks (MB)
Method Blank met method specification.

Reporting Limit Laboratory Control Samples (RLLCS)
RLLCS met method specification with 90% of compounds within the 60-140% recovery range. Individual compounds outside of the recovery range may be listed below.

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**

Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Case Narrative

Manual Integration *: -Listed below if applicable. Before and after documentation provided in extended deliverable packages.*

491800829-9 - acetonitrile, chloromethane, ethanol and propene were manually integrated as the software did not fully integrate the peak. 491800829-12 - acetonitrile was manually integrated because the software chose the wrong peak. Ethanol was manually integrated because the software did not fully integrate the

The following data qualifiers that may have been reported with the data,

ND- Non Detect. This notation would be used in the results column in lieu of a "U" qualifier.

U- Compound was analyzed for but not detected at a listed and appropriately adjusted reporting level.

J- Estimated value reported below adjusted reporting limit for target compounds or estimating a concentration for TICs where a 1:1 response is assumed

B- Compound found in associated method blank as well as in the sample.

E- Estimated value exceeding upper calibration range of instrument. Ethanol and isopropyl alcohol are not specifically targeted to dilute within calibration range.

D- Compound reported from additional diluted analysis.

N- indicates presumptive evidence of a compound based on library search match.

EMSL Analytical, Inc. certifies that this data package is in compliance with the terms and conditions of this contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer –readable data submitted on diskette has been authorized by the laboratory manager or his/her designee, as verified by the following signature.

Report Date	Report Revision	Revision Comments
9/12/2018	R0	Initial Report

Marjorie Howley

Marjorie Howley, Laboratory Manager
or other approved signatory

Test results meet all NELAP requirements unless otherwise specified.

EMSL Analytical
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http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-1**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17169.D	HD0183	32.2 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	21	10		37	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	12	5.0		25	10	
n-Butane	106-97-8	58.12	24	5.0		56	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	300	5.0		570	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	8.8	5.0		22	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	28	5.0		65	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	24	5.0		76	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 03-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**TP**	**K17169.D**	**HD0183**	**32.2 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**16**	5.0		**60**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**8.9**	5.0		**39**	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**440**	**ppbv**		**1000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-1**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17169.D	HD0183	32.2 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	15	JN	34	6.01	
Total TIC Concentrations:			15	ppbv	34	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-2**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17171.D	HD2155	27.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**15**	10		**26**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**11**	5.0		**24**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**1200**	5.0	E	**2200**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**5.4**	5.0		**13**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**13**	5.0		**30**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**23**	5.0		**75**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-2**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 01-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17171.D	HD2155	27.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**8.7**	5.0		**33**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**8.1**	5.0		**35**	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	**5.3**	5.0		**23**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**1300**	**ppbv**		**2500**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Sample #: **491800829-2**
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Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 01-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17171.D	HD2155	27.8 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
unknown		92	61	JN	230	25.19	
		Total TIC Concentrations:	61	ppbv	230	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.
B = Compound also found in method blank.
J= Estimated value based on a 1:1 response to internal standard.
N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-3**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17172.D	HD2275	26.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**290**	10		**500**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**140**	5.0		**290**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**470**	5.0	E	**890**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**9.1**	5.0		**22**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**260**	5.0		**610**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**66**	5.0		**110**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**16**	5.0		**56**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**46**	5.0		**140**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**26**	5.0		**77**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**14**	5.0		**59**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**320**	5.0		**1000**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-3**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**TP**	**K17172.D**	**HD2275**	**26.8 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**92**	5.0		**350**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	**5.4**	5.0		**25**	23	
Ethylbenzene	100-41-4	106.2	**68**	5.0		**290**	22	
Xylene (p,m)	1330-20-7	106.2	**14**	10		**61**	43	
Xylene (Ortho)	95-47-6	106.2	**8.0**	5.0		**35**	22	
Styrene	100-42-5	104.1	**13**	5.0		**55**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**19**	5.0		**94**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**1900**	**ppbv**		**4700**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-3**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	TP	K17172.D	HD2275	26.8 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	13	JN	31	6.01	
unknown hydrocarbon		92	80	JN	300	6.46	
unknown hydrocarbon		92	11	JN	40	6.79	
Acetaldehyde	000075-07-0	44	21	JN	39	6.96	
unknown hydrocarbon		92	11	JN	43	7.13	
Pentane	000109-66-0	72	50	JN	150	9.02	
Furan	000110-00-9	68	44	JN	120	10.47	
Pentane, 2-methyl-	000107-83-5	86	10	JN	35	12.55	
Acetic acid, methyl ester	000079-20-9	74	41	JN	120	12.71	
unknown hydrocarbon		92	14	JN	51	14.24	
unknown		92	45	JN	170	16.19	
unknown hydrocarbon		92	19	JN	70	22.37	
unknown hydrocarbon		92	12	JN	45	23.77	
Nonane	000111-84-2	128	14	JN	74	25.09	
1-Hexanol	000111-27-3	102	15	JN	64	25.19	
Decane	000124-18-5	142	11	JN	64	27.39	
.alpha.-Methylstyrene	000098-83-9	118	12	JN	56	28.54	
unknown hydrocarbon		92	14	JN	52	29.43	
		Total TIC Concentrations:	440	ppbv	1500	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-4**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17174.D**	**HD2282**	**28 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**67**	10		**120**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**53**	5.0		**110**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**2200**	5.0	E	**4100**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**6.0**	5.0		**15**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**110**	5.0		**260**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**32**	5.0		**54**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**22**	5.0		**65**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**7.3**	5.0		**22**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**66**	5.0		**210**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-4**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17174.D	HD2282	28 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**31**	5.0		**110**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**18**	5.0		**77**	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	**5.5**	5.0		**23**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**2600**	**ppbv**		**5200**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-4**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17174.D	HD2282	28 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
unknown hydrocarbon		92	24	JN	89	6.47	
Pentane	000109-66-0	72	13	JN	39	9.03	
Acetic acid, methyl ester	000079-20-9	74	18	JN	54	12.71	
unknown		92	16	JN	62	16.18	
1-Hexanol	000111-27-3	102	110	JN	460	25.19	
		Total TIC Concentrations:	180	ppbv	700	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-5**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17175.D**	**HD2291**	**26.5 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	ND	10		ND	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	ND	5.0		ND	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**180**	5.0		**350**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	ND	5.0		ND	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**5.0**	5.0		**18**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	ND	5.0		ND	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

EMSL Order #: **491800829**
EMSL Sample #: **491800829-5**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17175.D	HD2291	26.5 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	ND	5.0		ND	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	ND	5.0		ND	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**190**	**ppbv**		**370**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	11	10	110%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-5**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17175.D	HD2291	26.5 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
No TICs to Report							
		Total TIC Concentrations:	0.0	ppbv	0.0	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-6**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17176.D	HD2298	73.5 cc	10
Dilution1	09/11/2018	TP	K17186.D	HD2298	33.2 cc	25

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**380**	10		**650**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**260**	5.0		**530**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**7.6**	5.0		**17**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**6300**	13	DE	**12000**	24	*Reported Dilution #1*
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**29**	5.0		**72**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**330**	5.0		**780**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**150**	5.0		**240**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**18**	5.0		**63**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**65**	5.0		**190**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**9.4**	5.0		**34**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**24**	5.0		**72**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**15**	5.0		**62**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**490**	13	D	**1600**	40	*Reported Dilution #1*
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	**20**	5.0		**83**	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	**5.8**	5.0		**21**	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-6**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17176.D	HD2298	73.5 cc	10
Dilution1	09/11/2018	TP	K17186.D	HD2298	33.2 cc	25

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	190	5.0		720	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	100	5.0		440	22	
Xylene (p,m)	1330-20-7	106.2	31	10		130	43	
Xylene (Ortho)	95-47-6	106.2	16	5.0		68	22	
Styrene	100-42-5	104.1	37	5.0		160	21	
Isopropylbenzene (cumene)	98-82-8	120.19	24	5.0		120	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	7.6	5.0		37	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	8.1	5.0		40	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	6.1	5.0		30	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	10	5.0		54	26	
Total Target Compound Concentrations:			**8500**	**ppbv**		**18000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-6**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17176.D**	**HD2298**	**73.5 cc**	**10**
Dilution1	**09/11/2018**	**TP**	**K17186.D**	**HD2298**	**33.2 cc**	**25**

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	**21**	JN	**49**	6.01	
unknown hydrocarbon		92	**120**	JN	**450**	6.47	
unknown hydrocarbon		92	**17**	JN	**64**	6.79	
Acetaldehyde	000075-07-0	44	**20**	JN	**37**	6.95	
unknown hydrocarbon		92	**18**	JN	**67**	7.13	
Pentane	000109-66-0	72	**72**	JN	**210**	9.03	
unknown hydrocarbon		92	**16**	JN	**58**	9.76	
Acetic acid, methyl ester	000079-20-9	74	**56**	JN	**170**	12.71	
Cyclopentene	000142-29-0	68	**23**	JN	**65**	13.15	
Silanol, trimethyl-	001066-40-6	90	**43**	JN	**160**	13.55	
unknown hydrocarbon		92	**21**	JN	**79**	14.24	
unknown hydrocarbon		92	**16**	JN	**61**	15.21	
unknown		92	**67**	JN	**250**	16.19	
Octane	000111-65-9	114	**20**	JN	**92**	22.37	
unknown hydrocarbon		92	**23**	JN	**86**	23.77	
Nonane	000111-84-2	128	**20**	JN	**100**	25.08	
1-Hexanol	000111-27-3	102	**420**	JN	**1700**	25.20	
.alpha.-Methylstyrene	000098-83-9	118	**21**	JN	**100**	28.54	
unknown hydrocarbon		92	**19**	JN	**70**	29.43	
Total TIC Concentrations:			**1000**	**ppbv**	**3900**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-7**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17177.D**	**HD2300**	**30.8 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**260**	10		**450**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**99**	5.0		**200**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**11**	5.0		**23**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**390**	5.0		**730**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**7.6**	5.0		**19**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**120**	5.0		**300**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**31**	5.0		**52**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**15**	5.0		**52**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**28**	5.0		**83**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**15**	5.0		**43**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**13**	5.0		**54**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**330**	5.0		**1100**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-7**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17177.D**	**HD2300**	**30.8 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**140**	5.0		**530**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**130**	5.0		**540**	22	
Xylene (p,m)	1330-20-7	106.2	**15**	10		**64**	43	
Xylene (Ortho)	95-47-6	106.2	**9.5**	5.0		**41**	22	
Styrene	100-42-5	104.1	**46**	5.0		**190**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**24**	5.0		**120**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**1700**	**ppbv**		**4600**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-7**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17177.D	HD2300	30.8 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
unknown hydrocarbon		92	78	JN	300	6.47	
Acetaldehyde	000075-07-0	44	11	JN	19	6.96	
unknown hydrocarbon		92	12	JN	44	7.13	
Pentane	000109-66-0	72	60	JN	180	9.03	
unknown hydrocarbon		92	11	JN	42	9.77	
Furan	000110-00-9	68	22	JN	62	10.46	
Acetic acid, methyl ester	000079-20-9	74	17	JN	51	12.71	
unknown hydrocarbon		92	28	JN	110	14.25	
unknown hydrocarbon		92	12	JN	46	15.21	
unknown		92	40	JN	150	16.19	
Octane	000111-65-9	114	23	JN	110	22.36	
unknown		92	11	JN	40	23.49	
unknown		92	22	JN	82	23.77	
Nonane	000111-84-2	128	21	JN	110	25.08	
1-Hexanol	000111-27-3	102	24	JN	100	25.20	
unknown hydrocarbon		92	16	JN	58	27.38	
.alpha.-Methylstyrene	000098-83-9	118	20	JN	98	28.54	
unknown hydrocarbon		92	20	JN	75	29.43	
unknown hydrocarbon		92	11	JN	41	31.34	
Total TIC Concentrations:			460	ppbv	1700	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

EMSL Order #: **491800829**
EMSL Sample #: **491800829-8**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17179.D	HD2303	30.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	ND	10		ND	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	ND	5.0		ND	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**320**	5.0		**610**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**6.2**	5.0		**15**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**7.8**	5.0		**25**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-8**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17179.D	HD2303	30.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	ND	5.0		ND	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	ND	5.0		ND	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**330**	**ppbv**		**650**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-8**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-005

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17179.D	HD2303	30.8 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
No TICs to Report							
		Total TIC Concentrations:	0.0	ppbv	0.0	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #:	**491800829**
EMSL Sample #:	**491800829-9**
Customer ID:	**EEG50**
Customer PO:	**20184191DEBRIS**

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5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone:	**305-374-8300**
Fax:	**305-374-8301**
Date Collected:	**8/30/2018**
Date Received:	**9/4/2018**

Project: **SXM Debris**

Sample ID: 03-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17187.D**	**HD2702**	**58.8 cc**	**10**
Dilution1	**09/11/2018**	**TP**	**K17180.D**	**HD2702**	**20.1 cc**	**25**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**440**	25	D	**770**	43	***Reported Dilution #1***
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**120**	5.0		**240**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**15**	5.0		**33**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**1600**	13	DE	**2900**	24	***Reported Dilution #1***
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**12**	5.0		**29**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**250**	5.0		**590**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**110**	5.0		**190**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	**8.4**	5.0		**18**	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**22**	5.0		**77**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**40**	5.0		**120**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**5.4**	5.0		**19**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**32**	5.0		**100**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**18**	5.0		**73**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**590**	13	D	**1900**	40	***Reported Dilution #1***
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

EMSL Order #: **491800829**
EMSL Sample #: **491800829-9**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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5751 Miami Lakes Drive East
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Phone: **305-374-8300**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17187.D**	**HD2702**	**58.8 cc**	**10**
Dilution1	**09/11/2018**	**TP**	**K17180.D**	**HD2702**	**20.1 cc**	**25**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**130**	5.0		**500**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	**10**	5.0		**48**	23	
Ethylbenzene	100-41-4	106.2	**86**	5.0		**380**	22	
Xylene (p,m)	1330-20-7	106.2	**18**	10		**77**	43	
Xylene (Ortho)	95-47-6	106.2	**10**	5.0		**45**	22	
Styrene	100-42-5	104.1	**30**	5.0		**130**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**25**	5.0		**120**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**6.0**	5.0		**30**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**6.4**	5.0		**34**	26	
Total Target Compound Concentrations:			**3600**	**ppbv**		**8400**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	11	10	110%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

EMSL Order #: **491800829**
EMSL Sample #: **491800829-9**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17187.D	HD2702	58.8 cc	10
Dilution1	09/11/2018	TP	K17180.D	HD2702	20.1 cc	25

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	15	JN	36	6.01	
unknown hydrocarbon		92	99	JN	370	6.47	
Acetaldehyde	000075-07-0	44	30	JN	55	6.94	
unknown hydrocarbon		92	15	JN	57	7.12	
Pentane	000109-66-0	72	72	JN	210	9.03	
unknown hydrocarbon		92	14	JN	51	9.76	
Furan	000110-00-9	68	53	JN	150	10.47	
Acetic acid, methyl ester	000079-20-9	74	21	JN	62	12.71	
Cyclopentene	000142-29-0	68	11	JN	30	13.16	
unknown hydrocarbon		92	20	JN	75	14.25	
unknown hydrocarbon		92	12	JN	47	15.22	
unknown		92	60	JN	220	16.19	
Octane	000111-65-9	114	23	JN	110	22.37	
unknown hydrocarbon		92	17	JN	62	23.77	
unknown hydrocarbon		92	20	JN	75	25.09	
1-Hexanol	000111-27-3	102	53	JN	220	25.20	
Decane	000124-18-5	142	15	JN	87	27.39	
.alpha.-Methylstyrene	000098-83-9	118	16	JN	76	28.54	
unknown hydrocarbon		92	24	JN	91	29.43	
Total TIC Concentrations:			590	ppbv	2100	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-10**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17183.D	HD2705	26.8 cc	10
Dilution2	09/12/2018	TP	K17212.D	HD2705	29.5 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	2600	90	D	4400	150	*Reported Dilution #1*
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	830	45	D	1700	93	*Reported Dilution #1*
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	67	5.0		150	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	22	5.0		58	13	
Ethanol	64-17-5	46.07	490	45	D	920	85	*Reported Dilution #1*
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	12	5.0		30	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	1800	45	D	4300	110	*Reported Dilution #1*
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	250	5.0		410	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	200	5.0		720	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	480	45	D	1400	130	*Reported Dilution #1*
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	240	5.0		720	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	7.2	5.0		25	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	180	5.0		750	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	2900	45	D	9200	140	*Reported Dilution #1*
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	170	5.0		600	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	10	5.0		41	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-10**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**TP**	**K17183.D**	**HD2705**	**26.8 cc**	**10**
Dilution2	**09/12/2018**	**TP**	**K17212.D**	**HD2705**	**29.5 cc**	**90**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**1700**	45	D	**6300**	170	*Reported Dilution #1*
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	**42**	5.0		**170**	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	**5.4**	5.0		**25**	23	
Ethylbenzene	100-41-4	106.2	**1700**	45	D	**7200**	200	*Reported Dilution #1*
Xylene (p,m)	1330-20-7	106.2	**230**	10		**1000**	43	
Xylene (Ortho)	95-47-6	106.2	**170**	5.0		**720**	22	
Styrene	100-42-5	104.1	**370**	5.0		**1600**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**420**	45	D	**2100**	220	*Reported Dilution #1*
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**79**	5.0		**390**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**78**	5.0		**380**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	**55**	5.0		**270**	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**120**	5.0		**620**	26	
Total Target Compound Concentrations:			**15000**	**ppbv**		**46000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	12	10	120%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-10**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17183.D	HD2705	26.8 cc	10
Dilution2	09/12/2018	TP	K17212.D	HD2705	29.5 cc	90

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
unknown hydrocarbon		92	650	JN	2400	6.46	
unknown hydrocarbon		92	130	JN	480	6.79	
Pentane	000109-66-0	72	470	JN	1400	9.02	
Furan	000110-00-9	68	220	JN	620	10.45	
Pentane, 2-methyl-	000107-83-5	86	120	JN	420	12.55	
Acetic acid, methyl ester	000079-20-9	74	170	JN	500	12.70	
unknown hydrocarbon		92	190	JN	730	14.25	
unknown hydrocarbon		92	130	JN	500	15.21	
unknown		92	470	JN	1800	16.19	
Furan, 2,5-dimethyl-	000625-86-5	96	110	JN	430	20.48	
Octane	000111-65-9	114	210	JN	960	22.37	
unknown hydrocarbon		92	140	JN	520	23.50	
unknown hydrocarbon		92	170	JN	650	23.78	
Nonane	000111-84-2	128	200	JN	1100	25.09	
Decane	000124-18-5	142	160	JN	930	27.39	
.alpha.-Methylstyrene	000098-83-9	118	220	JN	1100	28.54	
Undecane	001120-21-4	156	200	JN	1300	29.44	
Acetophenone	000098-86-2	120	140	JN	690	31.04	
unknown hydrocarbon		92	140	JN	540	31.33	
unknown hydrocarbon		92	110	JN	430	33.42	
		Total TIC Concentrations:	4400	ppbv	18000	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-11**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17184.D	HD2727	30.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	130	10		230	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	71	5.0		150	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	110	5.0		210	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	130	5.0		310	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	23	5.0		38	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	13	5.0		44	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	33	5.0		100	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	6.4	5.0		23	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	14	5.0		42	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	12	5.0		50	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	310	5.0		1000	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	6.3	5.0		23	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-11**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17184.D	HD2727	30.8 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**88**	5.0		**330**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**78**	5.0		**340**	22	
Xylene (p,m)	1330-20-7	106.2	**13**	10		**58**	43	
Xylene (Ortho)	95-47-6	106.2	**9.5**	5.0		**41**	22	
Styrene	100-42-5	104.1	**21**	5.0		**90**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**26**	5.0		**130**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**5.0**	5.0		**26**	26	
Total Target Compound Concentrations:			**1100**	**ppbv**		**3200**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-11**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 01-003

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	TP	K17184.D	HD2727	30.8 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	**11**	JN	**25**	6.01	
1-Propene, 2-methyl-	000115-11-7	56	**54**	JN	**120**	6.46	
Pentane	000109-66-0	72	**42**	JN	**120**	9.02	
Acetic acid, methyl ester	000079-20-9	74	**16**	JN	**50**	12.71	
1-Pentene, 2-methyl-	000763-29-1	84	**14**	JN	**49**	14.24	
unknown		92	**34**	JN	**130**	16.18	
unknown hydrocarbon		92	**19**	JN	**71**	22.37	
unknown hydrocarbon		92	**71**	JN	**270**	23.50	
unknown hydrocarbon		92	**14**	JN	**51**	23.78	
Nonane	000111-84-2	128	**20**	JN	**100**	25.08	
Decane	000124-18-5	142	**16**	JN	**93**	27.38	
Unknown Substituted Naphthalene		92	**40**	JN	**150**	28.15	
.alpha.-Methylstyrene	000098-83-9	118	**22**	JN	**110**	28.54	
Undecane	001120-21-4	156	**21**	JN	**130**	29.43	
Acetophenone	000098-86-2	120	**19**	JN	**95**	31.03	
unknown hydrocarbon		92	**20**	JN	**75**	31.33	
unknown hydrocarbon		92	**24**	JN	**90**	33.43	
unknown hydrocarbon		92	**11**	JN	**40**	33.74	
	Total TIC Concentrations:		**470**	**ppbv**	**1800**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-12**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4324.D	HD2733	34 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**17**	10		**29**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**8.0**	5.0		**17**	10	
n-Butane	106-97-8	58.12	**11**	5.0		**26**	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**5200**	5.0	E	**10000**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**21**	5.0		**49**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**6.2**	5.0		**22**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**16**	5.0		**52**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-12**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**KW**	**J4324.D**	**HD2733**	**34 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**7.4**	5.0		**28**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**5.4**	5.0		**23**	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**5300**	**ppbv**		**10000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	9.0	10	90%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-12**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Date Collected: **8/30/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 03-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4324.D	HD2733	34 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
1-Hexanol	000111-27-3	102	100	JN	420	23.83	
Total TIC Concentrations:			100	ppbv	420	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-13**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4325.D	HD2743	28 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	ND	10		ND	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	ND	5.0		ND	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**650**	5.0	E	**1200**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**8.5**	5.0		**21**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**9.0**	5.0		**21**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	ND	5.0		ND	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	ND	5.0		ND	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-13**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4325.D	HD2743	28 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	ND	5.0		ND	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	ND	5.0		ND	22	
Xylene (p,m)	1330-20-7	106.2	ND	10		ND	43	
Xylene (Ortho)	95-47-6	106.2	ND	5.0		ND	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**670**	**ppbv**		**1200**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	9.5	10	95%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

EMSL Order #: **491800829**
EMSL Sample #: **491800829-13**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-007 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4325.D	HD2743	28 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
No TICs to Report							
		Total TIC Concentrations:	0.0	ppbv	0.0	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #:	**491800829**
EMSL Sample #:	**491800829-14**
Customer ID:	**EEG50**
Customer PO:	**20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone:	**305-374-8300**
Fax:	**305-374-8301**
Date Collected:	**8/29/2018**
Date Received:	**9/4/2018**

Project: **SXM Debris**

Sample ID: 02-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**KW**	**J4326.D**	**HD2752**	**30 cc**	**10**
Dilution1	**09/12/2018**	**KW**	**J4366.D**	**HD2752**	**30 cc**	**90**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**1500**	90	D	**2700**	150	***Reported Dilution #1***
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**130**	5.0		**270**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**140**	5.0		**310**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	**8.4**	5.0		**22**	13	
Ethanol	64-17-5	46.07	**750**	45	D	**1400**	85	***Reported Dilution #1***
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**530**	45	D	**1300**	110	***Reported Dilution #1***
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**240**	5.0		**400**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**83**	5.0		**290**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**140**	5.0		**420**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	ND	5.0		ND	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**55**	5.0		**160**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**84**	5.0		**340**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**1800**	45	D	**5700**	140	***Reported Dilution #1***
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	**12**	5.0		**42**	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

EMSL Order #: **491800829**
EMSL Sample #: **491800829-14**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4326.D	HD2752	30 cc	10
Dilution1	09/12/2018	KW	J4366.D	HD2752	30 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**710**	45	D	**2700**	170	*Reported Dilution #1*
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	**12**	5.0		**49**	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**640**	45	D	**2800**	200	*Reported Dilution #1*
Xylene (p,m)	1330-20-7	106.2	**95**	10		**410**	43	
Xylene (Ortho)	95-47-6	106.2	**62**	5.0		**270**	22	
Styrene	100-42-5	104.1	**340**	45	D	**1500**	190	*Reported Dilution #1*
Isopropylbenzene (cumene)	98-82-8	120.19	**120**	5.0		**590**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**25**	5.0		**120**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**24**	5.0		**120**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	**17**	5.0		**84**	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**59**	5.0		**310**	26	
Total Target Compound Concentrations:			**7600**	**ppbv**		**22000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	12	10	120%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-14**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 02-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**KW**	**J4326.D**	**HD2752**	**30 cc**	**10**
Dilution1	**09/12/2018**	**KW**	**J4366.D**	**HD2752**	**30 cc**	**90**

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
1-Propene, 2-methyl-	000115-11-7	56	**330**	JN	**750**	6.66	
Unknown hydrocarbon		92	**44**	JN	**170**	7.03	
Acetaldehyde	000075-07-0	44	**52**	JN	**93**	7.24	
Pentane	000109-66-0	72	**190**	JN	**550**	9.21	
2-Pentene	000109-68-2	70	**35**	JN	**100**	9.80	
Unknown hydrocarbon		92	**39**	JN	**150**	10.15	
Furan	000110-00-9	68	**67**	JN	**190**	10.36	
1-Pentene, 2-methyl-	000763-29-1	84	**160**	JN	**560**	13.04	
Unknown		92	**120**	JN	**440**	14.64	
Unknown hydrocarbon		92	**89**	JN	**330**	20.52	
Unknown		92	**94**	JN	**350**	22.07	
Nonane	000111-84-2	128	**81**	JN	**420**	23.51	
Unknown		92	**65**	JN	**250**	26.14	
.alpha.-Methylstyrene	000098-83-9	118	**140**	JN	**680**	27.52	
Benzaldehyde	000100-52-7	106	**69**	JN	**300**	27.85	
Unknown		92	**81**	JN	**300**	28.55	
Unknown Substituted Benzene		92	**63**	JN	**240**	28.62	
Acetophenone	000098-86-2	120	**71**	JN	**350**	30.47	
Unknown		92	**71**	JN	**270**	30.74	
Unknown		92	**65**	JN	**250**	32.82	
		Total TIC Concentrations:	**1900**	**ppbv**	**6700**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-15**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**KW**	**J4328.D**	**HD2768**	**33 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**23**	10		**40**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**9.1**	5.0		**19**	10	
n-Butane	106-97-8	58.12	**32**	5.0		**76**	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	ND	5.0		ND	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**770**	5.0	E	**1400**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**11**	5.0		**26**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**34**	5.0		**81**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	ND	5.0		ND	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	ND	5.0		ND	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**6.8**	5.0		**20**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**7.2**	5.0		**26**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	ND	5.0		ND	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	ND	5.0		ND	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**21**	5.0		**67**	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-15**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4328.D	HD2768	33 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**23**	5.0		**85**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**10**	5.0		**45**	22	
Xylene (p,m)	1330-20-7	106.2	**15**	10		**64**	43	
Xylene (Ortho)	95-47-6	106.2	**5.7**	5.0		**25**	22	
Styrene	100-42-5	104.1	ND	5.0		ND	21	
Isopropylbenzene (cumene)	98-82-8	120.19	ND	5.0		ND	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	ND	5.0		ND	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	5.0		ND	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	ND	5.0		ND	26	
Total Target Compound Concentrations:			**1000**	**ppbv**		**2000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	9.8	10	98%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-15**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 02-006 (P)

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/10/2018**	**KW**	**J4328.D**	**HD2768**	**33 cc**	**10**

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	13	JN	31	6.16	
	Total TIC Concentrations:		**13**	**ppbv**	**31**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-16**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4329.D	HD2786	25 cc	10
Dilution1	09/12/2018	KW	J4367.D	HD2786	25 cc	20

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**180**	10		**310**	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**78**	5.0		**160**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**5.3**	5.0		**12**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**98**	5.0		**180**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	**7.5**	5.0		**19**	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**360**	5.0		**850**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**74**	5.0		**120**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**19**	5.0		**66**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**67**	5.0		**200**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**8.8**	5.0		**32**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**24**	5.0		**70**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**17**	5.0		**71**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**310**	10	D	**1000**	32	***Reported Dilution #1***
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	ND	5.0		ND	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-16**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Phone: **305-374-8300**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4329.D	HD2786	25 cc	10
Dilution1	09/12/2018	KW	J4367.D	HD2786	25 cc	20

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**130**	5.0		**500**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**160**	5.0		**680**	22	
Xylene (p,m)	1330-20-7	106.2	**17**	10		**73**	43	
Xylene (Ortho)	95-47-6	106.2	**13**	5.0		**54**	22	
Styrene	100-42-5	104.1	**32**	5.0		**140**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**47**	5.0		**230**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**5.9**	5.0		**29**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**7.9**	5.0		**39**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	5.0		ND	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**5.5**	5.0		**29**	26	
Total Target Compound Concentrations:			**1700**	**ppbv**		**4900**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	10	10	100%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-16**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/10/2018	KW	J4329.D	HD2786	25 cc	10
Dilution1	09/12/2018	KW	J4367.D	HD2786	25 cc	20

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
1-Propene, 2-methyl-	000115-11-7	56	60	JN	140	6.66	
Pentane	000109-66-0	72	36	JN	110	9.21	
Furan	000110-00-9	68	15	JN	42	10.34	
Pentane, 2-methyl-	000107-83-5	86	11	JN	40	11.77	
Acetic acid, methyl ester	000079-20-9	74	34	JN	100	11.89	
1-Pentene, 2-methyl-	000763-29-1	84	16	JN	54	13.02	
Unknown		92	30	JN	110	14.63	
Unknown hydrocarbon		92	22	JN	82	20.52	
Cyclohexane, propyl-	001678-92-8	126	17	JN	88	21.76	
Unknown		92	16	JN	60	22.07	
Nonane	000111-84-2	128	22	JN	120	23.52	
Decane	000124-18-5	142	17	JN	100	26.15	
.alpha.-Methylstyrene	000098-83-9	118	26	JN	130	27.52	
Undecane	001120-21-4	156	18	JN	120	28.53	
Acetophenone	000098-86-2	120	16	JN	76	30.49	
Dodecane	000112-40-3	170	20	JN	140	30.75	
Tridecane	000629-50-5	184	27	JN	200	32.82	
Tetradecane	000629-59-4	198	16	JN	130	35.09	
		Total TIC Concentrations:	420	ppbv	1800	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, "Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-17**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 02-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	KW	J4350.D	HD2787	279 cc	10
Dilution1	09/12/2018	KW	J4351.D	HD2787	31 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**1100**	90	D	**1900**	150	***Reported Dilution #1***
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**180**	5.0		**380**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**69**	5.0		**150**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	**12**	5.0		**30**	13	
Ethanol	64-17-5	46.07	**46**	5.0		**87**	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**1500**	45	D	**3600**	110	***Reported Dilution #1***
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**650**	45	D	**1100**	75	***Reported Dilution #1***
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**170**	5.0		**610**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**310**	5.0		**900**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**15**	5.0		**54**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**72**	5.0		**210**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	**5.5**	5.0		**19**	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**160**	5.0		**660**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**4100**	45	DE	**13000**	140	***Reported Dilution #1***
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	**19**	5.0		**68**	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	**5.9**	5.0		**24**	20	

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EMSL Order #:	**491800829**
EMSL Sample #:	**491800829-17**
Customer ID:	**EEG50**
Customer PO:	**20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone:	**305-374-8300**
Fax:	**305-374-8301**
Date Collected:	**8/29/2018**
Date Received:	**9/4/2018**

Project: **SXM Debris**

Sample ID: 02-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	KW	J4350.D	HD2787	279 cc	10
Dilution1	09/12/2018	KW	J4351.D	HD2787	31 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**1900**	45	D	**7100**	170	***Reported Dilution #1***
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	**26**	5.0		**110**	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**1700**	45	D	**7200**	200	***Reported Dilution #1***
Xylene (p,m)	1330-20-7	106.2	**200**	10		**890**	43	
Xylene (Ortho)	95-47-6	106.2	**170**	5.0		**740**	22	
Styrene	100-42-5	104.1	**240**	5.0		**1000**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**290**	5.0		**1400**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**67**	5.0		**330**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**68**	5.0		**340**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	**47**	5.0		**230**	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**110**	5.0		**590**	26	
Total Target Compound Concentrations:			**13000**	**ppbv**		**43000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	12	10	120%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

EMSL Analytical
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EMSL Order #: **491800829**
EMSL Sample #: **491800829-17**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/29/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**
Sample ID: 02-002

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**KW**	**J4350.D**	**HD2787**	**279 cc**	**10**
Dilution1	**09/12/2018**	**KW**	**J4351.D**	**HD2787**	**31 cc**	**90**

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
1-Propene, 2-methyl-	000115-11-7	56	**440**	JN	**1000**	6.66	
Unknown hydrocarbon		92	**77**	JN	**290**	7.01	
Pentane	000109-66-0	72	**240**	JN	**710**	9.20	
Unknown hydrocarbon		92	**79**	JN	**300**	10.30	
1-Pentene, 2-methyl-	000763-29-1	84	**110**	JN	**390**	13.02	
Unknown		92	**120**	JN	**440**	14.62	
Unknown hydrocarbon		92	**120**	JN	**460**	20.51	
Unknown hydrocarbon		92	**120**	JN	**470**	22.06	
Nonane	000111-84-2	128	**170**	JN	**860**	23.51	
Decane	000124-18-5	142	**140**	JN	**800**	26.14	
Benzene, propyl-	000103-65-1	120	**74**	JN	**360**	26.58	
Unknown Substituted Benzene		92	**80**	JN	**300**	27.43	
.alpha.-Methylstyrene	000098-83-9	118	**130**	JN	**640**	27.52	
Unknown hydrocarbon		92	**150**	JN	**570**	28.53	
Unknown		92	**150**	JN	**560**	28.62	
Unknown Substituted Benzene		92	**61**	JN	**230**	29.10	
Acetophenone	000098-86-2	120	**250**	JN	**1200**	30.46	
Dodecane	000112-40-3	170	**190**	JN	**1300**	30.73	
Tridecane	000629-50-5	184	**92**	JN	**690**	32.82	
Total TIC Concentrations:			**2800**	**ppbv**	**12000**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-18**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	KW	J4333.D	HD2802	33 cc	10

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	1100	10	E	1800	17	
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	350	5.0		730	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	26	5.0		57	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	29	5.0		77	13	
Ethanol	64-17-5	46.07	860	5.0	E	1600	9.4	
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	680	5.0	E	1600	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	160	5.0		270	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	5.9	5.0		13	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	120	5.0		420	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	170	5.0		490	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	19	5.0		68	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	75	5.0		220	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	120	5.0		510	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	1900	5.0	E	6000	16	
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	19	5.0		67	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	5.8	5.0		24	20	

EMSL Order #: **491800829**
EMSL Sample #: **491800829-18**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

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Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	**09/11/2018**	**KW**	**J4333.D**	**HD2802**	**33 cc**	**10**

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**830**	5.0	E	**3100**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**980**	5.0	E	**4200**	22	
Xylene (p,m)	1330-20-7	106.2	**89**	10		**390**	43	
Xylene (Ortho)	95-47-6	106.2	**79**	5.0		**340**	22	
Styrene	100-42-5	104.1	**330**	5.0		**1400**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**250**	5.0		**1200**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**31**	5.0		**150**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**40**	5.0		**200**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	**21**	5.0		**100**	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**39**	5.0		**210**	26	
Total Target Compound Concentrations:			**8300**	**ppbv**		**25000**	**ug/m3**	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	12	10	120%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-18**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-001

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/11/2018	KW	J4333.D	HD2802	33 cc	10

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Acetaldehyde	000075-07-0	44	**62**	JN	**110**	7.22	
Pentane	000109-66-0	72	**250**	JN	**740**	9.21	
Furan	000110-00-9	68	**72**	JN	**200**	10.34	
Pentane, 2-methyl-	000107-83-5	86	**55**	JN	**190**	11.77	
1-Pentene, 2-methyl-	000763-29-1	84	**130**	JN	**450**	13.02	
Unknown hydrocarbon		92	**65**	JN	**250**	13.79	
Unknown		92	**130**	JN	**480**	14.64	
Unknown hydrocarbon		92	**48**	JN	**180**	19.45	
Unknown hydrocarbon		92	**110**	JN	**400**	20.53	
Unknown		92	**87**	JN	**330**	21.74	
Unknown		92	**140**	JN	**530**	22.07	
Nonane	000111-84-2	128	**120**	JN	**610**	23.51	
Decane	000124-18-5	142	**81**	JN	**470**	26.15	
.alpha.-Methylstyrene	000098-83-9	118	**160**	JN	**790**	27.52	
Benzaldehyde	000100-52-7	106	**45**	JN	**190**	27.85	
Undecane	001120-21-4	156	**100**	JN	**650**	28.53	
Unknown Substituted Benzene		92	**93**	JN	**350**	28.62	
Acetophenone	000098-86-2	120	**87**	JN	**430**	30.47	
Dodecane	000112-40-3	170	**130**	JN	**900**	30.75	
Tridecane	000629-50-5	184	**99**	JN	**740**	32.82	
Total TIC Concentrations:			**2100**	**ppbv**	**9000**	**ug/m3**	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

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EMSL Order #: **491800829**
EMSL Sample #: **491800829-19**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
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Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/12/2018	KW	J4354.D	HD2831	112 cc	10
Dilution1	09/12/2018	KW	J4355.D	HD2831	37 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
Propylene	115-07-1	42.08	**1300**	90	D	**2200**	150	*Reported Dilution #1*
Freon 12(Dichlorodifluoromethane)	75-71-8	120.9	ND	5.0		ND	25	
Freon 114(1,2-Dichlorotetrafluoroethan	76-14-2	170.9	ND	5.0		ND	35	
Chloromethane	74-87-3	50.49	**56**	5.0		**120**	10	
n-Butane	106-97-8	58.12	ND	5.0		ND	12	
Vinyl chloride	75-01-4	62.50	ND	5.0		ND	13	
1,3-Butadiene	106-99-0	54.09	**9.1**	5.0		**20**	11	
Bromomethane	74-83-9	94.94	ND	5.0		ND	19	
Chloroethane	75-00-3	64.52	ND	5.0		ND	13	
Ethanol	64-17-5	46.07	**21000**	45	DE	**40000**	85	*Reported Dilution #1*
Bromoethene(Vinyl bromide)	593-60-2	106.9	ND	5.0		ND	22	
Freon 11(Trichlorofluoromethane)	75-69-4	137.4	ND	5.0		ND	28	
Isopropyl alcohol(2-Propanol)	67-63-0	60.10	ND	5.0		ND	12	
Freon 113(1,1,2-Trichlorotrifluoroethan	76-13-1	187.4	ND	5.0		ND	38	
Acetone	67-64-1	58.08	**340**	5.0		**800**	12	
1,1-Dichloroethene	75-35-4	96.94	ND	5.0		ND	20	
Acetonitrile	75-05-8	41.00	**56**	5.0		**94**	8.4	
Tertiary butyl alcohol(TBA)	75-65-0	74.12	ND	5.0		ND	15	
Bromoethane(Ethyl bromide)	74-96-4	108.0	ND	5.0		ND	22	
3-Chloropropene(Allyl chloride)	107-05-1	76.53	ND	5.0		ND	16	
Carbon disulfide	75-15-0	76.14	ND	5.0		ND	16	
Methylene chloride	75-09-2	84.94	ND	5.0		ND	17	
Acrylonitrile	107-13-1	53.00	ND	5.0		ND	11	
Methyl-tert-butyl ether(MTBE)	1634-04-4	88.15	ND	5.0		ND	18	
trans-1,2-Dichloroethene	156-60-5	96.94	ND	5.0		ND	20	
n-Hexane	110-54-3	86.17	**34**	5.0		**120**	18	
1,1-Dichloroethane	75-34-3	98.96	ND	5.0		ND	20	
Vinyl acetate	108-05-4	86.00	ND	5.0		ND	18	
2-Butanone(MEK)	78-93-3	72.10	**62**	5.0		**180**	15	
cis-1,2-Dichloroethene	156-59-2	96.94	ND	5.0		ND	20	
Ethyl acetate	141-78-6	88.10	**8.1**	5.0		**29**	18	
Chloroform	67-66-3	119.4	ND	5.0		ND	24	
Tetrahydrofuran	109-99-9	72.11	**19**	5.0		**56**	15	
1,1,1-Trichloroethane	71-55-6	133.4	ND	5.0		ND	27	
Cyclohexane	110-82-7	84.16	ND	5.0		ND	17	
2,2,4-Trimethylpentane(Isooctane)	540-84-1	114.2	ND	5.0		ND	23	
Carbon tetrachloride	56-23-5	153.8	ND	5.0		ND	31	
n-Heptane	142-82-5	100.2	**30**	5.0		**120**	20	
1,2-Dichloroethane	107-06-2	98.96	ND	5.0		ND	20	
Benzene	71-43-2	78.11	**2700**	45	D	**8500**	140	*Reported Dilution #1*
Trichloroethene	79-01-6	131.4	ND	5.0		ND	27	
1,2-Dichloropropane	78-87-5	113.0	ND	5.0		ND	23	
Methyl Methacrylate	80-62-6	100.12	ND	5.0		ND	20	
Bromodichloromethane	75-27-4	163.8	ND	5.0		ND	33	
1,4-Dioxane	123-91-1	88.12	**6.0**	5.0		**22**	18	
4-Methyl-2-pentanone(MIBK)	108-10-1	100.2	ND	5.0		ND	20	

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-19**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/12/2018	KW	J4354.D	HD2831	112 cc	10
Dilution1	09/12/2018	KW	J4355.D	HD2831	37 cc	90

Target Compound Results Summary

Target Compounds	CAS#	MW	Result ppbv	RL ppbv	Q	Result ug/m3	RL ug/m3	Comments
cis-1,3-Dichloropropene	10061-01-5	111.0	ND	5.0		ND	23	
Toluene	108-88-3	92.14	**300**	5.0		**1100**	19	
trans-1,3-Dichloropropene	10061-02-6	111.0	ND	5.0		ND	23	
1,1,2-Trichloroethane	79-00-5	133.4	ND	5.0		ND	27	
2-Hexanone(MBK)	591-78-6	100.1	ND	5.0		ND	20	
Tetrachloroethene	127-18-4	165.8	ND	5.0		ND	34	
Dibromochloromethane	124-48-1	208.3	ND	5.0		ND	43	
1,2-Dibromoethane	106-93-4	187.8	ND	5.0		ND	38	
Chlorobenzene	108-90-7	112.6	ND	5.0		ND	23	
Ethylbenzene	100-41-4	106.2	**280**	5.0		**1200**	22	
Xylene (p,m)	1330-20-7	106.2	**37**	10		**160**	43	
Xylene (Ortho)	95-47-6	106.2	**28**	5.0		**120**	22	
Styrene	100-42-5	104.1	**44**	5.0		**190**	21	
Isopropylbenzene (cumene)	98-82-8	120.19	**62**	5.0		**310**	25	
Bromoform	75-25-2	252.8	ND	5.0		ND	52	
1,1,2,2-Tetrachloroethane	79-34-5	167.9	ND	5.0		ND	34	
4-Ethyltoluene	622-96-8	120.2	**11**	5.0		**53**	25	
1,3,5-Trimethylbenzene	108-67-8	120.2	**13**	5.0		**66**	25	
2-Chlorotoluene	95-49-8	126.6	ND	5.0		ND	26	
1,2,4-Trimethylbenzene	95-63-6	120.2	**7.9**	5.0		**39**	25	
1,3-Dichlorobenzene	541-73-1	147.0	ND	5.0		ND	30	
1,4-Dichlorobenzene	106-46-7	147.0	ND	5.0		ND	30	
Benzyl chloride	100-44-7	126.0	ND	5.0		ND	26	
1,2-Dichlorobenzene	95-50-1	147.0	ND	5.0		ND	30	
1,2,4-Trichlorobenzene	120-82-1	181.5	ND	5.0		ND	37	
Hexachloro-1,3-butadiene	87-68-3	260.8	ND	5.0		ND	53	
Naphthalene	91-20-3	128.17	**17**	5.0		**89**	26	
Total Target Compound Concentrations:			**26000**	ppbv		**56000**	ug/m3	

Surrogate	Result	Spike	Recovery
4-Bromofluorobenzene	11	10	110%

Qualifier Definitions

ND = Non Detect

B = Compound also found in method blank.

E= Estimated concentration exceeding upper calibration range.

D= Result reported from diluted analysis.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

EMSL Analytical
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856)858-4800 / (856)858-4571
http://www.EMSL.com to15lab@EMSL.com

EMSL Order #: **491800829**
EMSL Sample #: **491800829-19**
Customer ID: **EEG50**
Customer PO: **20184191DEBRIS**

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: **305-374-8300**
Fax: **305-374-8301**
Date Collected: **8/28/2018**
Date Received: **9/4/2018**

Project: **SXM Debris**

Sample ID: 01-004

Analysis	Analysis Date	Analyst Init.	Lab File ID	Canister ID	Sample Vol.	Dil. Factor
Initial	09/12/2018	KW	J4354.D	HD2831	112 cc	10
Dilution1	09/12/2018	KW	J4355.D	HD2831	37 cc	90

Tentatively Identified Compound Results Summary

Tentatively Identified Compounds	CAS#	MW(1)	Result ppbv	Q	Result ug/m3	Retention Time	Comments
Isobutane	000075-28-5	58	17	JN	40	6.14	
1-Propene, 2-methyl-	000115-11-7	56	110	JN	260	6.64	
Unknown hydrocarbon		92	22	JN	82	6.99	
Unknown hydrocarbon		92	16	JN	60	7.36	
Pentane	000109-66-0	72	71	JN	210	9.19	
2-Butene, 2-methyl-	000513-35-9	70	16	JN	47	9.78	
Unknown hydrocarbon		92	29	JN	110	10.29	
1-Pentene, 2-methyl-	000763-29-1	84	26	JN	89	13.00	
Unknown hydrocarbon		92	17	JN	64	13.77	
Unknown		92	37	JN	140	14.62	
Unknown hydrocarbon		92	32	JN	120	20.51	
Nonane	000111-84-2	128	15	JN	80	23.49	
1-Hexanol	000111-27-3	102	210	JN	870	23.76	
.alpha.-Methylstyrene	000098-83-9	118	15	JN	71	27.50	
Acetophenone	000098-86-2	120	16	JN	79	30.45	
Dodecane	000112-40-3	170	16	JN	110	30.73	
Tridecane	000629-50-5	184	18	JN	140	32.80	
Total TIC Concentrations:			680	ppbv	2600	ug/m3	

Qualifier Definitions

(1) = If unknown, MW is assigned as equivalent Toluene (92) for ug/m3 conversion purposes.

B = Compound also found in method blank.

J= Estimated value based on a 1:1 response to internal standard.

N= Presumptive evidence of compound based on library match.

Method Reference

USEPA: Compendium Method TO-15, “Determination of Volatile Organic Compounds (VOCs) in Air…" Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), January 1999, (EPA/625/R-96/010b).

USEPA TO-15

External Chain of Custody/ Field Test Data Sheet

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ph. (800) 220-3675
Fax (856) 786-0327

EMSL Order Number (Lab Use Only): -491800829

Report To Contact Name:	Bill To Company:	Sampled By (Sign):
Company Name:	Attention To:	Sampled By (Name):
Address 1:	Address 1:	Total # of Samples:
Address 2:	Address 2:	Date Shipped:
Phone No.: Fax:	Phone No.: Fax:	Sample Collection Zip Code:
Email Results To:	Project Name:	Purchase Order:

Turnaround Time (In Business Days): ☐ 10 Day Standard ☐ 5 Day ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other - 1-WEEK

Reporting Format: ☐ Results Only (Standard Lab Report) ☐ Full Deliverables (Surcharge may apply) ☐ Other

Field Use - All Information Required! / Lab Use Only

EMSL Sample Identifier	Client Field Sample Identification	Sampling Start Information: Start Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Sampling Stop Information: Stop Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Canister ID	Size (L)	Can Cert Batch ID	Outgoing Pressure ("Hg)	Incoming Pressure ("Hg)	Flow Controller: Reg. ID	Cal Flow (ml/min)	USEPA TO-15	NJDEP LLTO-15	LIBRARY SEARCH	Other (Specify)		Indoor/ Ambient Air	Soil Gas	Landfill/ Vent
	01-003	8/28	9:45	-29"		8/28	17:53	-5"		HD2727	1.4	H0470	-300	-6.5	5992*	2.4	X		X					X
	03-007 (P)	8/30	9:45	-31"		8/30	17:15	-9"		2733	↓	↓	↓	-9.5	5994	↓	X		X					
	02-007 (P)	8/29	9:15	-30"		8/29	17:22	-1"		2743	↓	↓	↓	-4.0	7391	↓	X		X					↓
	02-004	8/29	8:37	-29"		8/29	17:05	-1"		2752	↓	↓	↓	-6.0	7874*	↓	X		X					↓
	02-006 (P)	8/29	8:55	-30"		8/29	16:20	-1"		2768	↓	↓	↓	-9.0	7881	↓	X		X					↓
	01-002	8/28	9:30	-30"		8/28	17:29	-4.5"		2786	↓	↓	↓	-5.0	7926	↓	X		X					↓
	02-002	8/29	8:20	-29.5"		8/29	16:30	-1"		2787	↓	↓	↓	-7.0	7928*	↓	X		X					↓
	01-001	8/28	09:15	-30"		8/28	17:20	-7"		2802	↓	↓	↓	-8.5	7934*	↓	X		X					↓
	01-004	8/28	10:00	-31"		8/28	17:40	-10"		2831	↓	↓	↓	-12.0	8068*	↓	X		X					↓

Comments:

Lab Canister Certification
Analyst Signature (TO-15):

Relinquished by:	Date/ Time	Received by:	Date/ Time	Seal #/Intact	Reason for Exchange (circle appropriate)
Carly Peter	8.16.18 1527			580-581	[✓ Shipping] Courier Receiving Sampling Other:
		Alex Mavrelis	8/27/2018 ~4:00pm		Shipping Courier [✓ Receiving] [✓ Sampling] Other:
Alex Mavrelis	8/31/2018 10:00A	(Fedex)			[✓ Shipping] Courier Receiving Sampling Other:
		B. Tx	9/5/18/0832		Shipping Courier Receiving Sampling [✓ Other:]
					Shipping Courier Receiving Sampling Other:

Controlled Document - COC-50 TO-15 Cinnaminson R7.1 2017.07.26

Page 2 of 2

* 9/5/18 really dirty regs from 0847

USEPA TO-15

External Chain of Custody/ Field Test Data Sheet

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Ph. (800) 220-3675
Fax (856) 786-0327

EMSL Order Number (Lab Use Only): -491800829

Report To Contact Name: Alex Mavrelis	Bill To Company: SAME		Sampled By (Sign):
Company Name: EE+G Environmental	Attention To: Alex Mavrelis		Sampled By (Name): Alex Mavrelis
Address 1: 5751 Miami Lakes Drive	Address 1:		Total # of Samples: 19
Address 2: Miami Lakes, FL 33014	Address 2:		Date Shipped: 8/31/2018
Phone No.: (305) 984-3218 Fax:	Phone No.:	Fax:	Sample Collection Zip Code:
Email Results To: amavrelis@eeandg.com	Project Name: SXM Debris		Purchase Order: 2018-4191.DEBRIS.Task10

Turnaround Time (in Business Days): ☐ 10 Day Standard ☐ 5 Day ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other 1-WEEK

Reporting Format: ☒ Results Only (Standard Lab Report) ☐ Full Deliverables (Surcharge may apply) ☐ Other

Field Use - All Information Required! Sampling Start Information: Barometric Pres. ("Hg): Sampling Stop Information: Barometric Pres. ("Hg):

Lab Use Only

EMSL Sample Identifier	Client Field Sample Identification	Start Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	Stop Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp. (F)	AO2 9/5/18 HD183 Canister ID	Size (L)	Can Cert Batch ID	Outgoing Pressure ("Hg)	Incoming Pressure ("Hg)	Reg. ID	Cal Flow (ml/min)	USEPA TO-15	NJDEP LLTO-15	LIBRARY SEARCH	Other (Specify)		Indoor/ Ambient Air	Soil Gas	Landfill/ Vent
HD183	03-006 (P)	8/30	9:25	-31"		8/30	17:20	-8"		HD2183	1.4	HD4710	-30.0	-8.0	3583	2.4	X		X					X
	01-005	8/28	10:10	-29"		8/28	17:42	-0.5		2155				-3.0	3595		X		X					
	03-002	8/30	8:50	-31"		8/30	16:50	-5"		2275				-1.5	3644		X		X					
	03-003	8/30	8:55	-31"		8/30	16:55	-3"		2282				-4.0	3689		X		X					
	03-005	8/30	9:05	-29"		8/30	16:50	0"		2291				-1.0	3715		X		X					
	03-004	8/30	9:00	-31"		8/30	14:17	UNK		2298				-24.0	4344		X		X					
	02-003	8/29	8:25	-29"		8/29	16:35	-2"		2300				-6.5	6957		X		X					
	02-005	8/29	8:44	-30"		8/29	17:06	-4.5"		2303				-7.0	5974		X		X					
	03-001	8/30	8:45	-31"		8/30	14:15	UNK		2702				-18.0	5979		X		X					
	02-001	8/29	8:15	-30"		8/29	16:31	-1"		↓ 2705	↓	↓	↓	-1.5	5989	* ↓	X		X					↓

Comments: Samples 03-001 and 03-004 have unknown end pressures, please analyze based on incoming pressure at the lab and assume no intake leaks since testing.

Lab Canister Certification
Analyst Signature (TO-15):

Relinquished by:	Date/ Time	Received by:	Date/ Time	Seal #/Intact	Reason for Exchange (circle appropriate)
Carly Peters	8.16.18 1527			580-581	[✓ Shipping] Courier Receiving Sampling Other:
		Alex Mavrelis	8/27/2018 ~4:00pm		Shipping Courier [✓ Receiving] [✓ Sampling] Other:
Alex Mavrelis	8/31/2018 10:00A	(Fedex)	9/4/18 930		[✓ Shipping] Courier Receiving Sampling Other:
	9/4/18 3300		9/5/18 / 0837		Shipping Courier Receiving Sampling [✓ Other:]
					Shipping Courier Receiving Sampling Other:

Controlled Document - COC-50 TO-15 Cinnaminson R7.1 2017.07.26

Page 1 of 2

* 9/5/18 really dirty Regs. Ros 0847

ATTACHMENT E

LABORATORY RESULTS, HYDROGEN SULFIDE (H_2S)

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649

Order ID: 331817900

Attn:	Alex Mavrelis EE & G Environmental 5751 Miami Lakes Dr. Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received: LA Testing Order:	EEG50 2018-4191 09/07/18 331817900
Fax:	(305) 374-8301	Project:	**SXM Landfill**
Phone:	(305) 984-3218		
E-mail:	amavrelis@eeandg.com		
Report Date:	09/12/18	Date Analyzed:	09/04/18

HYDROGEN SULFIDE via NIOSH 6013M
SKC 226-09

LA Testing Sample ID	Sample ID	Air Volume (L)	Test	µg/tube	ppm	Reporting Limit µg/tube
331817900-0001	01-001	39.5	Hydrogen Sulfide	170*	3.1	14
331817900-0002	01-002	36.75	Hydrogen Sulfide	<14	<0.28	14
331817900-0003	01-003	33.5	Hydrogen Sulfide	<14	<0.30	14
331817900-0004	01-004	31	Hydrogen Sulfide	<14	<0.33	14
331817900-0005	01-005	29.25	Hydrogen Sulfide	<14	<0.35	14
331817900-0006	02-001	43	Hydrogen Sulfide	<14	<0.24	14
331817900-0007	02-002	42.75	Hydrogen Sulfide	<14	<0.24	14
331817900-0008	02-003	42.5	Hydrogen Sulfide	<14	<0.24	14
331817900-0009	02-004	41.5	Hydrogen Sulfide	<14	<0.25	14
331817900-0010	02-005	40.25	Hydrogen Sulfide	<14	<0.25	14

Sample received in acceptable condition unless otherwise noted. This report may not be reproduced except in full, without written approval by LA Testing. Unless otherwise noted, the results in this report have been blank corrected. Quality Control Data associated with this sample set is within acceptable limits, unless otherwise noted. Tube front and tube back analyzed separately, tube backs are ND unless otherwise indicated. *Note: tube back was detected and added to the result.

CD
Analyst

Michael Chapman
Michael Chapman, Laboratory Manager

AIHA-LAP, LLC Accredited - Laboratory ID #101650

Order ID: 331817900

Attn:	Alex Mavrelis EE & G Environmental 5751 Miami Lakes Dr. Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received: LA Testing Order:	EEG50 2018-4191 09/07/18 331817900
Fax:	(305) 374-8301	Project:	**SXM Landfill**
Phone:	(305) 984-3218		
E-mail:	amavrelis@eeandg.com		
Report Date:	09/12/18	Date Analyzed:	09/04/18

HYDROGEN SULFIDE via NIOSH 6013M
SKC 226-09

LA Testing Sample ID	Sample ID	Air Volume (L)	Test	µg/tube	ppm	Reporting Limit µg/tube
331817900-0011	02-006	41.75	Hydrogen Sulfide	<14	<0.24	14
331817900-0012	02-007	40.75	Hydrogen Sulfide	<14	<0.25	14
331817900-0013	03-001	38.5	Hydrogen Sulfide	<14	<0.26	14
331817900-0014	03-002	38	Hydrogen Sulfide	<14	<0.27	14
331817900-0015	03-003	37.25	Hydrogen Sulfide	<14	<0.27	14
331817900-0016	03-004	36.75	Hydrogen Sulfide	<14	<0.28	14
331817900-0017	03-005	38.75	Hydrogen Sulfide	<14	<0.26	14
331817900-0018	03-006	35.75	Hydrogen Sulfide	<14	<0.28	14
331817900-0019	03-007	33.75	Hydrogen Sulfide	38	0.81	14
331817900-0020	FB001	-	Hydrogen Sulfide	<14	NA	14

Sample received in acceptable condition unless otherwise noted. This report may not be reproduced except in full, without written approval by LA Testing. Unless otherwise noted, the results in this report have been blank corrected. Quality Control Data associated with this sample set is within acceptable limits, unless otherwise noted. Tube front and tube back analyzed separately, tube backs are ND unless otherwise indicated. *Note: tube back was detected and added to the result.

CD
Analyst

Michael Chapman

Michael Chapman, Laboratory Manager

AIHA-LAP, LLC Accredited - Laboratory ID #101650

ATTACHMENT F

LABORATORY RESULTS, PAHS

Order ID: 281803937

Attn:	Alex Mavrelis EE & G 5751 Miami Lakes Drive East Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received:	EEG50 2018-4191 (Tio) 08/30/18
		EMSL Order:	281803937
Project:	**SXM Landfill**		
Report Date:	09/11/18	Date Analyzed:	09/10/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281803937-0001**	**281803937-0002**	**281803937-0003**
Sample ID	**01-001**	**01-002**	**01-003**
Sample Volume (L)	**970**	**958**	**936**
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**
Naphthalene	**29**	<0.65	**9.0**
Acenaphthylene	**83**	**25**	**27**
Acenaphthene	**20**	<0.65	<0.67
Fluorene	**13**	**13**	**3.0**
Phenanthrene	**4.8**	**17**	<0.33
Anthracene	**2.8**	<0.65	<0.67
Fluoranthene	**2.1**	**3.5**	**0.54**
Pyrene	**3.3**	**4.5**	**0.37**
Benzo(a)anthracene	<0.32	<0.33	<0.33
Chrysene	<0.32	<0.33	<0.33
Benzo(e)pyrene	<0.32	<0.33	<0.33
Benzo(b)fluoranthene	<0.32	<0.33	<0.33
Benzo(k)fluoranthene	<0.32	<0.33	<0.33
Benzo(a)pyrene	**0.56**	**0.44**	**0.39**
Dibenzo(a,h)anthracene	<0.32	<0.33	<0.33
Benzo(g,h,i)perylene	<0.32	<0.33	<0.33
Indeno(1,2,3-c,d)pyrene	<0.32	<0.33	<0.33

Notes*:*

1. Samples were received in acceptable condition unless otherwise noted.
2. These results relate only to the samples tested.
3. Sample results are media blank corrected.
4. Discernible blank submitted with samples if listed.

KFoster
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

Order ID: 281803937

Attn: Alex Mavrelis
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Customer ID: EEG50
Customer PO: 2018-4191 (Tio)
Date Received: 08/30/18

EMSL Order: 281803937

Project: **SXM Landfill**
Report Date: 09/11/18

Date Analyzed: 09/10/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281803937-0004**	**281803937-0005**	**Media Blank**	**Analytical Sensitivity**
Sample ID	**01-004**	**01-005**		
Sample Volume (L)	**920**	**904**		
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg)**	**Conc. (µg)**
Naphthalene	**12**	<0.69	<0.62	0.62
Acenaphthylene	**28**	**4.8**	<0.62	0.62
Acenaphthene	**2.6**	<0.69	<0.62	0.62
Fluorene	<0.68	<0.69	<0.62	0.62
Phenanthrene	<0.34	<0.35	<0.31	0.31
Anthracene	<0.68	<0.69	<0.62	0.62
Fluoranthene	<0.34	<0.35	<0.31	0.31
Pyrene	<0.34	<0.35	<0.31	0.31
Benzo(a)anthracene	<0.34	<0.35	<0.31	0.31
Chrysene	**13**	<0.35	<0.31	0.31
Benzo(e)pyrene	**6.8**	<0.35	<0.31	0.31
Benzo(b)fluoranthene	**0.73**	<0.35	<0.31	0.31
Benzo(k)fluoranthene	**0.63**	<0.35	<0.31	0.31
Benzo(a)pyrene	<0.34	<0.35	<0.31	0.31
Dibenzo(a,h)anthracene	<0.34	<0.35	<0.31	0.31
Benzo(g,h,i)perylene	<0.34	<0.35	<0.31	0.31
Indeno(1,2,3-c,d)pyrene	<0.34	<0.35	<0.31	0.31

Notes*:*

1. Samples were received in acceptable condition unless otherwise noted.
2. These results relate only to the samples tested.
3. Sample results are media blank corrected.
4. Discernible blank submitted with samples if listed.

KFoster
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc. **200 Route 130 North, Cinnaminson, NJ 08077**

Order ID: 281803982

Attn:	Alex Mavrelis EE & G 5751 Miami Lakes Drive East Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received: EMSL Order:	EEG50 2018-4191 (Tio) 09/04/18 281803982
Project:	**SXM Landfill**		
Report Date:	09/11/18	Date Analyzed:	09/10/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281803982-0001**	**281803982-0002**	**281803982-0003**	**281803982-0004**
Sample ID	**02-001**	**02-002**	**02-003**	**02-004**
Sample Volume (L)	**105**	**980**	**982**	**103**
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**
Naphthalene	<6.0	<0.64	<0.64	<6.1
Acenaphthylene	**50**	**210**	**25**	**550**
Acenaphthene	<6.0	<0.64	<0.64	<6.1
Fluorene	<6.0	<0.64	<0.64	<6.1
Phenanthrene	<3.0	<0.32	<0.32	<3.0
Anthracene	<6.0	<0.64	<0.64	<6.1
Fluoranthene	<6.0	<0.32	<0.32	<3.0
Pyrene	<3.0	<0.32	<0.32	<3.0
Benzo(a)anthracene	<3.0	<0.32	<0.32	<3.0
Chrysene	<3.0	<0.32	<0.32	<3.0
Benzo(e)pyrene	<3.0	<0.32	<0.32	<3.0
Benzo(b)fluoranthene	<3.0	<0.32	<0.32	<3.0
Benzo(k)fluoranthene	<3.0	**0.53**	<0.32	<3.0
Benzo(a)pyrene	<3.0	**1.5**	<0.32	**4.4**
Dibenzo(a,h)anthracene	<3.0	<0.32	<0.32	<3.0
Benzo(g,h,i)perylene	<3.0	<0.32	<0.32	<3.0
Indeno(1,2,3-c,d)pyrene	<3.0	<0.32	<0.32	<3.0

Notes*:*

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4. Discernible blank submitted with samples if listed.

KFoster
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

Order ID: 281803982

Attn:	Alex Mavrelis EE & G 5751 Miami Lakes Drive East Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received:	EEG50 2018-4191 (Tio) 09/04/18
		EMSL Order:	281803982
Project:	**SXM Landfill**		
Report Date:	09/11/18	Date Analyzed:	09/10/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281803982-0005**	**281803982-0006**	**281803982-0007**	**Media Blank**	**Analytical Sensitivity**
Sample ID	**02-005**	**02-006**	**02-007**		
Sample Volume (L)	**1004**	**890**	**974**		
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg)**	**Conc. (µg)**
Naphthalene	<0.62	**2.0**	<0.64	<0.62	0.62
Acenaphthylene	**0.93**	**4.4**	**1.0**	<0.62	0.62
Acenaphthene	<0.62	<0.70	<0.64	<0.62	0.62
Fluorene	<0.62	<0.70	<0.64	<0.62	0.62
Phenanthrene	<0.31	<0.35	<0.32	<0.31	0.31
Anthracene	<0.62	<0.70	<0.64	<0.62	0.62
Fluoranthene	<0.31	<0.35	<0.32	<0.31	0.31
Pyrene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(a)anthracene	<0.31	<0.35	<0.32	<0.31	0.31
Chrysene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(e)pyrene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(b)fluoranthene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(k)fluoranthene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(a)pyrene	<0.31	<0.35	<0.32	<0.31	0.31
Dibenzo(a,h)anthracene	<0.31	<0.35	<0.32	<0.31	0.31
Benzo(g,h,i)perylene	<0.31	<0.35	<0.32	<0.31	0.31
Indeno(1,2,3-c,d)pyrene	<0.31	<0.35	<0.32	<0.31	0.31

Notes:

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2. These results relate only to the samples tested.
3. Sample results are media blank corrected.
4. Discernible blank submitted with samples if listed.

KFoster
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

Order ID: 281804001

Attn:	Alex Mavrelis EE & G 5751 Miami Lakes Drive East Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received:	EEG50 2018-4191 (Tio) 09/04/18
		EMSL Order:	281804001
Project:	**SXM Landfill**		
Report Date:	09/06/18	Date Analyzed:	09/05/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281804001-0001**	**281804001-0002**	**281804001-0003**	**281804001-0004**
Sample ID	**03-001**	**03-002**	**03-003**	**03-004**
Sample Volume (L)	**270**	**960**	**960**	**257**
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**
Naphthalene	<2.3	<0.65	<0.65	<2.4
Acenaphthylene	**169**	<0.65	<0.65	<2.4
Acenaphthene	<2.3	<0.65	<0.65	<2.4
Fluorene	<2.3	<0.65	<0.65	<2.4
Phenanthrene	<1.2	<0.33	<0.33	<1.2
Anthracene	<2.3	<0.65	<0.65	<2.4
Fluoranthene	**10**	<0.33	<0.33	<1.2
Pyrene	<1.2	<0.33	<0.33	<1.2
Benzo(a)anthracene	<1.2	<0.33	<0.33	<1.2
Chrysene	<1.2	<0.33	<0.33	<1.2
Benzo(e)pyrene	<1.2	<0.33	<0.33	<1.2
Benzo(b)fluoranthene	<1.2	<0.33	<0.33	<1.2
Benzo(k)fluoranthene	<1.2	<0.33	<0.33	<1.2
Benzo(a)pyrene	<1.2	<0.33	<0.33	<1.2
Dibenzo(a,h)anthracene	<1.2	<0.33	<0.33	<1.2
Benzo(g,h,i)perylene	<1.2	<0.33	<0.33	<1.2
Indeno(1,2,3-c,d)pyrene	<1.2	<0.33	<0.33	<1.2

Note:

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2. These results relate only to the samples tested.
3. Sample results are media blank corrected.
4. Discernable field blank(s) submitted with sample if listed above.

<u>KF</u>
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc. 200 Route 130 North, Cinnaminson, NJ 08077

Order ID: 281804001

Attn:	Alex Mavrelis EE & G 5751 Miami Lakes Drive East Miami Lakes, FL 33014	Customer ID: Customer PO: Date Received:	EEG50 2018-4191 (Tio) 09/04/18
		EMSL Order:	281804001
Project:	**SXM Landfill**		
Report Date:	09/06/18	Date Analyzed:	09/05/18

Test Report – Polynuclear Aromatic Hydrocarbon Analysis by HPLC/FLD/UV of Air Samples via mod. NIOSH 5506, Issue 3, 1/15/98

EMSL ID	**281804001-0005**	**281804001-0006**	**281804001-0007**	**Media Blank**	**Analytical Sensitivity**
Sample ID	**03-005**	**03-006**	**03-007**		
Sample Volume (L)	**960**	**910**	**940**		
Sample Media	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	**Tube 226-30-04 Filter 225-1713**	
Compound	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg/m3)**	**Conc. (µg)**	**Conc. (µg)**
Naphthalene	<0.65	<0.69	<0.66	<0.62	0.62
Acenaphthylene	<0.65	<0.69	**3**	<0.62	0.62
Acenaphthene	<0.65	<0.69	<0.66	<0.62	0.62
Fluorene	<0.65	<0.69	<0.66	<0.62	0.62
Phenanthrene	<0.33	<0.34	<0.33	<0.31	0.31
Anthracene	<0.65	<0.69	<0.66	<0.62	0.62
Fluoranthene	<0.33	<0.34	<0.33	<0.31	0.31
Pyrene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(a)anthracene	<0.33	<0.34	<0.33	<0.31	0.31
Chrysene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(e)pyrene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(b)fluoranthene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(k)fluoranthene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(a)pyrene	<0.33	<0.34	<0.33	<0.31	0.31
Dibenzo(a,h)anthracene	<0.33	<0.34	<0.33	<0.31	0.31
Benzo(g,h,i)perylene	<0.33	<0.34	<0.33	<0.31	0.31
Indeno(1,2,3-c,d)pyrene	<0.33	<0.34	<0.33	<0.31	0.31

Note:

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KF
Analyst

Scott VanEtten, CIH- Lab Manager
Or other approved signatory

ATTACHMENT G

LABORATORY RESULTS, OZONE (O_3)

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301

9/17/2018

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 9/6/2018. The results are tabulated on the attached data pages for the following client designated project:

SXM Landfill

The reference number for these samples is EMSL Order #011807128. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry Laboratory Director

AIHA LAP, LLC
ACCREDITED LABORATORY
INDUSTRIAL HYGIENE
ISO/IEC 17025:2005
www.aihaaccreditedlabs.org

AIHA-LAP, LLC-IHLAP Lab # 100194
NELAP Certification: NJ 03036; NY 10872

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301
Received: 09/06/18 11:55 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 01-001 D1-Site 001 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807128-0001*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	0.91	0.21	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 01-002 D1-Site 002 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807128-0002*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.21	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 01-003 D1-Site 003 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807128-0003*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.20	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 01-004 D1-Site 004 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807128-0004*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.20	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 01-005 D1-Site 005 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807128-0005*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.20	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-001 D2-Site 001 ***Collected:*** 8/29/2018 ***Lab ID:*** *011807128-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301
Received: 09/06/18 11:55 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 02-001
D2-Site 001
Collected: 8/29/2018 ***Lab ID:*** *011807128-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.23	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-002
D2-Site 002
Collected: 8/29/2018 ***Lab ID:*** *011807128-0007*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	0.26	0.24	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-003
D2-Site 003
Collected: 8/29/2018 ***Lab ID:*** *011807128-0008*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.22	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-004
D2-Site 004
Collected: 8/29/2018 ***Lab ID:*** *011807128-0009*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	0.20	0.20	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-005
D2-Site 005
Collected: 8/29/2018 ***Lab ID:*** *011807128-0010*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.21	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-006
D2-Site 006
Collected: 8/29/2018 ***Lab ID:*** *011807128-0011*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301
Received: 09/06/18 11:55 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 02-006 D2-Site 006 ***Collected:*** 8/29/2018 ***Lab ID:*** *011807128-0011*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.31	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 02-007 D2-Site 007 ***Collected:*** 8/29/2018 ***Lab ID:*** *011807128-0012*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.21	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 03-002 D3-Site 002 ***Collected:*** 8/30/2018 ***Lab ID:*** *011807128-0013*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.23	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 03-003 D3-Site 003 ***Collected:*** 8/30/2018 ***Lab ID:*** *011807128-0014*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.23	mg/m^3	9/11/2018	MM	9/12/2018	MM

Client Sample Description 03-005 D3-Site 005 ***Collected:*** 8/30/2018 ***Lab ID:*** *011807128-0015*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.24	mg/m^3	9/11/2018	MM	9/13/2018	MM

Client Sample Description 03-006 D3-Site 006 ***Collected:*** 8/30/2018 ***Lab ID:*** *011807128-0016*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301
Received: 09/06/18 11:55 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 03-006
D3-Site 006
Collected: 8/30/2018 ***Lab ID:*** *011807128-0016*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.20	mg/m^3	9/11/2018	MM	9/13/2018	MM

Client Sample Description 03-007
D3-Site 007
Collected: 8/30/2018 ***Lab ID:*** *011807128-0017*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.22	mg/m^3	9/11/2018	MM	9/13/2018	MM

Client Sample Description FB001
Field Blank
Collected: ***Lab ID:*** *011807128-0018*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
WET								
ID-214	Ozone	ND	0.0086	mg/filter	9/11/2018	MM	9/13/2018	MM

Definitions:
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution

ATTACHMENT H

LABORATORY RESULTS, DIOXINS AND FURANS

Pace Analytical™

www.pacelabs.com

Pace Analytical Services, LLC.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

Report Prepared for:

Alex Mavrelis
EE&G Environmental
5751 Miami Lakes Dr.
Miami Lakes FL 33014

REPORT OF LABORATORY ANALYSIS FOR PCDD/PCDF

Report Prepared Date:

September 14, 2018

Report Information:

Pace Project #: 10445726
Sample Receipt Date: 08/30/2018
Client Project #: 2018-4191
Client Sub PO #: 2018-4191.Debris.T10
State Cert #: E87605

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 2 PCDD/PCDF Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Scott Unze, your Pace Project Manager.

This report has been reviewed by:

September 14, 2018
Scott Unze, Project Manager
(612) 607-6383
(612) 607-6444 (fax)
scott.unze@pacelabs.com

NELAP ACCREDITED
TNI
LABORATORY

Report of Laboratory Analysis

DISCUSSION

This report presents the results from the analyses performed on five samples submitted by a representative of EE&G Environmental. The samples were analyzed for the presence or absence of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) using a modified version of USEPA Method TO9A. The reporting limits were based on signal-to-noise measurements. Estimated Maximum Possible Concentration (EMPC) values were treated as positives in the toxic equivalence calculations. The samples were received above the laboratory-recommended temperature range of 0-6 degrees Celsius.

Second column confirmation analyses of 2,3,7,8-TCDF values obtained from the primary (DB5-MS) column are performed only when specifically requested for a project and only when the values are above the concentration of the lowest calibration standard. Typical resolution for this isomer using the DB5-MS column ranges from 25-30%.

The recoveries of the isotopically labeled PCDD/PCDF internal standards in the sample extracts ranged from 32-108%. Except for two low values, which were flagged "R" on the results tables, the labeled internal standard recoveries obtained for this project were within the target ranges for the method. Also, since the internal standards were added to the sample prior to the extraction step, the data were automatically corrected for recovery and accurate values were obtained. Since the field samples did not include PUF cartridge components, surrogates were not present in the field sample extracts.

Values were flagged "I" where incorrect isotope ratios were obtained or "P" where polychlorinated diphenyl ethers were present. Concentrations below the calibration range were flagged "J" and should be regarded as estimates. Concentrations above the calibration range were flagged "E" and should also be regarded as estimates.

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results show the blank to contain a trace level of OCDD. This level was below the calibration range of the method. Sample levels similar to the corresponding blank level were flagged "B" on the results tables and may be, at least partially, attributed to the background. It should be noted that levels less than ten times the background are not generally considered to be statistically different from the background.

Laboratory quality control PCDD/PCDF spike samples were also prepared with the sample batch using clean PUF cartridges that had been fortified with native standard materials. The results show that the spiked native compounds were recovered at 93-130% with relative percent differences of 0.0-7.7%. These results were within the target ranges for the method. Matrix spikes were not prepared with the sample batch.

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Minnesota - Pet	1240
Alabama	40770	Mississippi	MN00064
Alaska - DW	MN00064	Missouri - DW	10100
Alaska - UST	17-009	Montana	CERT0092
Arizona	AZ0014	Nebraska	NE-OS-18-06
Arkansas - DW	MN00064	Nevada	MN00064
Arkansas - WW	88-0680	New Hampshire	2081
CNMI Saipan	MP0003	New Jersey (NE	MN002
California	2929	New York	11647
Colorado	MN00064	North Carolina	27700
Connecticut	PH-0256	North Carolina -	27700
EPA Region 8+	via MN 027-053	North Carolina -	530
Florida (NELAP	E87605	North Dakota	R-036
Georgia	959	Ohio - DW	41244
Guam	17-001r	Ohio - VAP	CL101
Hawaii	MN00064	Oklahoma	9507
Idaho	MN00064	Oregon - Primar	MN300001
Illinois	200011	Oregon - Secon	MN200001
Indiana	C-MN-01	Pennsylvania	68-00563
Iowa	368	Puerto Rico	MN00064
Kansas	E-10167	South Carolina	74003
Kentucky - DW	90062	South Dakota	NA
Kentucky - WW	90062	Tennessee	TN02818
Louisiana - DE	03086	Texas	T104704192
Louisiana - DW	MN00064	Utah (NELAP)	MN00064
Maine	MN00064	Virginia	460163
Maryland	322	Washington	C486
Massachusetts	M-MN064	West Virginia -	382
Michigan	9909	West Virginia -	9952C
Minnesota	027-053-137	Wisconsin	999407970
Minnesota - De	via MN 027-053	Wyoming - UST	2926.01

Appendix A

Sample Management

WO#:10445726

10445726

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A
Required Client Information:
Company: EE+G Environmental
Address: 5751 Miami Lakes Dr.
Miami Lakes, FL 33014
Email To: amavrelis@eeandg.com
Phone: 305-984-3218 Fax:
Requested Due Date/TAT: 2 WEEK

Section B
Required Project Information:
Report To: Alex Mavrelis
Copy To:
Purchase Order No.: 2018-4191.DEBRIS.Task10
Project Name: SXM Landfill
Project Number: 2018-4191

Section C
Invoice Information:
Attention: Alex Mavrelis
Company Name: SAME
Address:
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY
☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER
Site Location
STATE:

Section D
Required Client Information

Matrix Codes
MATRIX / CODE
Drinking Water DW
Water WT
Waste Water WW
Product P
Soil/Solid SL
Oil OL
Wipe WP
Air AR
Tissue TS
Other OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N ↓Analysis Test↓	Dioxins/Furans By TO-9A mod	Residual Chlorine (Y/N)	Flow + Volume ~~Pace Project No./Lab I.D.~~
1	01-001	AR		8/28	9:15	8/28	17:20	90°											X		5 LPM / 2,425 L 001
2	01-002	↓		↓	9:30	↓	17:29	↓											X		↓ / 2,395 L 002
3	01-003				9:45		17:33												X		/ 2,340 L 003
4	01-004				10:00		17:40												X		/ 2,300 L 004
5	01-005				10:10		17:42												X		/ 2,260 L 005
6																					/
7																					
8																					
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
				Pace	8/30/18	950	20.6	N	?	Y
								custody?	Ice?	intact

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 02May2018 Page 1 of 2
	Document No.: **F-MN-L-213-rev.23**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: EE + G Environmental

Project #:

WO# : 10445726

PM: SCU **Due Date: 09/14/18**

CLIENT: EE&G Enviro

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 8120 6545 6533

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☒ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other:

Temp Blank? ☐ Yes ☒ No

Thermometer Used: ☒ G87A9170600254 ☐ G87A9155100842

Type of Ice: ☐ Wet ☒ Blue ☐ None ☐ Dry ☐ Melted

Cooler Temp Read (°C): 20.8 **Cooler Temp Corrected (°C):** 20.6

Biological Tissue Frozen? ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.2 **Date and Initials of Person Examining Contents:** MD 8/30/18

USDA Regulated Soil (☒ N/A, water sample) Filters

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☐ Yes	☒ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☒ No	☐ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☐ Yes	☒ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Is sufficient information available to reconcile the samples to the COC? Matrix: Filters	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: Alex M. Date/Time: 08/30/18

Comments/Resolution:

Waived temp req

Project Manager Review: **Date:** 08/31/18

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interference present

J = Estimated value

L = Suppressive interference, analyte may be biased low

Nn = Value obtained from additional analysis

P = PCDE Interference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = See Discussion

Appendix B

Sample Analysis Summary

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	01-001		
Lab Sample ID	10445726001		
Filename	U180907A_05	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.42 m3	Collected	08/28/2018 17:20
ICAL ID	U180508	Received	08/30/2018 09:50
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 12:01

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	-----	170	2.2	P
Total TCDF	11000	-----	2.2	E
2,3,7,8-TCDD	16	-----	3.8	
Total TCDD	3900	-----	3.8	E
1,2,3,7,8-PeCDF	110	-----	1.9	
2,3,4,7,8-PeCDF	130	-----	1.7	
Total PeCDF	2000	-----	1.8	
1,2,3,7,8-PeCDD	33	-----	2.5	
Total PeCDD	2000	-----	2.5	
1,2,3,4,7,8-HxCDF	30	-----	4.0	
1,2,3,6,7,8-HxCDF	62	-----	2.8	
2,3,4,6,7,8-HxCDF	75	-----	1.6	
1,2,3,7,8,9-HxCDF	13	-----	3.0	J
Total HxCDF	720	-----	2.9	
1,2,3,4,7,8-HxCDD	23	-----	2.8	
1,2,3,6,7,8-HxCDD	39	-----	2.3	
1,2,3,7,8,9-HxCDD	27	-----	2.3	
Total HxCDD	1500	-----	2.5	
1,2,3,4,6,7,8-HpCDF	94	-----	3.5	
1,2,3,4,7,8,9-HpCDF	ND	-----	6.3	
Total HpCDF	94	-----	4.9	
1,2,3,4,6,7,8-HpCDD	120	-----	5.9	
Total HpCDD	500	-----	5.9	
OCDF	-----	6.8	5.5	IJ
OCDD	53	-----	1.8	

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	87	
2,3,7,8-TCDD-13C	2.00	72	
1,2,3,7,8-PeCDF-13C	2.00	93	
1,2,3,7,8-PeCDD-13C	2.00	82	
1,2,3,6,7,8-HxCDF-13C	2.00	62	
1,2,3,6,7,8-HxCDD-13C	2.00	70	
1,2,3,4,6,7,8-HpCDF-13C	2.00	70	
1,2,3,4,6,7,8-HpCDD-13C	2.00	34	R
OCDD-13C	4.00	80	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 150 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	01-002		
Lab Sample ID	10445726002		
Filename	U180907A_06	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.40 m3	Collected	08/28/2018 17:29
ICAL ID	U180508	Received	08/30/2018 09:50
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 12:48

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	2.5	
Total TCDF	200	-----	2.5	
2,3,7,8-TCDD	ND	-----	2.4	
Total TCDD	150	-----	2.4	
1,2,3,7,8-PeCDF	1.5	-----	1.0	J
2,3,4,7,8-PeCDF	3.8	-----	0.96	J
Total PeCDF	36	-----	0.99	
1,2,3,7,8-PeCDD	2.0	-----	1.3	J
Total PeCDD	47	-----	1.3	
1,2,3,4,7,8-HxCDF	-----	2.0	1.3	IJ
1,2,3,6,7,8-HxCDF	1.6	-----	0.97	J
2,3,4,6,7,8-HxCDF	-----	1.7	1.1	IJ
1,2,3,7,8,9-HxCDF	1.2	-----	0.71	J
Total HxCDF	16	-----	1.0	J
1,2,3,4,7,8-HxCDD	ND	-----	1.2	
1,2,3,6,7,8-HxCDD	1.1	-----	0.82	J
1,2,3,7,8,9-HxCDD	-----	0.53	0.45	IJ
Total HxCDD	45	-----	0.82	
1,2,3,4,6,7,8-HpCDF	3.4	-----	0.66	J
1,2,3,4,7,8,9-HpCDF	ND	-----	0.79	
Total HpCDF	3.4	-----	0.73	J
1,2,3,4,6,7,8-HpCDD	6.6	-----	2.9	J
Total HpCDD	22	-----	2.9	
OCDF	ND	-----	1.3	
OCDD	13	-----	1.9	BJ

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	93	
2,3,7,8-TCDD-13C	2.00	82	
1,2,3,7,8-PeCDF-13C	2.00	108	
1,2,3,7,8-PeCDD-13C	2.00	96	
1,2,3,6,7,8-HxCDF-13C	2.00	63	
1,2,3,6,7,8-HxCDD-13C	2.00	71	
1,2,3,4,6,7,8-HpCDF-13C	2.00	64	
1,2,3,4,6,7,8-HpCDD-13C	2.00	32	R
OCDD-13C	4.00	72	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 3.9 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	01-003		
Lab Sample ID	10445726003		
Filename	U180907A_07	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.34 m3	Collected	08/28/2018 17:33
ICAL ID	U180508	Received	08/30/2018 09:50
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 13:36

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	1.6	-----	1.1	J
Total TCDF	120	-----	1.1	
2,3,7,8-TCDD	ND	-----	0.62	
Total TCDD	83	-----	0.62	
1,2,3,7,8-PeCDF	0.99	-----	0.39	J
2,3,4,7,8-PeCDF	1.5	-----	0.46	J
Total PeCDF	19	-----	0.42	J
1,2,3,7,8-PeCDD	ND	-----	0.94	
Total PeCDD	17	-----	0.94	J
1,2,3,4,7,8-HxCDF	ND	-----	0.98	
1,2,3,6,7,8-HxCDF	ND	-----	0.73	
2,3,4,6,7,8-HxCDF	ND	-----	0.91	
1,2,3,7,8,9-HxCDF	ND	-----	0.83	
Total HxCDF	4.1	-----	0.86	J
1,2,3,4,7,8-HxCDD	ND	-----	1.1	
1,2,3,6,7,8-HxCDD	ND	-----	0.86	
1,2,3,7,8,9-HxCDD	ND	-----	0.99	
Total HxCDD	20	-----	0.98	J
1,2,3,4,6,7,8-HpCDF	-----	1.2	0.61	IJ
1,2,3,4,7,8,9-HpCDF	ND	-----	1.1	
Total HpCDF	ND	-----	0.84	
1,2,3,4,6,7,8-HpCDD	ND	-----	2.7	
Total HpCDD	ND	-----	2.7	
OCDF	ND	-----	1.8	
OCDD	3.4	-----	1.2	BJ

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	106
2,3,7,8-TCDD-13C	2.00	90
1,2,3,7,8-PeCDF-13C	2.00	103
1,2,3,7,8-PeCDD-13C	2.00	89
1,2,3,6,7,8-HxCDF-13C	2.00	79
1,2,3,6,7,8-HxCDD-13C	2.00	83
1,2,3,4,6,7,8-HpCDF-13C	2.00	80
1,2,3,4,6,7,8-HpCDD-13C	2.00	43
OCDD-13C	4.00	105
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 1.00 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	01-004		
Lab Sample ID	10445726004		
Filename	U180907A_08	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.30 m3	Collected	08/28/2018 17:40
ICAL ID	U180508	Received	08/30/2018 09:50
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 14:23

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	79	-----	1.8	
Total TCDF	5600	-----	1.8	E
2,3,7,8-TCDD	35	-----	1.9	
Total TCDD	11000	-----	1.9	E
1,2,3,7,8-PeCDF	-----	70	0.56	P
2,3,4,7,8-PeCDF	8.4	-----	0.68	J
Total PeCDF	1500	-----	0.62	
1,2,3,7,8-PeCDD	96	-----	0.97	
Total PeCDD	6100	-----	0.97	
1,2,3,4,7,8-HxCDF	39	-----	0.86	
1,2,3,6,7,8-HxCDF	47	-----	1.2	
2,3,4,6,7,8-HxCDF	-----	70	1.1	P
1,2,3,7,8,9-HxCDF	ND	-----	1.3	
Total HxCDF	410	-----	1.1	
1,2,3,4,7,8-HxCDD	58	-----	3.0	
1,2,3,6,7,8-HxCDD	100	-----	2.8	
1,2,3,7,8,9-HxCDD	96	-----	2.6	
Total HxCDD	3200	-----	2.8	
1,2,3,4,6,7,8-HpCDF	43	-----	1.0	
1,2,3,4,7,8,9-HpCDF	ND	-----	1.0	
Total HpCDF	43	-----	1.0	
1,2,3,4,6,7,8-HpCDD	280	-----	1.7	
Total HpCDD	830	-----	1.7	
OCDF	36	-----	2.4	J
OCDD	230	-----	1.5	

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	97
2,3,7,8-TCDD-13C	2.00	74
1,2,3,7,8-PeCDF-13C	2.00	94
1,2,3,7,8-PeCDD-13C	2.00	82
1,2,3,6,7,8-HxCDF-13C	2.00	65
1,2,3,6,7,8-HxCDD-13C	2.00	62
1,2,3,4,6,7,8-HpCDF-13C	2.00	64
1,2,3,4,6,7,8-HpCDD-13C	2.00	69
OCDD-13C	4.00	97
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 140 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	01-005		
Lab Sample ID	10445726005		
Filename	U180907A_09	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.26 m3	Collected	08/28/2018 17:42
ICAL ID	U180508	Received	08/30/2018 09:50
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 15:10

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	2.2	
Total TCDF	160	-----	2.2	
2,3,7,8-TCDD	ND	-----	2.0	
Total TCDD	310	-----	2.0	
1,2,3,7,8-PeCDF	1.4	-----	0.77	J
2,3,4,7,8-PeCDF	----	2.6	1.1	IJ
Total PeCDF	40	-----	0.92	
1,2,3,7,8-PeCDD	4.2	-----	1.6	J
Total PeCDD	120	-----	1.6	
1,2,3,4,7,8-HxCDF	----	1.9	1.6	IJ
1,2,3,6,7,8-HxCDF	ND	-----	0.80	
2,3,4,6,7,8-HxCDF	ND	-----	1.4	
1,2,3,7,8,9-HxCDF	ND	-----	2.0	
Total HxCDF	2.4	-----	1.4	J
1,2,3,4,7,8-HxCDD	ND	-----	1.4	
1,2,3,6,7,8-HxCDD	3.7	-----	1.0	J
1,2,3,7,8,9-HxCDD	2.8	-----	1.9	J
Total HxCDD	63	-----	1.4	
1,2,3,4,6,7,8-HpCDF	ND	-----	1.3	
1,2,3,4,7,8,9-HpCDF	ND	-----	1.7	
Total HpCDF	ND	-----	1.5	
1,2,3,4,6,7,8-HpCDD	----	6.5	1.0	IJ
Total HpCDD	9.3	-----	1.0	J
OCDF	ND	-----	2.8	
OCDD	----	8.6	2.4	IJ

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	94
2,3,7,8-TCDD-13C	2.00	79
1,2,3,7,8-PeCDF-13C	2.00	87
1,2,3,7,8-PeCDD-13C	2.00	72
1,2,3,6,7,8-HxCDF-13C	2.00	76
1,2,3,6,7,8-HxCDD-13C	2.00	72
1,2,3,4,6,7,8-HpCDF-13C	2.00	69
1,2,3,4,6,7,8-HpCDD-13C	2.00	72
OCDD-13C	4.00	92
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 4.4 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

REPORT OF LABORATORY ANALYSIS

Method TO9 Blank Analysis Results

Lab Sample ID	BLANK-64437	Matrix	XAD/PUF
Filename	U180907A_04	Dilution	NA
Amount Extracted	2.26 m3	Extracted	08/31/2018 18:00
ICAL ID	U180508	Analyzed	09/07/2018 11:13
CCal Filename(s)	U180907A_01	Injected By	ZMS

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	1.3	
Total TCDF	ND	-----	1.3	
2,3,7,8-TCDD	ND	-----	1.8	
Total TCDD	ND	-----	1.8	
1,2,3,7,8-PeCDF	ND	-----	0.46	
2,3,4,7,8-PeCDF	ND	-----	0.46	
Total PeCDF	ND	-----	0.46	
1,2,3,7,8-PeCDD	ND	-----	0.57	
Total PeCDD	ND	-----	0.57	
1,2,3,4,7,8-HxCDF	ND	-----	0.41	
1,2,3,6,7,8-HxCDF	ND	-----	0.39	
2,3,4,6,7,8-HxCDF	----	0.64	0.42	IJ
1,2,3,7,8,9-HxCDF	----	0.71	0.51	IJ
Total HxCDF	ND	-----	0.43	
1,2,3,4,7,8-HxCDD	ND	-----	0.63	
1,2,3,6,7,8-HxCDD	ND	-----	0.61	
1,2,3,7,8,9-HxCDD	ND	-----	0.51	
Total HxCDD	ND	-----	0.58	
1,2,3,4,6,7,8-HpCDF	ND	-----	0.45	
1,2,3,4,7,8,9-HpCDF	ND	-----	0.71	
Total HpCDF	ND	-----	0.58	
1,2,3,4,6,7,8-HpCDD	ND	-----	0.94	
Total HpCDD	ND	-----	0.94	
OCDF	ND	-----	1.3	
OCDD	1.4	-----	1.4	J

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	91
2,3,7,8-TCDD-13C	2.00	77
1,2,3,7,8-PeCDF-13C	2.00	106
1,2,3,7,8-PeCDD-13C	2.00	100
1,2,3,6,7,8-HxCDF-13C	2.00	101
1,2,3,6,7,8-HxCDD-13C	2.00	89
1,2,3,4,6,7,8-HpCDF-13C	2.00	71
1,2,3,4,6,7,8-HpCDD-13C	2.00	70
OCDD-13C	4.00	65
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	104
2,3,4,7,8-PeCDF-13C	2.00	105
1,2,3,4,7,8-HxCDF-13C	2.00	79
1,2,3,4,7,8-HxCDD-13C	2.00	95
1,2,3,4,7,8,9-HpCDF-13C	2.00	93

Total 2,3,7,8-TCDD
Equivalence: 0.14 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise
R = Recovery outside of target range

I = Interference
P = PCDE Interference
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCS-64438		
Filename	U180914A_02	Matrix	XAD/PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	U180508	Extracted	08/31/2018 18:00
CCal Filename(s)	U180914A_01	Analyzed	09/13/2018 23:55
Method Blank ID	BLANK-64437	Injected By	SMT

Native Isomers	Qs (ng)	Qm (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.20	100
Total TCDF			
2,3,7,8-TCDD	0.20	0.23	115
Total TCDD			
1,2,3,7,8-PeCDF	1.0	0.94	94
2,3,4,7,8-PeCDF	1.0	1.1	109
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.1	105
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.1	106
1,2,3,6,7,8-HxCDF	1.0	1.0	104
2,3,4,6,7,8-HxCDF	1.0	1.0	105
1,2,3,7,8,9-HxCDF	1.0	1.1	105
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.1	108
1,2,3,6,7,8-HxCDD	1.0	1.2	116
1,2,3,7,8,9-HxCDD	1.0	1.00	100
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.3	129
1,2,3,4,7,8,9-HpCDF	1.0	1.3	130
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.2	120
Total HpCDD			
OCDF	2.0	1.9	93
OCDD	2.0	2.5	123

Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF-13C	2.0	88
2,3,7,8-TCDD-13C	2.0	97
1,2,3,7,8-PeCDF-13C	2.0	87
1,2,3,7,8-PeCDD-13C	2.0	102
1,2,3,6,7,8-HxCDF-13C	2.0	69
1,2,3,6,7,8-HxCDD-13C	2.0	96
1,2,3,4,6,7,8-HpCDF-13C	2.0	98
1,2,3,4,6,7,8-HpCDD-13C	2.0	114
OCDD-13C	4.0	99
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	97
2,3,4,7,8-PeCDF-13C	2.0	101
1,2,3,4,7,8-HxCDF-13C	2.0	100
1,2,3,4,7,8-HxCDD-13C	2.0	106
1,2,3,4,7,8,9-HpCDF-13C	2.0	108

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCSD-64439		
Filename	U180914A_03	Matrix	XAD/PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	U180508	Extracted	08/31/2018 18:00
CCal Filename(s)	U180914A_01	Analyzed	09/14/2018 00:43
Method Blank ID	BLANK-64437	Injected By	SMT

Native Isomers	**Qs** (ng)	**Qm** (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.21	104
Total TCDF			
2,3,7,8-TCDD	0.20	0.23	113
Total TCDD			
1,2,3,7,8-PeCDF	1.0	0.99	99
2,3,4,7,8-PeCDF	1.0	1.1	112
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.0	105
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.1	105
1,2,3,6,7,8-HxCDF	1.0	1.0	101
2,3,4,6,7,8-HxCDF	1.0	1.1	106
1,2,3,7,8,9-HxCDF	1.0	1.00	100
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.1	115
1,2,3,6,7,8-HxCDD	1.0	1.2	120
1,2,3,7,8,9-HxCDD	1.0	1.1	108
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.3	130
1,2,3,4,7,8,9-HpCDF	1.0	1.2	124
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.2	122
Total HpCDD			
OCDF	2.0	1.9	94
OCDD	2.0	2.4	122

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.0	71
2,3,7,8-TCDD-13C	2.0	79
1,2,3,7,8-PeCDF-13C	2.0	72
1,2,3,7,8-PeCDD-13C	2.0	85
1,2,3,6,7,8-HxCDF-13C	2.0	59
1,2,3,6,7,8-HxCDD-13C	2.0	77
1,2,3,4,6,7,8-HpCDF-13C	2.0	77
1,2,3,4,6,7,8-HpCDD-13C	2.0	89
OCDD-13C	4.0	79
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	94
2,3,4,7,8-PeCDF-13C	2.0	102
1,2,3,4,7,8-HxCDF-13C	2.0	99
1,2,3,4,7,8-HxCDD-13C	2.0	110
1,2,3,4,7,8,9-HpCDF-13C	2.0	108

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9

Spike Recovery Relative Percent Difference (RPD) Results

Client EE&G Environmental

Spike 1 ID	LCS-64438	Spike 2 ID	LCSD-64439
Spike 1 Filename	U180914A_02	Spike 2 Filename	U180914A_03

Compound	Spike 1 %REC	Spike 2 %REC	%RPD
2,3,7,8-TCDF	100	104	3.9
2,3,7,8-TCDD	115	113	1.8
1,2,3,7,8-PeCDF	94	99	5.2
2,3,4,7,8-PeCDF	109	112	2.7
1,2,3,7,8-PeCDD	105	105	0.0
1,2,3,4,7,8-HxCDF	106	105	0.9
1,2,3,6,7,8-HxCDF	104	101	2.9
2,3,4,6,7,8-HxCDF	105	106	0.9
1,2,3,7,8,9-HxCDF	105	100	4.9
1,2,3,4,7,8-HxCDD	108	115	6.3
1,2,3,6,7,8-HxCDD	116	120	3.4
1,2,3,7,8,9-HxCDD	100	108	7.7
1,2,3,4,6,7,8-HpCDF	129	130	0.8
1,2,3,4,7,8,9-HpCDF	130	124	4.7
1,2,3,4,6,7,8-HpCDD	120	122	1.7
OCDF	93	94	1.1
OCDD	123	122	0.8

%REC = Percent Recovered
RPD = The difference between the two values divided by the mean value

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Pace Analytical Services, LLC.
1700 Elm Street
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444

Report Prepared for:

Alex Mavrelis
EE&G Environmental
5751 Miami Lakes Dr.
Miami Lakes FL 33014

REPORT OF LABORATORY ANALYSIS FOR PCDD/PCDF

Report Prepared Date:

September 17, 2018

Report Information:

Pace Project #: 10445797
Sample Receipt Date: 08/31/2018
Client Project #: 2018-4191
Client Sub PO #: 2018-4191.Debris.T10
State Cert #: E87605

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 2 PCDD/PCDF Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Scott Unze, your Pace Project Manager.

This report has been reviewed by:

September 17, 2018
Nathan Boberg, Project Manager
612-360-0728
(612) 607-6444 (fax)
nathan.boberg@pacelabs.com

Report of Laboratory Analysis

DISCUSSION

This report presents the results from the analyses performed on seven samples submitted by a representative of EE&G Environmental. The samples were analyzed for the presence or absence of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) using a modified version of USEPA Method TO9A. The reporting limits were based on signal-to-noise measurements. Estimated Maximum Possible Concentration (EMPC) values were treated as positives in the toxic equivalence calculations. The samples were received above the laboratory-recommended temperature range of 0-6 degrees Celsius.

Second column confirmation analyses of 2,3,7,8-TCDF values obtained from the primary (DB5-MS) column are performed only when specifically requested for a project and only when the values are above the concentration of the lowest calibration standard. Typical resolution for this isomer using the DB5-MS column ranges from 25-30%.

The recoveries of the isotopically labeled PCDD/PCDF internal standards in the sample extracts ranged from 50-141%. Except for six elevated values, which were flagged "R" on the results tables, the labeled internal standard recoveries obtained for this project were within the target ranges for the method. Also, since the internal standards were added to the sample prior to the extraction step, the data were automatically corrected for recovery and accurate values were obtained. Since the field samples did not include PUF cartridge components, surrogates were not present in the field sample extracts.

Values were flagged "I" where incorrect isotope ratios were obtained or "P" where polychlorinated diphenyl ethers were present. Concentrations below the calibration range were flagged "J" and should be regarded as estimates. Concentrations above the calibration range were flagged "E" and should also be regarded as estimates. Values obtained from the analysis of a diluted extract were flagged "D".

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results show the blank to contain a trace level of OCDD. This level was below the calibration range of the method. Sample levels similar to the corresponding blank level were flagged "B" on the results tables and may be, at least partially, attributed to the background. It should be noted that levels less than ten times the background are not generally considered to be statistically different from the background.

Laboratory quality control PCDD/PCDF spike samples were also prepared with the sample batch using clean PUF cartridges that had been fortified with native standard materials. The results show that the spiked native compounds were recovered at 93-130% with relative percent differences of 0.0-7.7%. These results were within the target ranges for the method. Matrix spikes were not prepared with the sample batch.

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Minnesota - Pet	1240
Alabama	40770	Mississippi	MN00064
Alaska - DW	MN00064	Missouri - DW	10100
Alaska - UST	17-009	Montana	CERT0092
Arizona	AZ0014	Nebraska	NE-OS-18-06
Arkansas - DW	MN00064	Nevada	MN00064
Arkansas - WW	88-0680	New Hampshire	2081
CNMI Saipan	MP0003	New Jersey (NE	MN002
California	2929	New York	11647
Colorado	MN00064	North Carolina	27700
Connecticut	PH-0256	North Carolina -	27700
EPA Region 8+	via MN 027-053	North Carolina -	530
Florida (NELAP	E87605	North Dakota	R-036
Georgia	959	Ohio - DW	41244
Guam	17-001r	Ohio - VAP	CL101
Hawaii	MN00064	Oklahoma	9507
Idaho	MN00064	Oregon - Primar	MN300001
Illinois	200011	Oregon - Secon	MN200001
Indiana	C-MN-01	Pennsylvania	68-00563
Iowa	368	Puerto Rico	MN00064
Kansas	E-10167	South Carolina	74003
Kentucky - DW	90062	South Dakota	NA
Kentucky - WW	90062	Tennessee	TN02818
Louisiana - DE	03086	Texas	T104704192
Louisiana - DW	MN00064	Utah (NELAP)	MN00064
Maine	MN00064	Virginia	460163
Maryland	322	Washington	C486
Massachusetts	M-MN064	West Virginia -	382
Michigan	9909	West Virginia -	9952C
Minnesota	027-053-137	Wisconsin	999407970
Minnesota - De	via MN 027-053	Wyoming - UST	2926.01

REPORT OF LABORATORY ANALYSIS

Appendix A

Sample Management

WO#:10445797

10445797

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CHAIN-OF-CUSTODY / Analytical Request Docu.

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A
Required Client Information:

Company: EE+G Environmental
Address: 5751 Miami Lakes Dr.
Miami Lakes, FL 33014
Email To: amavrelis@eeandg.com
Phone: 305-984-3218 Fax:
Requested Due Date/TAT: 2-Week

Section B
Required Project Information:

Report To: Alex Mavrelis
Copy To:
Purchase Order No.: 2018-4191.DEBRIS.Task10
Project Name: SXM Landfill
Project Number: 2018-4191

Section C
Invoice Information:

Attention: Alex Mavrelis
Company Name: SAME
Address:
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY
☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ______

Site Location
STATE: ______

Section D
Required Client Information

Matrix Codes	MATRIX / CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Dioxins/Furans by TO-9A Mod	Residual Chlorine (Y/N)	FLOW RATE / VOL. ~~Pace Project No./Lab I.D.~~
1	02-001	AR		8-29	8:15	8-29	1631	90°											X		
2	02-002				8:20		1630												X		5 LPM / 2,480 L
3	02-003				8:25		1635												X		/ 2,450 L
4	02-004				8:37		1705												X		/ 2,455 L
5	02-005				8:44		1706												X		/ 2,540 L
6	02-006 Ⓟ				8:55		1620												X		/ 2,510 L
7	02-007 Ⓟ				9:15		1722												X		/ 2,225 L
8																					/ 2,435 L
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
Sent via Fedex St. Maarten	(EE+G)	8/30/2018	12:50p	Pace	8/31/18	1015	18.5	Y	N	Y

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 02May2018 Page 1 of 2
	Document No.: **F-MN-L-213-rev.23**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: EE&G ENVIRONMENTAL

Project #:

WO#: 10445797

PM: SCU **Due Date:** 09/17/18

CLIENT: EE&G Enviro

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 8120 0545 5066

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☒ Other: NEWS PAPER **Temp Blank?** ☐ Yes ☒ No

Thermometer Used: ☒ G87A9170600254 ☐ G87A9155100842 **Type of Ice:** ☐ Wet ☒ Blue ☐ None ☐ Dry ☐ Melted

Cooler Temp Read (°C): 18.8 **Cooler Temp Corrected (°C):** 18.8 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** TRUE **Date and Initials of Person Examining Contents:** EPT 8/31/18

USDA Regulated Soil (☑ N/A, water sample) AIR FILTER

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☑ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☒ No	☐ N/A	4. FIELD NOT PRINTED ON COC DOCUMENT - UNABLE TO COMPLETE BY CLIENT
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☐ Yes	☒ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Is sufficient information available to reconcile the samples to the COC? Matrix: AF	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO₃ ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: Alex M

Date/Time: 08/30/18

Comments/Resolution:

Previously waived temp.

Project Manager Review: Sam C. [illegible]

Date: 08/31/18

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interferencepresent

J = Estimated value

L = Suppressive interference, analyte may be biased low

Nn = Value obtained from additional analysis

P = PCDEInterference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = SeeDiscussion

Appendix B

Sample Analysis Summary

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-001		
Lab Sample ID	10445797001		
Filename	U180907A_10	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.48 m3	Collected	08/29/2018 16:31
ICAL ID	U180508	Received	08/31/2018 10:15
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 15:58

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	27	-----	1.4	
Total TCDF	1700	-----	1.4	
2,3,7,8-TCDD	7.2	-----	2.1	
Total TCDD	1100	-----	2.1	
1,2,3,7,8-PeCDF	27	-----	0.95	
2,3,4,7,8-PeCDF	----	10	1.0	PJ
Total PeCDF	450	-----	0.98	
1,2,3,7,8-PeCDD	7.2	-----	0.96	J
Total PeCDD	300	-----	0.96	
1,2,3,4,7,8-HxCDF	7.7	-----	0.92	J
1,2,3,6,7,8-HxCDF	----	7.3	0.79	IJ
2,3,4,6,7,8-HxCDF	----	3.0	0.90	IJ
1,2,3,7,8,9-HxCDF	ND	-----	2.0	
Total HxCDF	63	-----	1.2	
1,2,3,4,7,8-HxCDD	----	2.5	1.9	IJ
1,2,3,6,7,8-HxCDD	5.2	-----	2.0	J
1,2,3,7,8,9-HxCDD	6.3	-----	2.2	J
Total HxCDD	160	-----	2.0	
1,2,3,4,6,7,8-HpCDF	5.7	-----	1.4	J
1,2,3,4,7,8,9-HpCDF	ND	-----	1.8	
Total HpCDF	5.7	-----	1.6	J
1,2,3,4,6,7,8-HpCDD	17	-----	1.8	J
Total HpCDD	38	-----	1.8	
OCDF	ND	-----	2.7	
OCDD	----	19	3.2	IJ

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	96
2,3,7,8-TCDD-13C	2.00	76
1,2,3,7,8-PeCDF-13C	2.00	75
1,2,3,7,8-PeCDD-13C	2.00	77
1,2,3,6,7,8-HxCDF-13C	2.00	90
1,2,3,6,7,8-HxCDD-13C	2.00	85
1,2,3,4,6,7,8-HpCDF-13C	2.00	84
1,2,3,4,6,7,8-HpCDD-13C	2.00	83
OCDD-13C	4.00	110
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 23 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-002		
Lab Sample ID	10445797002		
Filename	Y180913A_13	Matrix	Filter
Injected By	SMT	Dilution	5
Amount Extracted	2.45 m3	Collected	08/29/2018 16:30
ICAL ID	Y180827	Received	08/31/2018 10:15
CCal Filename(s)	Y180913A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/13/2018 11:38

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	79	-----	7.7	D
Total TCDF	3700	-----	7.7	D
2,3,7,8-TCDD	15	-----	7.0	JD
Total TCDD	820	-----	7.0	D
1,2,3,7,8-PeCDF	-----	22	6.2	IJD
2,3,4,7,8-PeCDF	18	-----	5.7	JD
Total PeCDF	410	-----	5.9	D
1,2,3,7,8-PeCDD	9.7	-----	3.0	JD
Total PeCDD	220	-----	3.0	D
1,2,3,4,7,8-HxCDF	ND	-----	5.1	D
1,2,3,6,7,8-HxCDF	ND	-----	3.2	D
2,3,4,6,7,8-HxCDF	ND	-----	4.0	D
1,2,3,7,8,9-HxCDF	-----	8.5	4.2	IJD
Total HxCDF	26	-----	4.1	JD
1,2,3,4,7,8-HxCDD	ND	-----	6.4	D
1,2,3,6,7,8-HxCDD	ND	-----	4.1	D
1,2,3,7,8,9-HxCDD	-----	4.8	3.6	IJD
Total HxCDD	160	-----	4.7	D
1,2,3,4,6,7,8-HpCDF	-----	3.6	3.0	IJD
1,2,3,4,7,8,9-HpCDF	ND	-----	3.8	D
Total HpCDF	ND	-----	3.4	D
1,2,3,4,6,7,8-HpCDD	16	-----	2.6	JD
Total HpCDD	40	-----	2.6	JD
OCDF	ND	-----	5.6	D
OCDD	22	-----	5.5	JD

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	105	D
2,3,7,8-TCDD-13C	2.00	95	D
1,2,3,7,8-PeCDF-13C	2.00	130	RD
1,2,3,7,8-PeCDD-13C	2.00	126	RD
1,2,3,6,7,8-HxCDF-13C	2.00	116	D
1,2,3,6,7,8-HxCDD-13C	2.00	91	D
1,2,3,4,6,7,8-HpCDF-13C	2.00	91	D
1,2,3,4,6,7,8-HpCDD-13C	2.00	84	D
OCDD-13C	4.00	70	D
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 40 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

REPORT OF LABORATORY ANALYSIS

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-003		
Lab Sample ID	10445797003		
Filename	U180907A_12	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.46 m3	Collected	08/29/2018 16:35
ICAL ID	U180508	Received	08/31/2018 10:15
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 17:33

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	28	-----	2.0	
Total TCDF	2100	-----	2.0	
2,3,7,8-TCDD	5.2	-----	3.6	
Total TCDD	990	-----	3.6	
1,2,3,7,8-PeCDF	23	-----	0.89	
2,3,4,7,8-PeCDF	28	-----	0.96	
Total PeCDF	620	-----	0.92	
1,2,3,7,8-PeCDD	10	-----	1.1	J
Total PeCDD	430	-----	1.1	
1,2,3,4,7,8-HxCDF	16	-----	1.4	J
1,2,3,6,7,8-HxCDF	16	-----	1.2	J
2,3,4,6,7,8-HxCDF	18	-----	1.3	J
1,2,3,7,8,9-HxCDF	3.7	-----	1.6	J
Total HxCDF	200	-----	1.4	
1,2,3,4,7,8-HxCDD	6.0	-----	2.0	J
1,2,3,6,7,8-HxCDD	8.2	-----	0.96	J
1,2,3,7,8,9-HxCDD	6.6	-----	1.1	J
Total HxCDD	210	-----	1.4	
1,2,3,4,6,7,8-HpCDF	23	-----	2.4	
1,2,3,4,7,8,9-HpCDF	ND	-----	3.5	
Total HpCDF	23	-----	3.0	
1,2,3,4,6,7,8-HpCDD	22	-----	1.3	
Total HpCDD	61	-----	1.3	
OCDF	ND	-----	1.7	
OCDD	34	-----	1.6	J

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	75
2,3,7,8-TCDD-13C	2.00	64
1,2,3,7,8-PeCDF-13C	2.00	70
1,2,3,7,8-PeCDD-13C	2.00	60
1,2,3,6,7,8-HxCDF-13C	2.00	60
1,2,3,6,7,8-HxCDD-13C	2.00	53
1,2,3,4,6,7,8-HpCDF-13C	2.00	50
1,2,3,4,6,7,8-HpCDD-13C	2.00	57
OCDD-13C	4.00	80
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 36 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-004		
Lab Sample ID	10445797004		
Filename	U180907A_13	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.54 m3	Collected	08/29/2018 17:05
ICAL ID	U180508	Received	08/31/2018 10:15
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 18:20

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3		**Internal Standards**	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF	-----	350	2.0	P	2,3,7,8-TCDF-13C	2.00	133	R
Total TCDF	17000	-----	2.0	E	2,3,7,8-TCDD-13C	2.00	97	
					1,2,3,7,8-PeCDF-13C	2.00	141	R
2,3,7,8-TCDD	150	-----	2.0		1,2,3,7,8-PeCDD-13C	2.00	124	R
Total TCDD	25000	-----	2.0	E	1,2,3,6,7,8-HxCDF-13C	2.00	81	
					1,2,3,6,7,8-HxCDD-13C	2.00	67	
1,2,3,7,8-PeCDF	170	-----	1.0		1,2,3,4,6,7,8-HpCDF-13C	2.00	70	
2,3,4,7,8-PeCDF	280	-----	1.1		1,2,3,4,6,7,8-HpCDD-13C	2.00	62	
Total PeCDF	4000	-----	1.1		OCDD-13C	4.00	96	
1,2,3,7,8-PeCDD	270	-----	1.1		Recovery			
Total PeCDD	9300	-----	1.1		Standards			
					1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,4,7,8-HxCDF	120	-----	2.2		1,2,3,7,8,9-HxCDD-13C	2.00	NA	
1,2,3,6,7,8-HxCDF	150	-----	0.84					
2,3,4,6,7,8-HxCDF	-----	96	1.8	P	Surrogates			
1,2,3,7,8,9-HxCDF	19	-----	0.90	J	2,3,7,8-TCDD-37Cl4	2.00	NC	
Total HxCDF	1400	-----	1.4		2,3,4,7,8-PeCDF-13C	2.00	NC	
					1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD	140	-----	3.4		1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,6,7,8-HxCDD	300	-----	2.6		1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	
1,2,3,7,8,9-HxCDD	240	-----	2.8					
Total HxCDD	5700	-----	2.9					
1,2,3,4,6,7,8-HpCDF	400	-----	1.3					
1,2,3,4,7,8,9-HpCDF	17	-----	2.4	J				
Total HpCDF	510	-----	1.9					
1,2,3,4,6,7,8-HpCDD	720	-----	2.2					
Total HpCDD	2200	-----	2.2					
OCDF	27	-----	2.0	J				
OCDD	480	-----	2.1					

Total 2,3,7,8-TCDD
Equivalence: 590 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-005		
Lab Sample ID	10445797005		
Filename	Y180913A_06	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	2.51 m3	Collected	08/29/2018 17:06
ICAL ID	Y180827	Received	08/31/2018 10:15
CCal Filename(s)	Y180913A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/13/2018 06:05

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	-----	0.66	0.54	IJ
Total TCDF	110	-----	0.54	
2,3,7,8-TCDD	ND	-----	0.60	
Total TCDD	280	-----	0.60	
1,2,3,7,8-PeCDF	ND	-----	0.61	
2,3,4,7,8-PeCDF	-----	1.0	0.58	IJ
Total PeCDF	22	-----	0.60	
1,2,3,7,8-PeCDD	ND	-----	1.1	
Total PeCDD	110	-----	1.1	
1,2,3,4,7,8-HxCDF	0.56	-----	0.29	J
1,2,3,6,7,8-HxCDF	-----	0.33	0.23	IJ
2,3,4,6,7,8-HxCDF	0.49	-----	0.25	J
1,2,3,7,8,9-HxCDF	ND	-----	0.24	
Total HxCDF	2.4	-----	0.25	J
1,2,3,4,7,8-HxCDD	-----	0.84	0.59	IJ
1,2,3,6,7,8-HxCDD	1.4	-----	0.30	J
1,2,3,7,8,9-HxCDD	0.87	-----	0.32	J
Total HxCDD	64	-----	0.40	
1,2,3,4,6,7,8-HpCDF	-----	0.55	0.15	IJ
1,2,3,4,7,8,9-HpCDF	ND	-----	0.29	
Total HpCDF	ND	-----	0.22	
1,2,3,4,6,7,8-HpCDD	2.8	-----	0.61	J
Total HpCDD	8.0	-----	0.61	J
OCDF	ND	-----	0.39	
OCDD	-----	1.7	0.33	IJ

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	81
2,3,7,8-TCDD-13C	2.00	74
1,2,3,7,8-PeCDF-13C	2.00	87
1,2,3,7,8-PeCDD-13C	2.00	75
1,2,3,6,7,8-HxCDF-13C	2.00	76
1,2,3,6,7,8-HxCDD-13C	2.00	63
1,2,3,4,6,7,8-HpCDF-13C	2.00	69
1,2,3,4,6,7,8-HpCDD-13C	2.00	66
OCDD-13C	4.00	71
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 1.1 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

REPORT OF LABORATORY ANALYSIS

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-006		
Lab Sample ID	10445797006		
Filename	U180907A_15	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.22 m3	Collected	08/29/2018 16:20
ICAL ID	U180508	Received	08/31/2018 10:15
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 19:55

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	0.74	
Total TCDF	16	-----	0.74	
2,3,7,8-TCDD	ND	-----	1.0	
Total TCDD	34	-----	1.0	
1,2,3,7,8-PeCDF	ND	-----	0.69	
2,3,4,7,8-PeCDF	ND	-----	0.90	
Total PeCDF	6.2	-----	0.79	J
1,2,3,7,8-PeCDD	ND	-----	0.98	
Total PeCDD	13	-----	0.98	J
1,2,3,4,7,8-HxCDF	ND	-----	0.77	
1,2,3,6,7,8-HxCDF	ND	-----	0.48	
2,3,4,6,7,8-HxCDF	ND	-----	0.66	
1,2,3,7,8,9-HxCDF	ND	-----	0.83	
Total HxCDF	1.1	-----	0.68	J
1,2,3,4,7,8-HxCDD	ND	-----	1.4	
1,2,3,6,7,8-HxCDD	ND	-----	1.1	
1,2,3,7,8,9-HxCDD	ND	-----	0.94	
Total HxCDD	9.9	-----	1.2	J
1,2,3,4,6,7,8-HpCDF	0.65	-----	0.54	J
1,2,3,4,7,8,9-HpCDF	ND	-----	0.81	
Total HpCDF	0.65	-----	0.68	
1,2,3,4,6,7,8-HpCDD	----	1.1	0.60	IJ
Total HpCDD	2.6	-----	0.60	J
OCDF	ND	-----	0.87	
OCDD	3.0	-----	1.2	BJ

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	108	
2,3,7,8-TCDD-13C	2.00	89	
1,2,3,7,8-PeCDF-13C	2.00	121	R
1,2,3,7,8-PeCDD-13C	2.00	109	
1,2,3,6,7,8-HxCDF-13C	2.00	88	
1,2,3,6,7,8-HxCDD-13C	2.00	80	
1,2,3,4,6,7,8-HpCDF-13C	2.00	75	
1,2,3,4,6,7,8-HpCDD-13C	2.00	77	
OCDD-13C	4.00	88	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 0.021 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	02-007		
Lab Sample ID	10445797007		
Filename	U180907A_16	Matrix	Filter
Injected By	ZMS	Dilution	NA
Amount Extracted	2.44 m3	Collected	08/29/2018 17:22
ICAL ID	U180508	Received	08/31/2018 10:15
CCal Filename(s)	U180907A_01	Extracted	08/31/2018 18:00
Method Blank ID	BLANK-64437	Analyzed	09/07/2018 20:42

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	0.44	
Total TCDF	9.2	-----	0.44	
2,3,7,8-TCDD	ND	-----	0.86	
Total TCDD	11	-----	0.86	
1,2,3,7,8-PeCDF	ND	-----	0.25	
2,3,4,7,8-PeCDF	ND	-----	0.27	
Total PeCDF	1.9	-----	0.26	J
1,2,3,7,8-PeCDD	ND	-----	0.42	
Total PeCDD	ND	-----	0.42	
1,2,3,4,7,8-HxCDF	ND	-----	0.41	
1,2,3,6,7,8-HxCDF	ND	-----	0.35	
2,3,4,6,7,8-HxCDF	ND	-----	0.40	
1,2,3,7,8,9-HxCDF	ND	-----	0.50	
Total HxCDF	ND	-----	0.41	
1,2,3,4,7,8-HxCDD	ND	-----	0.64	
1,2,3,6,7,8-HxCDD	ND	-----	0.65	
1,2,3,7,8,9-HxCDD	ND	-----	0.50	
Total HxCDD	1.7	-----	0.60	J
1,2,3,4,6,7,8-HpCDF	ND	-----	0.58	
1,2,3,4,7,8,9-HpCDF	ND	-----	0.66	
Total HpCDF	ND	-----	0.62	
1,2,3,4,6,7,8-HpCDD	ND	-----	0.59	
Total HpCDD	ND	-----	0.59	
OCDF	ND	-----	0.78	
OCDD	1.6	-----	1.0	BJ

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	91
2,3,7,8-TCDD-13C	2.00	78
1,2,3,7,8-PeCDF-13C	2.00	104
1,2,3,7,8-PeCDD-13C	2.00	92
1,2,3,6,7,8-HxCDF-13C	2.00	73
1,2,3,6,7,8-HxCDD-13C	2.00	68
1,2,3,4,6,7,8-HpCDF-13C	2.00	65
1,2,3,4,6,7,8-HpCDD-13C	2.00	65
OCDD-13C	4.00	72
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 0.0016 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Blank Analysis Results

Lab Sample ID	BLANK-64437	Matrix	XAD/PUF
Filename	U180907A_04	Dilution	NA
Amount Extracted	2.22 m3	Extracted	08/31/2018 18:00
ICAL ID	U180508	Analyzed	09/07/2018 11:13
CCal Filename(s)	U180907A_01	Injected By	ZMS

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	1.3	
Total TCDF	ND	-----	1.3	
2,3,7,8-TCDD	ND	-----	1.9	
Total TCDD	ND	-----	1.9	
1,2,3,7,8-PeCDF	ND	-----	0.46	
2,3,4,7,8-PeCDF	ND	-----	0.47	
Total PeCDF	ND	-----	0.47	
1,2,3,7,8-PeCDD	ND	-----	0.58	
Total PeCDD	ND	-----	0.58	
1,2,3,4,7,8-HxCDF	ND	-----	0.41	
1,2,3,6,7,8-HxCDF	ND	-----	0.40	
2,3,4,6,7,8-HxCDF	----	0.65	0.43	IJ
1,2,3,7,8,9-HxCDF	----	0.72	0.52	IJ
Total HxCDF	ND	-----	0.44	
1,2,3,4,7,8-HxCDD	ND	-----	0.64	
1,2,3,6,7,8-HxCDD	ND	-----	0.61	
1,2,3,7,8,9-HxCDD	ND	-----	0.52	
Total HxCDD	ND	-----	0.59	
1,2,3,4,6,7,8-HpCDF	ND	-----	0.46	
1,2,3,4,7,8,9-HpCDF	ND	-----	0.72	
Total HpCDF	ND	-----	0.59	
1,2,3,4,6,7,8-HpCDD	ND	-----	0.95	
Total HpCDD	ND	-----	0.95	
OCDF	ND	-----	1.3	
OCDD	1.4	-----	1.4	J

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	91
2,3,7,8-TCDD-13C	2.00	77
1,2,3,7,8-PeCDF-13C	2.00	106
1,2,3,7,8-PeCDD-13C	2.00	100
1,2,3,6,7,8-HxCDF-13C	2.00	101
1,2,3,6,7,8-HxCDD-13C	2.00	89
1,2,3,4,6,7,8-HpCDF-13C	2.00	71
1,2,3,4,6,7,8-HpCDD-13C	2.00	70
OCDD-13C	4.00	65
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	104
2,3,4,7,8-PeCDF-13C	2.00	105
1,2,3,4,7,8-HxCDF-13C	2.00	79
1,2,3,4,7,8-HxCDD-13C	2.00	95
1,2,3,4,7,8,9-HpCDF-13C	2.00	93

Total 2,3,7,8-TCDD
Equivalence: 0.14 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise
R = Recovery outside of target range

I = Interference
P = PCDE Interference
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCS-64438		
Filename	U180914A_02	Matrix	XAD/PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	U180508	Extracted	08/31/2018 18:00
CCal Filename(s)	U180914A_01	Analyzed	09/13/2018 23:55
Method Blank ID	BLANK-64437	Injected By	SMT

Native Isomers	**Qs** (ng)	**Qm** (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.20	100
Total TCDF			
2,3,7,8-TCDD	0.20	0.23	115
Total TCDD			
1,2,3,7,8-PeCDF	1.0	0.94	94
2,3,4,7,8-PeCDF	1.0	1.1	109
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.1	105
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.1	106
1,2,3,6,7,8-HxCDF	1.0	1.0	104
2,3,4,6,7,8-HxCDF	1.0	1.0	105
1,2,3,7,8,9-HxCDF	1.0	1.1	105
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.1	108
1,2,3,6,7,8-HxCDD	1.0	1.2	116
1,2,3,7,8,9-HxCDD	1.0	1.00	100
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.3	129
1,2,3,4,7,8,9-HpCDF	1.0	1.3	130
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.2	120
Total HpCDD			
OCDF	2.0	1.9	93
OCDD	2.0	2.5	123

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.0	88
2,3,7,8-TCDD-13C	2.0	97
1,2,3,7,8-PeCDF-13C	2.0	87
1,2,3,7,8-PeCDD-13C	2.0	102
1,2,3,6,7,8-HxCDF-13C	2.0	69
1,2,3,6,7,8-HxCDD-13C	2.0	96
1,2,3,4,6,7,8-HpCDF-13C	2.0	98
1,2,3,4,6,7,8-HpCDD-13C	2.0	114
OCDD-13C	4.0	99
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	97
2,3,4,7,8-PeCDF-13C	2.0	101
1,2,3,4,7,8-HxCDF-13C	2.0	100
1,2,3,4,7,8-HxCDD-13C	2.0	106
1,2,3,4,7,8,9-HpCDF-13C	2.0	108

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCSD-64439		
Filename	U180914A_03	Matrix	XAD/PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	U180508	Extracted	08/31/2018 18:00
CCal Filename(s)	U180914A_01	Analyzed	09/14/2018 00:43
Method Blank ID	BLANK-64437	Injected By	SMT

Native Isomers	**Qs** (ng)	**Qm** (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.21	104
Total TCDF			
2,3,7,8-TCDD	0.20	0.23	113
Total TCDD			
1,2,3,7,8-PeCDF	1.0	0.99	99
2,3,4,7,8-PeCDF	1.0	1.1	112
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.0	105
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.1	105
1,2,3,6,7,8-HxCDF	1.0	1.0	101
2,3,4,6,7,8-HxCDF	1.0	1.1	106
1,2,3,7,8,9-HxCDF	1.0	1.00	100
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.1	115
1,2,3,6,7,8-HxCDD	1.0	1.2	120
1,2,3,7,8,9-HxCDD	1.0	1.1	108
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.3	130
1,2,3,4,7,8,9-HpCDF	1.0	1.2	124
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.2	122
Total HpCDD			
OCDF	2.0	1.9	94
OCDD	2.0	2.4	122

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.0	71
2,3,7,8-TCDD-13C	2.0	79
1,2,3,7,8-PeCDF-13C	2.0	72
1,2,3,7,8-PeCDD-13C	2.0	85
1,2,3,6,7,8-HxCDF-13C	2.0	59
1,2,3,6,7,8-HxCDD-13C	2.0	77
1,2,3,4,6,7,8-HpCDF-13C	2.0	77
1,2,3,4,6,7,8-HpCDD-13C	2.0	89
OCDD-13C	4.0	79
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	94
2,3,4,7,8-PeCDF-13C	2.0	102
1,2,3,4,7,8-HxCDF-13C	2.0	99
1,2,3,4,7,8-HxCDD-13C	2.0	110
1,2,3,4,7,8,9-HpCDF-13C	2.0	108

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9

Spike Recovery Relative Percent Difference (RPD) Results

Client EE&G Environmental

Spike 1 ID LCS-64438
Spike 1 Filename U180914A_02
Spike 2 ID LCSD-64439
Spike 2 Filename U180914A_03

Compound	Spike 1 %REC	Spike 2 %REC	%RPD
2,3,7,8-TCDF	100	104	3.9
2,3,7,8-TCDD	115	113	1.8
1,2,3,7,8-PeCDF	94	99	5.2
2,3,4,7,8-PeCDF	109	112	2.7
1,2,3,7,8-PeCDD	105	105	0.0
1,2,3,4,7,8-HxCDF	106	105	0.9
1,2,3,6,7,8-HxCDF	104	101	2.9
2,3,4,6,7,8-HxCDF	105	106	0.9
1,2,3,7,8,9-HxCDF	105	100	4.9
1,2,3,4,7,8-HxCDD	108	115	6.3
1,2,3,6,7,8-HxCDD	116	120	3.4
1,2,3,7,8,9-HxCDD	100	108	7.7
1,2,3,4,6,7,8-HpCDF	129	130	0.8
1,2,3,4,7,8,9-HpCDF	130	124	4.7
1,2,3,4,6,7,8-HpCDD	120	122	1.7
OCDF	93	94	1.1
OCDD	123	122	0.8

%REC = Percent Recovered
RPD = The difference between the two values divided by the mean value

REPORT OF LABORATORY ANALYSIS

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Report Prepared for:

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REPORT OF LABORATORY ANALYSIS FOR PCDD/PCDF

Report Prepared Date:

September 18, 2018

Report Information:

Pace Project #: 10446080
Sample Receipt Date: 09/04/2018
Client Project #: 2018-4191
Client Sub PO #: 2018-4191.Debris.T10
State Cert #: E87605

Invoicing & Reporting Options:

The report provided has been invoiced as a Level 2 PCDD/PCDF Report. If an upgrade of this report package is requested, an additional charge may be applied.

Please review the attached invoice for accuracy and forward any questions to Scott Unze, your Pace Project Manager.

This report has been reviewed by:

September 19, 2018
Scott Unze, Project Manager
(612) 607-6383
(612) 607-6444 (fax)
scott.unze@pacelabs.com

Report of Laboratory Analysis

DISCUSSION

This report presents the results from the analyses performed on six of seven samples submitted by a representative of EE&G Environmental. The samples were analyzed for the presence or absence of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) using a modified version of USEPA Method TO9A. The reporting limits were based on signal-to-noise measurements. Estimated Maximum Possible Concentration (EMPC) values were treated as positives in the toxic equivalence calculations. The samples were received above the laboratory-recommended temperature range of 0-6 degrees Celsius. One sample, 03-002, was received broken.

Second column confirmation analyses of 2,3,7,8-TCDF values obtained from the primary (DB5-MS) column are performed only when specifically requested for a project and only when the values are above the concentration of the lowest calibration standard. Typical resolution for this isomer using the DB5-MS column ranges from 25-30%.

The recoveries of the isotopically labeled PCDD/PCDF internal standards in the sample extracts ranged from 26-91%. Except for three low values, which were flagged "R" on the results tables, the labeled internal standard recoveries obtained for this project were within the target ranges for the method. Also, since the internal standards were added to the sample prior to the extraction step, the data were automatically corrected for recovery and accurate values were obtained.

Since the field samples did not include PUF cartridge components, surrogates were not present in the field sample extracts. One surrogate in the method blank was recovered above the target range and flagged "R".

Values were flagged "I" where incorrect isotope ratios were obtained or "P" where polychlorinated diphenyl ethers were present. Concentrations below the calibration range were flagged "J" and should be regarded as estimates. Concentrations above the calibration range were flagged "E" and should also be regarded as estimates.

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results show that PCDDs and PCDFs were not detected.

Laboratory quality control PCDD/PCDF spike samples were also prepared with the sample batch using clean PUF cartridges that had been fortified with native standard materials. The results show that the spiked native compounds were recovered at 104-141% with relative percent differences of 0.0-8.1%. Three recovery values obtained for spiked native HxCDD isomers were above the 70-130% target range and may indicate high biases for these isomers in these determinations. Matrix spikes were not prepared with the sample batch.

Minnesota Laboratory Certifications

Authority	Certificate #	Authority	Certificate #
A2LA	2926.01	Minnesota - Pet	1240
Alabama	40770	Mississippi	MN00064
Alaska - DW	MN00064	Missouri - DW	10100
Alaska - UST	17-009	Montana	CERT0092
Arizona	AZ0014	Nebraska	NE-OS-18-06
Arkansas - DW	MN00064	Nevada	MN00064
Arkansas - WW	88-0680	New Hampshire	2081
CNMI Saipan	MP0003	New Jersey (NE	MN002
California	2929	New York	11647
Colorado	MN00064	North Carolina	27700
Connecticut	PH-0256	North Carolina -	27700
EPA Region 8+	via MN 027-053	North Carolina -	530
Florida (NELAP	E87605	North Dakota	R-036
Georgia	959	Ohio - DW	41244
Guam	17-001r	Ohio - VAP	CL101
Hawaii	MN00064	Oklahoma	9507
Idaho	MN00064	Oregon - Primar	MN300001
Illinois	200011	Oregon - Secon	MN200001
Indiana	C-MN-01	Pennsylvania	68-00563
Iowa	368	Puerto Rico	MN00064
Kansas	E-10167	South Carolina	74003
Kentucky - DW	90062	South Dakota	NA
Kentucky - WW	90062	Tennessee	TN02818
Louisiana - DE	03086	Texas	T104704192
Louisiana - DW	MN00064	Utah (NELAP)	MN00064
Maine	MN00064	Virginia	460163
Maryland	322	Washington	C486
Massachusetts	M-MN064	West Virginia -	382
Michigan	9909	West Virginia -	9952C
Minnesota	027-053-137	Wisconsin	999407970
Minnesota - De	via MN 027-053	Wyoming - UST	2926.01

Appendix A

Sample Management

WO#:10446080

10446080

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A
Required Client Information:

Company: EE+G Environmental
Address: 5751 Miami Lakes Dr.
Miami Lakes, FL 33014
Email To: amavrelis@eeandg.com
Phone: 305-984-3218 Fax:
Requested Due Date/TAT: 2-weeks

Section B
Required Project Information:

Report To: Alex Mavrelis
Copy To:
Purchase Order No.: 2018-4191.DEBRIS.Task10
Project Name: SXM Landfill
Project Number: 2018-4191

Section C
Invoice Information:

Attention: Alex Mavrelis
Company Name: SAME
Address:
Pace Quote Reference:
Pace Project Manager: Christina Raschke
Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location
STATE:

Section D
Required Client Information

Matrix Codes
MATRIX / CODE
Drinking Water DW
Water WT
Waste Water WW
Product P
Soil/Solid SL
Oil OL
Wipe WP
Air AR
Tissue TS
Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	↓Analysis Test↓ Y/N	Dioxins/Furans by TO-9A Mod	Residual Chlorine (Y/N)	FLOW RATE / VOL ~~Pace Project No./Lab I.D.~~
1	03-001	AR		8-30	0845	830	1415	90°	1										X		5 LPM / 1,350 L 001
2	03-002	↓		↓	0850	↓	1650	↓	1										X		↓ / 2,400 L 002
3	03-003				0855		1655		1										X		/ 2,400 L 003
4	03-004				0900		1417		1										X		/ 1,285 L 004
5	03-005				0905		1705		1										X		/ 2,400 L 005
6	03-006				0945		1720		1										X		/ 2,275 L 006
7	03-007				0925		1715		1										X		/ 2,350 L 007
8	~~[illegible]~~																				
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
Sent via Fedex St. Maarten	(EE+G)	8/31/18	1:00pm	PACE	9/4/18	950	23.5	N	N	Y

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 02May2018 Page 1 of 2
	Document No.: **F-MN-L-213-rev.23**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: EE+G Enviormental

Project #:

WO# : 10446080
PM: SCU Due Date: 09/18/18
CLIENT: EE&G Enviro

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 813428379413

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☒ Bubble Wrap ☐ Bubble Bags ☐ None ☒ Other: Newspaper **Temp Blank?** ☐ Yes ☒ No

Thermometer Used: ☒ G87A9170600254 ☐ G87A9155100842

Type of Ice: ☐ Wet ☐ Blue ☒ None ☐ Dry ☐ Melted

Cooler Temp Read (°C): 13.7 **Cooler Temp Corrected (°C):** 13.5 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.2 **Date and Initials of Person Examining Contents:** AJ 9/4/18

USDA Regulated Soil (☒ N/A, water sample) AJ

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☐ No	☒ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☐ Yes	☒ No		
Containers Intact?	☐ Yes	☒ No		10. Sample OJ-002 arrived broken
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Is sufficient information available to reconcile the samples to the COC? Matrix: DR	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO$_3$ ☐ H$_2$SO$_4$ ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO$_3$, H$_2$SO$_4$, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Previously waived temp.

Project Manager Review: **Date:** 09/04/18

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Reporting Flags

A = Reporting Limit based on signal to noise

B = Less than 10x higher than method blank level

C = Result obtained from confirmation analysis

D = Result obtained from analysis of diluted sample

E = Exceeds calibration range

I = Interference present

J = Estimated value

L = Suppressive interference, analyte may be biased low

Nn = Value obtained from additional analysis

P = PCDE Interference

R = Recovery outside target range

S = Peak saturated

U = Analyte not detected

V = Result verified by confirmation analysis

X = %D Exceeds limits

Y = Calculated using average of daily RFs

* = See Discussion

Appendix B

Sample Analysis Summary

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-001		
Lab Sample ID	10446080001		
Filename	Y180913A_07	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	1.35 m3	Collected	08/30/2018 14:15
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180913A_01	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/13/2018 06:52

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	----	520	3.5	P
Total TCDF	42000	-----	3.5	E
2,3,7,8-TCDD	180	-----	3.2	
Total TCDD	54000	-----	3.2	E
1,2,3,7,8-PeCDF	200	-----	5.4	
2,3,4,7,8-PeCDF	300	-----	5.5	
Total PeCDF	6700	-----	5.4	
1,2,3,7,8-PeCDD	200	-----	3.5	
Total PeCDD	21000	-----	3.5	E
1,2,3,4,7,8-HxCDF	82	-----	2.1	
1,2,3,6,7,8-HxCDF	75	-----	1.8	
2,3,4,6,7,8-HxCDF	90	-----	2.4	
1,2,3,7,8,9-HxCDF	10	-----	2.4	J
Total HxCDF	1100	-----	2.2	
1,2,3,4,7,8-HxCDD	76	-----	2.7	
1,2,3,6,7,8-HxCDD	130	-----	1.4	
1,2,3,7,8,9-HxCDD	100	-----	1.9	
Total HxCDD	8700	-----	2.0	
1,2,3,4,6,7,8-HpCDF	64	-----	1.7	
1,2,3,4,7,8,9-HpCDF	ND	-----	2.1	
Total HpCDF	64	-----	1.9	
1,2,3,4,6,7,8-HpCDD	200	-----	4.5	
Total HpCDD	790	-----	4.5	
OCDF	ND	-----	4.4	
OCDD	54	-----	2.1	J

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	79	
2,3,7,8-TCDD-13C	2.00	74	
1,2,3,7,8-PeCDF-13C	2.00	91	
1,2,3,7,8-PeCDD-13C	2.00	85	
1,2,3,6,7,8-HxCDF-13C	2.00	68	
1,2,3,6,7,8-HxCDD-13C	2.00	63	
1,2,3,4,6,7,8-HpCDF-13C	2.00	65	
1,2,3,4,6,7,8-HpCDD-13C	2.00	39	R
OCDD-13C	4.00	66	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 550 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-003		
Lab Sample ID	10446080003		
Filename	Y180913A_08	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	2.40 m3	Collected	08/30/2018 16:55
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180913A_01	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/13/2018 07:40

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	33	-----	3.0	
Total TCDF	1900	-----	3.0	
2,3,7,8-TCDD	15	-----	1.3	
Total TCDD	4400	-----	1.3	E
1,2,3,7,8-PeCDF	15	-----	1.5	J
2,3,4,7,8-PeCDF	23	-----	2.1	
Total PeCDF	580	-----	1.8	
1,2,3,7,8-PeCDD	24	-----	3.8	
Total PeCDD	2400	-----	3.8	
1,2,3,4,7,8-HxCDF	6.3	-----	0.86	J
1,2,3,6,7,8-HxCDF	6.1	-----	0.89	J
2,3,4,6,7,8-HxCDF	6.7	-----	0.97	J
1,2,3,7,8,9-HxCDF	ND	-----	0.71	
Total HxCDF	58	-----	0.86	
1,2,3,4,7,8-HxCDD	7.3	-----	1.8	J
1,2,3,6,7,8-HxCDD	13	-----	1.1	J
1,2,3,7,8,9-HxCDD	12	-----	0.99	J
Total HxCDD	780	-----	1.3	
1,2,3,4,6,7,8-HpCDF	5.0	-----	0.58	J
1,2,3,4,7,8,9-HpCDF	ND	-----	0.93	
Total HpCDF	5.0	-----	0.75	J
1,2,3,4,6,7,8-HpCDD	17	-----	2.8	J
Total HpCDD	87	-----	2.8	
OCDF	ND	-----	1.7	
OCDD	-----	7.1	3.3	IJ

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	68	
2,3,7,8-TCDD-13C	2.00	63	
1,2,3,7,8-PeCDF-13C	2.00	80	
1,2,3,7,8-PeCDD-13C	2.00	73	
1,2,3,6,7,8-HxCDF-13C	2.00	66	
1,2,3,6,7,8-HxCDD-13C	2.00	55	
1,2,3,4,6,7,8-HpCDF-13C	2.00	60	
1,2,3,4,6,7,8-HpCDD-13C	2.00	32	R
OCDD-13C	4.00	60	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 48 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-004		
Lab Sample ID	10446080004		
Filename	Y180918A_07	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	1.28 m3	Collected	08/30/2018 14:14
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180918A_02	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/18/2018 13:46

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	----	39	1.3	P
Total TCDF	2500	-----	1.3	
2,3,7,8-TCDD	15	-----	1.2	
Total TCDD	3300	-----	1.2	
1,2,3,7,8-PeCDF	19	-----	3.3	J
2,3,4,7,8-PeCDF	34	-----	3.0	J
Total PeCDF	740	-----	3.2	
1,2,3,7,8-PeCDD	23	-----	4.0	J
Total PeCDD	1300	-----	4.0	
1,2,3,4,7,8-HxCDF	14	-----	1.2	J
1,2,3,6,7,8-HxCDF	13	-----	0.95	J
2,3,4,6,7,8-HxCDF	13	-----	1.5	J
1,2,3,7,8,9-HxCDF	ND	-----	1.6	
Total HxCDF	150	-----	1.3	
1,2,3,4,7,8-HxCDD	12	-----	1.4	J
1,2,3,6,7,8-HxCDD	17	-----	1.2	J
1,2,3,7,8,9-HxCDD	15	-----	1.4	J
Total HxCDD	620	-----	1.3	
1,2,3,4,6,7,8-HpCDF	19	-----	1.1	J
1,2,3,4,7,8,9-HpCDF	ND	-----	1.5	
Total HpCDF	19	-----	1.3	J
1,2,3,4,6,7,8-HpCDD	43	-----	3.9	
Total HpCDD	210	-----	3.9	
OCDF	ND	-----	3.7	
OCDD	43	-----	3.8	J

Internal Standards	**ng's Added**	**Percent Recovery**	
2,3,7,8-TCDF-13C	2.00	78	
2,3,7,8-TCDD-13C	2.00	69	
1,2,3,7,8-PeCDF-13C	2.00	87	
1,2,3,7,8-PeCDD-13C	2.00	83	
1,2,3,6,7,8-HxCDF-13C	2.00	68	
1,2,3,6,7,8-HxCDD-13C	2.00	60	
1,2,3,4,6,7,8-HpCDF-13C	2.00	61	
1,2,3,4,6,7,8-HpCDD-13C	2.00	26	R
OCDD-13C	4.00	53	
Recovery Standards			
1,2,3,4-TCDD-13C	2.00	NA	
1,2,3,7,8,9-HxCDD-13C	2.00	NA	
Surrogates			
2,3,7,8-TCDD-37Cl4	2.00	NC	
2,3,4,7,8-PeCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDF-13C	2.00	NC	
1,2,3,4,7,8-HxCDD-13C	2.00	NC	
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC	

Total 2,3,7,8-TCDD
Equivalence: 58 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-005		
Lab Sample ID	10446080005		
Filename	Y180913A_10	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	2.40 m3	Collected	08/30/2018 17:05
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180913A_01	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/13/2018 09:15

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	0.63	
Total TCDF	0.97	-----	0.63	J
2,3,7,8-TCDD	ND	-----	0.80	
Total TCDD	ND	-----	0.80	
1,2,3,7,8-PeCDF	ND	-----	0.88	
2,3,4,7,8-PeCDF	ND	-----	0.72	
Total PeCDF	ND	-----	0.80	
1,2,3,7,8-PeCDD	ND	-----	1.2	
Total PeCDD	ND	-----	1.2	
1,2,3,4,7,8-HxCDF	ND	-----	0.44	
1,2,3,6,7,8-HxCDF	ND	-----	0.42	
2,3,4,6,7,8-HxCDF	ND	-----	0.40	
1,2,3,7,8,9-HxCDF	ND	-----	0.46	
Total HxCDF	ND	-----	0.43	
1,2,3,4,7,8-HxCDD	ND	-----	0.83	
1,2,3,6,7,8-HxCDD	ND	-----	0.70	
1,2,3,7,8,9-HxCDD	ND	-----	0.75	
Total HxCDD	ND	-----	0.76	
1,2,3,4,6,7,8-HpCDF	ND	-----	0.51	
1,2,3,4,7,8,9-HpCDF	ND	-----	1.0	
Total HpCDF	ND	-----	0.76	
1,2,3,4,6,7,8-HpCDD	ND	-----	1.5	
Total HpCDD	ND	-----	1.5	
OCDF	ND	-----	1.2	
OCDD	ND	-----	1.2	

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	80
2,3,7,8-TCDD-13C	2.00	74
1,2,3,7,8-PeCDF-13C	2.00	86
1,2,3,7,8-PeCDD-13C	2.00	72
1,2,3,6,7,8-HxCDF-13C	2.00	67
1,2,3,6,7,8-HxCDD-13C	2.00	52
1,2,3,4,6,7,8-HpCDF-13C	2.00	52
1,2,3,4,6,7,8-HpCDD-13C	2.00	48
OCDD-13C	4.00	44
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 0.00 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-006		
Lab Sample ID	10446080006		
Filename	Y180913A_11	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	2.28 m3	Collected	08/30/2018 17:20
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180913A_01	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/13/2018 10:03

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	1.3	
Total TCDF	14	-----	1.3	
2,3,7,8-TCDD	ND	-----	1.9	
Total TCDD	19	-----	1.9	
1,2,3,7,8-PeCDF	ND	-----	2.3	
2,3,4,7,8-PeCDF	ND	-----	2.8	
Total PeCDF	ND	-----	2.5	
1,2,3,7,8-PeCDD	ND	-----	2.7	
Total PeCDD	ND	-----	2.7	
1,2,3,4,7,8-HxCDF	ND	-----	1.8	
1,2,3,6,7,8-HxCDF	ND	-----	1.8	
2,3,4,6,7,8-HxCDF	ND	-----	2.0	
1,2,3,7,8,9-HxCDF	ND	-----	2.1	
Total HxCDF	ND	-----	1.9	
1,2,3,4,7,8-HxCDD	ND	-----	2.9	
1,2,3,6,7,8-HxCDD	ND	-----	1.9	
1,2,3,7,8,9-HxCDD	ND	-----	1.7	
Total HxCDD	5.8	-----	2.1	J
1,2,3,4,6,7,8-HpCDF	3.1	-----	1.2	J
1,2,3,4,7,8,9-HpCDF	ND	-----	1.9	
Total HpCDF	8.4	-----	1.6	J
1,2,3,4,6,7,8-HpCDD	12	-----	1.8	J
Total HpCDD	24	-----	1.8	
OCDF	9.3	-----	3.7	J
OCDD	160	-----	5.6	

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	81
2,3,7,8-TCDD-13C	2.00	70
1,2,3,7,8-PeCDF-13C	2.00	86
1,2,3,7,8-PeCDD-13C	2.00	78
1,2,3,6,7,8-HxCDF-13C	2.00	76
1,2,3,6,7,8-HxCDD-13C	2.00	64
1,2,3,4,6,7,8-HpCDF-13C	2.00	65
1,2,3,4,6,7,8-HpCDD-13C	2.00	62
OCDD-13C	4.00	63
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 0.33 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Sample Analysis Results

Client - EE&G Environmental

Client's Sample ID	03-007		
Lab Sample ID	10446080007		
Filename	Y180913A_12	Matrix	Filter
Injected By	SMT	Dilution	NA
Amount Extracted	2.35 m3	Collected	08/30/2018 17:15
ICAL ID	Y180827	Received	09/04/2018 09:50
CCal Filename(s)	Y180913A_01	Extracted	09/05/2018 15:10
Method Blank ID	BLANK-64463	Analyzed	09/13/2018 10:50

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	ND	-----	0.96	
Total TCDF	19	-----	0.96	
2,3,7,8-TCDD	ND	-----	1.5	
Total TCDD	28	-----	1.5	
1,2,3,7,8-PeCDF	ND	-----	1.4	
2,3,4,7,8-PeCDF	ND	-----	1.5	
Total PeCDF	2.0	-----	1.4	J
1,2,3,7,8-PeCDD	ND	-----	1.7	
Total PeCDD	10	-----	1.7	J
1,2,3,4,7,8-HxCDF	ND	-----	0.64	
1,2,3,6,7,8-HxCDF	ND	-----	0.60	
2,3,4,6,7,8-HxCDF	ND	-----	0.47	
1,2,3,7,8,9-HxCDF	ND	-----	0.68	
Total HxCDF	ND	-----	0.60	
1,2,3,4,7,8-HxCDD	ND	-----	1.4	
1,2,3,6,7,8-HxCDD	ND	-----	1.3	
1,2,3,7,8,9-HxCDD	ND	-----	1.1	
Total HxCDD	7.8	-----	1.3	J
1,2,3,4,6,7,8-HpCDF	ND	-----	0.56	
1,2,3,4,7,8,9-HpCDF	ND	-----	0.65	
Total HpCDF	ND	-----	0.60	
1,2,3,4,6,7,8-HpCDD	ND	-----	0.92	
Total HpCDD	1.8	-----	0.92	J
OCDF	ND	-----	1.1	
OCDD	1.6	-----	1.1	J

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	81
2,3,7,8-TCDD-13C	2.00	73
1,2,3,7,8-PeCDF-13C	2.00	86
1,2,3,7,8-PeCDD-13C	2.00	75
1,2,3,6,7,8-HxCDF-13C	2.00	78
1,2,3,6,7,8-HxCDD-13C	2.00	64
1,2,3,4,6,7,8-HpCDF-13C	2.00	68
1,2,3,4,6,7,8-HpCDD-13C	2.00	64
OCDD-13C	4.00	66
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	NC
2,3,4,7,8-PeCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDF-13C	2.00	NC
1,2,3,4,7,8-HxCDD-13C	2.00	NC
1,2,3,4,7,8,9-HpCDF-13C	2.00	NC

Total 2,3,7,8-TCDD
Equivalence: 0.0016 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
B = Less than 10 times higher than method blank level
R = Recovery outside of target range
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise

I = Interference
P = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Blank Analysis Results

Lab Sample ID	BLANK-64463	Matrix	PUF
Filename	Y180913A_05	Dilution	NA
Amount Extracted	1.28 m3	Extracted	09/05/2018 15:10
ICAL ID	Y180827	Analyzed	09/13/2018 05:17
CCal Filename(s)	Y180913A_01	Injected By	SMT

Native Isomers	**Conc** pg/m3	**EMPC** pg/m3	**LRL** pg/m3	
2,3,7,8-TCDF	-----	2.2	1.7	IJ
Total TCDF	ND	-----	1.7	
2,3,7,8-TCDD	ND	-----	2.2	
Total TCDD	ND	-----	2.2	
1,2,3,7,8-PeCDF	ND	-----	3.0	
2,3,4,7,8-PeCDF	ND	-----	1.7	
Total PeCDF	ND	-----	2.4	
1,2,3,7,8-PeCDD	ND	-----	3.3	
Total PeCDD	ND	-----	3.3	
1,2,3,4,7,8-HxCDF	ND	-----	1.2	
1,2,3,6,7,8-HxCDF	ND	-----	1.0	
2,3,4,6,7,8-HxCDF	ND	-----	1.0	
1,2,3,7,8,9-HxCDF	ND	-----	1.1	
Total HxCDF	ND	-----	1.1	
1,2,3,4,7,8-HxCDD	ND	-----	1.5	
1,2,3,6,7,8-HxCDD	ND	-----	1.1	
1,2,3,7,8,9-HxCDD	ND	-----	1.2	
Total HxCDD	ND	-----	1.3	
1,2,3,4,6,7,8-HpCDF	ND	-----	0.86	
1,2,3,4,7,8,9-HpCDF	ND	-----	1.6	
Total HpCDF	ND	-----	1.2	
1,2,3,4,6,7,8-HpCDD	ND	-----	2.3	
Total HpCDD	ND	-----	2.3	
OCDF	ND	-----	3.3	
OCDD	ND	-----	3.7	

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.00	81
2,3,7,8-TCDD-13C	2.00	72
1,2,3,7,8-PeCDF-13C	2.00	86
1,2,3,7,8-PeCDD-13C	2.00	76
1,2,3,6,7,8-HxCDF-13C	2.00	87
1,2,3,6,7,8-HxCDD-13C	2.00	71
1,2,3,4,6,7,8-HpCDF-13C	2.00	70
1,2,3,4,6,7,8-HpCDD-13C	2.00	68
OCDD-13C	4.00	68
Recovery Standards		
1,2,3,4-TCDD-13C	2.00	NA
1,2,3,7,8,9-HxCDD-13C	2.00	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.00	108
2,3,4,7,8-PeCDF-13C	2.00	106
1,2,3,4,7,8-HxCDF-13C	2.00	110
1,2,3,4,7,8-HxCDD-13C	2.00	125 R
1,2,3,4,7,8,9-HpCDF-13C	2.00	117

Total 2,3,7,8-TCDD
Equivalence: 0.22 pg/m3
(Lower-bound - Using ITE Factors)

Conc = Concentration (Totals include 2,3,7,8-substituted isomers).
EMPC = Estimated Maximum Possible Concentration
LRL = Lower Reporting Limit
J = Estimated value
Nn = Value obtained from additional analysis
A = Detection Limit based on signal to noise
R = Recovery outside of target range

I = Interference
P = PCDE Interference
ND = Not Detected
NA = Not Applicable
NC = Not Calculated

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCS-64464		
Filename	Y180913A_02	Matrix	PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	Y180827	Extracted	09/05/2018 15:10
CCal Filename(s)	Y180913A_01	Analyzed	09/13/2018 02:54
Method Blank ID	BLANK-64463	Injected By	SMT

Native Isomers	**Qs** (ng)	**Qm** (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.23	115
Total TCDF			
2,3,7,8-TCDD	0.20	0.21	107
Total TCDD			
1,2,3,7,8-PeCDF	1.0	1.1	107
2,3,4,7,8-PeCDF	1.0	1.2	120
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.1	107
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.1	112
1,2,3,6,7,8-HxCDF	1.0	1.0	104
2,3,4,6,7,8-HxCDF	1.0	1.1	108
1,2,3,7,8,9-HxCDF	1.0	1.0	104
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.3	132 R
1,2,3,6,7,8-HxCDD	1.0	1.3	130
1,2,3,7,8,9-HxCDD	1.0	1.2	116
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.1	112
1,2,3,4,7,8,9-HpCDF	1.0	1.2	116
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.1	107
Total HpCDD			
OCDF	2.0	2.2	112
OCDD	2.0	2.2	110

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.0	78
2,3,7,8-TCDD-13C	2.0	72
1,2,3,7,8-PeCDF-13C	2.0	86
1,2,3,7,8-PeCDD-13C	2.0	79
1,2,3,6,7,8-HxCDF-13C	2.0	83
1,2,3,6,7,8-HxCDD-13C	2.0	71
1,2,3,4,6,7,8-HpCDF-13C	2.0	66
1,2,3,4,6,7,8-HpCDD-13C	2.0	66
OCDD-13C	4.0	65
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	99
2,3,4,7,8-PeCDF-13C	2.0	98
1,2,3,4,7,8-HxCDF-13C	2.0	103
1,2,3,4,7,8-HxCDD-13C	2.0	108
1,2,3,4,7,8,9-HpCDF-13C	2.0	104

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9 Laboratory Control Spike Results

Lab Sample ID	LCSD-64465		
Filename	Y180913A_03	Matrix	PUF
Total Amount Extracted	1.00 Sample	Dilution	NA
ICAL ID	Y180827	Extracted	09/05/2018 15:10
CCal Filename(s)	Y180913A_01	Analyzed	09/13/2018 03:42
Method Blank ID	BLANK-64463	Injected By	SMT

Native Isomers	**Qs** (ng)	**Qm** (ng)	% Rec.
2,3,7,8-TCDF	0.20	0.24	120
Total TCDF			
2,3,7,8-TCDD	0.20	0.23	113
Total TCDD			
1,2,3,7,8-PeCDF	1.0	1.1	109
2,3,4,7,8-PeCDF	1.0	1.2	120
Total PeCDF			
1,2,3,7,8-PeCDD	1.0	1.1	112
Total PeCDD			
1,2,3,4,7,8-HxCDF	1.0	1.2	115
1,2,3,6,7,8-HxCDF	1.0	1.1	108
2,3,4,6,7,8-HxCDF	1.0	1.1	114
1,2,3,7,8,9-HxCDF	1.0	1.1	111
Total HxCDF			
1,2,3,4,7,8-HxCDD	1.0	1.4	141 R
1,2,3,6,7,8-HxCDD	1.0	1.3	134 R
1,2,3,7,8,9-HxCDD	1.0	1.2	124
Total HxCDD			
1,2,3,4,6,7,8-HpCDF	1.0	1.2	116
1,2,3,4,7,8,9-HpCDF	1.0	1.2	123
Total HpCDF			
1,2,3,4,6,7,8-HpCDD	1.0	1.2	116
Total HpCDD			
OCDF	2.0	2.4	119
OCDD	2.0	2.2	111

Internal Standards	**ng's Added**	**Percent Recovery**
2,3,7,8-TCDF-13C	2.0	80
2,3,7,8-TCDD-13C	2.0	72
1,2,3,7,8-PeCDF-13C	2.0	87
1,2,3,7,8-PeCDD-13C	2.0	78
1,2,3,6,7,8-HxCDF-13C	2.0	85
1,2,3,6,7,8-HxCDD-13C	2.0	71
1,2,3,4,6,7,8-HpCDF-13C	2.0	68
1,2,3,4,6,7,8-HpCDD-13C	2.0	68
OCDD-13C	4.0	70
Recovery Standards		
1,2,3,4-TCDD-13C	2.0	NA
1,2,3,7,8,9-HxCDD-13C	2.0	NA
Surrogates		
2,3,7,8-TCDD-37Cl4	2.0	98
2,3,4,7,8-PeCDF-13C	2.0	97
1,2,3,4,7,8-HxCDF-13C	2.0	100
1,2,3,4,7,8-HxCDD-13C	2.0	111
1,2,3,4,7,8,9-HpCDF-13C	2.0	108

Qs = Quantity Spiked
Qm = Quantity Measured
Rec. = Recovery (Expressed as Percent)
R = Outside the method specified target recovery range
NA = Not Applicable
Nn = Value obtained from additional analysis

Method TO9

Spike Recovery Relative Percent Difference (RPD) Results

Client EE&G Environmental

Spike 1 ID	LCS-64464	Spike 2 ID	LCSD-64465
Spike 1 Filename	Y180913A_02	Spike 2 Filename	Y180913A_03

Compound	Spike 1 %REC	Spike 2 %REC	%RPD
2,3,7,8-TCDF	115	120	4.3
2,3,7,8-TCDD	107	113	5.5
1,2,3,7,8-PeCDF	107	109	1.9
2,3,4,7,8-PeCDF	120	120	0.0
1,2,3,7,8-PeCDD	107	112	4.6
1,2,3,4,7,8-HxCDF	112	115	2.6
1,2,3,6,7,8-HxCDF	104	108	3.8
2,3,4,6,7,8-HxCDF	108	114	5.4
1,2,3,7,8,9-HxCDF	104	111	6.5
1,2,3,4,7,8-HxCDD	132	141	6.6
1,2,3,6,7,8-HxCDD	130	134	3.0
1,2,3,7,8,9-HxCDD	116	124	6.7
1,2,3,4,6,7,8-HpCDF	112	116	3.5
1,2,3,4,7,8,9-HpCDF	116	123	5.9
1,2,3,4,6,7,8-HpCDD	107	116	8.1
OCDF	112	119	6.1
OCDD	110	111	0.9

%REC = Percent Recovered
RPD = The difference between the two values divided by the mean value

ATTACHMENT I

LABORATORY RESULTS, POLYCHLORINATED BIPHENYLS (PCBS)

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014
Phone: (305) 374-8300
Fax: (305) 374-8301

9/13/2018

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 9/6/2018. The results are tabulated on the attached data pages for the following client designated project:

SXM Landfill

The reference number for these samples is EMSL Order #011807122. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry Laboratory Director

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NELAP Certification: NJ 03036; NY 10872

A filter was not received with the florisil tube for sample -0006. The reporting limits for sample -0013 are elevated for one or more Aroclors due to matrix interference.

EMSL Order: 011807122
CustomerID: EEG50
CustomerPO: 2018-4191(T10)
ProjectID:

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Phone: (305) 374-8300
Fax: (305) 374-8301
Received: 09/06/18 9:30 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 01-001
D1-Site 001

Collected: 8/28/2018 ***Lab ID:*** *011807122-0001*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1254	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00061	mg/m^3	9/6/2018	AC	9/12/2018	EH

Client Sample Description 01-002
D1-Site 002

Collected: 8/28/2018 ***Lab ID:*** *011807122-0002*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1221	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1232	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1242	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1248	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1254	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1260	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1262	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1268	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH

Client Sample Description 01-003
D1-Site 003

Collected: 8/28/2018 ***Lab ID:*** *011807122-0003*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1221	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1232	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1242	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1248	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH

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Project: **SXM Landfill**

Analytical Results

Client Sample Description 01-003
D1-Site 003
Collected: 8/28/2018 ***Lab ID:*** *011807122-0003*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1254	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1260	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1262	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1268	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH

Client Sample Description 01-004
D1-Site 004
Collected: 8/28/2018 ***Lab ID:*** *011807122-0004*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1254	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00060	mg/m^3	9/6/2018	AC	9/12/2018	EH

Client Sample Description 01-005
D1-Site 005
Collected: 8/28/2018 ***Lab ID:*** *011807122-0005*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1221	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1232	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1242	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1248	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1254	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1260	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1262	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH
5503 Modified	Aroclor-1268	ND	0.00061	mg/m^3	9/6/2018	AC	9/6/2018	EH

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Client Sample Description 02-001
D2-001
Collected: 8/28/2018 ***Lab ID:*** *011807122-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00056	mg/m^3	9/6/2018	AC	9/7/2018	EH

Client Sample Description 02-002
D2-002
Collected: 8/28/2018 ***Lab ID:*** *011807122-0007*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1254	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH

Client Sample Description 02-003
DS-003
Collected: 8/28/2018 ***Lab ID:*** *011807122-0008*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH

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Analytical Results

Client Sample Description 02-003
DS-003
Collected: 8/28/2018 ***Lab ID:*** *011807122-0008*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1254	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH

Client Sample Description 02-004
D2-Site 004
Collected: 8/28/2018 ***Lab ID:*** *011807122-0009*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1254	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00057	mg/m^3	9/6/2018	AC	9/12/2018	EH

Client Sample Description 02-005
D2-Site 005
Collected: 8/28/2018 ***Lab ID:*** *011807122-0010*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00057	mg/m^3	9/6/2018	AC	9/7/2018	EH

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Analytical Results

Client Sample Description 02-006
D2-Site 006

Collected: 8/28/2018 ***Lab ID:*** *011807122-0011*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00060	mg/m³	9/6/2018	AC	9/7/2018	EH

Client Sample Description 02-007
D2-Site 007

Collected: 8/28/2018 ***Lab ID:*** *011807122-0012*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00062	mg/m³	9/6/2018	AC	9/7/2018	EH

Client Sample Description 03-001
D3-Site 001

Collected: 8/28/2018 ***Lab ID:*** *011807122-0013*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND D	0.0028	mg/m³	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1221	ND D	0.0028	mg/m³	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1232	ND D	0.0028	mg/m³	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1242	ND D	0.0028	mg/m³	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1248	ND D	0.0028	mg/m³	9/6/2018	SM	9/12/2018	EH

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CustomerID: EEG50
CustomerPO: 2018-4191(T10)
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Analytical Results

Client Sample Description 03-001
D3-Site 001
Collected: 8/28/2018 ***Lab ID:*** *011807122-0013*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1254	ND D	0.0028	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1260	ND D	0.0028	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1262	ND D	0.0028	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1268	ND D	0.0028	mg/m^3	9/6/2018	SM	9/12/2018	EH

Client Sample Description 03-002
D3-Site 002
Collected: 8/28/2018 ***Lab ID:*** *011807122-0014*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00056	mg/m^3	9/6/2018	SM	9/7/2018	EH

Client Sample Description 03-003
D3-Site 003
Collected: 8/28/2018 ***Lab ID:*** *011807122-0015*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00055	mg/m^3	9/6/2018	SM	9/7/2018	EH

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Analytical Results

Client Sample Description 03-004
D3-Site 004
Collected: 8/28/2018 ***Lab ID:*** *011807122-0016*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1221	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1232	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1242	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1248	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1254	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1260	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1262	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH
5503 Modified	Aroclor-1268	ND	0.00059	mg/m^3	9/6/2018	SM	9/12/2018	EH

Client Sample Description 03-005
D3-Site 005
Collected: 8/28/2018 ***Lab ID:*** *011807122-0017*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00060	mg/m^3	9/6/2018	SM	9/7/2018	EH

Client Sample Description 03-006
D3-Site 006
Collected: 8/28/2018 ***Lab ID:*** *011807122-0018*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00061	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00061	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00061	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00061	mg/m^3	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00061	mg/m^3	9/6/2018	SM	9/7/2018	EH

EMSL Order:	011807122
CustomerID:	EEG50
CustomerPO:	2018-4191(T10)
ProjectID:	

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Project: **SXM Landfill**

Analytical Results

Client Sample Description 03-006
D3-Site 006
Collected: 8/28/2018 ***Lab ID:*** *011807122-0018*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1254	ND	0.00061	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00061	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00061	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00061	mg/m³	9/6/2018	SM	9/7/2018	EH

Client Sample Description 03-007
D3-Site 007
Collected: 8/28/2018 ***Lab ID:*** *011807122-0019*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
GC-SVOA								
5503 Modified	Aroclor-1016	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1221	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1232	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1242	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1248	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1254	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1260	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1262	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH
5503 Modified	Aroclor-1268	ND	0.00064	mg/m³	9/6/2018	SM	9/7/2018	EH

Definitions:
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution

ATTACHMENT J

LABORATORY RESULTS, HEAVY METALS

EMSL Analytical, Inc.
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9/12/2018

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 9/6/2018. The results are tabulated on the attached data pages for the following client designated project:

SXM Landfill

The reference number for these samples is EMSL Order #011807125. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry Laboratory Director

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AIHA-LAP, LLC-IHLAP Lab # 100194
NELAP Certification: NJ 03036; NY 10872

The filters received were PVC which does not completely dissolve during digestion. The results may be biased low.

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Project: **SXM Landfill**

Analytical Results

Client Sample Description 01-001 D1-Site 001 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0001*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.000077	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00068	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 01-002 D1-Site 002 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0002*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.00016	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00068	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	0.000088	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 01-003 D1-Site 003 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0003*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.00018	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	0.00076	0.00068	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	0.000047	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW

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Project: **SXM Landfill**

Analytical Results

Client Sample Description 01-004 D1-Site 004 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0004*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00067	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 01-005 D1-Site 005 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0005*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	0.00073	0.00067	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 02-001 D2-Site 001 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.000073	0.000038	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00038	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000038	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00076	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000038	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000038	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00038	mg/m^3	9/7/2018	KB	9/7/2018	JW

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Project: **SXM Landfill**

Analytical Results

Client Sample Description 02-002 D2-Site 002 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0007*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	0.00020	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00067	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00033	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 02-003 D2-Site 003 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0008*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	0.00016	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	0.00068	0.00066	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	0.000038	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000033	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00033	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 02-004 D2-Site 004 ***Collected:*** 8/28/2018 ***Lab ID:*** *011807125-0009*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	0.00050	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	0.000071	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00063	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	0.0017	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	0.000047	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00031	mg/m^3	9/7/2018	KB	9/7/2018	JW

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Analytical Results

Client Sample Description 02-005
D2-Site 005
Collected: 8/28/2018 ***Lab ID:*** *011807125-0010*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00063	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000031	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00031	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 02-006
D2-Site 006 Pers.
Collected: 8/28/2018 ***Lab ID:*** *011807125-0011*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000044	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00044	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000044	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.00088	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000044	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000044	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00044	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 02-007
D2-Site 007 Pers.
Collected: 8/28/2018 ***Lab ID:*** *011807125-0012*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	0.00083	0.00076	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00038	mg/m^3	9/7/2018	KB	9/10/2018	JW

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Analytical Results

Client Sample Description 03-001
D3-Site 001
Collected: 8/28/2018 ***Lab ID:*** *011807125-0013*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.00065	0.000053	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00053	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000053	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.0011	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	0.0023	0.000053	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	0.00014	0.000053	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00053	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 03-002
D3-Site 002
Collected: 8/28/2018 ***Lab ID:*** *011807125-0014*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.00015	0.000032	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00032	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000032	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	0.00080	0.00065	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000032	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000032	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00032	mg/m^3	9/7/2018	KB	9/10/2018	JW

Client Sample Description 03-003
D3-Site 003
Collected: 8/28/2018 ***Lab ID:*** *011807125-0015*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	0.00018	0.000032	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00032	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000032	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	0.00070	0.00065	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000032	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	ND	0.000032	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00032	mg/m^3	9/7/2018	KB	9/7/2018	JW

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Analytical Results

Client Sample Description 03-004
D3-Site 004
Collected: 8/28/2018 ***Lab ID:*** *011807125-0016*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	0.0013	0.000056	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Barium	ND	0.00056	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Cadmium	ND	0.000056	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Chromium	ND	0.0011	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Lead	ND	0.000056	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Selenium	0.00014	0.000056	mg/m^3	9/7/2018	KB	9/7/2018	JW
7300 Modified	Silver	ND	0.00056	mg/m^3	9/7/2018	KB	9/7/2018	JW

Client Sample Description 03-005
D3-Site 005
Collected: 8/28/2018 ***Lab ID:*** *011807125-0017*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	ND	0.000034	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00034	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000034	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	ND	0.00068	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000034	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000034	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00034	mg/m^3	9/7/2018	KB	9/10/2018	JW

Client Sample Description 03-006
D3-Site 006
Collected: 8/28/2018 ***Lab ID:*** *011807125-0018*

Method	***Parameter***	***Result***	***RL***	***Units***	***Prep Date***	***Analyst***	***Analysis Date***	***Analyst***
METALS								
7300 Modified	Arsenic	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	ND	0.00075	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000038	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00038	mg/m^3	9/7/2018	KB	9/10/2018	JW

Attn: **Alex Mavrelis**
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

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Received: 09/06/18 9:30 AM

Project: **SXM Landfill**

Analytical Results

Client Sample Description 03-007
D3-Site 007
Collected: 8/28/2018 ***Lab ID:*** *011807125-0019*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000040	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00040	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000040	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	ND	0.00079	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000040	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000040	mg/m^3	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00040	mg/m^3	9/7/2018	KB	9/10/2018	JW

Client Sample Description FB001
Field Blank
Collected: 8/28/2018 ***Lab ID:*** *011807125-0020*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date*	*Analyst*	*Analysis Date*	*Analyst*
METALS								
7300 Modified	Arsenic	ND	0.000050	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Barium	ND	0.00050	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Cadmium	ND	0.000050	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Chromium	ND	0.0010	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Lead	ND	0.000050	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Selenium	ND	0.000050	mg/filter	9/7/2018	KB	9/10/2018	JW
7300 Modified	Silver	ND	0.00050	mg/filter	9/7/2018	KB	9/10/2018	JW

Definitions:

ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution

ATTACHMENT K

LABORATORY RESULTS, ASBESTOS FIBERS

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 /
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 041827066
Customer ID: EEG50
Customer PO:
Project ID:

Attention: Alex Mavrelis
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Project: SXM Landfill

Phone: (305) 374-8300
Fax: (305) 374-8301
Received Date: 09/06/2018 09:30 AM
Analysis Date: 09/11/2018 - 09/12/2018
Collected Date:

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	*Location*	*Volume (Liters)*	*Area Analyzed (mm^2)*	*Non Asb*	*Asbestos Type(s)*	*#Structures ≥0.5μ < 5μ*	*≥5μ*	*Analytical Sensitivity (S/cc)*	*Asbestos Concentration (S/mm^2)*	*(S/cc)*
01-001 *041827066-0001*	D1- Site 001	480.00	0.1290	0	None Detected	0	0	0.0062	<7.80	<0.0062
01-002 *041827066-0002*	D1- Site 002	220.00	0.1300	0	None Detected	0	0	0.0135	<7.70	<0.0130
01-003 *041827066-0003*	D1- Site 003	352.80	0.1300	0	None Detected	0	0	0.0084	<7.70	<0.0084
01-004 *041827066-0004*	D1- Site 004	356.00	0.1290	0	None Detected	0	0	0.0084	<7.80	<0.0084
01-005 *041827066-0005*	D1- Site 005	291.60	0.1300	0	None Detected	0	0	0.0102	<7.70	<0.0100
02-001 *041827066-0006* Sample muddy. Particulate loading greater than 10%.	D2- Site 001	306.80			Not Analyzed					N/A
02-002 *041827066-0007*	D2- Site 002	460.00	0.1300	0	None Detected	0	0	0.0064	<7.70	<0.0064
02-003 *041827066-0008*	D2- Site 003	387.60	0.1290	0	None Detected	0	0	0.0077	<7.80	<0.0077
02-004 *041827066-0009*	D2- Site 004	333.00	0.1290	0	None Detected	0	0	0.0090	<7.80	<0.0090
02-005 *041827066-0010*	D2- Site 005	346.50	0.1290	0	None Detected	0	0	0.0086	<7.80	<0.0086
02-006 *041827066-0011*	D2- Site 006	282.80	0.1290	0	None Detected	0	0	0.0106	<7.80	<0.0110
02-007 *041827066-0012*	D2- Site 007	474.00	0.1290	0	None Detected	0	0	0.0063	<7.80	<0.0063
03-001 *041827066-0013*	D3- Site 001	304.00	0.1290	0	None Detected	0	0	0.0098	<7.80	<0.0098
03-002 *041827066-0014*	D3- Site 002	247.00	0.1290	0	None Detected	0	0	0.0121	<7.80	<0.0120
03-003 *041827066-0015*	D3- Site 003	304.00	0.1300	0	None Detected	0	0	0.0097	<7.70	<0.0097
03-004 *041827066-0016*	D3- Site 004	285.00	0.1290	0	None Detected	0	0	0.0105	<7.80	<0.0100
03-005 *041827066-0017*	D3- Site 005	304.00	0.1300	0	None Detected	0	0	0.0097	<7.70	<0.0097
03-006 *041827066-0018*	D3- Site 006	457.60	0.1300	0	None Detected	0	0	0.0065	<7.70	<0.0065
03-007 *041827066-0019*	D3- Site 007	459.00	0.1290	0	None Detected	0	0	0.0065	<7.80	<0.0065

Initial report from: 09/12/2018 08:58 AM

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 /
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 041827066
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Attention: Alex Mavrelis
EE & G
5751 Miami Lakes Drive East
Miami Lakes, FL 33014

Project: SXM Landfill

Phone: (305) 374-8300
Fax: (305) 374-8301
Received Date: 09/06/2018 09:30 AM
Analysis Date: 09/11/2018 - 09/12/2018
Collected Date:

Test Report: Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM) Performed by EPA 40 CFR Part 763 Appendix A to Subpart E

Sample	*Location*	*Volume (Liters)*	*Area Analyzed (mm²)*	*Non Asb*	*Asbestos Type(s)*	*#Structures ≥0.5µ < 5µ*	*#Structures ≥5µ*	*Analytical Sensitivity (S/cc)*	*Asbestos Concentration (S/mm²)*	*Asbestos Concentration (S/cc)*

Analyst(s)

Garret Vliet (18)

Benjamin Ellis, Laboratory Manager
or other approved signatory

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NYS ELAP 10872, NJ DEP 03036, PA ID# 68-00367

Initial report from: 09/12/2018 08:58 AM

Annex E

GALLAGHER BASSETT | TECHNICAL SERVICES

DRAFT
BASELINE ENVIRONMENTAL SITE ASSESSMENT

OF

SALT POND ISLAND – “BLUE BOX” ZONE
ALONG SOUALIGA ROAD AND ADJACENT TO THE MUNICIPAL SOLID WASTE (MSW) LANDFILL AND IRMA DEBRIS SITE (IDS)
PHILIPSBURG, SINT MAARTEN

PREPARED FOR

SINT MAARTEN NATIONAL RECOVERY PROGRAM BUREAU
ATTN: MR. THIJN LAURENSSE, PROCUREMENT ADVISOR
WALTER NISBETH ROAD #57
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REPORT ISSUANCE DATE: JANUARY 13, 2020

PROJECT NO. 2019-3249

TABLE OF CONTENTS

SECTION 1.0 – INTRODUCTION 1

SECTION 2.0 - DISCUSSION OF CONTAMINANT COMPARISSON CRITERIA 3

SECTION 3.0 – BASELINE SURFICIAL SOIL ASSESSMENT 4

SECTION 4.0 - BASELINE SOIL VAPOR ASSESSMENT 13

SECTION 5.0 - BASELINE SURFACE WATER ASSESSMENT 17

SECTION 6.0 - QA/QC & LABORATORY VALIDATION DISCUSSION 20

SECTION 6.0 – CONCLUSIONS 23

SECTION 8.0 - ENVIRONMENTAL PROFESSIONAL STATEMENT 19

FIGURES

1 Site Location Map / World Map
2 “Blue Box” Zone & Pond Island Use Layout Map
3 Commercial vs Residential Use Layout Map
4 Sampling Locations Map
5 Background Sampling Locations and Results Map
6 Great Salt Pond Features and Surface Water Sampling Locations Map
7 Bathymetric Survey Map
8 Soil Sampling Results - TPHs
9 Soil Sampling Results – Arsenic
10 Soil Sampling Results – Other Metals
11 Soil Sampling Results – Dioxins / Furans
12 Vapor Sampling Results Map
13 Surface Water Results Map

TABLES

1 Sample Location Global Positioning System (GPS) coordinates
2 Soil Results – VOAs, TPHs and Metals
3 Soil Results – VOCs
4 Soil Results – Carcinogenic PAHs
5 Soil Results – Non-Carcinogenic PAHS
6 Soil Results – Pesticides and PCBs
7 Soil Results – Dioxins / Furans
8 Vapor Wells Results
9 Surface Water Field Data
10 Surface Water – Metals
11 Surface Water – Other Analyzed Parameters

APPENDICES

A Hazardous Substance & Waste Management Research, Inc. - *Focused Risk Evaluation*
B Laboratory Analytical Reports and Chain-of-Custody Forms
C Company Statement of Qualifications and Resumes

SECTION 1.0
INTRODUCTION

Gallagher Bassett Technical Services (GBTS), a division of Gallagher Bassett Services, Inc., has prepared this Baseline Environmental Site Assessment (ESA) to summarize the methodologies and findings of sampling activities within a designated mixed-use residential/commercial area adjoining a Municipal Solid Waste (MSW) landfill, referred to as the "Blue Box" Zone, and the surrounding Great Salt Pond (GSP). The objective of the assessment activities was to obtain an understanding of existing baseline surface soil, soil vapor and surface water conditions prior to the commencement of proposed Fire Suppression Activities on the MSW landfill and Irma Debris Disposal Site (IDDS). The scope contained herein consists of a baseline sampling regime that is intended to satisfy the conditions set forth in the Environmental Assessment (OB/BP 4.01) portion of the World Bank's Safeguard Policies

The assessment area was located within Sint Maarten, which is a constituent country of the Kingdom of the Netherlands located on an island in the Caribbean. The island's location within the Caribbean is presented as **Figure 1**. Dutch Sint Maarten comprises the southern half of the island while the French Collectivity of Saint Martin comprises the northern half. It is the most densely populated country in the Caribbean with a population of about 40,000. The island is a popular tourist destination known for its beaches and tropical weather. The islandis also a popular port for cruise ships. Tourism is the largest industry on the island, and the majority of the workforce relies on the tourism industry for employment. Philipsburg is the capital of Sint Maarten.

The Great Salt Pond is a 2.25 square kilometer saltwater pond historically used for salt production, which is located in south-central Sint Maarten and is bordered on all sides by downtown Philipsburg and its suburbs. It is the largest permanent saline lagoon saltwater pond on the island which serves as a natural water catchment basin for much of the runoff water from surrounding hills. It is unprotected, and the majority of its shorelines have been cleared of their native mangroves and grasses. The Great Salt Pond has been designated as a national monument based on its cultural and historical significance.in the central portion of Philpsburg.

The topography surrounding the MSW and IDDS is relatively flat. Stormwater flows from the MSW and IDDS directly to the Great Salt Pond or to drainage ditches that ultimately drain into the pond. The Great Salt Pond also receives sewage and stormwater runoff from surrounding neighborhoods and roadways. Water from the Great Salt Pond is periodically pumped into the Great Bay, which is located to the south.

A manmade island, named Pond Island, is located the east side of the Great Salt Pond, created sometime in the mid to late 1900s. The total area of Pond Island is approximately 48 hectares, and it is accessible via two bridges on the southern and northern ends of the island.

Pond Island has two waste disposal sites:

- The Irma Debris Disposal Site (IDDS), measuring approximately 3.8 hectares and located on a former community playfield, was utilized as a temporary storage area designated for debris from the hurricane.

- The Municipal Solid Waste (MSW) landfill, measuring approximately 14.9 hectares, is located immediately north and west of the IDDS & was designated for commercial and household waste; however hurricane debris was also deposited there.

The total area covered by the IDDS and MSW (collectively referred to as the "Landfill") was approximately 18.7 hectares. The remaining portions of Pond Island contain populated areas with residences, commercial businesses, government buildings, a university, primary roads, and a baseball field.

The Baseline ESA was conducted within an area has been referred to as the "Blue Box" Zone, which is developed with both residential structures and commercial facilities. The location of the "Blue Box" Zone and the layout & use of the remainder of the Salt Pond Island is presented as **Figure 2**. A map illustrating the residential versus commercial / industrial areas of the "Blue Box" Zone is presented as **Figure 3**. The "Blue Box" Zone measures approximately 25,000 m^2 and is located immediately adjacent and southeast of the MSW/IDDS.

The Baseline ESA assessed for the presence of potential contaminants of concern (COCs) within the "Blue Box" Zone that may be attributed to the ongoing landfill fires, historic landfilling activities (prior to development), along with ongoing and historical commercial/industrial activities apparently performed over the past 30+ years. The community within the "Blue Box" Zone appears to be at greatest potential risk from impacts related to the proposed Fire Suppression Activities at the MSW/IDDS; therefore, this Baseline ESA was intended to establish pre-suppression surficial soil, soil vapor, and surface water conditions.

SECTION 2.0
DISCUSSION OF CONTAMINANT COMPARISSON CRITERIA

According to the European Commission website, only a few European Union (EU) Member States have specific legislation on soil protection. Soil is not subject to a comprehensive and coherent set of rules in the EU. Existing EU policies in areas such as agriculture, water, waste, chemicals, and prevention of industrial pollution do indirectly contribute to the protection of soils. But as these policies have other aims and scope of action, they are not sufficient to ensure an adequate level of protection for all soils in Europe or commonwealth & territorial areas. The continued unsustainable use of soils was reported to be compromising the Union's domestic and international biodiversity and climate change objectives. For all these reasons, the Commission adopted a Soil Thematic Strategy (COM(2006) 231) on 22 September 2006 with the objective to protect soils across the EU. While the Commission in May 2014 decided to withdraw the proposal for a Soil Framework Directive, the Seventh Environment Action Programme, which entered into force on 17 January 2014, recognizes that soil degradation is a serious challenge. It provides that by 2020, the land is to be managed sustainably in the Union, the soil is to be adequately protected, and the remediation of contaminated sites conducted as warranted for use or re-use.

According to the United States Environmental Protection Agency (EPA) website, soil contamination in Europe is a widespread problem of varying intensity and significance. Cleaning up all historically-contaminated sites, commonly of industrial origin, to background concentrations or levels suitable to all uses often is not viewed as technically or economically feasible. As a result, clean-up strategies increasingly are designed to employ sustainable, long-term solutions, often using a risk-based approach to land management aimed at achieving "fitness for use" appropriate to the location.

Soil analytical results were compared to the Dutch Soil Remediation Circular 2009 which has established target values (D-TV) and intervention values (D-IV) for a limited number of compounds, along with Maximum Permissible Risk (MPR) values. In lieu of a defined set of cleanup criteria or any previously established Risk-Based Criteria (RBCs) for the EU or the Netherlands, the island of St. Maarten and/or the “Blue Box” Zone, GBTS has also included a comparison of soil cleanup criteria established by the Florida Department of Environmental Protection (FDEP) and the United States Environmental Protection Agency (USEPA). These criteria included the FDEP’s *Contaminant Cleanup Target Levels*, per Chapter 62-777, Florida Administrative Code (FAC), which regulates Soil Cleanup Target Levels (SCTLs) for *residential-use direct exposure* (SCTL-R), *commercial-use direct exposure* (SCTL-C) and *leachability* (SCTL-L) concerns. The comparison criterion also included the USEPAs Regional Site Screening Levels (SSLs) established for residential (SSL-R) and commercial (SSL-C) use.

The surface water analytical results were compared to the Maximum Allowable Concentrations (MACs) for pollutants regulated under the European Union's Environmental Quality Standards for Priority Substances under Annex I of Directive 2008/105/EC. The pollutant list within Annex I was considered limited; therefore, GBTS also compared the results to the FDEP’s Freshwater/Marine Surface Water Cleanup Target Level criteria (FWSWCTL/MSWCTL). This FDEP criterion was selected as the surface water within the Great Salt Pond would not be considered a potable source for drinking purposes.

An independent evaluation of soil quality comparison criteria was obtained from a renowned toxicologist, Dr. Chris Teaf, Ph.D., which is presented in **Appendix A**.

SECTION 3.0
BASELINE SURFICIAL SOIL ASSESSMENT

3.1 SURFICIAL SOIL ASSESSMENT METHODOLOGY

GBTS collected 40 surficial soil samples from within the "Blue Box" Zone which were designated SB-1 through SB-40. A map illustrating the soil boring locations is presented as **Figure 4**. The Global Positioning System (GPS) coordinates for the samples is provided as **Table 1**. Soil borings SB-1 thru SB-21 were located within the residential areas of the "Blue Box" Zone, while soil borings SB-22 thru SB-40 were located within the commercial/industrial areas. Two background soil samples also were collected from outside the "Blue Box" Zone and they were designated Background SB-41 and Background SB-42. These samples were collected eastern adjacent to the St. Maarten government center at the southern portion of the Salt Pond Island. A map illustrating the background soil sample locations is presented as **Figure 5**.

The soil samples were collected utilizing a stainless-steel handauger which was cleaned and decontaminated with Liquinox-brand soap & water between boring locations. The soil samples were collected from the surficial 0 to 6-inches below land surface (BLS) interval. The soils from each boring were individually homogenized within a stainless-steel bowl prior to placement within sample jars. Samples were collected from the yards of residences, playgrounds or other similar areas where children may play, along within industrial areas affected by historical commercial activities involving petroleum hydrocarbons, sanding/grinding/welding, vehicle maintenance, dumping, recycling material storage, etc.

The soil samples were laboratory analyzed for the following parameters:

- All 42 Soil Samples:
  - Total Arsenic, Barium, Cobalt, Copper, Iron, Lead, Nickel and Zinc by EPA Method 6010
  - Volatile Organic Compounds (VOCs) by EPA Method 8260
  - Polynuclear Aromatic Hydrocarbons (PAHs) by EPA Method 8270
  - Total Petroleum Hydrocarbons (TPHs) by Method FL-PRO
  - Polychlorinated Biphenyls (PCBs) by EPA Method 8082

- 16 Soil Samples also were analyzed for:
  - Total Cadmium, Chromium, Mercury, Selenium and Silver by EPA Methods 6010 and 7471

- 16 Soil Samples also were analyzed for:
  - Organochlorine Pesticides by EPA Method 8081
  - Organophosphorus Pesticides by EPA Method 8141
  - Chlorinated Herbicides by EPA Method 8151

- 14 Soil Samples also were analyzed for:
  - Dioxins/Furans by EPA Method 8290

3.2 SURFICIAL SOIL ASSESSMENT FINDINGS

Surficial Soil – Field Observations

- Field reconnaissance identified many areas throughout the "Blue Box" Zone where there had been dumping or general storage of vehicles, heavy equipment, "white goods" (i.e. air conditioners, refrigerators), drums, used tires, trash, metal & wood products, industrial drums, etc.

- Stained surface soils were noted in many areas across the "Blue Box" Zone, particularly near areas of dumped industrial items or materials which were stored for future recycling.

Surficial Soil - Analytical Results

A copy of the soil laboratory results and sample chain of custody is provided within **Appendix B**. As discussed in Section 2.0, these results were compared to USEPA, FDEP and Dutch Standard criterion, as no established soil cleanup criteria was published for the entire EU. The following tables have been prepared summarizing the soil analytical results: **Table 2 – VOAs, TPHs and Heavy Metals, Table 3 – Other VOCs, Table 4 – Carcinogenic PAHs, Table 5 – Non-Carcinogenic PAHs, Table 6 - Pesticides, Herbicides & PCBs, Table 7 - Dioxins / Furans**. The soil analytical results have been summarized in below:

- **Total Petroleum Hydrocarbons (TPHs)**: TPHs is a general measurement of the aromatic and aliphatic hydrocarbon components of a sample, which are indicative of a wide-range of petroleum-containing compounds primarily associated with gasoline, diesel fuel and motor oils. Several of the analyzed soil samples contained detectable concentrations of TPHs above the laboratory method reporting limits (MRLs). Soil samples with TPHs detected above the MRLs were identified at concentrations ranging from 88.7 milligrams per kilogram (mg/Kg) to 9,170 mg/Kg. Please note the EPA does not regulate or have comparison criteria for TPHs as a total value and instead subdivides the results into oil, gas and diesel ranges, which was not conducted as part of this assessment. Of the detected TPH results, the following samples exhibited elevated values above FDEPs criteria.

  - SB-11: 3,300 mg/Kg
  - SB-22: 3,210 mg/Kg
  - SB-27: 525 mg/Kg
  - SB-31: 9,170 mg/Kg
  - SB-32: 638 mg/Kg
  - SB-38: 349 mg/Kg
  - SB-42 Background: 1,230 mg/Kg

  The seven above results exceeded the FDEPs 340 mg/Kg SCTL-L. The results from SB-11, SB-22, SB-27, SB-31, SB-32 and SB-42 Background also exceeded the 460 mg/Kg SCTL-R. Results from SB-11, SB-22 and SB-31 exceeded the 2,700 mg/g SCTL-C. A map illustrating the TPH results which exceeded the comparison criteria is presented as **Figure 8**. Although one sample (SB-11) from a residential area contained a value in excess of the SCTL-C, the pattern of TPH distribution with values in excess of the SCTL-C appeared to be in the commercial areas of the "Blue Box" Zone.

- **Heavy metals:** Heavy metals including arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, silver and zinc were detected in one or more soil samples at concentrations above their respective laboratory MRLs. Of these detected metals, the following were noted at concentrations above the FDEP SCTLs, USEPA SSLs and/or Dutch D-TV & D-IV comparison criteria:

  - **Arsenic:** Total arsenic was detected in all analyzed samples above its MRLs. The concentrations ranged from 1.0 mg/Kg to 12.1 mg/Kg. Of the 40 samples collected from within the "Blue Box" zone, 32 of the samples contained total arsenic above the FDEP's 2.1 mg/Kg SCTL-R. Of these 32 samples with elevated readings of total arsenic, only one sample (SB-1 at 12.1 mg/Kg) contained a value above the FDEP's 12.0 mg/Kg SCTL-C. The detected arsenic concentrations did not exceed the 29 mg/Kg D-TV or 55 mg/L D-IV.

    The USEPA SSLs for arsenic are much more conservative than the FDEPs. This has, in part, to do with difference in regional background levels, with Florida containing in general a higher background level than other areas of the USA. The USEPA SSL-R is 0.68 mg/Kg and the SSL-C is 3.0 mg/Kg. Based on this criterion, all 42 samples exceeded the SSL-R and 31 samples exceeded the SSL-C.

    Arsenic was detected throughout the "Blue Box" Zone, with a slight pattern of higher values being located within the residential area adjacent to the MSW/IDS. Background samples SB-41 and SB-42 also contained detectable concentrations of total arsenic consistent with those identified within the "Blue Box" Zone. A map illustrating the arsenic results within the "Blue Box" Zone is presented as **Figure 9**. Results of the background samples are provided in **Figure 5**.

  - **Barium:** Total barium was detected in all analyzed samples above its MRLs. The concentrations ranged from 13.5 mg/Kg to 142 mg/Kg. Of the 40 samples collected from within the "Blue Box" zone, four of the samples contained total barium above the FDEP's 120 mg/Kg SCTL-R (SB-1, SB-13, SB-26 and SB-36). None of the barium concentrations exceeded the FDEP's 130,000 mg/Kg SCTL-C. The total barium results did not exceed the USEPA SSLs. The detected barium concentrations did not exceed the 160 mg/Kg D-TV or 265 mg/L D-IV. A map illustrating the barium results (and other heavy metals noted below) which exceeded the comparison criteria is presented as **Figure 10**.

  - **Cadmium:** Only one of the 16 soil samples contained total cadminum above the comparrion criteria. Soil sample SB-1 contained 106 mg/Kg of total cadmium, which exceeded the FDEP's 7.5 mg/Kg SCTL-L and 82 mg/Kg SCTL-R, and the USEPA's 71 mg/Kg SSL-R. The detected values of cadmium in SB-1, SB-2, SB-8 and SB-18 also exceeded the 0.8 mg/Kg D-TV, and the result from SB-1 also exceeded the 12 mg/Kg D-IV. Cadmium was detected in the other analyzed soil samples, but the values were below the comparison criteria.

- **Chromium:** Soil sample SB-1 contained a value of chromium at 127 mg/Kg which exceeded its 38 mg/Kg SCTL-L. The value of chromium in SB-1 did not exceed the 120 mg/Kg SCTL-R or 470 mg/Kg SCTL-C. This value of chromium in SB-1 also exceeded the 100 mg/Kg D-TV, but was below the 380 mg/Kg D-IV. Total chromium was detected in the other analyzed soil samples, but the values were below the comparison criteria. Please note the EPA does not regulate or have comparison criteria for total chromium and instead utilizes hexavalent chromium, which was not conducted as part of this assessment.

- **Cobalt:** Total cobalt was detected in all analyzed samples above its MRLs. The concentrations ranged from 3.4 mg/Kg to 17.1 mg/Kg. None of the samples contained total cobalt above the 1,700 mg/Kg SCTL-R or 23 mg/Kg SSL-R. Samples SB-6, SB-14, SB-15 and SB-42 Background contained total cobalt above the 9 mg/Kg D-TV, but below the 240 mg/Kg D-IV.

- **Copper:** Total copper was detected in all analyzed samples above its MRLs at concentrations ranging from 36.0 mg/Kg to 32,900 mg/Kg. None of the detected values of total copper were in excess of the 89,000 mg/Kg SCTL-R or 47,000 mg/Kg SSL-R. However, all analyzed soil samples contained total copper above the 36 mg/Kg D-TV. In addition, approximately 60% of the samples contained total copper above the 150 mg/Kg SCTL-C and 40% exceeded the 190 mg/Kg D-IV. Further, three samples (SB-18 @ 32,900 mg/Kg, SB-21 @ 7,620 mg/Kg and SB-31 @ 5,440 mg/Kg) contained total copper above the 3,100 mg/Kg SSL-R.

- **Iron:** Total iron was detected in sample SB-5 at 89,700 mg/Kg, which exceeded the 53,000 mg/Kg SCTL-R and 55,000 mg/Kg SSL-R. This concentration did not exceed the 820,000 mg/Kg SSL-C. Total iron was detected in the other analyzed soil samples, but the values were below the comparison criteria.

- **Lead:** Total lead was detected in all analyzed samples above its MRLs at concentrations ranging from 2.9 mg/Kg to 2,670 mg/Kg. Samples SB-5 (539 mg/Kg) and SB-11 (2,670 mg/Kg) contained concentrations of total lead that exceeded the 400 mg/Kg SCTL-R and SSL-R. The concentration in sample SB-11 also exceeded the 1,400 mg/Kg SCTL-C and 800 mg/Kg SSL-C. Thirteen of the 42 samples contained total lead above the 85 mg/Kg D-TV, while samples SB-5 and SB-11 both exceeded the 530 mg/Kg D-IV. The other detected values of total lead were below the comparison criteria.

- **Zinc:** Total zinc was detected in all analyzed samples above its MRLs at concentrations ranging from 23.9 mg/Kg to 4,590 mg/Kg. None of the detected total zinc concentrations exceeded its FDEP SCTLs or EPA SSLs. However, 23 of the 42 samples contained zinc above its 140 mg/L D-TV. Of these 23 samples results, three samples (SB-1 @ 1,410 mg/Kg, SB-11 @ 776 mg/Kg and SB-25 @ 4,590 mg/Kg) contained total zinc above its 720 mg/Kg D-IV. The other detected total zinc concentrations did not exceed its comparison criteria.

- **Volatile Organic Aromatics (VOAs):** VOA compounds commonly associated with gasoline (benzene, toluene, ethylbenzene and xylenes (BTEX)) were not identified in the soil samples above the laboratory method detection limits (MDLs) or comparison criteria.

- **Other VOCs:** No VOCs were detected in the soil samples above their laboratory MDLs or MRLs with the exception of methylene chloride. Methylene chloride was detected in samples SB-1 (0.030 mg/Kg), SB-19 (0.028 mg/Kg) and SB-20 (0.020 mg/Kg). These detections only slightly exceeded the 0.02 mg/Kg SCTL-L, but were well below the other FDEP and EPA comparison criteria.

- **PAHs:** Neither carcinogenic nor non-carcinogenic PAHs were detected above their FDEP and EPA comparison criteria. The results also did not exceed the Dutch total PAHs criterion of 40 mg/kg. The majority of the PAH results were noted to be below the laboratory MDLs, with the exception of SB-29 and SB-32. These samples were collected in the commercial area of the "Blue Box" Zone (near the Soualiga Road) and contained low concentrations of PAHs well below the comparison criteria.

- **PCBs:** PCB-1260 was detected at 0.71 mg/Kg in sample SB-1. This value exceeded the 0.5 mg/Kg SCTL-R and 0.24 mg/Kg SSL-R, but was below the 17 mg/Kg SCTL-L, 2.6 mg/Kg SCTL-R and 0.99 mg/Kg SSL-C. Other samples analyzed for PCBs did not exhibit concentrations above the laboratory MDLs or FDEP and EPA comparison criteria.

- **Chlorinated Pesticides and Herbicides:** Neither chlorinated pesticides nor herbicides were detected above their FDEP and EPA comparison criteria with the exception of dieldrin (a pesticide). Dieldrin was detected in sample SB-2 at 0.0043 mg/Kg, which slightly exceeds its 0.002 mg/Kg SCTL-L, but was below the other FDEP and EPA comparison criteria.

- **Dioxins / Furans:** Dioxins / furans were analyzed for in 16 soil samples, all of which contained detectable concentrations of one or more of these compounds above the laboratory MRLs. The following soil samples contained dioxin / furan results above the FDEPs SCTL-R of 7 nanograms per kilogram (ng/Kg).

  - SB-1 at 15.94 ng/Kg
  - SB-4 at 9.24 ng/Kg
  - SB-18 at 31.40 ng/Kg
  - SB-26 at 30.34 ng/Kg
  - SB-29 at 11.10 ng/Kg
  - SB-32 at 12.22 ng/Kg
  - SB-33 at 19.5 ng/Kg

  The detected values of dioxins / furans within samples SB-18 and SB-26 also exceeded the FDEP's 30 ng/Kg SCTL-C. The Dutch Soil Remediation Circular 2009 established a maximum permissible risk (MPR) for human exposure to dioxin. The sum TEQ MPR was established at 1.8 ng/Kg. Given this comparison criteria, 12 of the 16 samples exceeded the Dutch MPR. A map illustrating the dioxins / furan results is presented as **Figure 11**.

Discussion of Surficial Soil Sampling Results

GBTS retained Mr. Christopher M. Teaf, Ph.D, a renowned toxicologist and the President & Director of Toxicology of Hazardous Substance & Waste Management Research, Inc. (HSWMR), to conduct a focused risk evaluation of the health concerns for select heavy metals and dioxins/furans detected in the soil samples collected as part of this assessment. The full HSWMR report is provided as **Appendix B**. The following is a summary of HSWMRs conclusion and recommendations:

- HWSMR indicated that the detected compounds of interest were the heavy metals including arsenic copper and lead, as well as the PAHs, TPHs and the dioxin/furan compounds.

- Although some of the total arsenic levels exceed conservative international default risk-based guidelines for residential soils (EPA SSL and the FDEPs SCTL), they do not approach other available health-protective guidelines for unrestricted use (Dutch IV of 76 mg/kg). It was further noted that the arsenic concentrations reported for the background samples (SB-41 and SB-42) are consistent with the “Blue Box” Zone sample results. HSWMR noted that it is widely acknowledged that many soil types, including those derived from marine sediments contain naturally elevated arsenic values. HSWMR concluded that the reported detections of arsenic in surface soils at the “Blue Box” Zone do not represent a significant exposure concern for residential or commercial/industrial use.

- Total copper concentrations were less than available commercial/industrial guidelines (EPA Industrial SSL) in all samples. The two background sample results both were less than 100 mg/kg. The pattern of detection (results generally greater in residential area closest to the dump) and consistent elevated concentrations compared to background results, suggest that copper impacts, particularly in the residential area of the “Blue Box” Zone, may be related to activities at the adjacent MSW/IDS. HSWMR concluded that the reported detections of copper in surface soils in the “Blue Box” Zone do not represent a major exposure concern for commercial/industrial use. Further, additional risk evaluation (e.g., residence type and location, receptor activity) may be appropriate for determining risk from copper in the residential area of the “Blue Box” Zone, although no imminent, widespread risk appeared to be evident.

- Total lead was noted in two samples (SB-5 and SB-11) collected from the residential area of the “Blue Box” Zone which were greater than default residential guidelines (EPA, FDEP and Dutch TV), with only one of the samples exceeding commercial guidelines (FDEP commercial SCTL). Both of the background sample results were less than 20 mg/kg. As with copper results, the pattern of distribution of results generally greater in residential area closest to the MSW/IDS and being consistently elevated concentrations compared to background results, the results suggest that lead impacts, particularly in the residential area, may be related to activities at the adjacent MSW/IDS. HSWMR concluded that the reported detections of lead in surface soils at the “Blue Box” Zone do not represent a pervasive exposure concern for residential or commercial/industrial use. However, two identified locations may warrant additional investigation or risk management depending on actual exposure circumstances in the areas.

- With the exception of results for soil sample SB-32, essentially all of the PAH results that were not below detectable limits were low levels located between the laboratory MDLs and MRLs.

According to the laboratory report, the laboratory flagged indicates that the result exhibited "interference present". But even those flagged results were well below default guidelines (EPA residential and commercial SSLs). The results for sample SB-32, which is in the commercial area of the "Blue Box" Zone and was immediately adjacent to a major roadway (Soualiga Road), they also were notably less than guidelines of interest (e.g., Dutch total PAHs criterion of 40 mg/kg). It is broadly understood that PAHs are ubiquitously present in urban soils ranging from 1 to tens of mg/kg (ATSDR, 1995; Teaf et al, 2008), due to vehicular traffic, backyard burning, and industrial activity. Thus, it is not surprising that low level PAHs are present in the soils throughout the "Blue Box" Zone, and they do not represent a major health risk. HSWMR concluded that the reported detections of PAHs in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use.

- TPHs (petroleum range organics) typically represent a generalized preliminary screening tool to determine if additional more detailed analysis is recommended for classes of substances such as VOCs, PAHs and PCBs. Although TPH results for several samples exceeded conservative default FDEP screening levels, no significant levels of VOCs, PCBs or PAHs were detected in the samples. For example, the maximum TPH concentration was reported in commercial location sample SB-31 at 9,170 mg/kg (which exceeded the FDEP commercial SCTL of 2,700 mg/kg). All of the VOC and PCB results for that sample were BDL and all but one of the PAHs also was BDL. The one PAH was reported at a low concentration between the laboratory MDL and MRL. Thus, HSWMR concluded that the reported TPH detections likely represent weathered, high molecular weight, low toxicity hydrocarbons that pose limited health concern. Further, the reported detections of TPH in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use.

- Seven residential and seven commercial locations within the "Blue Box" Zone and two background locations were selected for analysis of dioxins/furans. As with PAHs, arsenic, and to a certain extent TPH parameters, the dioxins/furans often are widely distributed and a component of natural background soil levels. As such, the two background locations exhibited detectable levels of dioxins/furans. Five of the seven residential samples exceeded the EPA residential guideline, and three of the seven residential samples exceeded the FDEPs guideline. None of the results exceeded the Dutch Intervention Value, but it is noted that the Dutch value is based on protection at a target cancer risk of 1 in 10,000, as compared to the 1 in 1,000,000 target risk which forms the basis for the EPA and FDEP guidelines. The Dutch value recalculated at a 1 in 1,000,000 risk target would be 1.8 ng/Kg, which is in the same magnitude as the EPA and FDEP guidelines. The default Dutch guideline, while less protective than the EPA and FDEP default screening guidelines, is consistent with the acceptable cancer risk range utilized by the EPA when they develop remedial goals (1 in 10,000 to 1 in 1,000,000), even for unrestricted residential-use purposes. HSWMR concluded that the reported dioxins/furans in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use. This conclusion for residential areas is based on application of the Dutch cancer risk target and the EPA target risk range.

SECTION 4.0
BASELINE SOIL VAPOR ASSESSMENT

4.1 SOIL VAPOR ASSESSMENT METHODOLOGY

GBTS conducted a limited soil vapor assessment within the “Blue Box” Zone to evaluate for the presence of landfill-types gases (such as methane, hydrogen sulfide, etc.) and/or volatile compounds, which may be migrating from the MSW/IDDS or have originated from the historic landfilling or ongoing commercial/industrial operations.

GBTS installed seven vapor well points inside the “Blue Box” Zone (designated VP-1 thru VP-7), and additional two vapor wells outside the zone (designated VP-East and VP-SW). A map illustrating the vapor well locations is presented as **Figure 4**. The GPS coordinates for the vapor wells is provided as **Table 1**. The wells were installed using a stainless steel handauger to a depth of refusal. The vapor well points were constructed of 1.5-inch diameter PVC, which included 2 to 3-feet of slotted screen (located below grade) and sufficient solid PVC riser to extend above the surface. The top of the vapor well was finished with a PVC cap and valve for attaching field instruments.

Following a minimum 24-hour equilibration & stabilization period, GBTS conducted two field-screening events of the vapor well points. The first event was a screening conducted following the initial opening of the vapor port. The second screening event was following the elapse of a 10-minute venting period.

The vapor screening included measurements with a 4-gas meter that detected hydrogen sulfide (HS), oxygen levels, carbon monoxide (CO), and combustible gas (methane) as a percentage of the Lower Explosive Limit (LEL). The vapor points also were field-screened for indications of volatile compounds utilizing a Photo Ionization Detector (PID).

4.2 SOIL VAPOR ASSESSMENT FINDINGS

A summary of the vapor screening results are summarized in **Table 8** and illustrated in **Figure 12**. The following is a summary of those findings:

- During the field PID screening events, no organic vapors (which may be indicative of VOCs) were detected above the instrument’s 1 part per million (ppm) detection limit.

- Oxygen was detected in a range from 18.4% to 20.9%, which was generally within the typical 18.5% to 23.5% range for breathing space.

- Carbon monoxide (CO) was noted in 6 of the 9 screened vapor samples at concentrations ranging from 1-ppm to 4-ppm.

- H2S was not detected.

- Methane readings were below the LEL.

SECTION 5.0
BASELINE SURFACE WATER ASSESSMENT

5.1 SURFACE WATER ASSESSMENT METHODOLOGY

Prior to the initiation of baseline surface water sampling activities, a site reconnaissance & bathymetric survey was performed to determine the morphological features of the pond including: depths, general submarine topography, and inflow/outflow locations as well as storm water outfall areas from Pond Island and surrounding areas. The site reconnaissance and bathymetric surveys were conducted by GBTS, along with members of the University of South Florida Water Institute. The information obtained during the site reconnaissance was utilized to confirm and/or modify the proposed surface water sampling plan to ensure collection of representative surface water samples. A map illustrating the location outfalls, pump house, etc. is provided as **Figure 6**.

The bottom of the GSP was mapped at select intervals using a Lowrance LCX 28C Wide Area Augmentation System (WAAS) enabled with Global Positioning System (GPS) with a fathometer (bottom sounder) or equivalent to determine the boat's position and bottom depth in a single measurement. To generate the data required to create the bathymetric map, a sufficient number of transects were run in both north-south and east-west orientations to ensure reasonably adequate coverage. The data collected was utilized to create a bottom contour map that assessed the pond's area, depth, and volume. Data generated via the Lowrance LCX 28C chart-plotter was placed into a Microsoft Excel file with X, Y, Z (latitude, longitude, depth) data fields, which were them integrated into an ArcGIS mapping application for the creation of a bathymetric contour map. A map illustrating the bathymetric survey results is provided as **Figure 7**.

A map illustrating the surface water sample locations is provided as **Figure 6**. The GPS coordinates for the samples is provided as **Table 1**. In order to establish baseline surface water quality conditions within the Great Salt Pond prior to the initiation of fire suppression activities, GBTS collected the following surface water samples:

- A total of 13 shallow-interval surface water samples were collected from eight discrete sampling locations (GSP-1 through GSP-8).

- Five additional deeper-interval surface water samples also were collected from discrete locations (GSP-1D, GSP-2D, GSP-4D, GSP-5D and GSP-6D).

- The samples were located both close to the landfill and near stormwater outfall areas.

- At sampling locations, measurements of field parameters and representative water samples were collected from the surface (top 18-inches) and the bottom (bottom 18-inches) of the water column.

- Sampling locations also were located in more distal background locations, aimed at characterizing the water quality conditions throughout the GSP and away from known storm water/drainage outfall areas.

The depth of the water column was measured with a weighted tape and recorded. Field parameters including: temperature, dissolved oxygen (DO), pH (as Standard Units), and conductivity (micro Siemens, ug/S) were collected with a calibrated water quality probe. The salinity also was measured using a hydrometer. Turbidity was measured with a nephelometer. Field parameters were measured in separate containers than those used for the collection of samples for laboratory analysis. Field probes were submerged in containers containing samples to be analyzed at the laboratory.

A discrete depth sampler was utilized to collect the surface water samples at depth. A discrete depth sampler consists of a plastic cylinder with rubber stoppers that leave the ends of the sampler open while it's being lowered into the water column. Once the sampler reached the intended depth, a metallic messenger was sent down a rope which caused the cylinder to close and which then allowed for the collection at the desired depth.

Surface water samples were analyzed for the following parameters:

- Total and Dissolved Target Analyte List (TAL) Metals: Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium and Zinc by EPA Methods 6010, 6020 and 7470
- Volatile Organic Compounds (VOCs) by EPA Method 8260
- Polycyclic Aromatic Hydrocarbons (PAHs) by EPA Method 8270
- Chlorinated Pesticides by EPA Method 8081
- Chlorinated Herbicides by EPA Method 8151
- Ammonia (as Nitrogen) by EPA Method 350.1
- Nitrite (NO2) and Nitrate (NO3) by EPA Method 353.2
- Chloride, Fluoride and Sulfate by EPA Method 300.0
- Chemical Oxygen Demand (COD) by EPA Method 410.4
- Total Dissolved Solids (TDS) by EPA Method 2540C
- Perfluoroalkyl Substances (PFOAS) by EPA Method 537.1

5.2 SURFACE WATER ASSESSMENT FINDINGS

A copy of the surface water laboratory results and sample chain of custody is provided within **Appendix B**. As discussed in Section 2.0, these results were compared to USEPA, FDEP and Dutch Standard criterion, as no established soil cleanup criteria was published for the entire EU. Due to a lack a comparison criteria, GBTS included the State of Florida FDEP criteria for both Fresh Water and Marine Water Surface Water Cleanup Levels (FW/MWCTL) The following tables have been prepared summarizing the soil analytical results: **Table 9 – Field Parameters, Table 10 – Heavy Metals, Table 11 - Other Lab Parameters**. The following is a summary of the surface water assessment findings:

- The general appearance of the surface water within the Great Salt Pond was noted to be a bright green with noticeable levels of suspended algae / chlorophyll within the water column. GBTS did note the presence of dead fish floating within different areas of the pond.

- The following is a summary of the field measurements. The field parameter readings are summarized in **Table 9**.

  - The pH values ranged from 8.16 Standard Units (SU) to 9.16 SU.

  - Turbidity readings ranged from 45.2 Nephelometric Turbidity Units (NTU) to 85.0 NTUs. Higher readings were generally noted at 1 m below surface.

  - Dissolved oxygen readings varied at depth intervals. The surface water readings (0.1 m) ranged from 102.1 % saturation to 320.5 %. The deeper interval readings (1 m) ranged from 34.9 % to 335.3%.

  - Conductivity readings were generally high due to the effect of the brackish / salt water and ranged from 9,025 micro Siemens per centimeter (µS/cm) to 14,346 µS/cm.

- Total aluminum was detected in the 13 surface water samples at concentrations ranging from 110 micrograms per liter (ug/L) and 1,140 ug/L. All of the total aluminum results exceeded the 13 ug/L FWSWCTL and the 1.5 ug/L MWSCTL. The dissolved aluminum readings were reported by the lab at a concentration below the MDLs; however, the detection limit was noted at 30.7 ug/L, which exceeded the FW/MWSCTL.

- Total copper was noted in surface water samples GSP-1D (6.0 ug/L) and GSP-5D (3.7 ug/L), which exceeded the 3.7 ug/L FWSWCTL and 0.3 ug/L MWSCTL. Dissolved copper was not exhibited in the 13 samples above either the lab MDL or FW/MSWCTL.

- Total iron was noted in all 13 surface water samples at concentrations ranging from 182 ug/L to 1,300 ug/L. These total concentrations exceeded the 0.3 ug/L FWSWCTL. Dissolved iron was only detected in one sample above the FWSWCTL which was in GSP-4D at 46.8 ug/L. The other analyzed samples did not exhibit dissolved iron above the laboratory MRLs; however, the laboratory MRLs and MDLs were both at values above the FW/MWCTL.

- Other analyzed total and/or dissolved metals including arsenic, antimony, barium, calcium, magnesium, manganese, potassium, sodium, and vanadium were detected in one or more samples above their respective laboratory MRLs; however, not comparison criteria was available for these metals. It should be noted that the concentrations ranges detected for each of these metals was fairly consistent, suggesting that these are likely to be naturally-occurring background levels.

- Neither the chlorinated pesticides, chlorinated herbicides nor the VOCs were detected above their respective laboratory MRLs or applicable FW/MSWCTL.

- PAHs were not detected above their respective laboratory MRLs in the analyzed surface water samples with the exception of GSP-4D. The sample GSP-4D contained detectable concentrations of the 18 PAH compounds above the laboratory MRLs. The detected concentrations of anthracene (2.2 ug/L) and benzo(a)pyrene (2.3 ug/L) were exhibited above their 0.4 ug/L and 0.1 ug/L MACs, but were both below their FW/MSWCTL. Fluoranthene was detected at 2.3 ug/L, which exceeded its 1 ug/L MAC and 0.370 ug/L FW/MSWCTL. The other detected PAHs in GSP-4D did not exceed the comparison criteria.

- Total dissolved solids (TDS) were detected in the 13 samples at concentrations ranging from 5,520 milligrams per liter (mg/L) to 9,640 mg/L. All 13 samples exceeded the 500 mg/L FWSWCTL. The presence of high TDS values was likely due to the high turbidity associated with the presence of salt in the water and large amounts of algae in the samples.

- Chloride and fluoride was detected above the laboratory MRLs in all 13 surface water samples. The concentrations of chloride ranged from 2,450 mg/L to 4,200 mg/L. All 13 samples exceeded the 250 mg/L FWSWCTL. Fluoride was detected at concentrations which ranged from 0.77 mg/L to 2.1 mg/L. None of the detected concentrations of fluoride exceeded its 5 mg/L.

- Nitrogen (as N) was detected above the laboratory MRLs in all 13 surface water samples at concentrations which ranged from 0.47 mg/L to 2.0 mg/L. None of the detected concentrations exceeded the 2.1 mg/L FWSWCTL.

Detectable concentrations of sulfate, nitrate/nitrite and chemical oxygen demand (COD) were detected above the laboratory MRLs in most of the 13 surface water samples. No comparison criterion was available for these parameters.

SECTION 6.0
QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) & LABORATORY VALIDATION DISCUSSION

The following is a discussion of the project's limitations, the QA/QC of the sample collection & shipping procedures, and the quality and validation of the laboratory analytical data.

- During the sampling event the lithology included large rocks as well as significant debris used to in-fill and create Pond Island. Therefore, the lithology was not considered to be homogeneous, and analytical results may not necessarily be representative of the entire assessment area. Furthermore, logistical challenges were encountered during the collection of samples, including access to parcels, limitations due to concrete, storage, and surface debris obstacles. The data is considered to be a general representation of the conditions within the "Blue Box" Zone and Great Salt Pond.

- The QA/QC of the field sampling event was conducted in accordance with the Sampling Plan and the FDEPs Standard Operating Procedures (SOPs) per Chapter 62-160, FAC. Sampling equipment was properly decontaminated between locations. Dedicated latex gloves also were used between each sampling point.

- Soil and surface water samples were collected into laboratory-supplied containers with appropriate preservatives (when applicable). The containers were labeled, placed on ice, and delivered via international courier (Amerijet) to Pace Analytical Services, Inc. in Pompano Beach, Florida USA, a National Environmental Laboratory Accreditation Conference (NELAC)-certified laboratory. Samples were placed under appropriate chain-of-custody upon collection which includes unique sample IDs, collection date and time, container size and material, preservatives, and requested analyses. Appropriate chain-of-custody documentation accompanied the samples from field collection through laboratory delivery. A Custody Seal was placed on the coolers and the lab was instructed to make note if the Custody Seal was intact upon receipt. A temperature blank was shipped with the samples to ensure that samples were kept below 4 degrees Celsius.

- Due to overnight shipping & courier conditions associated with the international island location, sample shipment back into the USA was delayed by the courier. This delay resulted in a select number of samples arriving at the laboratory in Pompano Beach, FL in a condition which was outside the sample's hold-time and/or temperature guidelines. The following is a summary of the samples which were out-of-hold (OOH) or out-of-temperature (OOT) guidelines:

  <u>Surface Water – Collection Date Oct 16, 2019</u>
  Total Dissolved Solids (TDS) - OOH
  Polycyclic Aromatic Hydrocarbons (PAHs) - OOH
  Pesticides - OOH
  Herbicides – OOH
  GSP-1, GSP-1D, GSP-2, GSP-2D, GSP-5, GSP-5D - OOT

Surface Water – Collection Date Oct 17, 2019
GSP-3, GSP-4D and GSP-7 - OOT

Soils – Collection Date Oct 17, 2019
VOCs – OOH (and not frozen)

- Holdings times for EPA analytical methods were set to ensure that analysis are performed before degradation of samples could impact the analytical results. In most cases, this was established for water and waste samples that are typically not obtained from surficial environments where they are naturally-located daily in the sun & UV rays and exposed to the humid tropical atmosphere. For these reasons, it does not appear that a minor 24-hour exceedance of a 7-day holding time for the collected samples resulted in a significant variation in the results.

- When sample holding times are exceeded, the analytical results may be considered questionable or qualitative due to possible degradation of compounds of interest. That is very important when analyzing samples for drinking water analytics or determining if a waste is hazardous by characteristic. However, the purpose of the Salt Pond surface water and "Blue Box" surficial soil assessment objectives, the results of samples that were slightly past holding times or arrived with an elevated cooler temperature are still considered representative of surface water and surficial soil conditions.

- Upon review of the overall analytical data sets, samples which were out of recommended hold and/or temperature guidelines, generally did not exhibit the analyzed parameter above either its comparison criteria or were below the laboratory's method detection and/or reporting limits. Therefore, these QA/QC items did not appear to create any significant concerns that would invalidate the data for the health-based assessment purposes they are being used for on this project.

GBTS also contacted Pace Analytical Laboratory's QA Department who noted the following general comments regarding the sample holding and temperature guidelines:

- Volatiles results may be biased low, if they are out of hold or out of temperature guidelines. These would be the most likely impacted of the analysis that was performed in the current assessment.

- Surface water samples out of temperature holds would not affect metals, chloride, or fluoride analysis.

- Soil samples out of temperature holds would not affect metal values except potentially for mercury.

- Samples that are unpreserved are likely more vulnerable to hold time and temperature exceedances than those that have some sort of chemical preservation in addition to thermal preservation. The purpose of thermal (and/or chemical) preservation in the samples is to inhibit or slow biological activity and chemical breakdown. Therefore, samples that are out of temperature hold could be biased low. For degradation due to bacterial activity, the bacteria most commonly encountered in environmental samples have a significant decline in growth and activity around 10 C. So a sample over 10 C may be more impacted than a sample at 7 C.

- With the exception of short holds, most hold times do not have much scientific basis. Without a comparison study though the laboratory cannot say with any certainty that the data is biased or not. If it were biased, it most likely would be biased low.

SECTION 7.0
CONCLUSIONS

GBTS was retained to conduct a Baseline ESA to evaluate current conditions of soil and surface water prior to a fire suppression event to address fires in the MSW landfill and IDDS staging areas. The Baseline ESA sampling event was conducted in October 2019, which included collection of surface water samples from the Great Salt Pond, which surrounding the MSW landfill, along with soil and soil vapor samples from the "Blue Box" Zone, a residential/commercial area located adjacent to the MSW landfill.

Surficial Soil Quality

Surficial soils tested in the "Blue Box" Zone contained detectable concentrations of heavy metals, PCB, TPHs and dioxins/furans. The heavy metals identified above this assessments comparison criterion included arsenic, barium, cadmium, chromium, cobalt, chromium, copper, iron, lead and zinc. Of these heavy metals, elevated arsenic, copper and zinc were persistent in nearly all of the analyzed soil samples. Concentrations of heavy metals including arsenic, copper and zinc were noted in select samples above their commercial criteria and/or Dutch Target & Intervention Values.

The source of these constituents was attributed to a combination of runoff & ash deposition from the MWS/IDDS, ongoing discharges from commercial activities ongoing in the "Blue Box" Zone (i.e., leaking oils/grease from stored/dumped vehicles & equipment, along with the storage and recycling of metals in the general assessment area), runoff from the adjoining Soualiga Road, the creation of the island using landfilled materials, along with naturally-occurring processes.

The data was reviewed by a renowned toxicologist, Dr. Chris Teaf, Ph.D., who concluded that the concentrations of arsenic, lead, PAHs, TPHs, and dioxins/furans detected in the surficial soils did not represent a major exposure concerns for the existing residential and commercial uses ongoing in the "Blue Box" Zone.

- HSWMR concluded that the reported detections of copper in surface soils in the "Blue Box" Zone do not represent a major exposure concern for commercial/industrial use. However, further evaluation (e.g., residence type and location, receptor activity) may be appropriate for determining risk from copper in the residential area of the "Blue Box" Zone, although no imminent, widespread risk appeared to be evident.

Surface Water Soil Quality

The surface water within the Great Salt Pond contained detectable concentrations of aluminum, copper and iron, along with Total Dissolved Solids (TDS) and chlorides. One sample also contained a detectable concentrations of PAH compounds. None of the analyzed samples were found to contain elevated values in excess of the few compounds listed in the EU's Maximum Allowable Concentrations (MACs) established in the Directive 2008/10/EC Annex 1, except for PAH compounds anthracene, fluoranthene and benzo(a)pyrene. However, the comparison criteria was limited; therefore, GBTS also compared these concentrations to the State of Florida FDEP Fresh and Marine Surface Water Cleanup Criteria, of which the aluminum, iron, copper, fluoranthene, TDS and chloride concentrations exceeded. The levels of elevated concentrations of chlorides and TDS do not appear to warrant significant concern given the saltwater/brackish environment and the amount of stormwater runoff directed into the pond. Further, a review of the field readings showed that there are typically low dissolved oxygen levels at just 1 m below surface. Given the levels of COD noted in the analytical results and the high turbidity at depths, the general water quality appears to be poor and likely the main influence in the fish kills observed during the site reconnaissance. The source of the aluminum, copper, iron and PAHs are likely the results of runoff from the MSW/IDDS and Soualiga Road, as well as the large metal recycling facility located east of the landfill, and also may be an indication of naturally-occurring processes. The water within the Great Salt Pond does not appear suitable for consumption; therefore, the presence of these constituents does not appear to pose a significant exposure concern.

Vapor Quality

This assessment did not identify significant landfill-type gases or VOCs in the vapor wells placed inside and outside the “Blue Box” Zone. Very low concentrations of carbon monoxide and LEL were noted in one sample location (VP-3) located in the center of the commercial / industrial portion of the “Blue Box” Zone. These results were likely from industrial activity in this area and do not appear to warrant further assessment or monitoring. Other vapor wells spread throughout the “Blue Box” Zone also had very low carbon monoxide readings – but these results did not warrant additional assessment.

SECTION 8.0
ENVIRONMENTAL PROFESSIONAL STATEMENT

The company statement of qualifications and the resumes for the professional who completed this report is are provided in **Appendix C**.

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Annex F

EE&G Disaster Response, LLC

Air Monitoring Plan

For

Pond Island Municipal Waste Disposal Site
and Temporary Debris Site
International Advisory Support for Debris Management and
Short Term Solid Waste Priorities for the
Hurricane Irma Reconstruction, Recovery and Resilience Program
Sint Maarten
World Bank Contract: 7187552

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CONTENTS

Section **Page**

SECTION 1.0 – INTRODUCTION 1

- 1.1 INTRODUCTION 1
- 1.2 BACKGROUND 1
- 1.3 PURPOSE 2

SECTION 2.0 – CONSTITUENTS OF CONCERN 3

- 2.1 COCS INCLUDED IN PRELIMINARY TESTING 3
- 2.2 COCS INCLUDED IN AMP 5

SECTION 3.0 – SAMPLING AND MONITORING METHODS 6

- 3.1 DATA INTERPRETATION 6
  - 3.1.1 Occupational Exposure Standards 7
  - 3.1.2 Community Exposure Standards 8
  - 3.1.3 Sampling Interpretive Criteria 11
- 3.2 SAMPLING AND MONITORING METHODS 14

SECTION 4.0 – AIR SAMPLING STRATEGY 16

- 4.1 OCCUPATIONAL SAMPLING STRATEGY 16
  - 4.1.1 Exclusion Zone 16
  - 4.1.2 Contamination Reduction Zone (CRZ) 16
  - 4.1.3 Support Zone and Perimeter Monitoring 17
- 4.2 SURROUNDING COMMUNITY 18

SECTION 5.0 – DATA COMMUNICATION AND RECORDKEEPING 19

- 5.1 DATA COMMUNICATION 19
  - 5.1.1 Site Monitoring (Personal and Area) 19
  - 5.1.2 Community Monitoring 20
- 5.2 RECORDKEEPING 20

SECTION 6.0 – QUALITY CONTROL 22

APPENDICES

Appendix A – HAZARDOUS SUBSTANCES DATA AND INFORMATION
Appendix B – OCCUPATIONAL EXPOSURE CRITERIA
Appendix C – MONITORING ANALYTICAL METHODS AND DEVICES
Appendix D – AIR MONITORING DEVICE SPECIFICATION DATA SHEETS
Appendix E – SAMPLE MONITORING PLAN SITE DIAGRAM

SECTION 1.0 – INTRODUCTION

1.1 INTRODUCTION

EE&G Disaster Response, LLC (EE&G) has been retained by the World Bank (the “Client”) to provide recommendations for air monitoring to be conducted during the performance of a fire suppression project (the “Project”) at the Pond Island municipal waste disposal site and temporary debris site (collectively referred to as the “debris and disposal sites”). The Air Monitoring Plan (AMP) described herein was provided in accordance with EE&G’s Technical Proposal Contract 7187552, Modification “B”, issued by the World Bank on August 22, 2018 (hereafter referred to as “the Contract”).

The intent of the AMP was to provide information that can be used in scoping activities for World Bank financing, in particular related to the general types and scale of activities to be included in the proposed fire suppression at the municipal waste disposal site and temporary debris site. It can be used by the Government of Sint Maarten as a reference in the development and implementation of these activities; however, the results are advisory and the contents are not ready or endorsed for use under World Bank financing.

Recommendations are provided by EE&G to the World Bank as advice and do not represent the views of the World Bank, its Executive Directors or the Government of Sint Maarten. While reasonable efforts have been made to provide accurate information, the use of the information by third parties is not the responsibility of the World Bank, the Government of Sint Maarten or EE&G and should be done by professionals qualified in the field and in the context of the time, method and scope of the analysis with due consideration of limitations it may present.

The Government of Sint Maarten is responsible for doing the necessary analysis to comply with environmental and social safeguards policies of the World Bank and local regulations, develop an associated documentation and the mitigation measures therein and for obtaining World Bank clearance and approval for those activities financed under World Bank administered financing as per World Bank Policies and the terms of the associated financing.

1.2 BACKGROUND

EE&G performed air testing at the Debris Sites from August 28-30, 2018. The testing consisted of a preliminary screening for chemical constituents of concern (COCs) identified by EE&G and other third party consultants retained by the Client, that may be in the smoke emanating from smoldering waste and debris through fissures at the debris and disposal sites. The purpose of the screening was to assess for COCs that may be present during upcoming fire suppression activities. The results of the screening activities are summarized in a draft report dated December 13, 2018.

Based upon the findings of the air screening activities, EE&G was requested to provide recommendations for an air monitoring plan (AMP) to be used by the contractor and Government of St. Maarten during the fire suppression activities. The fire suppression activities to be performed during the Project may result in emissions from the site that represent potential inhalation and skin contact hazards to the fire suppression contractor employees, government and landfill contractor employees working at the Debris Sites, site visitors and the local population in the surrounding communities. These hazards may originate from exposure to the

COCs identified in the preliminary site assessment performed by EE&G, as well as other compounds not previously identified.

1.3 PURPOSE

The intent of this AMP is to provide guidance to contractors, local government and community stakeholders for testing means and methods to monitor the potential airborne hazards emitted during the fire suppression activities The data collected from the AMP described below may be used to evaluate the exposures of personnel at the site and in the surrounding community as a result of the work being performed and determine appropriate personal protective equipment (PPE) and control measures. This plan provides a description of the methods to be utilized for air sampling and meteorological data collection, laboratory analytical methods, data evaluation and reporting. It is the intention of the plan to provide data collection methods and procedures designed to evaluate air quality as it relates to the following groups:

- Fire suppression personnel performing the Project.
- Ministry of Public Housing, Spatial Planning, Environment and Infrastructure (VROMI) employees assigned to the site.
- Authorized and unauthorized visitors to the site.
- Residential and commercial population located in the surrounding community.

The data collected should also be used to determine the classifications and delineation of hazard zones surrounding the work activities of the Project.

SECTION 2.0 – CONSTITUENTS OF CONCERN

2.1 COCS INCLUDED IN PRELIMINARY TESTING

Determination of the COCs to be screened for during the preliminary testing was based upon a general knowledge of which byproducts of incineration were likely to be found in a landfill setting, common components that make up landfill gasses and the input of other World Bank consultants. This included the following COCs:

- Landfill gases, which primarily included methane (CH_4) and carbon dioxide (CO_2). These gasses are produced when bacteria break down organic waste.
- Carbon monoxide (CO), a primary byproduct of combustion and incineration.
- Lower Explosive Limit (LEL), the concentration at which gas has the potential to explode.
- Volatile Organic Compounds (VOCs), other gasses besides landfill gasses (listed above) that can be produced by the breaking down/decomposition or combustion of waste.
- Hydrogen sulfide (H_2S), a gas that can be the source of most landfill odors.
- Polycyclic aromatic hydrocarbons (PAHs), compounds found in coal and tar and produced by burning of organic matter.
- Fine inhalable particulates with diameters that are 2.5 micrometers (μm) and smaller ($PM_{2.5}$). These come in many shapes and sizes and consist of airborne suspended solid or liquid particulates which are generated by chemical action, mechanical action or burning. Particulate composition depends on the parent material. Particles can be non-organic (silica, asbestos, metals or plastics) or organic (cellulose, mold or bacteria).
- Ozone (O_3), a COC that may be formed by landfill gasses.
- Dioxins and Furans, byproducts of combustion of plastic waste and other materials, particularly those containing chlorine.
- Polychlorinated biphenyls (PCBs), man-made chemicals that can be released into the environment through burning of waste. PCBs typically are associated with electronics.
- Heavy metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver), environmental pollutants that can be released into the environment through burning of waste as well as physical disturbance of landfill surfaces.
- Asbestos fibers, associated with the disturbance or incineration of building materials.

The primary objective of the initial screening activities was to obtain a general understanding of what COCs were present in the smoke plumes emanating from cracks/fissures on the surfaces of the debris and disposal sites. The tests were performed in the following locations:

- Upwind of smoke plumes ("upwind" samples), to establish background concentrations of the COCs in the air prior to reaching the areas where smoke was visibly emanating.

- From the smoke plumes ("smoke" samples), to obtain "worst-case" scenario concentrations of the COCs at their originating source.

- In the cabs of equipment performing normal operations at the active face of the municipal waste disposal site (MWDS) and on the temporary disposal site (TDS) that were reported to be part of a typical work day ("personnel" samples), to gauge COC concentrations relative to occupational limits.

The below table presents a summary of the results from the screening activities.

COC	Smoke - Northwest Municipal Waste Disposal Site	Smoke - South Municipal Waste Disposal Site	Smoke - Temporary Disposal Site	Upwind	Personnel
Methane	-	-	-	-	-
Carbon Dioxide	-	-	-	-	-
Carbon Monoxide	X	X	X	-	-
Respirable Particulates (PM 2.5)	X	X	X	X	X
Volatile Organic Compounds	X	X	X	-	-
Hydrogen Sulfide	X	-	-	-	-
PAH	X	X	X	-	-
Ozone	X	X	-	-	-
Dioxin/Furans (TCDD TEQ)	X	X	X	-	-
Heavy Metals	-	-	-	-	-
Asbestos	-	-	-	-	-

X – Denotes location where concentrations exceeded the exposure limits.
– Denotes concentrations not exceeding occupational limits.

2.2 COCS INCLUDED IN AMP

Based upon the results of the initial screening, this AMP includes sampling for COCs that were detected in the test locations, even if they did not exceed occupational levels. This is supported by the following:

- There will be variations in concentrations and presence of COCs based upon the non-homogenous mix of burning waste at the Debris Sites.
- Fire suppression activities will result in agitation of burning waste as well as other landfill material which may increase the potential for emissions of COCs.

Below are the COCs to be included in this AMP. In addition, links to detailed information, including descriptions and guidelines for these and other potential COCs are attached under **Appendix A**:

- Methane
- Carbon Dioxide
- Carbon Monoxide
- Total Particulates (dust)
- Volatile Organic Compounds including Benzene
- Hydrogen Sulfide
- Polycyclic aromatic hydrocarbons (PAHs), including Benzo(a)pyrene and acenaphthylene (PAHs)
- Ozone
- Dioxins and Furans
- Metals
- Based on similar projects, hydrogen cyanide has been added to the list of primary COCs addresses by this AMP and that shall be monitored during the Project.

SECTION 3.0 – SAMPLING AND MONITORING METHODS

3.1 DATA INTERPRETATION

Monitoring will be performed using instantaneous devices that provide results immediately, and analytical sampling which requires laboratory analysis. The interpretation of sample data obtained during this project will be used to assess the potential health risk of inhalation hazards to both workers on site as well as the surrounding community. Data interpretation will be performed accordingly:

- Worksite Monitoring (Personnel and Area Sampling) – these results will be compared to occupational exposure limits (OELs). OELs will also be used as criteria for comparison for area and perimeter sampling that will be performed on the Debris Sites.

- Community Monitoring – there are no established criteria for comparison that are directly applicable to this project. Community exposure and ambient air quality standards are typically based on consistent lifetime or long-term (“chronic”) exposures, which would be inconsistent with the period of potential exposure anticipated during the Project (the expected duration is weeks or months). For similar reasons the use of OELs are not applicable as they are based upon chronic exposures for employees working 40 hours a week, over a lifetime of employment. Given the duration of this project and expectation that exposures that may occur will be short-term (“acute”), acute exposure levels established by the United States Environmental Protection Agency (EPA), American Industrial Hygiene Association (AIHA) and United States Department of Energy (DOE) will be used as the criteria for comparison. In the event that acute exposure levels are not available for COCs, community exposure limits (CELs) will be used. Under this AMP, analysis of community samples will be limited to COCs that have established acute exposure levels or CELs.

There may be cases where worksite perimeter monitoring shows that the concentration of a particular COC or group of COCs exceed OELs. In this instance the data should be interpreted accordingly:

- The results should be compared to other worksite perimeter data to confirm that the fire suppression work was the likely source of the exceedance.

- The results of downwind community sampling locations should be evaluated. If these locations show elevated concentrations, the fire suppression contractor should be notified and the work methods should be modified to decrease emissions or stopped until satisfactory results are obtained.

This section will describe recommended criteria for interpreting data collected from workforce as and community monitoring.

3.1.1 Occupational Exposure Standards

Potential health risk to workers and visitors on the job site will be assessed based on existing regulatory standards. Given the differing exposure standards for the COCs and in an abundance of caution, the most conservative values should be used. A summary of applicable occupation exposure standards for this project are presented below.

- European Union (EU) Occupational Exposure Limits (OELs) – the data collected will be compared to regulatory exposure limits applicable to the European Union when possible. In Europe, there are two types of occupational exposure limits for chemical agents: EU community exposure limits and national exposure limits. The community limits are set by the European Agency for Safety and Health at Work. The EU Member States are required to establish national occupational exposure limit values for listed chemical agents, taking into account the community values. National exposure limit values may be different from the community values. National occupational exposure limit values should be used when EU community limits are not available.

- US Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and Short-term Exposure Limits (STELs) – these are the legal limits in the United States for employee exposures to chemical substances or physical agents. PELs are typically expressed as an 8-hour time weighted average (TWA) concentration. STELs are the acceptable average exposure over a short period of time, usually 15 minutes, as long as the TWA is not exceeded. Any fifteen-minute periods in which the average STEL concentration exceeds the permissible level must be separated from each other by at least one hour. A maximum of four of these periods is allowed per eight-hour shift. Ceiling limits have been assigned by OSHA to some substances and are concentrations above which individuals should not be exposed for any length of time without protective equipment.

- US National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs) – these are time-weighted average occupational exposure limits for up to 10-hours per day and 40 hours per week that have been recommended to OSHA for adoption as regulatory PELs. RELs are generally considered as recommended updates to the OSHA exposure regulations. Also presented below are chemical concentrations recommended by NIOSH to be immediately dangerous to life or health (IDLH), meaning an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. NIOSH also recommends 15-minute STELs and Ceiling limits (concentrations above which individuals should not be exposed for any length of time without protective equipment) for some substances.

- American Council of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) as required by The World Bank Group, International Finance Corporation Environmental Health and Safety Guidelines for Occupational Health and Safety dated April 30, 2007. ACGIH presents exposure limits as time-weighted averages (TLV-TWAs), 15-minute short-term exposure limits (TLV-

STELs) and ceiling limits (TLV-Cs). It should be noted that ACGIH applies Excursion Limits to TLV-TWAs that do not have STELs. ACGIH recommends that excursions in worker exposure may exceed 3 times the TLV-TWA for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed 5 times the TLV-TWA, provided the TLV-TWA is not exceeded.

3.1.2 Community Exposure Standards

A review of existing community exposure and ambient air quality standards is summarized below. These standards vary in applicability to the community monitoring recommended for the Project. Community monitoring for COCs should be performed in multiple locations using instantaneous meters that generate real-time results and are capable of providing that information to the project command center for interpretation. In order to minimize potential for exposure, the testing results should be monitored during the fire suppression activities. Results showing concentrations of COCs over thresholds shall be communicated to the Fire Suppression Contractor so actions can be implemented to decrease emissions. Following these protocols it is expected that in the event that they occur, peaks in COC concentrations in the community will be controlled and are anticipated to be limited.

The standards referenced below are either based upon acute or chronic exposures. The acute or short term exposures come from guidance documents prepared by the EPA, AIHA, and DOE for emergency response projects. In most of these instances, there is no consideration for multiple or cumulative exposures, however thresholds are provided for short periods of time, up to 8 hours. Given the following considerations, it is expected that using the 8-hour exposure limits, when available is most appropriate for this project:

- There is a direct relationship between community sampling results and fire suppression activities.
- Community sampling results will be reported real-time to the command center and be monitored.
- Corrective actions will be implemented immediately upon notification of an exceedance for a particular COC.

The standards presented below are in order of suitability for this Project, with first standard (EPA) being the most appropriate. When multiple exposure limits were presented under a given standard, the most conservative value will be selected. The most conservative value will be determined by considering the lowest exposure limit combined with the longest period of exposure.

- EPA Acute Exposure Guideline Levels (AEGLs) - are community exposure standards intended for use by emergency responders in managing rare, usually accidental, and temporary releases of chemicals into the air. AEGLs are expressed as specific concentrations of airborne chemicals at which adverse health effects may occur and are designed to protect the elderly and children, and other individuals who may be susceptible. Each chemical compound included in the AEGLs has a matrix of up to 15 recommended exposure limits that are based on 5 different short-term exposure periods (10 minutes, 30 minutes, I hour, 4 hours, and 8 hours) combined with 3 severity levels of toxic effects (Level 1 is least and Level 3 is most severe). AEGLs are expressed as concentrations above which it is predicted that the general population could experience the following:

- Level 1 - Notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
- Level 2 - Irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- Level 3 - Life-threatening health effects or death.

EPA AEGLs are the primary interpretive criteria that will be used for community monitoring, with the most conservative, 8-hour AEGL-1 thresholds being applied. Where a value is not provided for the 8-hour AEGL-1 scenario, then the next highest exposure period under Level 1 effects shall be used, followed by use of the 8-hour AEGL-2 limits. If AEGLs are not available for a chemical compound, then the interpretive criteria below will be used.

- American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs) – are community exposure standards intended to provide guidelines for once-in-a-lifetime, short-term (typically 1 hour) exposures to airborne concentrations of acutely toxic, high-priority chemicals. ERPGs are expressed as specific concentrations of airborne chemicals at which adverse health effects may occur. Each chemical compound included in the ERPGs has 3 thresholds based on the severity of toxic effects (Level 1 is least and Level 3 is most severe). ERPGs are defined as follows:

  - ERPG 1 - the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.
  - ERPG 2 - the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.
  - ERPG 3 - the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

  ERPGs are the secondary interpretive criteria that will be used for community monitoring, with the most conservative, ERPG-1 thresholds being applied. If AEGLs and ERPGs are not available for a chemical compound, then the interpretive criteria below will be used.

- Department of Energy (DOE) Temporary Emergency Exposure Limits (TEELs) - are temporary community exposure standards intended to provide guidelines during emergency response to an uncontrolled release of hazardous chemicals when AEGLs and ERPGs have not been established. TEELs may be used until AEGLs or ERPGs are developed. TEELs are expressed as specific concentrations of airborne chemicals at which adverse health effects may occur during an exposure period of one hour or more. Each chemical compound included in the TEELs has 3 thresholds based on the severity of toxic effects (Level 1 is least and Level 3 is most severe). TEELs are defined as follows:

- TEEL 1 - the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience notable discomfort, irritation, or certain asymptomatic, non-sensory effects. However, these effects are not disabling and are transient and reversible upon cessation of exposure.

- TEEL 2 - the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape.

- TEEL 3 - the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, when exposed for more than one hour, could experience life-threatening adverse health effects or death.

TEELs are the tertiary interpretive criteria that will be used for community monitoring, with the most conservative, TEEL-1 thresholds being applied. If AEGLs, ERPGs and TEELs are not available for a chemical compound, then the interpretive criteria below will be used.

- US Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) – An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. Inhalation MRLs are exposure concentrations expressed in units of parts per million (ppm) for gases and volatiles, or milligrams per cubic meter (mg/m^3) for particulates. Most MRLs contain some degree of uncertainty because of the lack of precise toxicological information on the people who might be most sensitive (e.g., infants, elderly, and nutritionally or immunologically compromised) to effects of hazardous substances. ATSDR uses a conservative (i.e., protective) approach to address these uncertainties consistent with the public health principle of prevention. MRLs are derived for acute (1-14 days), intermediate (>14-364 days), and chronic (365 days and longer) exposure durations. Exposure to concentrations above the MRL does not mean that adverse health effects will occur.

- World Health Organization (WHO) Air Quality Guidelines for Europe (2nd Ed., 2000) – The primary aim of these guidelines is to provide a basis for protecting public health from adverse effects of air pollution and for eliminating, or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human health and wellbeing. After additional research in the field new standards were recommended in the WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide (2005), which applied globally to all regions. These guidelines are not restricted to numerical values below which exposure for a given period of time does not constitute a significant health risk, but also include other pertinent recommendations.

- US Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) – developed as a requirement of the Clean Air Act and include two types of national ambient air quality standards for pollutants considered harmful to public health and the environment were developed. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

Given the lack of interpretive criteria, community testing and monitoring for COCs that do not have established CELs (in the standards above) is not recommended and not included in this AMP. During interpretation of community test data, downwind results should be compared to upwind and crosswind control sample results.

3.1.3 Sampling Interpretive Criteria

The recommended thresholds applicable to the interpretation of both occupational and community sampling results are presented in the table below. For additional reference, a summary of OELs from the different agencies outlined in Section 3.1.1 is presented in **Appendix B**.

Compound:	Units of Measure:	Occupational Exposure Limit:	Community Exposure Limit:
Landfill and Combustion Gases			
Methane	parts per million (ppm)	1,000 ppm (ACGIH TLV-TWA)	N/A
Carbon Dioxide	ppm	5,000 ppm (ACGIH TLV-TWA)	N/A
Carbon Monoxide	ppm	25 ppm (ACGIH TLV-TWA). 75 ppm (ACGIH 30-minute excursion limit). Personnel CO monitors outside Exclusion Zone with alarms set to go off when concentrations reach 1 ppm	27 ppm (8-hour AEGL-2)
Hydrogen Sulfide	ppm	1 ppm (ACGIH TLV-TWA), 5 ppm (TLV-STEL) and NIOSH IDLH concentration of 100 ppm	0.33 ppm (8-hour AEGL-1)
Ozone	ppm	0.05 ppm (ACGIH TLV-TWA for a heavy workload), Ceiling Limit of 0.1 ppm and IDLH concentration of 5 ppm (NIOSH)	0.05 ppm (WHO 8-hour mean)

Compound:	Units of Measure:	Occupational Exposure Limit:	Community Exposure Limit:
Hydrogen Cyanide	ppm	10 ppm (OSHA PEL), 4.7 ppm (ACGIH TLV-Ceiling)	1.0 ppm (8-hour AEGL-1)
Particulates			
Total particulate	milligrams per cubic meter (mg/m3)	10 mg/m^3 (ACGIH TLV-TWA)	0.05 mg/m^3 (WHO respirable particulate PM$_{10}$ 24-hour mean)
Volatile Organic Compounds			
Benzene	ppm	NIOSH REL of 0.1 ppm, STEL of 1 ppm and IDLH concentration of 500 ppm	9.0 ppm (8-hour AEGL-1)
Propylene	ppm	240 mg/m^3 (100 ppm) – OSHA PEL	N/A
Chloromethane	ppm	104 mg/m^3 (50 ppm) – ACGIH TLV	0.5 ppm (ATSDR acute MRL)
n-Butane	ppm	1,900 mg/m^3 (800 ppm) – NIOSH REL	5,500 ppm (8-hour AEGL-1)
1,3-Butadiene	ppm	2.2 mg/m^3 (1 ppm) – OSHA PEL	670 ppm (8-hour AEGL-1)
Chloroethane	ppm	264 mg/m^3 (100 ppm) – ACGIH TLV	N/A
Ethanol	ppm	260 mg/m^3 (500 ppm) – EU OEL	1,800 ppm (AIHA ERPG-1)
Isopropyl alcohol	ppm	490 mg/m^3 (200 ppm) – ACGIH TLV	N/A
Acetone	ppm	590 mg/m^3 (250 ppm) – NIOSH REL	200 ppm (8-hour AEGL-1)
Acetonitrile	ppm	34 mg/m^3 (20 ppm) – EU OEL, NIOSH REL and ACGIH TLV	13 ppm (4-hour AEGL-1)
Acrylonitrile	ppm	2.2 mg/m^3 (1 ppm) – NIOSH REL	1.5 (30 minute AEGL-1)
n-Hexane	ppm	72 mg/m^3 (20 ppm) – EU OEL	2,900 ppm (8-hour AEGL-2)
2-Butanone	ppm	590 mg/m^3 (200 ppm) – OSHA PEL, NIOSH REL AND ACGIH TLV	N/A
Ethyl acetate	ppm	1,400 mg/m^3 (400 ppm) – OSHA PEL, NIOSH REL AND ACGIH TLV	N/A
Tetrahydrofuran	ppm	150 mg/m^3 (50 ppm) – ACGIH TLV	100 ppm (AIHA ERPG-1)
Cyclohexane	ppm	350 mg/m^3 (100 ppm) – ACGIH TLV	N/A
n-Heptane	ppm	350 mg/m^3 (85 ppm) – NIOSH REL	N/A
Methyl Methacrylate	ppm	205 mg/m^3 (50 ppm) – EU OEL and ACGIH TLV	17 ppm (8-hour AEGL-1)
1,4-Dioxane	ppm	3.6 mg/m^3 (1 ppm) – NIOSH REL	17 ppm (8-hour AEGL-1)

Compound:	Units of Measure:	Occupational Exposure Limit:	Community Exposure Limit:
4-Methyl-2-pentanone	ppm	104 mg/m^3 (25 ppm) – EU OEL	N/A
Toluene	ppm	150 mg/m3 (40 ppm) – EU OEL	67 ppm (8-hour AEGL-1)
2-Hexanone	ppm	4.1 mg/m^3 (1 ppm) – NIOSH REL	N/A
Chlorobenzene	ppm	23 mg/m^3 (5 ppm) – EU OEL	10 ppm (8-hour AEGL-1)
Ethylbenzene	ppm	215 mg/m^3 (50 ppm) – EU OEL	33 ppm (8-hour AEGL-1)
Xylene (p,m)	ppm	210 mg/m^3 (50 ppm) – EU OEL	130 ppm (8-hour AEGL-1)
Xylene (Ortho)	ppm	210 mg/m^3 (50 ppm) – EU OEL	130 ppm (8-hour AEGL-1)
Styrene	ppm	86 mg/m^3 (20 ppm) – ACGIH TLV	20 ppm (8-hour AEGL-1)
Isopropylbenzene (cumene)	ppm	100 mg/m^3 (25 ppm) – EU OEL	50 ppm (8-hour AEGL-1)
4-Ethyltoluene	ppm	N/A	N/A
1,3,5-Trimethylbenzene	ppm	100 mg/m^3 (21 ppm) – EU OEL	45 ppm (8-hour AEGL-1)
1,2,4-Trimethylbenzene	ppm	100 mg/m^3 (21 ppm) – EU OEL	45 ppm (8-hour AEGL-1)
Naphthalene	ppm	50 mg/m3 (10 ppm) – EU OEL, OSHA PEL, NIOSH REL and ACGIH TLV	0.0007 ppm (ATSDR chronic MRL)
PAHs ***** NIOSH recommends an IDLH concentration of 80 mg/m^3 for the benzene-soluble fraction of coal tar pitch volatiles			
Naphthalene	mg/m^3	50 mg/m^3 – EU OEL (NL), OSHA PEL, NIOSH REL and ACGIH TLV	3.67 ug/m^3 (ATSDR MRL)
Acenaphthylene	mg/m^3	0.1 mg/m^3 – NIOSH REL	N/A
Acenaphthene	mg/m^3	0.1 mg/m^3 – NIOSH REL	3.6 mg/m3 (DOE TEEL-1)
Fluorene	mg/m^3	0.1 mg/m^3 NIOSH REL	6.6 mg/m3 (DOE TEEL-1)
Phenanthrene	mg/m^3	0.1 mg/m^3 – NIOSH REL and ACGIH TLV	5.4 mg/m3 (DOE TEEL-1)
Anthracene	mg/m^3	0.1 mg/m^3 – NIOSH REL	48 mg/m3 (DOE TEEL-1)
Fluoranthene	mg/m^3	0.1 mg/m^3 – NIOSH REL	8.2 mg/m3 (DOE TEEL-1)
Pyrene	mg/m^3	0.1 mg/m^3 – NIOSH REL	0.15 mg/m3 (DOE TEEL-1)
Chrysene	mg/m^3	0.1 mg/m^3 – NIOSH REL	0.6 mg/m3 (DOE TEEL-1)
Benzo(e)pyrene	mg/m^3	0.1 mg/m^3 – NIOSH REL	N/A
Benzo(b)fluoranthene	mg/m^3	0.1 mg/m^3 – NIOSH REL	0.12 mg/m3 (DOE TEEL-1)

Compound:	Units of Measure:	Occupational Exposure Limit:	Community Exposure Limit:
Benzo(k)fluoranthene	mg/m^3	0.1 mg/m^3 – NIOSH REL	N/A
Benzo(a)pyrene	mg/m^3	0.00055 mg/m^3 – EU OEL (NL)	0.6 mg/m3 (DOE TEEL-1)
Dioxins and Furans			
Dioxins/furans	pg/m^3	10 pg/m^3 (Germany), or lowest feasible concentration (LFC) (OSHA and NIOSH)	130,000 pg/m3 (TCDD) (DOE TEEL-1)
Heavy Metals			
Arsenic	mg/m^3	0.01 mg/m^3 (ACGIH TLV-TWAs)	N/A
Barium	mg/m^3	0.5 mg/m^3 (ACGIH TLV-TWAs)	N/A
Cadmium	mg/m^3	0.01 mg/m^3 (total) and 0.002 mg/m^3 (respirable) (ACGIH TLV-TWAs)	0.041 mg/m^3 (8-hour AEGL-1)
Chromium	mg/m^3	0.5 mg/m^3 (ACGIH TLV-TWAs)	0.0003 mg/m^3 (MRL, intermediate exposure)
Lead	mg/m^3	0.05 mg/m^3 (ACGIH TLV-TWAs)	0.0005 mg/m^3 (WHO)
Selenium	mg/m^3	0.2 mg/m^3 (ACGIH TLV-TWAs)	N/A
Silver	mg/m^3	0.1 mg/m^3 (ACGIH TLV-TWAs)	N/A
Mercury	mg/m^3	0.025 mg/m^3 (ACGIH TLV-TWAs)	0.33 mg/m^3 (8-hour AEGL-2)

N/A – an established community exposure limit was not found and routine community sampling or data interpretation (from group chemical tests) will not be performed for the compound.

3.2 SAMPLING AND MONITORING METHODS

Air testing shall be achieved through a combination of analytical sampling methods and the use of instantaneous read instruments that yield instant results. The methods described below will often be employed at stationary sampling stations. Given the possibility of high winds and inclement weather at the site, sampling stations should be secured to the ground to prevent tipping over and weather proof covers or enclosures should be utilized to protect pumps, devices, and sampling media.

The COCs covered in this AMP may be sampled by the following means:

- Carbon monoxide, VOCs, hydrogen sulfide, total particulates, ozone and hydrogen cyanide may be tested for using analytical samples and instantaneous read monitors.

- PAHs, dioxins and furans, and heavy metals may be tested for using analytical samples.

Air sampling for both occupational and community exposure purposes should be accomplished through sampling at fixed locations (area sampling) and on site workers (personal exposure sampling). The analytical and instantaneous read methods are summarized as follows and described in greater detail under **Appendix C**.

- Periodic Area Sampling (Occupational) – analytical area samples will be collected at portable stations consisting of an array of sampling media connected to battery vacuum pumps. In addition, instantaneous read monitoring stations should be set up, each consisting of a remote transmitting aerosol monitor and a remote transmitting multi-gas monitor. These devices will link to a monitoring system in the command center. Industrial hygiene personnel working at the site should also carry similar instantaneous read meters for real time evaluation of the site conditions and delineation of work zones.

- Personal Air Sampling (Occupational) – analytical air samples should be collected by securing battery pumps directly on personnel working at the Debris Sites, with placement of the filter media within their breathing zones. In addition, instantaneous read, remote transmitting multi-gas personal monitors should be worn on a regular basis. These devices will link to and be monitored in the command center.

- Perimeter and Community Monitoring (Community) – for the purposes of evaluating emissions from the fire suppression project, analytical area sampling and instantaneous read monitoring stations should be set up. The instantaneous devices will link to and be monitored in the command center. Manufacturer specification data sheets for the devices referenced above and described in Appendix C are included under **Appendix D**.

SECTION 4.0 – AIR SAMPLING STRATEGY

4.1 OCCUPATIONAL SAMPLING STRATEGY

Sampling activities on the project site will be performed in areas/zones that are established by the fire suppression contractor. The delineation of these zones will be based upon their location relative to the fire fighting activities, the fire fighting activities that are being performed and anticipated potential for exposure to the COCs. The following areas/zones are addressed in this AMP:

- Exclusion Zone
- Contamination Reduction Zone
- Support Zone and Perimeter

A discussion of these area/zones and recommended testing is presented below. A sample site diagram illustrating the potential work zones included in the Project is included under **Appendix E**.

4.1.1 Exclusion Zone

The Exclusion Zone (EZ) is the work area closest to the sources of airborne COCs, where fire suppression workers will be actively excavating landfill materials and applying foam/ sprays to extinguish fires. Concentrations of COCs in this zone would be anticipated to be relatively high compared to other areas and potentially above PELs if not near IDLH concentrations. The border between the exclusion zone and contamination reduction zone (described below) is the “hotline”. Workers in this zone are anticipated to be organized as follows:

- Heavy Equipment Operators – workers located in the cabs of heavy equipment digging into the active face of the landfill and redistributing the materials to other locations.

- Ground Support and Fire Suppression Workers – workers in the exclusion zone supporting equipment operators and aiding or performing fire suppression.

It is likely that the highest levels of personal protection equipment (PPE) will used by workers in this zone, this would include supplied air systems and chemical resistant suits. Furthermore it is anticipated that PPE use in the EZ would not be downgraded to lower levels after it is established. Therefore, personnel and area monitoring for the purposes of downgrading personal protection equipment would not be performed. For the purposes of monitoring conditions immediately dangerous to life and health (IDLH), sample collection within the exclusion zone should include personnel monitoring using remote transmitting multi-gas monitors placed on 100% of workers in heavy equipment and on the ground. Alarms (audible, visual and vibrating) should be set below IDLH concentrations.

4.1.2 Contamination Reduction Zone (CRZ)

The Contamination Reduction Zone (CRZ) is the work zone upwind to (as is feasible) and outside the perimeter of the EZ. In the CRZ workers assist in the decontamination of EZ workers, equipment and materials as they move out to the support zone. The border between the CRZ and support zone (described below) is the “contamination control line (CCL)”. Concentrations of COCs in this zone would be anticipated to be at or above PELs near the hotline and decrease to below the PELs at the CCL.

Sample collection within the CRZ will include the following:

- Personnel air sampling on at least 25% of workers (minimum of one). Workers should be sampled for respirable particulates and hydrogen sulfide, which will serve as surrogate constituents to represent overall exposure. Personal air sampling in the CRZ should be performed at the start of project activities and at least weekly thereafter, or again when the work zone is moved to a new location or the work activities are significantly changed. Results should be compared to TWA and short-term exposure thresholds (STEL, ceilings, peaks and IDLH) and used to evaluate the propriety of respiratory protection worn.

- Personnel monitoring using remote transmitting multi-gas monitors placed on 50% of workers. Alarms (audible, visual and vibrating) should be set to ceiling or maximum peak concentrations.

- Area monitoring stations as described in Appendix C. The devices should remain in use during active working hours for the duration of the project. The stations should be placed upwind of the active work operations based on predominant wind patterns and downwind of the active work operations at the hotline. Results may be used to evaluate changes in types of COCs being generated in the work areas.

4.1.3 Support Zone and Perimeter Monitoring

The Support Zone is the work zone upwind to (as is feasible) and outside the perimeter of the CRZ, where workers supervise and administer the site operations. Concentrations of COCs in this zone would be anticipated to be below the TWA exposure thresholds and personal protective equipment should not be necessary. Visitors (authorized or otherwise) to the site, VROMI site employees, or others not involved in the fire suppression activities would be expected to be limited to the Support Zone or areas outside the zone and would be prohibited from entering the CRZ or Exclusion Zone.

Perimeter monitoring should be performed at the boundaries of the landfill, to evaluate emissions from the fire suppression operations leaving the work site. Data collected from perimeter monitoring should be evaluated from upwind and downwind locations in order to assess the fire suppression methods used and to make modifications to such methods. The data collected should be compared to TWA exposure thresholds and should be considered along with wind speed and direction.

Sample collection within the support zone and in perimeter locations will include the following:

- Upwind of the active work operations at the perimeter.

- Downwind of the active work operations at the CCL.

- Downwind of the active work operations at the perimeter or “fence line” of the subject site. Multiple test devices shall draw air at varying heights in the range of visible emissions or smoke, as is feasible, and may require the use of tubing routed from the devices up a pole. The testing shall consist of area (instantaneous) monitoring stations that remain in use during active working hours for the duration of the project.

4.2 SURROUNDING COMMUNITY

Residential and commercial areas surrounding the project site and located in various directions related to prevailing wind direction will fall into this group. Given the variation of both distances to the job site as well as the wind direction, it is recommended that stationary monitoring sites be set up in multiple locations within the surrounding community, but at points closest to the job site. Sample results should be compared to the community exposure thresholds presented in section 3.1.3. Given the lack of interpretive criteria, community testing and monitoring for COCs that do not have established CELs (in section 3.1.3) is not recommended.

Sample collection for the surrounding community will likely need to be determined in the field prior to the start of the fire suppression project, but should include consideration of the following:

- The devices should remain in use during active working hours for the duration of the project.

- The stations should be placed in different directions from the active work operations in locations within the community closest to the subject site, based on the availability of secured test station locations with stable power sources.

- The placement of the stations around the perimeter of the site should include at least one station upwind of the work operations, based on predominant wind patterns, and should be more heavily weighted in the downwind directions.

- Air testing should be performed at residential areas, hotels, day-care facilities, schools, libraries, places of worship, hospitals and healthcare facilities, government facilities, parks and the port.

SECTION 5.0 – DATA COMMUNICATION AND RECORDKEEPING

5.1 DATA COMMUNICATION

The following personnel positions (or similar) may be included in the air monitoring program:

- Air Monitoring Program Supervisor – manages the air monitoring teams, data collection, interpretation, retrieval, and reporting, and communications with local government officials and the contractors performing the Project.

- Data Manager – responsible for data input, organization, production, and recordkeeping.

- Field Air Monitoring Team Supervisor – manages the various teams performing monitoring and analytical sampling at the Project site and surrounding community, equipment calibration and field data interpretation.

- Field Air Monitoring Technicians – performs calibration and maintenance of monitoring and analytical sampling equipment, and the collection and shipping of samples.

Air monitoring during the Project is intended to assess for potential overexposures to personnel at the work site and in the surrounding community. The following general protocol may be employed when potential overexposures are identified:

- Notification – alerting management personnel for the Project of overexposures or downwind hazardous conditions. Some hazardous conditions may necessitate temporary cessation of the Project work.

- Evaluation – assessment of the severity or extent of the overexposures and potential causes.

- Corrective Actions – implementation of greater engineering or hazard controls, or modification of work methods and materials being used.

- Follow-up – preparation to startup work activities again, verification that the hazardous conditions (onsite or downwind) have passed

5.1.1 Site Monitoring (Personal and Area)

Sampling at the work site will include area and personal monitoring, with data compared to occupational exposure limits (as discussed in Section 4.1). The data collected from the sampling devices will be collected and reviewed in the Command Center by the Air Monitoring Program Supervisor (air monitoring consultants) and Chief Health and Safety Officer (Project contractor). Exceedances in ceiling limits, STELs or PELs shall be conveyed to the Chief Health and Safety Officer and site managers for the Project in order to re-evaluate personal protective equipment and engineering controls, delineation of the hazardous work zones, or to modify the work methods to decrease hazardous exposures. Communications should include radio devices, with allowances for previously established and implemented hand signals/visual communications when audible means are not feasible. After implementation of corrective measures, work may continue contingent upon satisfactory follow-up monitoring data.

5.1.2 Community Monitoring

Monitoring in the surrounding community will include area instantaneous and analytical sampling, with data compared to available community exposure limits (as discussed in Section 4.2). The data collected from the sampling will be collected and reviewed in the Command Center by the Air Monitoring Program Supervisor (air monitoring consultants) and Chief Health and Safety Officer (Project contractor). Exceedances in CELs or evidence of the migration of emissions off the site that may result in overexposures in the community (based on perimeter monitoring data) shall be conveyed to the Chief Health and Safety Officer and site managers for the Project in order to re-evaluate or modify the work methods used in order to reduce emissions. In addition, notification of these incidents will be sent via telephone to the primary point of contact for local government agencies and emails to a previously agreed upon list of recipients, or by other means established for the Project. Protocols should be developed between the contractor performing the Project and local government agencies for the evacuation of surrounding communities, when monitoring data indicates it is warranted. Communications should include radio communications, with allowances for previously established and implemented hand signals/visual communications when audible means are not feasible. After implementation of corrective measures, work may continue contingent upon satisfactory follow-up monitoring data.

5.2 RECORDKEEPING

Each sample submitted to a laboratory for analysis will have an accompanying chain-of-custody (CHN). Each chain should be on a form provided by the laboratory. All CHNs must be complete and clearly legible. A copy of each CHN is to be kept on site at all times. Each sample will have a unique sample number that will include the following:

- Date.
- Initials of IH technician.
- Sequential sample number.

The sample number will take the following form:

Month/Day/Year/Technician’s initials/sequential number

An example of this is shown below and is for a sample collected on October 23, 2018, by John Doe, and is the third sample collected on that day by the IH technician:

102318JD03

In addition to the CHNs, two sample log forms should be maintained on site. The first log identifies samples currently being taken. The information includes the pump number, name of person being sampled or location of the pump station, and IH technician performing the tests. The second log is a daily total of samples submitted to the laboratory for analysis. This will be used to monitor the volume of samples being collected and submitted on a weekly and monthly basis.

A log of calibration of pumps and secondary calibration devices will be maintained on site at all times. The log will document the name of the person performing the test, date, pump or calibration device, and the results of the calibration.

Data Retrieval

The laboratory performing sample analysis will email copies of analysis reports and the associated CHNs to field operations on a daily basis or as results are requested. The data should be collected and reviewed by the Chief Health and Safety (or comparable) officer for the Project. The health and safety officer should initial and date the copies of each laboratory data sheet.

Data Input and Analysis

Calculated TWAs and lab analysis data may be entered into an Excel spreadsheet, or similar data management system. The spreadsheet should separate data collected from the various testing locations and methods (personnel monitoring, area monitoring, perimeter monitoring, periodic sampling, and community monitoring). The data management system should record the following:

- Sample ID
- Sample collection date
- Name of sampled person, or other means of identifying the sampled person
- Location
- Job function
- Regulatory limits: EU, OSHA, NIOSH, ACGIH
- Wind direction
- Wind speed
- Temperature
- Rain conditions

The spreadsheets should be used to develop data summaries for the various agencies or contractors involved in the Project.

SECTION 6.0 – QUALITY CONTROL

Quality Control (QC) should be maintained at two distinct levels, in the field and in the laboratories. The main emphasis of field-level QC should be to document accurate fields of data on CHNs, proper calculations of time weighted averages (TWAs), calibration records for rotameters, and written reports. The main emphasis of laboratory QC will be to ensure that laboratory data being produced meets industry standards for accuracy and precision. Elements of field-level QC are presented below:

- Each CHN should be checked for completeness by an IH technician other than the one whose initials appear in the sample number. The technician performing the review will print their name on, and initial the CHN.

- Field Blanks should be submitted with each group of samples to ensure that the sample cassettes have been properly handled while in the field. The frequency of field blanks should be two blanks (minimum) per sampling method for each daily batch of samples.

- A log-sheet that details the calibration of rotameters should be maintained onsite. Rotameters should be calibrated against a primary standard at least weekly.

- Data received from the laboratory may be used to calculate 8-hour TWAs. The calculation for the TWAs should be made on the emailed copy of the laboratory report. The IH technician performing the calculations should place their name on the sheet. Approximately 50% of the calculations should be reviewed by a second IH technician, who should also place their name on the sheet. For reference the formula for calculating time-weighted averages is below, where “t” indicates duration and “c” indicates concentration:

$$\text{TWA} = \frac{t_1c_1 + t_2c_2 + \ldots\ t_nc_n}{t_1 + t_2 + \ldots\ t_n}$$

- Following the calculation of TWAs, the data should be entered into a spreadsheet that will be used to generate periodic reports. Data entry should be performed by an IH technician, and should be checked by a second IH technician.

APPENDIX A

HAZARDOUS SUBSTANCES DATA AND INFORMATION

Methane

https://www.cdc.gov/niosh/ipcsneng/neng0291.html

Carbon Dioxide

https://www.cdc.gov/niosh/ipcsneng/neng0021.html

Carbon Monoxide

https://www.cdc.gov/niosh/ipcsneng/neng0023.html

Propylene

https://www.cdc.gov/niosh/ipcsneng/neng0559.html

Chloromethane

https://www.cdc.gov/niosh/ipcsneng/neng0419.html

n-Butane

https://www.cdc.gov/niosh/ipcsneng/neng0232.html

1,3-Butadiene

https://www.cdc.gov/niosh/ipcsneng/neng0017.html

Chloroethane

https://www.cdc.gov/niosh/ipcsneng/neng0132.html

Ethanol

https://www.cdc.gov/niosh/ipcsneng/neng0044.html

Isopropyl alcohol

https://www.cdc.gov/niosh/ipcsneng/neng0554.html

Acetone

https://www.cdc.gov/niosh/ipcsneng/neng0087.html

Acetonitrile

https://www.cdc.gov/niosh/ipcsneng/neng0088.html

Acrylonitrile

https://www.cdc.gov/niosh/ipcsneng/neng0092.html

n-Hexane

https://www.cdc.gov/niosh/ipcsneng/neng0279.html

2-Butanone

https://www.cdc.gov/niosh/ipcsneng/neng0179.html

Ethyl acetate

https://www.cdc.gov/niosh/ipcsneng/neng0367.html

Tetrahydrofuran

https://www.cdc.gov/niosh/ipcsneng/neng0578.html

Cyclohexane

https://www.cdc.gov/niosh/ipcsneng/neng0242.html

n-Heptane

https://www.cdc.gov/niosh/ipcsneng/neng0657.html

Benzene

https://www.cdc.gov/niosh/ipcsneng/neng0015.html

Methyl Methacrylate

https://www.cdc.gov/niosh/ipcsneng/neng0300.html

1,4-Dioxane

https://www.cdc.gov/niosh/ipcsneng/neng0041.html

4-Methyl-2-pentanone

https://www.cdc.gov/niosh/ipcsneng/neng0511.html

Toluene

https://www.cdc.gov/niosh/ipcsneng/neng0078.html

2-Hexanone

https://www.cdc.gov/niosh/ipcsneng/neng0489.html

Chlorobenzene

https://www.cdc.gov/niosh/ipcsneng/neng0642.html

Ethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng0268.html

Xylene (p,m)

https://www.cdc.gov/niosh/ipcsneng/neng0086.html

https://www.cdc.gov/niosh/ipcsneng/neng0085.html

Xylene (Ortho)

https://www.cdc.gov/niosh/ipcsneng/neng0084.html

Styrene

https://www.cdc.gov/niosh/ipcsneng/neng0073.html

Isopropylbenzene (cumene)

https://www.cdc.gov/niosh/ipcsneng/neng0170.html

4-Ethyltoluene

1,3,5-Trimethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng1155.html

1,2,4-Trimethylbenzene

https://www.cdc.gov/niosh/ipcsneng/neng1433.html

Naphthalene

https://www.cdc.gov/niosh/ipcsneng/neng0667.html

Hydrogen Sulfide

https://www.cdc.gov/niosh/ipcsneng/neng0165.html

Acenaphthylene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Acenaphthene

https://www.cdc.gov/niosh/ipcsneng/neng1674.html

Fluorene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Phenanthrene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Anthracene

https://www.cdc.gov/niosh/ipcsneng/neng0825.html

Fluoranthene

https://www.cdc.gov/niosh/docs/2003-154/pdfs/5506.pdf

Pyrene

https://www.cdc.gov/niosh/ipcsneng/neng1474.html

Chrysene

https://www.cdc.gov/niosh/ipcsneng/neng1672.html

Benzo(e)pyrene

https://www.cdc.gov/niosh/ipcsneng/neng0104.html

Benzo(b)fluoranthene

https://www.cdc.gov/niosh/ipcsneng/neng0720.html

Benzo(k)fluoranthene

https://www.cdc.gov/niosh/ipcsneng/neng0721.html

Benzo(a)pyrene

https://www.cdc.gov/niosh/ipcsneng/neng0104.html

Respirable Particulates

Ozone

https://www.cdc.gov/niosh/ipcsneng/neng0068.html

2,3,7,8 Tetrachlorodibenzo-*p*-dioxin

https://www.cdc.gov/niosh/ipcsneng/neng1467.html

PCBs

https://www.cdc.gov/niosh/ipcsneng/neng0939.html

Arsenic (As)

https://www.cdc.gov/niosh/ipcsneng/neng0013.html

Lead (Pb)

https://www.cdc.gov/niosh/ipcsneng/neng0052.html

Barium (Ba)

https://www.cdc.gov/niosh/ipcsneng/neng1052.html

Chromium (Cr)

https://www.cdc.gov/niosh/ipcsneng/neng0029.html

Cadmium (Cd)

https://www.cdc.gov/niosh/ipcsneng/neng0020.html

Silver (Ag)

https://www.cdc.gov/niosh/ipcsneng/neng0810.html

Selenium (Se)

https://www.cdc.gov/niosh/ipcsneng/neng0072.html

Asbestos

https://www.atsdr.cdc.gov/asbestos/

Hydrogen Cyanide

https://www.cdc.gov/niosh/ipcsneng/neng0492.html

https://www.cdc.gov/niosh/npg/npgd0333.html

APPENDIX B

OCCUPATIONAL EXPOSURE CRITERIA

OCCUPATIONAL EXPOSURE CRITERIA

Potential health risk to workers and visitors on the job site will be assessed based on existing regulatory standards. There were differing exposure standards for the Constituents of Concern (COCs) identified in this Air Monitoring Plan (AMP). Occupational exposure standards that were considered included the following:

- European Union (EU) Occupational Exposure Limits (OELs).
- US Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and Short-term Exposure Limits (STELs).
- US National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs).
- American Council of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) as required by The World Bank Group, International Finance Corporation Environmental Health and Safety Guidelines for Occupational Health and Safety dated April 30, 2007.

This Appendix contains a summary of occupational exposure criteria for the COCs, which are listed below.

Landfill Gases – Methane (CH_4), Carbon Dioxide (CO_2), and Carbon Monoxide (CO)

Methane, CO_2 and CO exposure limits are shown below. The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Methane	N/A	N/A	N/A	1,800 mg/m^3 (1,000 ppm)
Carbon dioxide	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)	9,000 mg/m^3 (5,000 ppm)
Carbon monoxide	29 mg/m^3 (25 ppm)	55 mg/m^3 (50 ppm)	40 mg/m^3 (35 ppm)	29 mg/m^3 (25 ppm)

Lower Explosive Level (LEL)

The OSHA action level for LEL is 10%.

Oxygen (O_2)

OSHA minimum levels for O_2 are 195,000 ppm, or 19.5%.

Particulates

Testing can be performed to assess for total or respirable particulates. Results are reported in milligrams per cubic meter (mg/m^3) and compared to 8-hour time weighted average exposures shown below.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Respirable Particulates	5 mg/m^3 (France)	5 mg/m^3 (20 ppm)	N/A	N/A
Total Particulates		15 mg/m^3	N/A	10 mg/m^3

Volatile Organic Compounds (VOCs)

Instantaneous and analytical testing can be performed to screen for VOCs, results are interpreted accordingly:

- Instantaneous testing - A screening performed using a photoionization detector (PID) can be used to assess for the presence of total VOCs (TVOCs). These results can to support the analytical sampling described below. The use of a PID allows for the collection of multiple readings from different locations over the sampling periods but does not provide the composition of the gases that are being measured.

- Analytical sampling - Results can be compared to the exposure limits shown in the below table. The values given are for 8-hour time weighted average exposures.

VOC Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Propylene	*N/A	240 mg/m^3 (100 ppm)	N/A	1,190 mg/m^3 (500 ppm)
Chloromethane	268 mg/m^3 (130 ppm)	207 mg/m^3 (100 ppm)	**LFC	104 mg/m^3 (50 ppm)
n-Butane	N/A	N/A	1,900 mg/m^3 (800 ppm)	2,400 mg/m^3 (1,000 ppm)
1,3-Butadiene	4.6 mg/m^3 (2 ppm)	2.2 mg/m^3 (1 ppm)	LFC	4.4 mg/m^3 (2 ppm)

VOC Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Chloroethane	268 mg/m^3 (100 ppm)	2,600 mg/m^3 (1,000 ppm)	LFC	264 mg/m^3 (100 ppm)
Ethanol	260 mg/m^3 (500 ppm)	1,900 mg/m^3 (1,000 ppm)	1,900 mg/m^3 (1,000 ppm)	1,900 mg/m^3 (1,000 ppm)
Isopropyl alcohol	N/A	980 mg/m3 (400 ppm)	980 mg/m3 (400 ppm)	490 mg/m^3 (200 ppm)
Acetone	1,210 mg/m^3 (505 ppm)	2,400 mg/m^3 (1,000 ppm)	590 mg/m^3 (250 ppm)	1,200 mg/m^3 (500 ppm)
Acetonitrile	34 mg/m^3 (20 ppm)	68 mg/m^3 (40 ppm)	34 mg/m^3 (20 ppm)	34 mg/m^3 (20 ppm)
Acrylonitrile	N/A	4.4 mg/m^3 (2 ppm)	2.2 mg/m^3 (1 ppm)	4.4 mg/m^3 (2 ppm)
n-Hexane	72 mg/m^3 (20 ppm)	1,800 mg/m^3 (500 ppm)	180 mg/m^3 (50 ppm)	180 mg/m^3 (50 ppm)
2-Butanone	N/A	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)
Ethyl acetate	N/A	1,400 mg/m^3 (400 ppm)	1,400 mg/m^3 (400 ppm)	1,400 mg/m^3 (400 ppm)
Tetrahydrofuran	300 mg/m^3 (101 ppm)	590 mg/m^3 (200 ppm)	590 mg/m^3 (200 ppm)	150 mg/m^3 (50 ppm)
Cyclohexane	700 mg/m^3 (200 ppm)	1,050 mg/m^3 (300 ppm)	1,050 mg/m^3 (300 ppm)	350 mg/m^3 (100 ppm)
n-Heptane	1,200 mg/m^3 (300 ppm)	2,000 mg/m^3 (500 ppm)	350 mg/m^3 (85 ppm)	1,600 mg/m^3 (400 ppm)
Benzene	3.2 mg/m^3 (1 ppm)	3.2 mg/m^3 (1 ppm)	0.3 mg/m^3 (0.1 ppm)	1.6 mg/m^3 (0.5 ppm)
Methyl Methacrylate	205 mg/m^3 (50 ppm)	410 mg/m^3 (100 ppm)	410 mg/m^3 (100 ppm)	205 mg/m^3 (50 ppm)
1,4-Dioxane	20 mg/m^3 (5 ppm)	360 mg/m^3 (100 ppm)	3.6 mg/m^3 (1 ppm)	72 mg/m^3 (20 ppm)

VOC Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
4-Methyl-2-pentanone	104 mg/m^3 (25 ppm)	410 mg/m^3 (100 ppm)	200 mg/m^3 (50 ppm)	200 mg/m^3 (50 ppm)
Toluene	150 mg/m^3 (40 ppm)	750 mg/m^3 (200 ppm)	375 mg/m^3 (100 ppm)	190 mg/m3 (50 ppm)
2-Hexanone	N/A	410 mg/m^3 (100 ppm)	4.1 mg/m^3 (1 ppm)	21 mg/m^3 (5 ppm)
Chlorobenzene	23 mg/m^3 (5 ppm)	350 mg/m^3 (75 ppm)	N/A	45 mg/m3 (10 ppm)
Ethylbenzene	215 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)
Xylene (p,m)	210 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)
Xylene (Ortho)	210 mg/m^3 (50 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)	435 mg/m^3 (100 ppm)
Styrene	N/A	430 mg/m^3 (100 ppm)	210 mg/m^3 (50 ppm)	86 mg/m^3 (20 ppm)
Isopropylbenzene (cumene)	100 mg/m^3 (25 ppm)	250 mg/m^3 (50 ppm)	250 mg/m^3 (50 ppm)	250 mg/m^3 (50 ppm)
4-Ethyltoluene	N/A	N/A	N/A	N/A
1,3,5-Trimethylbenzene	100 mg/m^3 (21 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)
1,2,4-Trimethylbenzene	100 mg/m^3 (21 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)	120 mg/m^3 (25 ppm)
Naphthalene	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)	50 mg/m3 (10 ppm)

*N/A – Not Applicable
**LFC – Lowest Feasible Concentration

Hydrogen Sulfide (H_2S)

Results of analytical sampling performed to screen for H_2S can be compared to the following exposure limits. The values given are for 8-hour time weighted average exposures unless otherwise noted:

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
H_2S	1.65 ppm	28 mg/m^3 (20 ppm) 10-minute ceiling	14 mg/m^3 (10 ppm) 10-minute ceiling	1.4 mg/m^3 (1 ppm)

Polycyclic Aromatic Hydrocarbons (PAHs)

Analytical sampling performed to screen for PAHs can be compared to the regulatory and recommended exposure limits summarized in the table below. Only criteria for comparison of constituents that were identified above detectable levels in the air screening are listed. The values given are for 8-hour time weighted average exposures.

PAH Constituent	**EU OEL (NL)**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Naphthalene	50 mg/m^3	50 mg/m^3	50 mg/m^3	50 mg/m^3
Acenaphthylene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Acenaphthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Fluorene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Phenanthrene	800 (Latvia)	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Anthracene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Pyrene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3

PAH Constituent	EU OEL (NL)	OSHA PEL	NIOSH REL	ACGIH TLV
Chrysene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(e)pyrene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(b)fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(k)fluoranthene	N/A	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3
Benzo(a)pyrene	0.00055 mg/m^3	0.2 mg/m^3	0.1 mg/m^3	0.2 mg/m^3

Ozone (O_3)

Analytical sampling performed to screen for O_3 can be compared to the following exposure limits. The values given are for 8-hour time weighted average exposures.

Constituent	EU OEL	OSHA PEL	NIOSH REL	ACGIH TLV
Ozone	0.12 mg/m^3 (0.05 ppm)	0.2 mg/m^3 (0.1 ppm)	0.2 mg/m^3 (0.1 ppm)	0.2 mg/m^3 (0.1 ppm)

Dioxins and Furans

Analytical sampling performed to screen for dioxins/furans should be reported in picograms per cubic meter of air (pg/m^3), which are given for 8-hour time weighed average exposures. The results should be normalized by toxicity equivalence factors to a toxicity equivalence (TEQ) value based on the dioxin compound tetra-chloro-dibenzo-dioxin (TCDD).

The TEQ will be calculated by the laboratory as prediction of the potency of the mixture of dioxins and furans present in a sample and expressed as a concentration of 2,3,7,8 Tetrachlorodibenzo-*p*-dioxin or TCDD alone. TCDD is commonly regarded as the most toxic compound (congener) in the dioxin group of chemicals and is used as a general measure of dioxin toxicity for the samples.

The TEQ can be compared to exposure limits presented below:

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
TCDD	10 pg/m^3 (Germany)	*LFC	LFC	LFC

*LFC – Lowest Feasible Concentration

Polychlorinated Biphenyls (PCB's)

Analytical sampling performed to screen for PCBs can be compared to the following exposure limits. The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
PCB's	0.01 mg/m^3 (Denmark)	0.5 mg/m^3 (skin)	0.001 mg/m^3	0.5 mg/m^3 (skin)

Heavy Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)

Analytical sampling performed to screen for the following heavy metals: arsenic, barium, cadmium, chromium, lead, selenium and silver should be reported in mg/m^3 and compared to the following exposure limits. The values given are for 8-hour time weighted average exposures.

Constituent	**EU OEL**	**OSHA PEL**	**NIOSH REL**	**ACGIH TLV**
Arsenic (As)	0.2 mg/m^3 (Israel)	0.01 mg/m^3	N/A	0.01 mg/m^3
Lead (Pb)	0.15 mg/m^3 (EU)	0.05 mg/m^3	0.05 mg/m^3	0.05 mg/m^3
Barium (Ba)	0.5 mg/m^3 (Finland)	0.5 mg/m^3	0.5 mg/m^3	0.5 mg/m^3
Chromium (Cr)	2.0 mg/m^3 (EU)	0.5 mg/m^3	0.5 mg/m^3	0.5 mg/m^3
Cadmium (Cd)	0.004 mg/m^3 (Finland)	0.005 mg/m^3	*LFC	0.002 mg/m^3
Silver (Ag)	0.01 mg/m^3 (Germany)	0.01 mg/m^3	0.01 mg/m^3	0.1 mg/m^3

Constituent	EU OEL	OSHA PEL	NIOSH REL	ACGIH TLV
Selenium (Se)	0.1 mg/m^3 (Finland)	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3

*N/A – Not Applicable
**LFC – Lowest Feasible Concentration

Asbestos Fibers

Analytical sampling performed to screen for airborne asbestos fibers should be reported in Structures per square millimeter (S/mm^2). Since the TEM analytical method allows for identification of asbestos fibers, the interpretive criteria for this constituent can be based upon the presence/absence of asbestos fibers in the samples, with detectable concentrations being deemed significant.

APPENDIX C

AIR MONITORING ANALYTICAL METHODS AND DEVICES

Analytical Sampling Methods

Periodic Area Sampling

Area samples will be collected at portable stations consisting of an array of sampling media connected to battery vacuum pumps. The collection faces of the sampling media should be placed at an approximate height of 5 feet above ground level. Area samples will be secured by use of a portable stand, or by securing to an appropriate structure. These stations should be secured to the ground to prevent tipping over and weather proof covers or enclosures should be utilized to protect pumps, devices, and sampling media

Personal Air Sampling

Personal air samples should be collected by securing battery pumps to the waist of the sampling subjects, and placement of the filter media within the breathing zone of the subject worker (approximately 10 inches from the subject's nose). For whole-shift samples, the subject should be instructed to wear the sampling pump regardless of their location or activity on the job.

Pump Calibration

- Primary standard – A primary standard manufactured by Buck should be used to calibrate air pumps, as well as to calibrate secondary standards. The primary standard should be the sole means of calibration for pumps when the test methods require the flow rate to be less than 1 liter of air per minute (LPM).

- Secondary standards – Rotameters should be used to calibrate air pumps when the analytical test method requires a flow rate in excess of 1 LPM. The rotameters shall be calibrated against a primary standard at least twice per week.

- Pumps should be calibrated pre and post-sample collection and the average of flow rates used to calculate the total air volume sampled.

Sampling and Analysis Methods

The following test methods and sampling media should be used:

- **TO-15 group VOCs (including carbon monoxide)** – collection of grab sample in an evacuated summa canister over 8-hour period. Samples shall be analyzed EPA TO-15 method (VOCs) with carbon monoxide analyzed via CMS method. Shorter draw times may be achieved by using different flow regulators.

- **Benzene (individually)** – collection of air at recommended rate of 0.2 LPM for a total of 5-30 liters. Air shall be pulled through a coconut charcoal tube and analyzed in accordance with NIOSH 1501 method. It is recommended that to cover a whole (8-hour) work shift that 4 samples be collected at a rate of 0.2 LPM for 120 minutes each, for 24 total liters. For STEL sampling air should be drawn at 0.2 LPM for 15 minutes for 3 total liters.

- **Hydrogen Sulfide** – collection of air at recommended rate of 0.2 LPM (0.1-1.5 LPM is allowed) for a total of 40 liters (1.2-40 liters is allowed). Air shall be pulled through a coconut charcoal tube and analyzed in accordance with NIOSH 6013 method. It is recommended that to cover a whole (8-hour) work shift that 3 samples be collected at a rate of 0.25 LPM for 160 minutes each, for 40 total liters. For STEL sampling air should be drawn at 1.5 LPM for 15 minutes for 22.5 total liters.

- **PAHs** – collection of air at recommended rate of 2 LPM for a total of 1,000 liters (200-1,000 liters is allowed). Air shall be pulled through XAD-2 sorbent tubes with PTFE pre-filters and analyzed in accordance with NIOSH 5506 method. It is recommended that to cover a whole (8-hour) work shift that one sample be collected at a rate of 2 LPM for 480 minutes each, for 960 total liters. Samples shall be wrapped in aluminum foil and shipped on ice as rapidly as possible to the laboratory for analysis.

- **Total particulates** – collection of air at recommended rate of 1-2 LPM for a total of up to 133 liters. Air shall be pulled through 37mm, 5-µm pre-weighed PVC cassettes fitted and analyzed in accordance with NIOSH 0500 method. It is recommended that to cover a whole (8-hour) work shift that 4 samples be collected at a rate of 1 LPM for 120 minutes each, for 120 total liters per cassette.

- **Respirable particulates (if performed)** – collection of air at recommended rate of 2.5 LPM for a total of 400 liters (20-400 liters is allowed). Air shall be pulled through 37mm, 5-µm pre-weighed PVC cassettes fitted with a cyclone and analyzed in accordance with NIOSH 0600 method. It is recommended that to cover a whole (8-hour) work shift that 3 samples be collected at a rate of 2.5 LPM for 160 minutes each, for 400 total liters.

- **Dioxins and Furans** – collection of air at recommended rate of 5 LPM over an 8-hour time period for a total of 2,400 liters. Air shall be pulled through polyurethane foam (PUF) tubes and analyzed in accordance with EPA TO-9A method. Samples shall be shipped on ice as rapidly as possible to the laboratory for analysis.

- **Ozone** – collection of air at recommended rate of 0.25-0.5 LPM for a total of 90 liters (up to 120 liters is allowed when sampling at 0.25 LPM). Air shall be pulled through nitrate-impregnated glass fiber filters and analyzed in accordance with OSHA ID214 method. It is recommended that to cover a whole (8-hour) work shift that 2 samples be collected at a rate of 0.375 LPM for 240 minutes each, for 90 total liters. Filter cassettes should be refrigerated or otherwise kept cold prior to sample collection. For STEL sampling air should be drawn at 1.5 LPM for 15 minutes for 22.5 total liters.

- **Hydrogen Cyanide –** collection of air at recommended rate of 0.05-0.2 LPM for a total of 2-90 liters. Air shall be pulled through soda lime solid sorbent tubes and analyzed in accordance with NIOSH 6010 method. It is recommended that to cover a whole (8-hour) work shift that two samples be collected at a rate of 0.2

LPM for 240 minutes each, for 48 total liters per sample. For STEL sampling air should be drawn at 0.2 LPM for 15 minutes for 22.5 total liters.

- **Heavy Metals** – collection of air at recommended rate of 1-4 LPM for a total of up to 2,000 liters. Air shall be pulled through 37mm, 5-µm pre-weighed PVC cassettes and analyzed in accordance with the NIOSH 7300 modified Method (for arsenic, barium, cadmium, chromium, lead, selenium, and silver). It is recommended that to cover a whole (8-hour) work shift that two samples be collected at a rate of 4 LPM for 480 minutes, for 1,920 total liters. Mercury shall be sampled by the collection of air at recommended rate of 0.15-0.25 LPM for a total of 2-100 liters. Air shall be pulled through Hopcalite solid sorbent tubes and analyzed in accordance with the NIOSH 6009 Method. It is recommended that to cover a whole (8-hour) work shift that samples be collected at a rate of 0.2 LPM for 480 minutes for 96 total liters.

Calculation of Time Weighted Averages

8-hour TWA values will be calculated according to the following formula:

$$\text{8-hr TWA} = \frac{(T_1 \text{ X } C_1) + (T_2 \text{ X } C_2)\ldots\ldots}{480 \text{ minutes}}$$

Where:

T_1 = time of first sample in the set.
C_1 = concentration of first sample in the set.
T_2 = time of second sample in the set.
C_2 = concentration of second sample in the set.

This formula will be used when a true whole-shift sample (or set of samples) has been collected. If the sample time (total) is less than 480 minutes, the formula assumes a “zero” exposure to the remaining amount of time in an 8-hour shift. If an employee works less than 480 minutes in a shift, this formula will provide an adjusted TWA for comparison to the OSHA standard. Likewise, if a person works longer than 480 minutes, the formula will compensate, and will yield a value that can be directly compared against the OSHA PEL.

In situations where a whole shift sample could not be collected, such as during a dusty operation that would overload a cassette, the formula should be adjusted by multiplying the reported concentration by the actual length of the shift, then dividing by 480 minutes. It should be noted, however, that the shorter the sample length, the less representative the sample may actually be of the whole shift exposure. In these situations, the person performing the data interpretation should note that the TWA was calculated based on a short-duration sample.

Calculations are to be performed on the chain of custody documents. The hygienist performing the calculations must print their name on the bottom each sheet.

Instantaneous Read Instruments

Air monitoring should be performed both at fixed locations (general area monitoring, perimeter monitoring and community monitoring) and on site workers (personal exposure monitoring). This shall be achieved by deploying a network-based real time data monitoring system. The capabilities and components of the monitoring system should be capable of recording, reporting and manipulating data transmitted from personnel monitoring devices and area monitoring stations placed within the work site and in the surrounding community. A system meeting these capabilities paired with field testing devices that meet with the same or comparable specifications as those referenced in the sections below should be satisfactory for this project.

As an example, such a system may consist of the following:

- Command center computer system with internet connection.
- Connection of the command center computer utilizing Honeywell RAE software, for use with RAE monitors described below.
- Connection to Netronix cloud-based network to receive data from the TSI Dusttrak 2 monitors described below. The TSI monitors transmit data through local cellular phone networks.
- The systems may be placed remotely up to 2 miles from the command center (based on the limitations of the RAE monitors, but may be remotely linked (as re-transmitters or repeaters) to cover areas up to 8 miles out. These systems can be used to establish logged data with set exposure limit alarms that may be plotted on an area map.

Personal Monitoring Devices

To achieve personnel monitoring, site workers should be fitted with remote transmitting multi-gas personal monitors (equivalent to MultiRAE Lite) equipped with the following sensors at a minimum (up to 6 slots are available):

- PID VOC sensor – measures 0-1,000 ppm with resolution of 1 ppm.
- NDIR Combustible Gas – measures 0-100% LEL with resolution of 1% LEL.
- Oxygen – measures 0-30% volume with resolution of 0.1% volume.
- Carbon monoxide – measures 0-500 ppm with resolution of 1 ppm.
- Hydrogen sulfide – measures 0-200 ppm with resolution of 0.1 ppm.
- Hydrogen cyanide – measures 0-50 ppm with resolution of 0.5 ppm.

These monitors should be set with various audible alarms to notify personnel of overexposure, depending on the work zones they are deployed in. They may be set to generate short-term exposure data in order to evaluate compliance with STELs and ceiling limits. These devices will also link to and be monitored by the command center.

Remote transmitting aerosol monitors (equivalent to TSI Dusttrak 2 8530) may be utilized for respirable dust personal exposures in heavy equipment cabs deployed in the exclusion zone.

Area Monitoring Devices

To achieve area monitoring, test stations should be setup, each consisting of a remote transmitting aerosol monitors and a remote transmitting multi-gas monitor (equivalent to AreaRAE Pro) equipped with the following sensors at a minimum (up to 7 slots are available):

- Weather sensor (equivalent to RAEMet) – measures wind speed and direction, temperature, humidity

- 4R PID VOC sensor – measures 0-2,000 ppm with resolution of 10 ppb.
- Combustible Gas – measures 0-100% LEL with resolution of 1% LEL.
- Oxygen – measures 0-30% volume with resolution of 0.1% volume.
- Carbon monoxide – measures 0-500 ppm with resolution of 1 ppm.
- Hydrogen sulfide – measures 0-100 ppm with resolution of 0.1 ppm.
- Hydrogen cyanide – measures 0-50 ppm with resolution of 0.5 ppm.

These monitors should be set with various audible alarms to notify personnel of overexposure, depending on the work zones they are deployed in. These devices will also link to and be monitored by the monitoring system in the command center.

APPENDIX D

MONITORING DEVICE SPECIFICATION DATA SHEETS

MultiRAE Lite

Wireless Portable Multi-Gas Monitor

The MultiRAE Lite is the optimal one-to-six[1]-gas monitor for personal protection and leak detection applications. The MultiRAE Lite is available in pumped and diffusion versions and features the broadest selection of sensor options in its class. The MultiRAE Lite can be configured to exactly meet the detection needs and compliance requirements of various countries, industries, and applications.

The MultiRAE Lite's optional wireless capability improves safety by providing commanders and safety officers real-time access to instrument readings and alarm status from any location for better situational awareness and faster incident response.

Confined space testing with the MultiRAE Lite

APPLICATIONS

- Personal protection and multi-gas leak detection in industries such as:
  - Chemical
  - Food and beverage
  - Oil and gas (downstream)
  - Pharmaceutical
  - Telecommunications
  - Wastewater treatment
- Fire overhaul

- *Available in pumped and diffusion versions*
- *Highly versatile and customizable*
- *Man Down Alarm with real-time remote wireless notification*
- *Easy maintenance with replaceable sensors, pump, and plug-and-play battery*
- *Fully automatic bump testing and calibration with AutoRAE 2*

FEATURES & BENEFITS

- Wireless access to real-time instrument readings and alarm status from any location
- Unmistakable five-way local and remote wireless notification of alarm conditions including Man Down Alarm[2]
- Over 25 interchangeable sensor options, including PID[4] for VOCs, NDIR5 and catalytic for combustibles, and NDIR for CO_2
- Intelligent sensors store calibration data, so they can be swapped in the field[6]
- Large graphical display with easy-to-use, icon-driven user interface
- Continuous datalogging (6 months for 5 sensors, 24x7)
- Device Management with Honeywell SafetySuite

MultiRAE Lite Specifications

INSTRUMENT SPECIFICATIONS[7]	
SIZE	- Pumped model: 7.6” H x 3.8” W x 2.6” D (193 x 96.5 x 66 mm) - Diffusion model: 6.9” x 3.8” x 2.2” (175 x 96.5 x 56 mm)
WEIGHT	- Pumped model: 31 oz (880 g) - Diffusion model: 26.8 oz (760g)
SENSORS	Over 25 intelligent interchangeable field-replaceable sensors including PID for VOCs, electrochemical sensors for toxic gases and oxygen, combustible LEL and NDIR sensors, and CO_2 NDIR sensor
BATTERY OPTIONS, RUNTIME[8] AND RECHARGE TIME	- Rechargeable Li-ion ~12-hr. (pumped)/18-hr. (diffusion) runtime, < 6-hr. recharge time - Extended duration Li-ion ~18-hr. (pumped)/28-hr. (diffusion) runtime, < 9-hr. recharge time - Alkaline adapter with 4 x AA batteries ~6-hr. (pumped)/8-hr. (diffusion) runtime
DISPLAY	Monochrome graphical LCD display (128 x 160) with backlighting. Automatic screen “flip” feature
DISPLAY READOUT	- Real-time reading of gas concentrations; PID measurement gas and correction factor; Man Down Alarm on/off; visual compliance indicator; battery status; datalogging on/off; wireless on/off and reception quality. - STEL, TWA, peak, and minimum values
KEYPAD BUTTONS	Automatic with AutoRAE 2 Test and Calibration System3 or manual
SAMPLING	Built-in pump or diffusion
CALIBRATION	Automatic with AutoRAE 2 Test and Calibration System or manual
ALARMS	Wireless remote alarm notification; audible (95 dB @ 30 cm), vibration, visible (flashing bright red LEDs), and on-screen indication of alarm conditions - Man Down Alarm with pre-alarm and real-time remote wireless notification[2]
DATALOGGING	Continuous datalogging (6 months for 5 sensors at 1-minute intervals, 24/7) - User-configurable datalogging intervals (from 1 to 3,600 seconds)
COMMUNICATION AND DATA DOWNLOAD	- Data download and instrument set-up and upgrades on PC via desktop charging and PC comm. cradle, travel charger, or AutoRAE 2 Automatic Test and Calibration System[3] - Wireless data and alarm status transmission via built-in RF modem (optional)
WIRELESS NETWORK	ProRAE Guardian Real-Time Wireless Safety System or EchoView Host-based Closed-Loop System
WIRELESS RANGE (TYPICAL)	MultiRAE Lite to RAELink3 [Z1] Mesh modem ~330 feet (100 meters) MultiRAE Lite to EchoView Host, RAEMesh Reader or RAEPoint ~660 feet (200 meters) MultiRAE Lite to Wi-Fi Access Point - 330 feet (100 meters)
OPERATING TEMPERATURE	-4° to 122°F (-20° to 50°C)
HUMIDITY	0% to 95% relative humidity (non-condensing)
DUST AND WATER RESISTANCE	IP-65 (pumped); IP-67 (diffusion) ingress protection rating
SAFETY CERTIFICATIONS	CSA: Class I, Division 1, Groups A, B, C and D, T4 Class II, Division 1, Groups E, F, G T85°C ATEX: 0575 II 1G Ex ia IIC T4 Ga 2G Ex ia d IIC T4 Gb with IR Sensor installed I M1 Ex ia I Ma IECEx: Ex ia IIC T4 Ga Ex ia d IIC T4 Gb with IR Sensor installed I M1 Ex ia I Ma IECEx/ANZEx: Ex ia IIC T4 Ga Ex ia d IIC T4 Gb with IR Sensor installed Ex ia I Ma
EMC/RFI[8]	EMC directive: 2004/108/EC
PERFORMANCE TESTS	LEL CSA C22.2 No. 152; ISA-12.13.01
LANGUAGES	Arabic, Chinese, Czech, Danish, Dutch, English, French, German, Indonesian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish, and Turkish
WARRANTY	- Four years on Liq O_2 sensors - Three years on CO and H_2S sensors - Two years on non-consumable components and catalytic LEL sensors - One year on all other sensors, pump, battery, and other consumable parts
WIRELESS FREQUENCY	ISM license free band. IEEE 802.15.4 Sub 1GHz - Wi-Fi 802.11 b/g
WIRELESS APPROVALS	FCC Part 15, CE R&TTE, Others[10]
RADIO MODULE	Supports RM900A

SENSOR SPECIFICATIONS[7]	RANGE	RESOLUTION
PID SENSORS[4]		
VOC 10.6 EV	0 to 1,000 ppm	1 ppm
COMBUSTIBLE SENSORS		
CATALYTIC LEL	0 to 100% LEL	1% LEL
NDIR (0-100% LEL METHANE)	0 to 100% LEL	1% LEL
NDIR (0-100% VOL. METHANE)[5]	0 to 100% Vol.	0.1% Vol.
CARBON DIOXIDE SENSOR		
CARBON DIOXIDE (CO_2) NDIR	0 to 50,000 ppm	100 ppm
ELECTROCHEMICAL SENSORS		
AMMONIA (NH_3)	0 to 100 ppm	1 ppm
CARBON MONOXIDE (CO)	0 to 500 ppm	1 ppm
CARBON MONOXIDE (CO), EXT. RANGE	0 to 2,000 ppm	10 ppm
CARBON MONOXIDE (CO), H_2-COMP.	0 to 2,000 ppm	10 ppm
CARBON MONOXIDE (CO) +	0 to 500 ppm	1 ppm
HYDROGEN SULFIDE (H_2S) COMBO	0 to 200 ppm	0.1 ppm
CHLORINE (CL_2)	0 to 50 ppm	0.1 ppm
CHLORINE DIOXIDE (CLO_2)	0 to 1 ppm	0.03 ppm
ETHYLENE OXIDE (ETO-A)	0 to 100 ppm	0.5 ppm
ETHYLENE OXIDE (ETO-B)	0 to 10 ppm	0.1 ppm
ETHYLENE OXIDE (ETO-C), EXT. RANGE[9]	0 to 500 ppm	10ppm
FORMALDEHYDE (HCHO)	0 to 10 ppm	0.05 ppm
HYDROGEN (H_2)[9]	0 to 1,000 ppm	10ppm
HYDROGEN CYANIDE (HCN)	0 to 50 ppm	0.5 ppm
HYDROGEN SULFIDE (H_2S)	0 to 100 ppm	0.1 ppm
HYDROGEN SULFIDE (H_2S), EXT. RANGE[9]	0 to 1,000 ppm	1 ppm
METHYL MERCAPTAN (CH_3-SH)	0 to 10 ppm	0.1 ppm
NITRIC OXIDE (NO)	0 to 250 ppm	0.5 ppm
NITROGEN DIOXIDE (NO_2)	0 to 20 ppm	0.1 ppm
OXYGEN (O_2)	0 to 30% Vol.	0.1% Vol.
OXYGEN (LIQ O_2)	0 to 30% Vol.	0.1% Vol.
PHOSPHINE (PH_3)	0 to 20 ppm	0.1 ppm
PHOSPHINE H (PH_3 H)	0 to 20 ppm	0.1 ppm
SULFUR DIOXIDE (SO_2)	0 to 20 ppm	0.1 ppm

---

[1] *A two-gas combination sensor is required for a 6-gas configuration.*

[2] *Additional equipment and/or software licenses may be required to enable remote wireless monitoring and alarm transmission.*

[3] *AutoRAE 2 supports the MultiRAE Lite pumped version only.*

[4] *PID sensor requires a pumped configuration.*

[5] *NDIR combustible sensors require a pumped configuration in CSA countries.*

[6] *RAE Systems recommends calibrating sensors on installation.*

[7] *Specifications are subject to change.*

[8] *Specification for non-wireless monitors.*

[9] *Supported in MultiRAE Lite Diffusion only.*

[10] *Please contact RAE Systems for specific wireless approvals*

ORDERING INFORMATION (MODELS: PGM-6208 and PGM-6208D)

- Wireless[2] and non-wireless configurations are available
- Refer to the Portables Pricing Guide for part numbers for monitors, accessories, sampling and calibration kits, gas, sensors, and replacement parts

For more information

www.honeywellanalytics.com
www.raesystems.com

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Device Management with
Honeywell SafetySuite

honeywellanalytics.com/SafetySuite

Datasheet_MultiRAE Lite_DS-1071-11_US-EN

Honeywell

AreaRAE Pro

Easy to use transportable area monitor for multiple threat detection.

AreaRAE Pro

Remote visibility on more threats than ever for a new level of real-time situational awareness

AreaRAE Pro is a wireless, transportable area monitor that can simultaneously detect toxic and combustible gases, volatile organic compounds, radiation and meteorological factors. Whether you're carrying it into a hazmat response, setting up perimeter at a fire or protecting a public venue, the AreaRAE Pro works with Honeywell's remote monitoring software to give you a real-time view of threat readings so you can make real time decisions to ensure the safety of your teams and the general public.

AreaRAE Pro delivers maximum flexibility and versatility in one device:

- **Up to six 4R+ sensors for toxic and combustible gas.**

AreaRAE Pro offers more than 20 interchangeable sensors that can be swapped at a moments notice to meet the changing needs of first responders.

- **7R+ photoionization detector.**

Monitor VOCs in parts per billion, with built-in compensation for temperature and humidity.

- **Meteorological station for tracking toxic plumes.**

Honeywell's compact RAEMet sensor sits at the top of the AreaRAE Pro and measures wind speed, wind direction, temperature and humidity. This information is then modeled in Honeywell's real time monitoring software which integrates the ALOHA hazard monitoring program.

- **Optional gamma sensor for radiation detection.**

Detect and measure gamma radiation with increased sensitivity and faster response without using an additional sensor slot.

Applications

- First responders
- Hazmat
- Civil Defense & Military
- Public Venue Protection

Ease and Fexibility

- Available in Rapid Deployment Kit for quick threat assessment
- User-friendly interface; turn it on and go
- Supports long-distance remote monitoring
- Built-in mesh modem for short-range monitoring — no external router required
- Flexible power options for short- and long-term deployments
- Easy to hear and see, with 108-decibel alarm
- Easy USB connection to configuration software
- Device Management with Honeywell Sotera™

Remote Visibility on Threats

- Delivers real-time readings to Honeywell's remote monitoring software, so you can instantly determine the location and severity of a threat
- Map-based display is accessible from any computer with an internet connection — or from our laptop as a turnkey host
- Enables coordination and data sharing in joint operations

Specifications

DIMENSIONS	314 x 306 x 166 mm (with rubber boot) 12.36" x 12.04" x 6.53" (with rubber boot)
WEIGHT	6.3 kg (13.88 lb) full option configuration 6.5 kg (14.33 lb) full option configuration (+RAEMet)
GAS SENSORS SLOTS	up to 7; see Sensor list
ADDITIONAL SENSORS	Gamma; RAEMet (Wind Speed, Wind Direction, Temperature & Humidity)
GPS	Standard equipment in every unit
BATTERY	Rechargeable 7.2 V / 10 Ah Li-ion battery pack with built-in charger Alkaline Battery Adapter
OPERATING HOURS	~20 hours with wireless connectivity on Li-ion battery pack ~12 hours with wireless connectivity on Alkaline battery adapter
	Specification at room temperature (20ºC)
DISPLAY	Large 240 x 320 pixel LCD backlit display
	64 x 85 mm / 2.5" x 3.33"
KEYPADS	3 operation and programming keys
ALARMS	Multi-tone 108 dB buzzer @ 3.3 ft / 1 m, Bright LED 360 degree view and on-screen indication of alarm conditions
	Additional diagnostic alarm and display message for low battery
	Wireless connectivity alarm
DATA LOGGING	Continuous data logging (90 days for 7 gas sensors, 1 Gamma sensor, 1 RAEMet (wind speed & direction, temp and RH), and GPS at 1 min intervals, 24/7)
DATA STORAGE	24M bytes (memory full action: stop when full or Wrap around)
DATA INTERVAL	User-configurable from 1 to 3,600 sec
WIRELESS[1]	Bluetooth Low Energy module (BT4.0) and GPS
	Primary radio module: - Long range ISM License Free 900 MHz or 2.4 GHz radio - IEEE 802.11 b/g Wi-Fi
	Secondary radio module: Short Range IEEE 802.15.4 900 MHz or 868 MHz Mesh Radio
	Wireless range[3]: Up to 2 miles (3 km) for ISM 900 MHz; Up to 1.2 miles (2 km) for ISM 2.4 GHz; Up to 330 ft (100m) for Wi-Fi; Up to 660 ft (200m) for Mesh secondary radio; Up to 15 ft (5m) for BLE.
	Wireless Approval: FCC Part 15, CE R&TTE, Others[4]
COMMUNICATION	Communicates to ProRAE Studio II via USB cable to PC;
	Wireless data and alarm status transmission via Wi-Fi or ISM modem;
	Act as gateway to connect up to 8 remote instruments (using secondary radio module)
SAFETY CERTIFICATION	US / Canada: Class 1, Division 2 Groups A, B, C, D
SAMPLING PUMP	Built-in pump, typical flow rate 450 cc/min
TEMPERATURE	-20 ºC to +50 ºC / (- 4 ºF to +122 ºF)
HUMIDITY	0% to 95% relative humidity (non-condensing)
INGRESS PROTECTION (IP)	IP 65
PERFORMANCE TESTS	MIL-STD-810G and 461F
	LEL CSA C22.2No. 152, ISA-12.13.01
WARRANTY[2]	Four years for O_2 Liquid Oxygen sensors Three years for CO, and H_2S sensors Two years for non-consumable components, catalytic LEL sensor and 10.6eV 7R+ PID lamp One year on all other sensors, battery, and other consumable parts Six months for 9.8eV lamp PID sensor

RAEMet SPECIFICATIONS	
WIND SPEED	Range: 0 to 20 m/s (0 to 44 mph) Start Speed: 0.1 m/s (0.22 mph)
WIND DIRECTION	Range: 360º (No dead band)
TEMPERATURE	- 20 ºC to 60 ºC (-4 ºF to 140 ºF) Resolution 0.1 ºC (1.8 ºF)
HUMIDITY	10 to 95% RH Resolution 1% RH
COMPASS	Resolution 1º
POWER	Power supplied by the AreaRAE Pro

[1] Additional equipment and/or software licenses may be required to enable remote wireless monitoring and alarm transmission

[2] Against factory defects

[3] Receiving > 80%

[4] Contact RAE Systems for country specific wireless approvals and certificates

Specifications are subject to change

Supported Sensors

SENSOR	RANGE	RESOLUTION
PID SENSORS		
4R+; 10.6eV ppb	0 to 2,000 ppm	10 ppb
7R+; 10.6 eV ppb	0 to 2,000 ppm	10 ppb
4R+; 9.8 eV*	0 to 2,000 ppm	0.1 ppm
COMBUSTIBLE SENSOR		
CATALYTIC BEAD SENSOR	0 to 100% LEL	1% LEL
NDIR SENSOR		
CARBONE DIOXIDE (CO_2)	0 to 50,000 ppm	100 ppm
ELECTROCHEMICAL SENSORS		
AMMONIA (NH_3)	0 to 100 ppm	1 ppm
CARBON MONOXIDE (CO)	0 to 500 ppm	1 ppm
CARBON MONOXIDE EXT. (CO HR)	0 to 2,000 ppm	10 ppm
CARBON MONOXIDE H_2 Comp (CO H_2 Comp)	0 to 2,000 ppm	10 ppm
CHLORINE (Cl_2)	0 to 50 ppm	0.1 ppm
CHLORINE DIOXIDE (ClO_2)	0 to 1 ppm	0.03 ppm
ETHYLENE OXIDE (ETO-A)	0 to 100 ppm	0.5 ppm
ETHYLENE OXIDE (ETO-B)	0 to 10 ppm	0.1 ppm
ETHYLENE OXIDE (ETO-C)	0 to 500 ppm	10 ppm
HYDROGEN (H_2)	0 to 2,000 ppm	10 ppm
HYDROGEN CHLORIDE (HCl)	0 to 15 ppm	1 ppm
HYDROGEN CYANIDE (HCN)	0 to 50 ppm	0.5 ppm
HYDROGEN FLUORIDE (HF)	0.5 to 10 ppm	0.1 ppm
HYDROGEN SULFIDE (H_2S)	0 to 100 ppm	0.1 ppm
HYDROGEN SULFIDE EXT. (H_2S HR)	0 to 1,000 ppm	1 ppm
OXYGEN (O_2)	0 to 30 %	0.10 %
SULFUR DIOXIDE (SO_2)	0 to 20 ppm	0.1 ppm
NITRIC OXIDE (NO)	0 to 250 ppm	0.5 ppm
NITROGEN DIOXIDE (NO_2)	0 to 20 ppm	0.1 ppm
PHOSPHINE (PH_3)	0 to 20 ppm	0.1 ppm
GAMMA RADIATION SENSOR		
GAMMA I-SENSOR	0.01 μSv/h to 0.2 mSv/h (1 μrem/h to 0.02 rem/h)	50 keV to 3 MeV

Honeywell Gas Detection

Honeywell is able to provide gas detection solutions to meet the requirements of all applications and industries. Contact us in the following ways:

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www.raesystems.com

AreaRAE Pro_DS01162_V3_EN
01-17

Device Management with
Honeywell Sotera™

honeywellanalytics.com/products/
Honeywell-Sotera

HEALTH AND SAFETY

Exposure Monitoring

DustTrak™ II Aerosol Monitor

Models 8530, 8531, and 8532

Desktop or Handheld Units for Any Environment, Any Application

The new DustTrak II Aerosol Monitors are battery-operated, data-logging, light-scattering laser photometers that give you real-time aerosol mass readings. They use a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Suitable for clean office settings as well as harsh industrial workplaces, construction and environmental sites and other outdoor applications. DustTrak II monitors measure aerosol contaminants such as dust, smoke, fumes and mists.

Features and Benefits

- Easy to program, easy to operate
- New graphical user interface with color touch-screen
- Perform in-line gravimetric analysis for custom reference calibrations
- Automatic zeroing (with optional zero module) minimizes the effect of zero drift
- Measure aerosol concentrations corresponding to PM_1, $PM_{2.5}$, PM_{10}, or Respirable size fractions

Applications

- Industrial/occupational hygiene surveys
- Indoor air quality investigations
- Outdoor environmental monitoring
- Baseline trending and screening
- Point source monitoring
- Engineering control evaluations
- Engineering studies
- Remote monitoring
- Process monitoring
- Emissions monitoring
- Aerosol research studies

TRUST. SCIENCE. INNOVATION.

Easy to Program and Operate

The new graphical user interface with color touch-screen puts everything at your fingertips. The easy-to-read display shows real-time mass concentration and graphical data as well as other statistical information along with instrument pump, laser and flow status, and much more. Perform quick walk-through surveys or program the instrument's advanced logging modes for long-term sampling investigations. Program start times, total sampling times, logging intervals, alarm setpoints and many other parameters. You can even set up the instrument for continuous unattended operation.

Desktop Models: Ideal for Long-Term Surveys and Remote Monitoring Applications

Manual and programmable data logging functions also make DustTrak II desktop monitors ideal for unattended applications. They come with USB (device and host), Ethernet, and analog and alarm outputs allowing remote access to data. User adjustable alarm setpoints for instantaneous or 15-minute short-term excursion limit (STEL) are available on desktop models. The alarm output with user-defined setpoint alerts you when upset or changing conditions occur.

All DustTrak II desktop monitors have three unique features:

- Gravimetric sampling capability using a 37-mm filter cassette which can be inserted in-line with the aerosol stream allowing you to perform an integral gravimetric analysis for custom reference calibrations.
- They can be zeroed automatically using the external zeroing module. This optional accessory is used when sampling over extended periods of time. By zeroing the monitor during sampling, the effect of zero drift is minimized.
- STEL alarm feature for tracking 15-minute average mass concentrations when alarm setpoint has been reached for applications like monitoring fugitive emissions at hazardous waste sites.

Handheld Models: Perfect for Walk-Through Surveys and Single-Point Data Collection Applications

DustTrak II handheld models are lightweight and portable. They're perfect for industrial hygiene surveys, point source location monitoring, indoor air quality investigations, engineering control evaluations/validation, and for baseline trending and screening. Like desktop models, they have manual and programmable data logging functions. In addition, they have single-point data logging capability. Single-point data collection is used for walk-through industrial hygiene surveys and indoor air quality investigations.

New Software Makes Monitoring Easier than Ever

TrakPro™ Data Analysis Software allows you to set up and program directly from a PC. A new feature is the ability for remote programming and data acquisition from your PC via wireless (922 MHz or 2.4 GHz) communications or over an Ethernet network. As always, you can print graphs, raw data tables, and statistical and comprehensive reports for recordkeeping purposes.

DustTrak II Aerosol Monitor Features

All Models

- Li-Ion rechargeable batteries
- Internal and external battery charging capabilities
- Outlet port for isokinetic sampling applications
- User serviceable sheath flow and pump filters
- Logged test pause and restart feature
- Logged test programming
  - Color touch screen—either manual mode or program mode
  - TrakPro™ Data Analysis Software via a PC
- User adjustable custom calibration settings
- Instantaneous alarm settings with visual and audible warnings
- Real-time graph display
- View statistical information during and after sampling
- On-screen instrument status indicators: FLOW, LASER and FILTER
- Filter service indicator for user preventative maintenance

All Desktop Models

- Hot swappable batteries
- Gravimetric reference sample capability
- Long life 10,000-hour internal pump
- TrakPro Data Analysis Software
- Auto zeroing module (optional accessory)
- STEL alarm setpoint

All Handheld Models

- Long life 2,500-hour internal pump
- Single-point data collection for walk through surveys
- TrakPro Data Analysis Software

Battery Performance

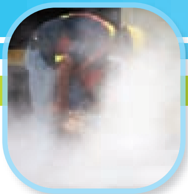
Models 8530/8531 (typical) 6600 mAH Li-Ion Battery Pack (P/N 801680)	**1 Battery**	**2 Batteries**
Battery Runtime (hours)	up to 6	up to 12
Charge Time * (hours) in DustTrak	4	8
Charge Time* (hours) in external battery charger (P/N 801685)	4	8

Model 8532 (typical) 3600 mAH Li-Ion Battery Pack (P/N 801681)	**Battery**
Battery Runtime (hours)	up to 6
Charge Time * (hours) in DustTrak	4
Charge Time* (hours) in external battery charger (P/N 801686)	4

*of a fully depleted battery

HEALTH AND SAFETY

Exposure Monitoring



Specifications

Models 8530, 8531, and 8532
DustTrak™ II Aerosol Monitor

Sensor Type
90° light scattering

Particle Size Range
0.1 to 10 µm

Aerosol Concentration Range

8530 Desktop	0.001 to 150 mg/m^3
8531 Desktop High Conc.	0.001 to 400 mg/m^3
8532 Handheld	0.001 to 150 mg/m^3

Resolution
±0.1% of reading or 0.001 mg/m^3, whichever is greater

Zero Stability
±0.002 mg/m^3 per 24 hours at 10 sec time constant

Flow Rate
3.0 L/min set at factory, 1.40 to 3.0 L/min, user adjustable

Flow Accuracy
±5% of factory set point, internal flow controlled

Temperature Coefficient
+0.001 mg/m^3 per °C

Operational Temp
32 to 120°F (0 to 50°C)

Storage Temp
-4 to 140°F (-20 to 60°C)

Operational Humidity
0 to 95% RH, non-condensing

Time Constant
User adjustable, 1 to 60 seconds

Data Logging
5 MB of on-board memory (>60,000 data points)
45 days at 1 minute logging interval

Log Interval
User adjustable, 1 second to 1 hour

Physical Size (HWD)

Handheld	4.9 x 4.8 x 12.5 in. (12.5 x 12.1 x 31.6 cm)
Desktop	5.3 x 8.5 x 8.8 in. (13.5 x 21.6 x 22.4 cm)

Weight

Handheld	2.9 lb (1.3 kg), 3.3 lb (1.5 kg) with battery
Desktop	3.5 lb (1.6 kg), 4.5 lb (2.0 kg)–1 battery, 5.5 lb (2.5 kg)–2 batteries

Communications

8530/31	USB (host and device) and Ethernet. Stored data accessible using flash memory drive
8532	USB (Hose and device). Stored data accessible using flash memory drive

Power–AC
Switching AC power adapter with universal line cord included, 115–240 VAC

Analog Out

8530/31	User selectable output, 0 to 5 V or 4 to 20 mA User selectable scaling range

Alarm Out

8530/31	Relay or audible buzzer Relay Non-latching MOSFET switch User selectable set point –5% deadband Connector 4-pin, Mini-DIN connectors
8532	Audible buzzer

Screen

8530/31	5.7 in. VGA color touchscreen
8532	3.5 in. VGA color touchscreen

Gravimetric Sampling

8530/31	Removable 37 mm cartridge (user supplied)

CE Rating

Immunity	EN61236-1:2006
Emissions	EN61236-1:2006

Specifications are subject to change without notice. TSI, the TSI logo, DustTrak, and TrakPro are trademarks of TSI Incorporated. Microsoft and Windows are trademarks of Microsoft Corporation.

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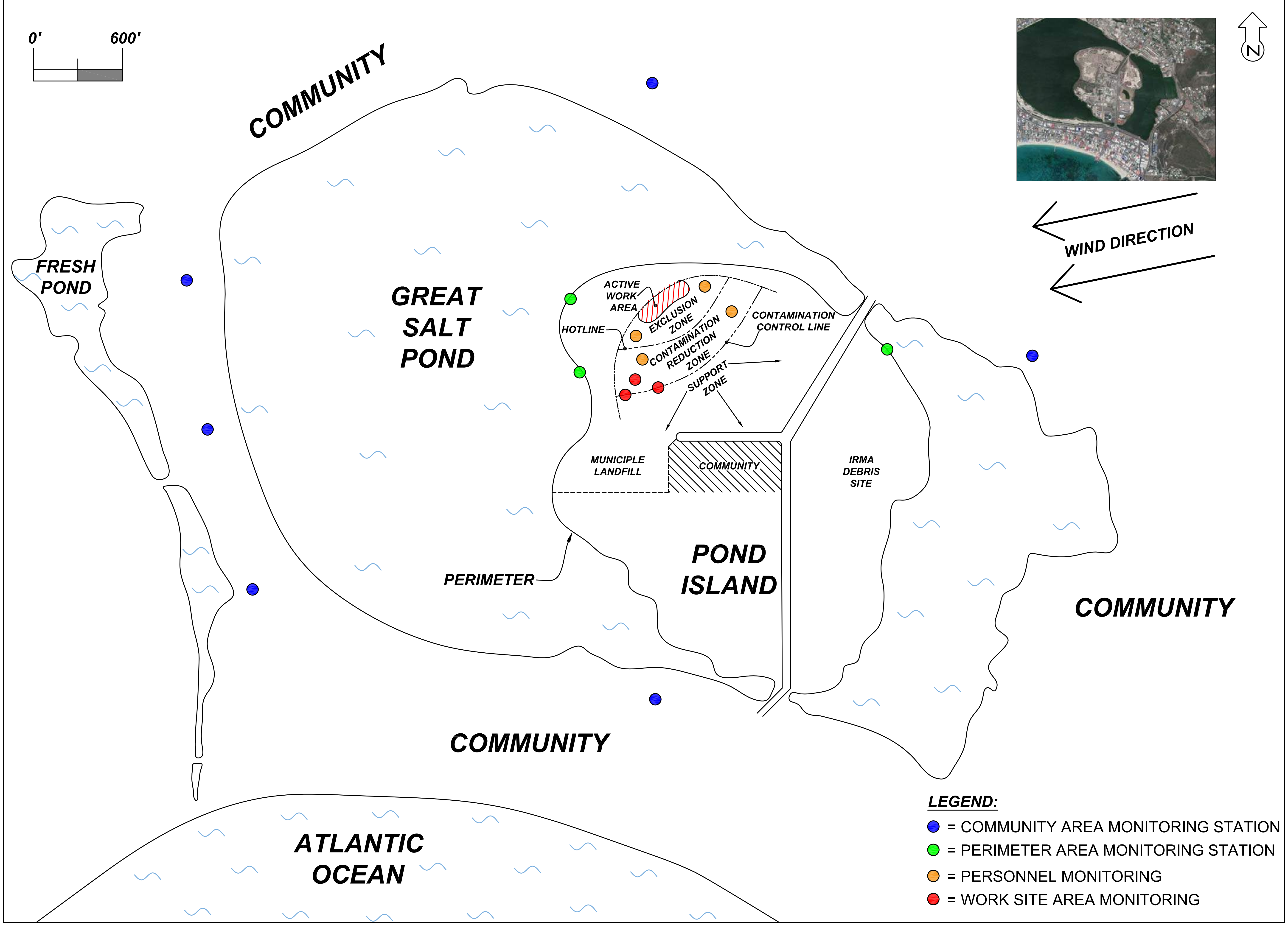
Contact your local TSI Distributor or visit our website **www.tsi.com** for more detailed specifications.

Printed in U.S.A.

APPENDIX E

SAMPLE MONITORING PLAN SITE DIAGRAM



LEGEND:

🔵 = COMMUNITY AREA MONITORING STATION

🟢 = PERIMETER AREA MONITORING STATION

🟠 = PERSONNEL MONITORING

🔴 = WORK SITE AREA MONITORING

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PROJECT:

LANDFILL
(SXM)

ST MAARTEN ISLAND
CARRIBEAN ISLANDS

SHEET TITLE:

SITE
MAP

Dwg. Date:	01/07/2019
Job No. :	2018-4191
Drawn By:	JML
App. By:	
Scale:	1"=600'
Cad File:	FIG1
Revisions:	
Figure No.	1

Annex G

National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Investigation of the air quality around the landfill Sint Maarten 2019

Measurements and results of the
MOD field visit in January 2019

RIVM Report 2019-0056

P. Morgenstern et al.

National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Investigation of the air quality around the landfill Sint Maarten 2019

Measurements and results of the MOD field visit in January 2019

RIVM Report 2019-0056

Colophon

DOI 10.21945/RIVM-2019-0056

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This investigation was performed by order, and for the account of the Ministry of VROMI, within the framework of the Environmental Incident Service.

This is a publication of:
National Institute for Public Health and the Environment
P.O. Box 1 | 3720 BA Bilthoven
The Netherlands
www.rivm.nl/en

Synopsis

Investigation of the air quality around the landfill at Phillipsburg, Sint Maarten, 2019

Measurements and results of the MOD field visit in January 2019

At the beginning of 2019, the RIVM measured the air quality around the landfill at Philipsburg, Sint Maarten for two weeks. No or hardly any harmful substances were measured. During the measurement period there were no open fires at the landfill. As a result, the RIVM is unable to assess the potential health risks of substances released in the event of an open fire at the landfill. In order to do so, it is necessary to take measurements during an open fire. The local fire department could perform this task. RIVM can support the fire brigade with specialized equipment and knowledge.

The measurements were taken by the Environmental Incident Service (MOD) of the National Institute for Public Health and the Environment (RIVM) between 24th January and 6th February 2019. The measurements were taken at a distance of 500 to 2500 metres from the landfill. The RIVM did not perform any measurements at the landfill itself. The locations were chosen to provide a good insight into the possible exposure of the local population.

Measurements were taken to identify the following substances: particulate matter (PM10), inorganic gases, Volatile Organic Components (VOC), aldehydes, Polycyclic Aromatic Hydrocarbons (PAHs), dioxins and Polychlorinated Biphenyls (PCB). This is a broad "package" of substances that might be relevant in case of a fire. From the 206 samples taken, a representative selection of 90 samples was analyzed in special laboratories.

In some cases, the concentrations of aluminum and possibly of chromium measured were found to exceed the standards that apply if people were to breathe these substances continuously throughout their lives. However, the health effects of these exceedances are negligible. For PAHs, some samples exceeded the standards that would apply if these substances were ingested daily during a lifetime. This results in an almost negligible health risk. The odour nuisance that people experience can cause health problems such as nausea and headache.

Keywords: MOD, RIVM, air quality, waste, landfill, fire, Sint Maarten, odour, Irma

Publiekssamenvatting

Onderzoek naar de luchtkwaliteit rond de afvalberg, te Philipsburg, Sint Maarten, 2019

Metingen en resultaten van het MOD onderzoek januari 2019

Begin 2019 heeft het RIVM twee weken lang de luchtkwaliteit gemeten rond de stortplaats van Philipsburg, Sint Maarten. Er zijn niet of nauwelijks schadelijke stoffen gemeten. In de meetperiode waren er geen uitslaande branden op de vuilstort. Het RIVM kan dus niet beoordelen wat de mogelijke gezondheidsrisico's zijn van stoffen die vrijkomen bij uitslaande branden op de stortplaats. Om dat wel te kunnen doen, is het noodzakelijk om tijdens een brand te meten. Deze taak zou de lokale brandweer kunnen uitvoeren. Het RIVM kan de brandweer indien nodig ondersteunen met apparatuur en kennis.

De metingen zijn tussen 24 januari en 6 februari uitgevoerd door de Milieu Ongevallen Dienst (MOD) van het RIVM. Op afstanden van 500 tot 2500 meter van de stortplaats zijn op diverse plekken metingen gedaan. Op de afvalberg zelf is niet gemeten. De meetlocaties zijn zo gekozen dat ze een goed inzicht geven in de mogelijke blootstelling voor de lokale bevolking.

Er zijn metingen gedaan naar: fijn stof (PM10), anorganische gassen, Vluchtige Organische Componenten (VOC), aldehyden, Polycyclische Aromatische Koolwaterstoffen (PAK's), dioxinen en Polychloorbifenylen (PCB). Dit is een breed 'pakket' van stoffen waar bij een brand naar kan worden gekeken. Van de 206 genomen monsters is een representatieve selectie van 90 monsters geanalyseerd in speciale laboratoria.

In enkele gevallen overschrijden de gemeten concentraties aluminium en chroom de normen die gelden als mensen deze stoffen continu, hun leven lang inademen. Het gezondheidseffect van deze overschrijdingen is echter verwaarloosbaar. Voor PAK's overschrijden enkele monsters de normen die gelden als deze stoffen gedurende een heel leven via de mond zouden worden ingenomen. Dit levert een vrijwel verwaarloosbaar gezondheidsrisico op. De geurhinder die mensen ervaren kan gezondheidsklachten veroorzaken, zoals misselijkheid en hoofdpijn.

Kernwoorden: MOD, RIVM, luchtkwaliteit, afval, afvalberg, brand, Sint Maarten, geurhinder, Irma

Contents

1 Introduction — 9
1.1 Background and context — 9
1.2 Aim / objectives — 9
1.3 Scope — 9

2 Study design — 11
2.1 Open fire versus smouldering fire — 11
2.2 Sampling, measurement, analysis, applied techniques — 11
2.3 Measurement techniques and strategies — 11
2.4 Sampling locations — 12
2.5 Health based guideline values to assess the risks of smoke — 16
2.6 Relationship to study of the World Bank Group — 17
2.7 Experiences in the Netherlands with landfill fires — 17

3 Field work and results — 19
3.1 Field observations — 19
3.1.1 Open fire — 19
3.1.2 Smouldering fires — 19
3.1.3 Nuisance caused by odour — 19
3.2 Samples taken — 20
3.3 Sample selection and analysis — 20
3.4 Results — 20

4 Risk assessment — 21
4.1 Introduction — 21
4.2 Risk assessment measured concentrations in air — 21
4.2.1 PM_{10} — 21
4.2.2 PAHs, dioxins, PCB’s and aldehydes — 21
4.2.3 Elements — 21
4.2.4 VOC — 22
4.3 Risk assessment measured concentrations in dust wipe samples — 22
4.3.1 Dioxins and elements — 22
4.3.2 PAHs — 22
4.3.3 Odour nuisance — 23

5 Conclusions and recommendations — 25
5.1 Conclusions — 25
5.2 Recommendations — 25

Appendix 1 Sampling and measurement techniques — 27

Appendix 2 Location description and strategy — 34

Appendix 3 Geographic setting and photograph locations — 38

Appendix 4 Particulate matter (PM_{10}) in air — 47

Appendix 5 Elements in PM_{10} in the air — 49

Appendix 6 Elements in coarse dust — 52

Appendix 7 PAHs in PM_{10} in the air — 55

Appendix 8 PAHs in coarse dust — 56

Appendix 9 Dioxins in PM_{10} in air — 58

Appendix 10 Dioxins in coarse dust — 59

Appendix 11 Volatile Organic Compounds in the air — 61

Appendix 12 Aldehydes in air — 64

Appendix 13 Experience with landfill fires in the Netherlands — 65

References — 68

Abbreviations — 71

1 Introduction

1.1 Background and context

The Environmental Incident Service (MOD) of the National Institute for Public Health and the Environment (RIVM) was commissioned to conduct research for the government of Sint Maarten. The request concerned support (in the form of technical assistance) in identifying the potential public health impact of fires at the landfill.

Regular outbreaks of fire at the Sint Maarten landfill generate dense clouds of smoke, a nuisance that affects a great many people. Apart from general known health concerns regarding smoke, there is no additional information available for this specific site. The government of Sint Maarten lacks the expertise to measure the possible impact this smoke might have for public health.

The Ministry of the Interior and Kingdom Relations has offered the government of Sint Maarten support, by requesting the RIVM's MOD to take measurements in order to assess the air quality around the landfill in relation to open fire on the landfill.

1.2 Aim / objectives

MOD's investigation was commissioned by Sint Maarten's Minister for Public Housing, Spatial Planning, Environment and Infrastructure (VROMI). Three questions were central to this investigation:

1. Which potentially hazardous substances released by the fire on Sint Maarten will MOD's measurement technology be able to identify?
2. What substances are currently being deposited there or have been deposited there in the past?
3. What potential public health risks do the identified substances pose?

1.3 Scope

The aim of our study was to measure hazardous materials in the air resulting from a fire. During our study, no fires broke out at the landfill. Therefore our research was limited to a 'no open fire scenario'. The research focused on gas and particulate matter in the area (downwind) where people potentially would be exposed. Sampling of crops has been considered, but there was no agricultural activity observed on the island (almost all food is imported), so that exposure route was considered irrelevant. Soil and water were not investigated.

Occasionally, the MOD took samples when odour was detected, presumably from the landfill. Occasionally, when there was activity involving excavators at the landfill, fumes from smouldering fires within the landfill were seen from a distance.

RIVM's MOD visited Sint Maarten from 21st January to 8th February 2019. Measurements were conducted between 24th January and 6th February 2019 (14 days).

2 Study design

2.1 Open fire versus smouldering fire

The purpose of this investigation was to carry out measurements of the potentially hazardous substances produced by an open fire at the landfill. This open fire did not occur. In the event of an open fire, massive amounts of black smoke would be expected. A lot of smoke presents good opportunities to measure the composition of the smoke and provides a picture of the 'worst case situation'. To study the potential effects that an open fire would have on public health, an actual fire is needed. Since there was no fire, these effects could not be studied.

In the absence of an open fire, measurements were taken in the surroundings of the landfill for 'no open fire conditions' over a period of 14 days. There was some marginal smoke produced by smouldering fires at the landfill and an odour presumably originating from the landfill was sometimes detected in the field. This might have had some influence on the measurements, but this is expected to be marginal.

2.2 Sampling, measurement, analysis, applied techniques

In this report, all three terms are used in a slightly different context. Measurement is the most general term and includes both measurements on-site (in the field) and the analysis conducted afterwards in a laboratory. Some measurements taken in the field, using field detection equipment, yield an immediate result: a component is detected or not. In general, the detection limit (lower limit of detection) of this type of equipment is high. This means that only high concentrations of a substance can be detected. Other measurements are done by sampling in the field in order to conduct an analysis in a laboratory afterwards. The detection limit of most analysis done is very low. This means low concentrations can be detected. In this study, RIVM has conducted specific measurements and analysis related to expected components in smoke. Samples were analysed by TNO Utrecht, RIKILT Wageningen, RPS Breda and RIVM's own laboratory at Bilthoven in the Netherlands. For personal protection of the RIVM team-members, also radiation detection equipment was used. No radiation was detected.

2.3 Measurement techniques and strategies

In Appendix 1, the instruments and techniques that are used in the field are described in greater detail. The measurement techniques basically consisted of the following categories:

1. Field detection that yields instantaneous (direct) information. For example, the multiRAE for inorganic gases.
2. Collecting gases for analyses. Examples are sample techniques such as canisters, 3M^{TM}-badges (Figure 1, a), aldehyde cartridges.
3. Collecting particulate matter in the air for analysis in a laboratory. There were four Leckel 'base stations' (Figure 1, b) where PM in the air was collected 24/7. KFG equipment (Figure *2*, a) was used for two hours of sampling at various locations.

4. A measurement-schedule was drafted to sample these various locations frequently. Field observations such as: 'we smell an odour that seems to be related to the landfill' were noted for all samples.
5. Collecting deposited (coarse) dust from smooth objects for a 'historical perspective' (Figure 1, c) and collecting coarse dust from petri dishes for a 'two-week perspective'.

All the applied sampling and measurement techniques are described in more detail in Appendix 1.

Figure 1. 3M badge for passive sampling at location 1 (a), Leckel filter equipment at location D (b) and swiping dust for historical interpretation (c).

Figure 2. Two KFG dust samplers (a), canister (b) and pump with sorbent tube (c) at VROMI yard (location 4).

2.4 Sampling locations

Most sampling locations were chosen during the first two days of our stay. Some additional locations where added in the course of the field work. The selection of the sampling locations was based on the following principles:

For *downwind* measurement locations:

- With the prevailing wind direction (usually between south-east and north-east) in mind, measuring locations should be exposed to emissions from the landfill. However, local orography has a great influence on the airflow and local winds can deviate greatly from the direction of the prevailing wind. The smoke of past fires moved towards the sea via Fort William or via Little Bay. This was taken into account when measuring locations were selected. Figure 3 gives a general impression of local airflows under easterly (dominant) wind conditions.
- Relevant measuring locations should be located at sites where, in general, the local population might be exposed to emissions from the landfill.
- At measurement locations, the influence of disturbing local sources should be minimized as much as possible. In the area around the landfill, local traffic was expected to have the largest influence on the measurements. The selected measurement locations were chosen in such a way that the influence of the traffic emissions was assumed to be as minimal as possible.
- At measuring locations with continuous sampling equipment, a power supply is required. Also, the location should have no free public access.

Figure 3 Local airflow under easterly wind conditions

For *upwind* measuring locations:

- Upwind measurement locations are intended to determine the composition of the air before it is affected by emissions from the landfill. These locations may therefore not be affected by emissions from the landfill itself. Also, the influence of local emissions should be minimized.

Furthermore, the MOD had to take into account:

- Emissions from an asphalt plant on the north side of the landfill might influence the measurements. In order to make an estimation of these emissions possible, additional measurement locations were setup for this purpose. This turned out to be an irrelevant factor, since there was no activity at the asphalt plant during our measurement period.
- The wind speed during the day can differ from the wind speed at night (as shown in Figure 4).

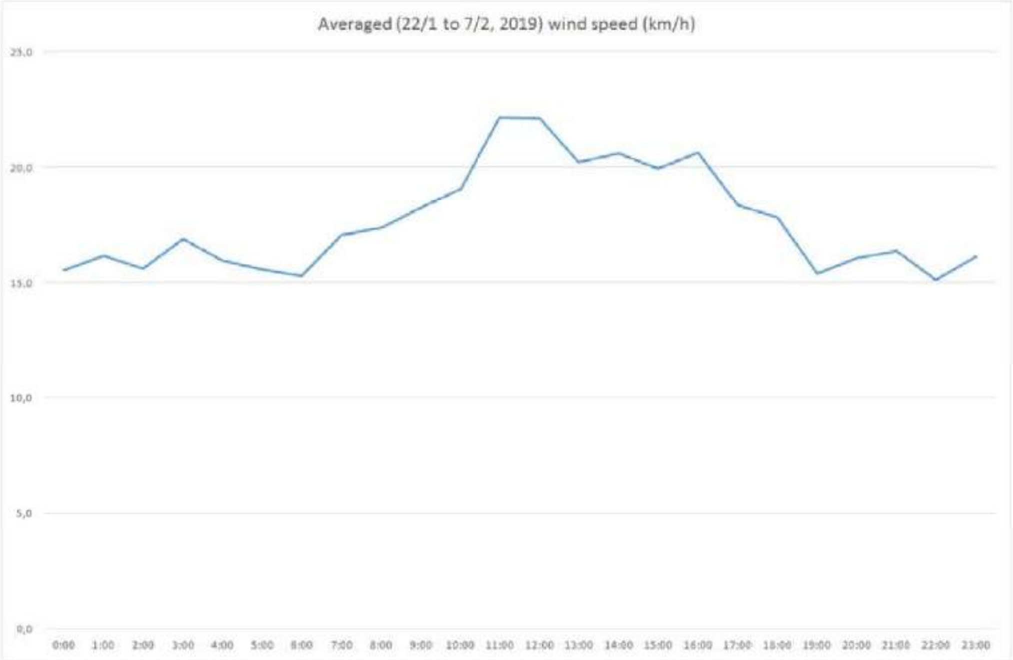

Figure 4 Averaged wind speed during the day for the period of 22th January to 7th February 2019.

In total, four monitoring locations (A-D) were chosen and fourteen other locations (1-14) were chosen for additional sampling. All locations are depicted in Figure 5 and a summarized description of the locations is given in Table 1.

Additional information on the locations and applied techniques is given in Appendix 1, Appendix 2 and Appendix 3.

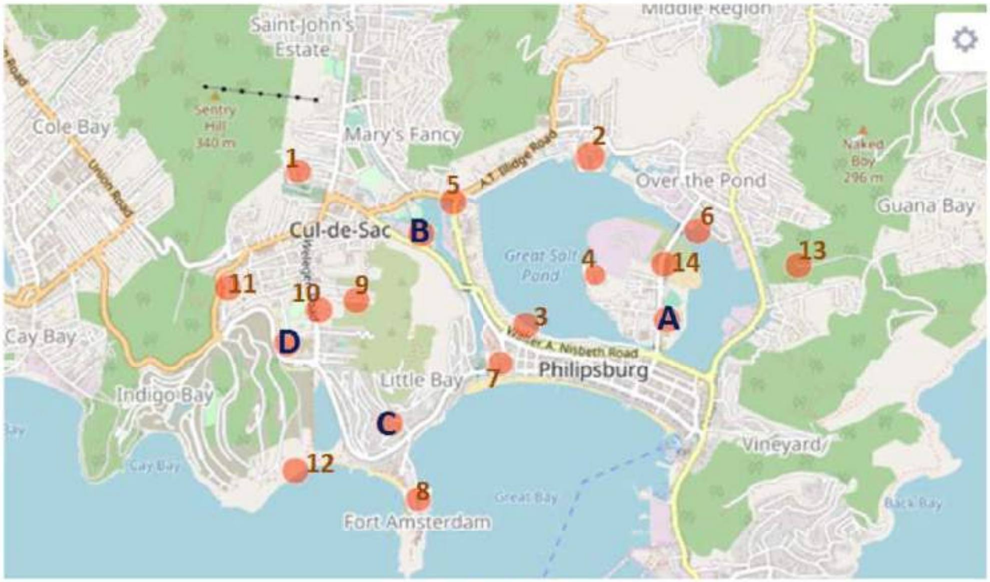

*Figure 5 Map of all sampling locations (●); **A-D** are fixed monitoring locations with Leckel 24/7 sampling equipment and **1-14** are historical and instantaneous locations using other techniques*

Table 1 Summarized description of locations and remarks

Code	**Description**	**Continuous monitoring**	**Non-continuous monitoring**
A	Festival terrain (upwind)	LE PA WI	KF CA SO AL
B	Miss Lalie	LE PA WI	CA SO AL
C	Belair	LE PA WI	CA SO AL
D	Fire department	LE PA WI	CA SO AL
1	Sugar Hill Drive	PA WI PE	KF CA SO AL
2	Asphalt plant – west side	PA WI PE	
3	W.A. Nisbeth road	PA PE WI	KF CA SO AL
4	VROMI yard	PA PE	KF CA SO
5	Roundabout near waste water treatment plant A.T. Illidge Road	PA	
6	Asphalt plant – east side	PA PE WI	
7	Graveyard (Kerkhofstraat)	PA PE WI	
8	Divi Hotel	PA (PE) WI	
9	Uphill east of Welgelegen Road	PA PE WI	
10	Welgelegen Road	PA PE WI	
11	Uphill west of Welgelegen Drive	PA PE WI	
12	Squirrel Drive	PA WI	
13	Viewpoint Bloomingdale (upwind)	PA	
14	Soualiga Road (Irma landfill)	PA	KF AL CA SO

Legend for Table 1

LE: Leckel air filter
KF: KFG air filter
CA: canister
SO: Sorbent tube
PA: Passive VOC (3M badge)
AL: Aldehyde sampling
PE: Petri dish Wipe
WI: Wiping of fixed objects

2.5 Health based guideline values to assess the risks of smoke

When accepting the assignment, RIVM assumed that substances could be measured in the smoke from an open fire during the investigation period. Smoke is a complex mixture of a large number of chemicals. Health complaints and health effects from exposure to smoke are caused by the combination of various chemicals and groups of chemicals that it contains. Currently, there is insufficient scientific literature available to derive health-based guideline values for exposure to smoke, as a complex mixture. Therefore, it is not possible to make a precise assessment of the health complaints or nuisance people experience at a given location caused by exposure to smoke.
But it is possible to estimate the potential health risks by comparing the measured concentrations of individual compounds that can be present in smoke (for example PM_{10}, PAHs, dioxins, heavy metals, volatile organic compounds (VOCs) and aldehydes) to health-based guideline values for the protection of public health.

These health-based guideline values are defined as the amount of a compound to which an individual can be exposed, on a daily basis, throughout their lifetime without incurring any significant health risk. They cover both oral and inhalation exposure (and, if necessary, dermal exposure), as well as classic toxic risks and carcinogenic risks.
The quality standards are generally expressed as a tolerable daily intake (TDI), an excess carcinogenic risk via intake (CR oral) – both of which cover exposure by oral ingestion – a tolerable concentration in air (TCA) or an excess carcinogenic risk via air (CR inhaled), both of which cover exposure by inhalation (Baars et al., 2001).

The health-based guideline values are based on existing toxicology reviews of such compounds, i.e. reviews conducted by national and international organizations such as RIVM, WHO, EU, US-EPA, IARC, ATSDR. These evaluations are carried out by national or international committees or by experts from home or abroad. They are generally considered to be critical and well-validated data sources.
The underlying dataset used for these reviews consists of the results of studies conducted into the effects of the compound in question in humans, a variety of toxicological endpoints investigated in animal experiments, plus information regarding the dose-effect relationship and regarding the mechanism (or mechanisms) of the toxic effect (or effects) observed. Full details of how these health-based guideline values were derived are given in the report by Baars et al. (2001).

For the purposes of the current investigation, RIVM compared the measured concentrations of particulate matter, PAHs, dioxins, heavy metals, VOCs and aldehydes with the available public health-based guideline values, as described above. Based on the outcomes of this comparison, information on the potential health risk due to exposure will be provided.

If no health-based guideline values were available, measured concentrations were compared to guideline values for workers. Though such values are derived for a specific group of people under specific exposure conditions, a comparison can give an indication of potential health risks.

2.6 Relationship to study of the World Bank Group

EE&G Disaster Response, LLC (EE&G) has been retained by the World Bank to perform a preliminary screening of smoke from subsurface fires at the “debris and disposal sites” in Phillipsburg. In our study we refer to the same area as “landfill”. The work of EE&G / World Bank was done in support of the Hurricane Irma Restoration, Recovery and Resilience Program in Sint Maarten. Their field work was conducted on the 28th, 29th and 30th August 2018. The main differences between the research conducted by EE&G/the World Bank in August 2018 and the research conducted by MOD/RIVM in January/February 2019 are described in Table 2.

Table 2 Study conducted by EE&G for the World Bank in 2018 versus study conducted by RIVM for VROMI in 2019 near the landfill, Sint Maarten

EE&G / World Bank	**MOD / RIVM**
28th, 29th, 30th August 2018	24th January - 6th February 2019
Research related to the workers on or near the landfill	Research related to local residents of Philipsburg
Research conducted on the landfill	Research conducted in the town of Philipsburg in the surroundings of the landfill (500 metres – 2500 metres away from the landfill)
No open fire, only (occasional) smouldering fire within the landfill	No open fire, only (occasional) smouldering fire within the landfill
Sampling and measurement directly from the smoke plumes	Sampling and measurement of air in the surrounding area
Same analysis as MOD with exceptions: • $PM_{2.5}$ instead of PM_{10} • Also asbestos and ozone • No aldehydes Also, there is a slight difference in some of the elements analysed	Same analysis as EE&G with exceptions: • PM_{10} instead of $PM_{2.5}$ • No asbestos and ozone • Also aldehydes Also, there is a slight difference in some of the elements analysed
Results are compared to short-term and working conditions exposure levels	Results are compared to long-term and chronic exposure levels

2.7 Experiences in the Netherlands with landfill fires

The RIVM has over 30 years of experience in the Netherlands with different types of fire, including landfills and emissions. A summary of our knowledge has been included in Appendix 13.

3 Field work and results

3.1 Field observations

3.1.1 *Open fire*

During this time, the MOD visited Sint Maarten (21st January – 8th February 2019) and **no** open fires occurred. The two weeks following the MOD visit (8th February – 22th February), when a Leckel filter was continuously sampling three types of particulate matter in the air, also **no** open fires occurred.

3.1.2 *Smouldering fires*

On some occasions limited quantities of smoke from smouldering fire within the landfill were visually detected (see Figure 6). However the focus of our investigation was not on the landfill itself (where this small amount of smoke can be detected best) but in the surrounded area (where it was impossible to see if smoke emerged on a small scale from the landfill). Since the amount of smoke from smouldering fires was so limited and this could only be seen near the landfill the presence or absence of smoke from smouldering fire did hardly play a role in our measurement strategy. However if smoke was detected on the landfill this was noted in the description of the samples of that day.

Figure 6 Smoke holes (brown/black spots marked by a red arrow) from smouldering fires inside the landfill.

3.1.3 *Nuisance caused by odour*

Nuisance caused by odour has been experienced by our team on several occasions during the field visits. This seems to be related primarily to the strength and precise path of the wind. The origin of the odour presumably was the landfill. If odour was detected in the field this was noted in the description of the samples.

3.2 Samples taken

The total number of samples taken with each technique are given in Table 3. In total, 206 samples were taken, 90 of which (44%) were analysed in the Netherlands (the selection of samples for analysis is explained in the next paragraph).

Table 3 Description of technique, number of locations

Technique	**Locations**	**Number of samples collected**	**Number of samples analysed**
Leckel air filter	4	52	15
KFG air filter	5	26	12
Canister	8	29	9
Sorbent tube	8	22	9
Passive VOC (3M badge)	18	18	18
Aldehyde sampling	7	11	8
Petri dish Swipe	10	20	13
Swiping of fixed objects	14	28	6
Total	**18**	**206**	**90**

Remark: the techniques are explained in 0.

After the MOD ended its investigation (22th February), a Leckel filter was left behind to take 24-hour samples for a period of two weeks. This Leckel was placed at a location near the sewage system. The idea was to have a last chance to take samples during an open fire. However, during these two weeks no fire occurred. The filters were not analysed (as it is expected the results would be similar to the samples taken earlier). Canisters were also left behind for the fire department to take air samples in the event of a fire (which occurred March 30th 2019).

3.3 Sample selection and analysis

A lot of samples were taken, but since there was no open fire during the measurement period, it was expected that the samples contain only very low amounts of chemicals, if any at all. Therefore a selection of samples was made. The sample selection included the variety in locations on different moments within the two week sampling period. All samples taken on days and/or locations when our field team detected either smoke from smouldering fire or odour presumably from the landfill, were included for analysis. The sample selection was deemed representative for the two weeks measurement period by the experts of the RIVM. Analysis was done in the Netherlands at RIVM, RPS, RIKILT and TNO. In total 90 samples out of 206 samples were analysed (see also Table 3).

3.4 Results

All the analysis results were processed. Many of the components investigated were not found in the samples. All results of the analysed samples that were above the detection and reporting limit are included in appendices Appendix 4 - Appendix 12. An interpretation of the results is made in the next chapter (Risk Assessment).

4 Risk assessment

4.1 Introduction

The results of the monitoring campaign are believed to be an indication for the long-term situation without an open fire. Substances that were measured were far below a health-based guideline value. In the sections below and in Appendix 4 – Appendix 12, a more elaborate assessment is provided.

4.2 Risk assessment measured concentrations in air

4.2.1 *PM_{10}*

With respect to Particulate Matter (PM_{10}), all measured concentrations at three out of four locations were below the EU annual average exposure limit of 40 µg/m^3. At the fourth location, this limit was exceeded twice during the monitoring campaign. On one of these occasions, the 24-hour exposure limit of 50 µg/m^3 was exceeded as well. The averaged exposures over the monitoring period indicate that the PM_{10} levels were well below the annual average exposure limit and does not present any concern. Whether exceeding the daily average exposure limit is a concern cannot be concluded with certainty. Exceeding this EU limit is permitted 35 times per year. Based on an extrapolation of the two-week monitoring campaign, the limit would be exceeded 26 times.

4.2.2 *PAHs, dioxins, PCBs and aldehydes*

The measured concentrations of PAHs (polycyclic aromatic hydrocarbons), dioxins, dioxin-like PCBs (polychlorinated biphenyls) in PM_{10} and the concentration of aldehydes did not exceed the health-based guideline values. Therefore, exposure to the measured concentrations of these substances in the air is not expected to result in adverse health effects.

4.2.3 *Elements*

Elements, including heavy metals, measured in PM_{10} in the air revealed relatively high concentration results for some of the elements, whereas most other elements show low concentrations. The elements found in higher concentrations probably come from sea salt and sand being blown over the island. Of these elements, the levels of aluminium and chromium call for a deeper look. For aluminium, the (conservative) tolerable concentration in air (TCA) was exceeded by a factor of 8. However, it should be noted that the TCA has lingering uncertainties due to missing data. Hence, the TCA was reported to be very conservative. Furthermore, the measured values of aluminium showed the same concentration range as found as a background in the Netherlands and USA (ATSDR, 2008).
In relation to the metal chromium (Cr), the oxidation state is relevant for the toxicity. It is unclear whether the chromium found is Cr(III) of Cr(VI)[1]. Cr(VI) is more toxic than Cr(III), but much less stable in the environment. For that reason (instability), it is assumed that most of the

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[1] Additional chromium discrimination analysis that might have revealed if chromium VI was present could not be conducted, since the elemental analysis method was destructive for the samples.

chromium present in particulate matter in the air is Cr(III). The TCA for Cr(III) in air was not exceeded. In the unlikely case all chromium would be chromium (VI), the TCA would be exceeded in some samples collected during 2-hour sampling periods. However, in the 24 hour averaged Leckel samples, none of the TCA values for chromium were exceeded.

4.2.4 VOC

For the VOC, only for benzene was the chronic health-based guideline value exceeded by a factor of 2 in one sample taken near the landfill. Other samples (collected using a different sampling technique) at other locations indicated low concentrations of benzene, but not above the chronic health based guideline. For the other VOC, the available health-based guideline values were not exceeded. The fire department used canisters left behind by RIVM to sample in the event of a fire, which happened at 30th of March 2019. As Table 18 shows the results are higher than the results from the analysis carried out with the RIVM samples. However due to the lack of data of the exact measuring locations no further conclusions can be drawn based on these measurements.

4.3 Risk assessment measured concentrations in dust wipe samples

4.3.1 Dioxins and elements

The measured concentrations of dioxins and dioxin-like PCBs in dust wipe samples that could be contacted dermally or ingested via hand-to-mouth contact did not give indications that health-based guideline values would be exceeded. Therefore, exposure to these substances are not expected to result in adverse health effects.
Similarly, elements found in the dust wipe samples did not give any indications that health-based guideline values are being exceeded.
For chromium, the measured values exceed the value for Cr(VI) in the case that all measured chromium would be Cr(VI). However, it is more likely that a significant part of the measured chromium is the less toxic Cr(III), and that the health based guideline values are not exceeded.
Again, it was noted that certain elements showed relatively high concentrations, which is probably due to sea salt and sand.

4.3.2 PAHs

For PAHs, the sum of the measured values expressed as benzo[a]pyrene equivalents was compared to the Virtually Safe Dose (VSD) of 0.005 µg/kg bw/day. The VSD is a chronic health-based guideline value that corresponds to a risk of an extra cancer case of one per million based on a lifetime exposure. At location ‘graveyard’, the benzo[a]pyrene equivalents amounted up to 0.009 µg/kg bw/day (highest value), which exceeds the VSD by a factor of 2. This may result in an extra risk of cancer (2 per million per lifetime exposure). Based on wind directions, as shown in Figure 3, higher levels of exposure were expected at this location and this is supported by findings of elements and dioxins at this location. PAHs may have other sources as well, such as traffic or combustion processes, and thus it is unknown whether the landfill is the primary source of the PAHs exposure. Also, the assumption has been made that the dust wipe samples are representative for the exposure potential of local residents. In any case, exposure to PAHs is undesirable, therefore RIVM advises preventing high emissions of PAHs (for example caused by fires at the landfill) or avoiding contact with contaminated surfaces as much as possible.

4.3.3 Odour nuisance

An unpleasant odour has been detected by the RIVM in the field on several occasions, which seemed to originate from the landfill. In general, the perception of an odour can cause nuisance and even cause nausea, without being exposed to harmful amounts of a certain substance (RIVM 2009b).

5 Conclusions and recommendations

5.1 Conclusions

On the basis of these measurements, no conclusions can be drawn about the possible substances released in the event of an open fire. The following conclusions are based on the ‘no open fire conditions’ scenario:

- In the two weeks during which measurements were taken, only a few substances were found in low concentrations.
- For aluminium, some of the measured concentrations exceeded the health-based guideline value for chronic exposure.
- In the unlikely case all chromium would be Cr(VI), some of the measured concentrations exceeded the health-based guideline value for chronic exposure. However it is assumed that most chromium would be Cr(III) since that form is more stable in the environment. In that case, no health-based guideline values are exceeded.
- For PAHs, the concentrations found in dust wipe samples exceeded the health-based guideline value for lifelong daily intake. PAHs are emitted as a result of fires, but are also emitted through combustion gases of vehicles.
- Odour was detected by the field team. Odour nuisance can be a source of health complaints by the population.
- RIVM has detailed information about background concentrations for different components in the Netherlands, but no information on the background concentrations for Sint Maarten. This study provides an initial insight into these background conditions.

5.2 Recommendations

- The recommendation is to strive for the prevention of fire. This might reduce the amounts of elements, dioxins and PAHs in coarse dust. Alternatives to waste incineration in open burn pits are available.
- Measurements during an open fire are needed to indicate possible health risks for the population as a result of such an event. The local fire department could perform this task. RIVM can support the fire brigade with specialized equipment and education. An additional project could strengthen this collaboration.

Appendix 1 Sampling and measurement techniques

The instruments and techniques that were used in the field are described in Table 4. The content is explained below the table.

Table 4 Instruments, techniques, components, measurement period

Components measured / analysed	**Coarse dust**	**Particulate Matter 10 µm (PM_{10})**	**Particulate matter per fraction 0.3 | 0.5 | 1.0 | 2.5 | 5.0 | 10 µm**	**PAHs**	**Dioxin**	**Elements (including heavy metals)**	**VOC**	**Aldehydes**	**Hg**	**Radioactivity (β and Y)**	**Inorganic: CO |H_2S | SO_2 | HCN | CL2 | |PH_3 | NH_3 | NO | NO_2**	
Instrument / technique												**Measurement period**
Low Volume Sampler Filter, Sequential sampler (**Leckel** SEQ47/50)		x		x	x	x						24 hours / 7 days a week
Low Volume Sampler Filter, small filter device (**KFG**)		x		x	x	x						± 2 hours
Dust particle counter (**Lighthouse** 3016 IAQ)			x									Continuous / minute
Canister							x					± 2 hours
3M (3500 **badge**)							x					± 2 weeks
Activated charcoal tube (SKC226-01)							x					± 2 hours
Aldehyde cartridge (Waters DNPH)								x				± 2 hours
Wipe sample	x			x	x	x						Historical / ± 2 weeks
Gas screening for personal protection (MultiRAE)											x	Instantaneous / continuous

Components measured / analysed	**Coarse dust**	**Particulate Matter 10 µm (PM_{10})**	**Particulate matter per fraction 0.3 | 0.5 | 1.0 | 2.5 | 5.0 | 10 µm**	**PAHs**	**Dioxin**	**Elements (including heavy metals)**	**VOC**	**Aldehydes**	**Hg**	**Radioactivity (β and Y)**	**Inorganic: CO |H_2S | SO_2 | HCN | CL2 | |PH_3 | NH_3 | NO | NO_2**	
Instrument / technique												**Measurement period**
Mercury vapour monitor (Lumex RA-915)									x			Instantaneous / continuous
IdentiFINDER for personal protection (FLIR R400)										x		Instantaneous / continuous
Niton-XL3t XRF						x						Instantaneous

<u>Underlined and bold</u>: as frequently used in this report

Explanation of the components measured / analysed:

- Coarse dust: coarse dust is released during fires and can be analysed for its components. Coarse dust includes both small and large particles. Coarse dust can be sampled by wiping a surface (the techniques are explained on the next page).
- Particulate matter: these particles are much smaller than coarse dust and are defined by their diameter. PM_{10} contains particles with a diameter smaller than 10µm. PM_{10} can be collected on a filter (both on the Leckel and the KFG filter equipment) and analysed for elements, PAHs and dioxins. The lighthouse particle counter was used to gain some insight into the differentiation of the diameters (no conclusive insights could be made however).
- Polycyclic aromatic hydrocarbons (PAHs): a group of organic compounds made up of two or more benzene rings. Always released during fires and considered to be suspected carcinogens. Coarse dust and PM_{10} samples were analysed for PAHs.
- Dioxin: a collective name for a group of organic compounds, some of which highly toxic, that can be formed when materials that contain chlorine, such as plastics, are burned. Coarse dust and PM_{10} samples were analysed for dioxin.
- Elements (including heavy metals): all types of elements can be released during a fire, depending on the material that is being burned. Some heavy metals, in particular, are considered highly toxic, such as lead and cadmium. Coarse dust and PM_{10} samples were analysed for elements.
- Volatile organic compounds (VOC): the collective name for a group of hydrocarbons that readily vaporize. For instance, the components of fuels and solvents. These substances are related to a number of different environmental problems, including climate change, smog (including summer smog), and acidification. Furthermore, some of these substances are known to have potentially harmful effects on human health. Air samples taken by canister, 3M-badge and charcoal-tube were analysed for VOC.
- Aldehydes: a collective name for a group of chemical compounds with a common structure. Many have a strong odour. Aldehydes are used in products such as glues, resins, perfumes and hairsprays. Aldehydes can be carcinogenic. Aldehydes are sampled on special DNPH cartridges.
- Hg (mercury), radioactivity and inorganics: these measurements were mostly done for personal protection / as a check.

Explanation of the instruments / techniques used:

- Leckel: we used this low-volume filter sampler to collect particulate matter with an aerodynamic diameter <10µm (PM_{10}) at four fixed ‘base locations’. Every day a new filter was sampled for 24 hours, seven days a week. Therefore the result gives good insight into the daily concentration of PM_{10}. The filters are analysed for PM_{10} concentration and the presence of PAHs, dioxin and elements (heavy metals). See Figure 7.
- KFG: we used this low-volume filter sampler to collect particulate matter with an aerodynamic diameter <10µm (PM_{10}) at various locations. The sampling time was around two hours per sample. We tried to gain extra insight through our sampling

strategy, e.g. by sampling at a short distance from the landfill and longer distances and at times and places where odour was detected. The filters are analysed for PM_{10} concentration and the presence of PAHs, dioxin and elements (heavy metals). See Figure 8.

- The lighthouse detector was used to measure particulate matter in the field in combination with both Leckel and KFG, but only for confirmative purposes. See Figure 9.
- Three sampling techniques were used with respect to Volatile Organic Compounds (VOC).
  - A canister is a metal vacuum sphere that can be filled with air during a determined period of time. We sampled for ±2 hours per sample.
  - The 3M™-badges work through vapor diffusion (a passive type of sampling) and our sampling period was ±2 weeks.
  - The charcoal tubes are filled with a sorbent (charcoal). Air is actively pumped through the tube for ±2 hours per sample.

  All (three) sampling techniques require analysis in a laboratory afterwards. See Figure 10.
- Aldehyde cartridges are specially designed to capture chemicals in the group of aldehydes (such as formaldehyde, acetone, etc.). Air is actively pumped through the cartridge for ±2 hours per sample. The samples are analysed in a laboratory afterwards. See Figure 11.
- Wipe sampling (Figure 12) of coarse dust was done primarily in three manners:
  - ‘Historical’ samples were taken by swiping coarse dust off a known surface (e.g. 25 cm^2) from smooth objects upon initial arrival at a location (for example, a stone at the graveyard). As can be imagined, this yields the dust deposited during a unknown timeframe.
  - ‘Two weeks’ samples are from exactly the same locations as the ‘Historical samples’ but wiped after two weeks.
  - ‘Petri dish’ samples are collected by placing petri dishes at chosen locations and wiping the petri dish after a period of ±14 days.
- Several techniques that are normally used for personal protection were applied during the field visits. The multiRAE sensors detect inorganic gases such as CO, H_2S, etc. If a fire were to occur, this equipment would collect information on inorganic compounds released as a result of the fire. Additionally, a mercury detector and equipment to detect radiation were also applied. Since nothing was detected using these techniques, no results are included in this report.
- A Niton handheld XRF was used in the field to obtain an initial estimate (semi-quantitative) of the heavy metals collected on filters. Since the analysis in the laboratory yields much more reliable and quantifiable results, no niton results are included in this report.

Figure 7 Leckel 24/7 dust sampler at Belair (location C)

Figure 8 Leckel 24/7 dust sampler (a), KFG dust sampler (b), canister (c) and pump with sorbent tube (d) at the festival terrain (location A)

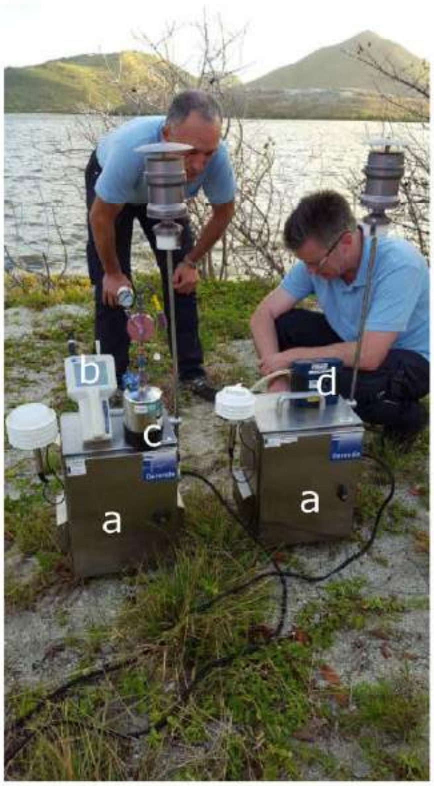


Figure 9 Two KFG dust samplers (a), a lighthouse dust detector (b) a canister (c) and pump with adsorption tube (d) at W.A. Nisbeth road (location 3)

Figure 10 Pump (a) with charcoal tube, 3M^{TM}-badge (b) for passive sampling and metal canister with restrictor (c) for a sampling time of ± 2 hours at Belair (location C).

Figure 11 Pumps with active carbon tube (a) and aldehyde cartridge (b)

Figure 12 Dust sampling: wiping a Petri dish (a) and a 'historical wipe' (b).

Appendix 2 Location description and strategy

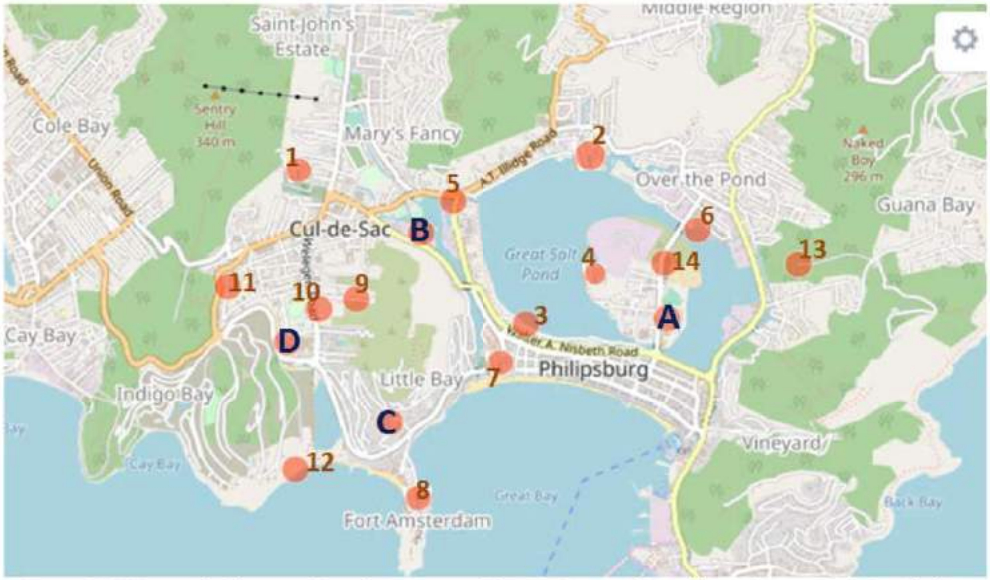


Figure 13 Map of all sampling locations (●); ***A-D*** *are fixed locations with Leckel 24/7 sampling equipment and* ***1-14*** *are locations with other techniques*

The locations can be classified into a few groups:

1. *Locations with continuous sampling of particulate matter (PM_{10}).*
   At these locations, daily samples of particulate are taken by the Leckel sampler. These samples can be used to determine the daily average PM_{10} concentration and can afterwards be analysed for the presence of heavy metals, polycyclic aromatic hydrocarbons (PAH) and dioxins.
   In addition to the Leckel sampler, these locations are also provided with a passive sampler. This sampler will indicate the average concentration of Volatile Organic Compounds (VOC) during the measurement campaign.
   At the start and at the end of the campaign, wipe samples were taken here.
   At regular intervals, mobile measurement equipment was used at these locations in order to monitor the emission from the landfill under smouldering conditions.
   Measurement locations in this group are: A-B-C-D, whereby location A is used for background measurements (marked * in Table 5).
2. *Measurement locations selected for additional measurements in the event a fire occurs.*
   In the event of a fire at these locations, mobile measurement equipment would be used for sampling the compounds released by the fire. When no fire occurs, measurements are taken at these locations at regular intervals in order to monitor the emission from the landfill under smouldering conditions. In addition, VOC sampler measurements and wipe samples are taken at these locations.Measurement locations in this group are: 1-3-4.

3. *Measurement locations used for information on the spatial distribution of released compounds*
   These locations were selected to get a more complete impression of the spatial distribution of compounds released by the landfill in addition to the measurements in groups 1 and 2.
   At these locations, only VOC sampler measurements and wipe samples are taken.
   Measurement locations in this group are: 7-8-9-10-11-12-13, such that 13 is used as background measurement without any traffic emissions (marked *). At this location, no wipe samples were taken.
4. *Locations for determining the influence of local emissions.*
   To produce estimates of the influence of local emission sources, some additional measurement locations were selected.
   Locations 2 and 6 were set up to monitor the contribution of emissions from the asphalt plant. Location 6 was to be used for background measurements here (marked * in Table 5).
   During the campaign, no activity was observed at the asphalt plant, so no mobile measurements were performed here during the campaign and therefore only VOC sampler measurements and wipe samples were taken at these locations.
   Location 5 was used as an indicator for local traffic emissions. Here only a passive VOC measurement was taken.
5. Location for monitoring smouldering emission
   In order to get an idea of the emissions from the smouldering landfill, location 14 was set up. At this location, a strong odour of smouldering material is almost always present. Measurements taken here can be used as a worst-case indicator for landfill emissions when no fire is present.

Table 5 Description of locations, sampling methods and remarks.

Code	**Description**	**Remarks**	**classification**	**Continuous monitoring**	**Non-continuous monitoring**
A	Festival terrain	Used for background measurements	1*	LE PA WI	KF CA SO AL
B	Miss Lalie	Situated on the rooftop in order to minimize influence of traffic emissions. Expected to be exposed to the highest concentration in the event of a fire when wind is from a SE-E direction.	1	LE PA WI	CA SO AL
C	Belair	Situated at a (unused) parking location of an apartment complex. Location is located on a hillside in order to minimize the influence of traffic emissions. Is expected to be exposed when wind is from a NE direction.	1	LE PA WI	CA SO AL
D	Fire department	Situated on a rooftop of the fire department. Is used to give an indication of ambient levels at a more remote location.	1	LE PA WI	CA SO AL
1	Sugar Hill Drive	In a residential area where the population is expected to be exposed to relatively high concentrations in the event of a fire with wind from a SE-E direction.	2	PA WI PE	KF CA SO AL
2	Asphalt plant – west side	Location originally meant to determine the contribution of the asphalt plant to the air quality. In hindsight, the asphalt plant was not active during the period of our study.	4	PA WI PE	
3	W.A. Nisbeth road	This site will be exposed to emissions from the landfill when winds are from a E-NE direction and, under these conditions, the highest concentrations are expected here. The site is not influenced by traffic emissions. Extensive sampling techniques were conducted at this site.	2	PA PE WI	KF CA SO AL
4	VROMI yard	Located at a storage location of VROMI. Location has shortest distance to the landfill and should give an indication of pollution levels in the centre of Philipsburg in the event of a fire with winds from a N-NE direction.	2	PA PE	KF CA SO
5	Roundabout near waste-water treatment plant A.T. Illidge Road	Located near a roundabout with a lot of traffic. Used as an indicator for local traffic emissions.	4	PA	
6	Asphalt plant – east side	Location was meant as a background location for the measurements at location 2.	4*	PA PE WI	

Code	Description	Remarks	classification	Continuous monitoring	Non-continuous monitoring
7	Graveyard (Kerkhofstraat)	Used to provide more spatial information in relation to the measurements at locations C, 3 and 4.	3	PA PE WI	
8	Divi Hotel	Used to provide more spatial information in relation to the measurements at locations C, 3 and 4.	3	PA (PE) WI	
9	Uphill east of Welgelegen Road	Is used to give an indication of ambient levels at a more remote location and should also give an indication of the spatial distribution along the slopes of the valley (together with locations 10 and 11). Contribution of traffic to the air quality is expected to be limited at this site.	3	PA PE WI	
10	Welgelegen road	Is used to give an indication of ambient levels at a more remote location and should also give an indication of the spatial distribution along the slopes of the valley (together with locations 9 and 11). Contribution of traffic to the air quality is expected to be limited at this site.	3	PA PE WI	
11	Uphill west of Welgelegen Drive	Is used to give an indication of ambient levels at a more remote location and should also give an indication of the spatial distribution along the slopes of the valley (together with locations 9 and 10). Contribution of traffic to the air quality is expected to be limited at this site.	3	PA PE WI	
12	Squirrel drive	Used to give more spatial information in relation to the measurements at locations C and D. Due to local orography, this location might be influenced by both most common local airflows (see Figure 1)	3	PA WI	
13	Viewpoint Bloomingdale (upwind)	Location used for visual observations of the landfill. Measurement should give an indication of background levels without any influence of traffic emissions.	3*	PA	
14	Soualiga Road (Irma landfill)	At this location, a strong odour of smouldering material is almost always present. Is used as a worst-case indicator of landfill emissions when no fire is present.	5	PA	KF CA SO AL

Legend for Table 1

LE: Leckel air filter,
KF: KFG air filter
CA: canister
SO: Sorbent tube
PA: Passive VOC (3M badge)

AL: Aldehyde sampling
PE: Petri dish Wipe
WI: Wiping of fixed objects
* considered as backgroun

Appendix 3 Geographic setting and photograph locations

Location A
Type of location: SE 0.56 km (from top of the landfill)
Location description: Festival terrain
Address: Festival Village
Coordinates: North 18.02791444449981 West 63.04373873118244
Situation map and picture:

Location B
Type of location: W 1.3 km (from top of the landfill)
Location description: Roof Miss Lalie Commercial Centre
Address: Bush Road
Coordinates: North 18.03297975624337 West 63.05906341007713
Situation map and picture:

Location C
Type of location: SW 1.8 km (from top of the landfill)
Location description: Garden overlooking Great Bay
Address: Spanish Fort Road
Coordinates: North 18.021837118302724 West 63.0610135969157
Situation map and picture:

Location D
Type of location: WSW 2.2 km (from top of the landfill)
Location description: Roof of the fire department
Address:
Coordinates: North 18.02658681137072 West 63.06737872106083
Situation map and picture:

Location 1 Sugar Hill Drive
Type of location: NNW 2.1 km (from top of the landfill)
Location description: Rural street with some local traffic. Few goats being herded
Address: Sugar Hill Drive
Coordinates: North 18.036295898189643 West 63.06614240223156
Situation map and picture:

Location 2 Asphalt plant – west side
Type of location: N 0.67 km (from top of the landfill)
Location description: Sand, undeveloped land
Address: Dominica Road
Coordinates: North 18.037238736435395 West 63.04820523397282
Situation map and picture:

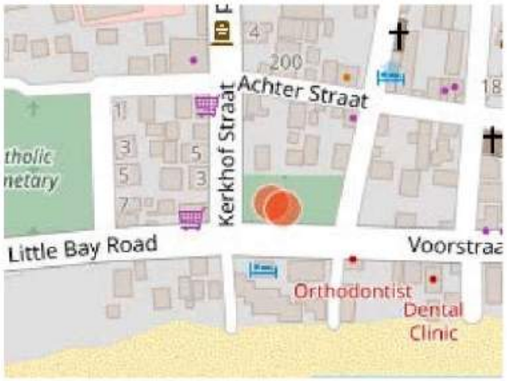
Location 3 W.A. Nisbeth Road
Type of location: WSW 0.71 km (from top of the landfill)
Location description: border of the salt lake
Address: W.A. Nisbeth Road
Coordinates: North 18.02770713583985 West 63.05257451456032
Situation map and picture:

Location 4 VROMI yard
Type of location : SSW 0.22 km (from top of the landfill)
Location description : Storage of material and vehicles
Address : Soualiga Drive
Coordinates : North 18.029713008580195 West 63.04850896209758
Situation map and picture:

Location 5 Roundabout WTP
Type of location: WNW 1.1 km (from top of the landfill)
Location description: Roundabout near water treatment plant
Address: A.T. Illidge Road
Coordinates: North 18.03485334384367 West 63.057064501928004
Situation map and picture:

Location 6 Asphalt plant – east side
Type of location: ENE 0.60 km (from top of the landfill)
Location description: border of the salt lake
Address: Golden Lily Cactus Road
Coordinates: North 18.03318114050508 West 63.04185345455505
Situation map and picture:

Location 7 Graveyard (Kerkhofstraat)
Type of location: SW 1.0 km (from top of the landfill)
Location description: Cemetery
Address: Kerkhofstraat
Coordinates: North 18.025181797615872 West 63.05362783522977
Situation map and picture:



Location 8 Divi Hotel
Type of location: SW 1.9 km (from top of the landfill)
Location description: garden near entrance resort
Address: Little Bay Road
Coordinates: North 18.01998525129316 West 63.05992769403065
Situation map and picture:

Location 9 Uphill east of Welgelegen Road
Type of location: W 1.7km (from top of the landfill)
Location description: Hillside, urban
Address: Chameleon Drive
Coordinates: North 18.029129318210288 West 63.063107383411
Situation map and picture:

Location 10 Welgelegen Road (Valley fire dept)
Type of location: W 2.0 km (from top of the landfill)
Location description: roadside
Address: Bison Drive
Coordinates: North 18.029129318210288 West 63.063107383411
Situation map and picture:

Location 11 Welgelegen Drive (West of fire dept)

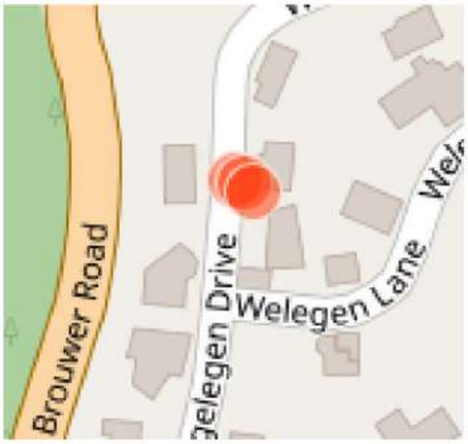
Type location: W 2.6 km (from top of the landfill)

Location description: Urban

Address: Welgelegen Drive

Coordinates: North 18.02770713583985 West 63.05257451456032

Situation map and picture:



Location 12 Squirrel Drive (Little Bay)

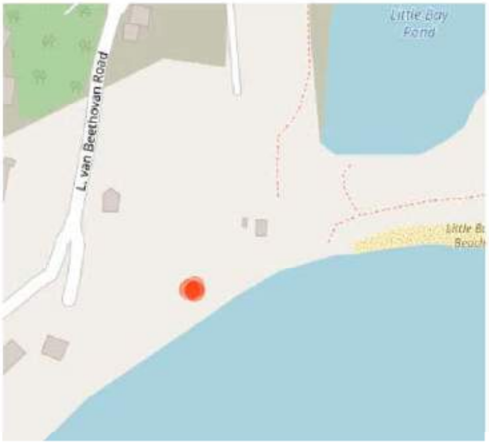
Type of location: SW 2.5 km (from top of the landfill)

Location description: Beach Little Bay

Address: Squirrel Drive

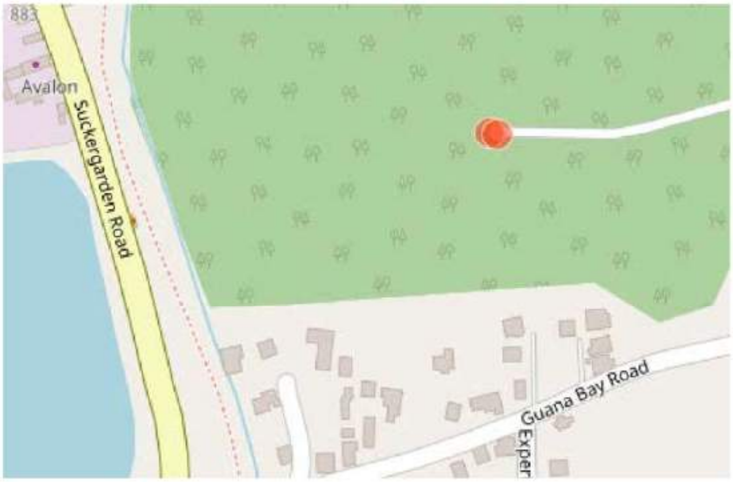
Coordinates: North 18.01907568368899 West 63.06686803829631

Situation map and picture:



Location 13 Viewpoint Bloomingdale

Type of location: W 1.2 km (from top of the landfill)
Location description: Viewpoint upwind
Address: Nameless parallel road, north of Guana Bay Road
Coordinates: North 18.031169172965505 West 63.0356433116587
Situation map and picture:



Location 14 Soualiga Road (Irma landfill)

Type of location: W 0.3 km (from top of the landfill)
Location description: Road
Address: Soualige Road
Coordinates: North 18.03118884460733 West 63.043964926364794
Situation map and picture:

Appendix 4 Particulate matter (PM_{10}) in air

Table 6 – daily average concentration for particulate matter (PM_{10}) in the air at the four monitoring (24/7) locations (A – D) in μg/m³.

	Festival terrain (A)	**Miss Lalie (B)**	**Belair (C)**	**Fire department (D)**
Date	μg/m³	μg/m³	μg/m³	μg/m³
24-1-2019	10	not monitored	11	12
25-1-2019	13	not monitored	16	42
26-1-2019	15	not monitored	15	17
27-1-2019	11	not monitored	14	15
28-1-2019	12	17	13	14
29-1-2019	8	13	9	55
30-1-2019	9	10	10	10
31-1-2019	10	13	12	12
1-2-2019	10	13	12	11
2-2-2019	11	12	11	9
3-2-2019	6	7	6	6
4-2-2019	9	11	10	10
5-2-2019	9	14	9	24
6-2-2019	9	14	10	14
7-2-2019	n.a.	9	10	12
average over period	**10**	**12**	**11**	**18**

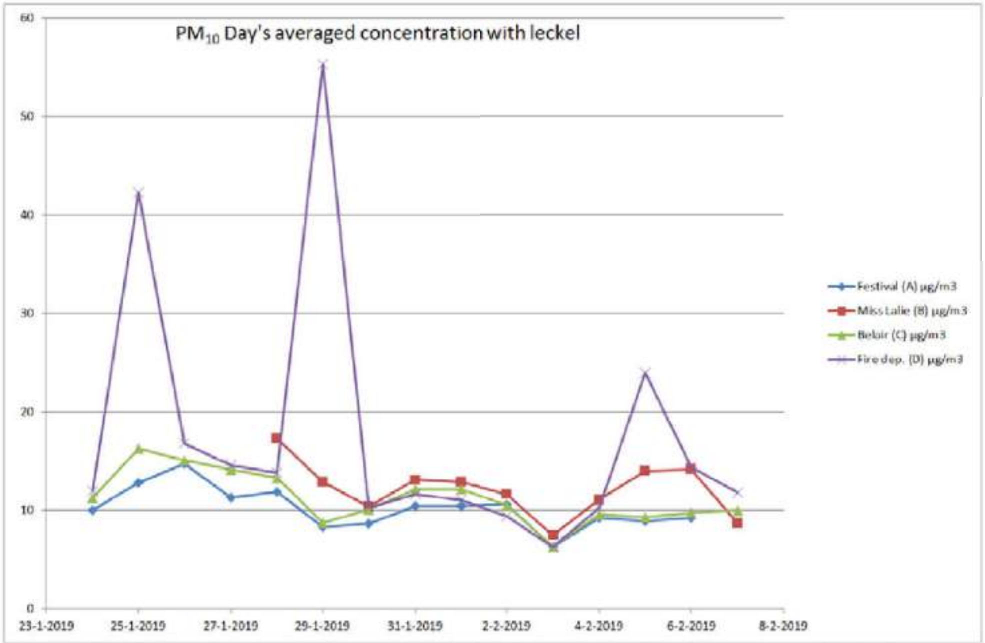


Figure 14 Chart of daily average concentration for particulate matter (PM_{10})

Figure 16 and Table 4 show that concentrations of particulate matter (PM_{10}) vary from day to day for all four locations following a similar pattern. Only at location D (fire department) were three peaks identified.

The European Union (EU) has set the annual average exposure limit for PM_{10} at 40 μg/m^3 and a 24-hour average exposure limit at 50 μg/m^3, which may be exceeded only 35 times a year (reference: rvs.rivm.nl).

All concentrations measured at locations A, B and C are below the EU annual average exposure limit of 40 μg/m^3. At location D (fire department), the annual average exposure limit is exceeded twice, one time of which exceeds the 24-hour average exposure limit of 50 μg/m^3. Note that the calculated daily average over the two-week period remains well below the annual average exposure limit.

Appendix 5 Elements in PM_{10} in the air

Table 7 Elements (including heavy metals) above the detection limit and reporting limit in PM_{10} in the air (µg/m³).

Sample code	SXMF005	SXMF007	SXMF019	SXMF031	SXMF053	SXMF098	SXMF101	SXMF090	SXMF080	SXMF085	SXMF083	SXMF125	SXMF077		
Element	Festival terrain (A)	Festival terrain (A)	Miss Lalie (B)	Belair (C)	Fire department (D)	Festival terrain (A)	Festival terrain (A)	Irma Landfill (15)	VROMI yard (4)	VROMI yard (4)	W.A. Nisbeth road (3)	W.A. Nisbeth road (3)	Sugar Hill Drive (1)	TCA (µg/m3)	Source
Al	0.02	0.02	0.05	0.04	0.03	**0.10**	**0.09**	**0.34**	**0.22**	**0.42**	**0.16**	**0.20**	**0.24**	0.05	RIVM, 1993
B	0.00	0.00	0.00	0.00	<	0.07	0.04	0.03	0.11	0.07	0.03	0.04	0.07	Sea salt/sand	
Ca	0.27	0.22	0.55	0.43	0.35	1.03	0.65	3.37	1.53	4.48	1.32	10.01	1.79	Sea salt/sand	
Cr	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.02	Cr (III): 60 Cr (VI): 0.0025	RIVM, 2001
Cu	0.00	<	0.00	0.00	0.00	<	<	<	<	<	<	0.03	<	1.00	RIVM, 2001
Fe	< DL	<	0.08	0.07	0.06	<	0.23	0.64	<	0.72	0.63	0.67	<	Not available	
K	0.12	0.07	0.10	0.10	0.08	<	0.13	<	0.26	<	<	0.26	0.27	Sea salt/sand	
Mg	0.30	0.23	0.32	0.32	0.28	0.25	0.44	0.72	0.45	0.75	0.55	0.80	0.69	Sea salt/sand	
Mn	<	<	0.00	<	<	<	<	<	<	<	<	<	<	0.15	WHO, 2000
Na	2.57	2.17	2.37	2.38	2.17	5.31	4.01	7.71	6.50	7.84	7.50	8.63	8.33	Sea salt/sand	
Sb	<	<	0.00	0.00	0.00	<	<	<	<	<	<	<	<	3.20	RIVM, 1992
Si	0.28	0.23	0.33	0.39	0.31	2.28	1.07	3.22	2.90	4.05	2.83	4.12	3.83	Sea salt/sand	
Sn	<	<	<	<	<	<	<	0.04	<	<	<	<	<	TWA 8-h: 2	SER
Sr	0.00	0.00	0.00	0.00	0.00	<	<	0.01	<	0.01	<	0.13	<	Not available	
Ti	0.00	<	0.00	0.00	0.00	<	0.00	0.01	<	0.02	<	<	0.01	Not available	
Zn	0.02	0.05	0.02	<	<	<	<	<	<	<	<	<	<	Not available	

Al = aluminium, B=Boron, Ca=Calcium, Cr=Chromium, Cu=Copper, Fe=Iron, K=Potassium, Mg=Magnesium, Mn=Manganese, Na=Natrium, Sb=Antimony, Si=Silicon, Sr=Strontium, Ti=Titanium, Zn=Zinc, <=below the analysis and / or reporting level

🟥	Leckel 24-hr sampling
🟦	KFG approximately 2-hr sampling

Samples of particulate matter present in the air have been collected using two techniques: 24-hr samples with Leckel filter equipment at the four monitoring locations (A-D) and 2-hr sampling with KFG equipment at various locations (A and 1-15). KFG sampling was performed for two hours, while Leckel sampling was done for 24 hours; so when there are peaks in the emission you can 'catch' these peaks with KFG while, with Leckel sampling, the peak is averaged over the day. Moreover, the KFG sampling was targeted as they, for example, were performed at moments when odour was detected or when it was anticipated that landfill emission could be detected.
In a selection of the samples (see Section 3.3), quantitative analysis of the elements was conducted in the Netherlands by TNO.

Based on the results of the analyses, the following can be concluded:

- The measured concentrations of boron, calcium, potassium, magnesium, sodium and silicon probably originate from sea salt and sand as these are known sources for these elements.
- Aluminium concentrations exceed the Tolerable Concentration in Air (TCA) of 0.05 µg/m^3 in the eight KFG samples, the highest measured concentration was 0.42 µg/m^3. However, the authors who derived this TCA in 1993 stated that "exposure data are missing and the proposed toxicological limit value is rather conservative". The critical toxic effect on which this TCA based is unknown. In a more recent evaluation aimed at deriving an Occupational Exposure Limit (OEL) for aluminium and aluminium compounds, the Dutch Health Council (Gezondheidsraad 2010) derived a value of 50 µg/m^3 for aluminium chlorohydrate (equivalent to 15 µg Al/m^3) based on increased frequency of local inflammation in airways in a study in rats (seen at $\geq$0,25 mg/m^3). However, because it is uncertain which form of aluminium (soluble or insoluble) was responsible for the critical toxic effect, the Dutch Health Council did not extrapolate this value to other aluminium compounds.
  Though the value of 15 µg Al/m^3 cannot be used for the general public exposure to unknown forms of aluminium, it does suggest that the 1993 TCA is likely to be overly conservative. As to possible systemic effects (in internal organs/tissues) by aluminium an oral tolerable daily intake of 0.3 mg Al/kg bw/day has been proposed (EU SCHEER 2017). Taking into account a low absorption of 0.3% in the GI-tract this value is associated with a body dose of 0.9 µg/kg bw/day. Exposure to the highest measured concentration would lead to maximal exposure of 0,12 µg/kg bw/day (based on inhalation of 20 m^3 per day and a body weight of 70 kg). This exposure is below the limit of 0.9 µg/kg bw/dag. This indicates the absence of a systemic health risk at the maximum concentration measured of 0.42 µg/m^3. Overall the conclusion for aluminium is that an actual health risk is unlikely.
- In relation to the metal chromium (Cr), the oxidation state is relevant for the toxicity. It is unclear whether the chromium found is Cr(III) of Cr(VI), of which the latter is the most toxic, yet much less stable in the environment. For that reason (instability), it is assumed that most of the chromium present in particulate matter in the air is mainly Cr(III). The TCA for Cr(III) in air was not exceeded.

- The measured concentrations of copper and tin (Sn) do not exceed the available guideline values of 1 $\mu g/m^3$ (TCA) and 2 mg/m^3 (occupational value, TWA 8-h), respectively.
- For zinc, there is no TCA available. However, occupational safety limits in the United States range from 1 to 5 mg/m3 for an 8¯hour time weighted average for a 40-hour workweek for zinc substances. (ATSDR, 2005).
- For iron (Fe), strontium (Sr) or titanium (Ti), no tolerable concentration in air was available.
- Manganese (Mn) and Antimony (Sb) were measured at very low concentrations, either below the detection limit or in the range of nanogram per cubic metre.

Appendix 6 Elements in coarse dust

Table 8 Elements (including heavy metals) in dust wipe samples (µg/m^2).

Sample	STN27	STN46	STM1928	STN44	STN31	STN34	STN40	STN41	STN52			
description (code)	Sugar Hill Drive (1)	Graveyard (7)	Graveyard (7)	**Graveyard (7)**	Sugar Hill Drive (1)	Up wind Asphalt plant (6)	VROMI yard (4)	W. A. Nisbeth Road (3)	Down wind Asphalt plant (2)	**Intake per exposure occasion [µg/kg bw/event] for STN44**	TDI [µg/kg lg/day]	Source
Al	3030	1226	3503	**13477**	10772	3458	11223	2893	14379	**456**	1000 (TWI)a	EFSA, 2008
As	2	2	5	**34**	8	66	18	15	9	**1.14**	3 (0.5BMDL)	JECFA, 2011
B	6	11	11	184	141	212	95	273	157	Sea salt/sand		
Ba	27	13	25	**152**	82	30	84	31	65	**5.13**	200	ATSDR, 2007
Ca	17352	3592	17352	585425	35371	53405	66931	292363	247277	Sea salt/sand		
Cd	1	0	2	**2**	13	1	1	3	3	**0.08**	2.5 (TWI)	EFSA, 2009
Ce	5	<	4	**13**	<	<	<	<	8	**0.45**	Not available	
Co	3	2	4	**13**	9	6	13	5	16	**0.44**	1.4	RIVM, 2001
Cr	6	6	10	**60**	21	19	32	22	96	**2.02**	Cr (III): 300 Cr (VI): 0.1	EFSA, 2014
Cu	19	27	57	**149**	108	32	367	68	63	**5.05**	83	EFSA, 2006
Fe	3822	2702	6702	**23394**	13475	5360	21591	4909	13926	**792**	800	JECFA, 1983
K	363	189	509	17489	32819	10726	10275	87824	10246	Sea salt/sand		
Mg	1119	744	2034	18356	7535	7535	11593	17004	13397	Sea salt/sand		
Mn	61	28	88	**445**	286	114	366	127	290	**15**	30	RIVM, 2006
Mo	<	3	<	<	<	<	<	5	7	**0.10**	9	Vyskocil & Viau, 1999
Na	<	1120	1120	22994	10370	42832	10821	60867	56358	Sea salt/sand		
Ni	3	3	6	**21**	11	9	22	11	71	**0.70**	10	RIVM, 2006
P	201	<	328	**2786**	4761	2565	3788	7028	<	**94**	70000	EFSA, 2006

Sample	STN27	STN46	STM1928	STN44	STN31	STN34	STN40	STN41	STN52			
description (code)	Sugar Hill Drive (1)	Graveyard (7)	Graveyard (7)	**Graveyard (7)**	Sugar Hill Drive (1)	Up wind Asphalt plant (6)	VROMI yard (4)	W. A. Nisbeth Road (3)	Down wind Asphalt plant (2)	**Intake per exposure occasion [µg/kg bw/event] for STN44**	TDI [µg/kg lg/day]	Source
Pb	9	5	21	**71**	19	8	51	9	6	**2.41**	0.5 (BMDL)	EFSA, 2010
Sb	1	1	3	**8**	3	<	30	3	2	**0.26**	6	RIVM, 2009
Si	416	1194	1866	3299	4124	3056	2804	3285	10233	Sea salt/sand		
Sr	37	40	178	**8113**	248	703	582	4193	2295	**275**	600	RIVM, 2006
Ti	154	28	191	**384**	214	104	357	30	882	**13**	Not availaible	
V	6	5	14	**63**	40	17	67	18	52	**2.12**	2	RIVM, 2009
Y	2	0	2	**9**	3	1	5	3	6	**0.31**	Not available	
Zn	35	19	238	**754**	430	9	278	180	404	**26**	360	EFSA, 2006

Al = aluminium, As=Arsenic, B=Boron, Ba=Barium, Ca=Calcium, Cd=Cadmium, Ce=Cesium, Co=Cobalt, Cr=Chromium, Cu=Copper, Fe=Iron, K=Potassium, Mg=Magnesium, Mn=Manganese, Mo=Molybdenum, Na=Natrium, Ni=Nickel, P=Phosphorus, Sb=Antimony, Si=Silicon, Sr=Strontium, Ti=Titanium, V=Vanadium, Y=Yttrium, Zn=Zinc, <=below the analysis and / or reporting level

🟫	'Historical'
🟦	Two weeks
🟧	Petri dish

Elements (including heavy metals)_in dust wipe samples are analysed according to the same methodology as the measurements for particulate matter present in air. However, human exposure to dust on surfaces is different from the exposure to dust in the air. The exposure route for particulate matter in air is via the lungs, while the most relevant exposure route to dust on the ground is dermal and hand-to-mouth contact.

It was noted that the concentration of the 'historical' samples yield lower concentrations than the 'petri dish' samples for the location Sugar Hill Drive. At the graveyard location, the historical sample lay between the two other samples at the graveyard location.

In general, the highest concentrations were measured in the sample obtained at the graveyard (sample no. STN 44, in bold in Table 9). As a reasonable worst-case scenario, the exposure of toddlers to elements, (including) heavy metals, was calculated based on this sample, following the draft MOD guideline.

Standard assumptions for calculating hand-to-mouth exposure:
- Skin-soil adherence: 0.35 mg/cm2 (child, recreation)[2]
- Hand surface from a 4.5 year-old child: 389 cm2
- Bodyweight (4.5 year-old child): 16.3 kg
- Amount of dust per m2: 500 mg/m2
- Uptake from metals from dust to hands: 50% (50% hand-mouth contact, worst-case)

Variables:
- Concentration in dust wipe sample: [C] in μg/m^2

Calculation of exposure:
- Exposure to dust per event: 0.35 x 389=138 mg dust
- Concentration per mg dust: C/500 μg/mg
- Exposure of child per event: 138 x C/500 μg
- Uptake fraction: 0.5
- Exposure per kg of bodyweight: 138 x C/500/16.3*0.5 μg/kg bw/event

The calculated values were compared to chronic health-based guideline values.

In relation to public health, the following can be stated:
- Most concentrations are low
- The elements boron, calcium, potassium, magnesium, sodium and silicon probably have their origin in sea salt and sand.
- In relation to the metal chromium (Cr), the oxidation state is relevant for the toxicity. It is unclear whether the chromium found is Cr(III) of Cr(VI), of which the latter is the most toxic, yet much less stable in the environment. For that reason (instability), it is assumed that most of the chromium present is mainly Cr(III).
- For all elements, where a chronic health-based guideline value for oral exposure was available, this was not exceeded.
- For the elements of caesium, titanium and yttrium, no health-based guideline values were available.

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[2] http://www.mass.gov/eea/docs/dep/cleanup/laws/dermadhe.pdf

Appendix 7 PAHs in PM_{10} in the air

Table 10 Polycyclic Aromatic Hydrocarbons (PAHs) above analytical and reporting threshold (pg/m^3).

Sample number	SXMF006	SXMF008	SXMF016	SXMF017	SXMF038	SXMF046	SXMF051	SXMF076	SXMF079	SXMF082	SXMF084	SXMF087	SXMF089	SXMF124
	Festival terrain (A)	Festival terrain (A)	Miss Lalie (B)	Miss Lalie (B)	Belair (C)	Fire department (D)	Fire department (D)	Sugar Hill Drive (1)	VROMI yard (4)	W.A. Nisbeth Road (3)	VROMI yard (4)	Festival terrain (A)	Irma landfill (14)	W.A. Nisbeth Road (3)
Benzo[a]anthracene	<	<	1.3	<	1.0	<	0.8	<	<	<	<	<	<	<
Chrysene	0.6	0.7	1.7	2.8	1.4	1.2	1.0	6.4	6.5	5.3	10.3	6.1	9.6	7.5
Benzo[b]fluoranthene	5.3	4.9	46.4	19.6	21.5	10.6	12.2	46.9	52.0	52.4	108.2	38.1	152.6	58.3
Benzo[k]fluoranthene	<	<	0.3	<	0.3	0.1	0.1	<	<	<	<	<	1.1	0.8
Benzo[j]fluoranthene	<	<	1.8	0.5	1.0	0.4	0.5	<	<	<	3.5	<	4.6	<
ieno[123cd]pyrene	0.2	<	3.0	0.4	1.0	0.4	0.6	<	1.6	5.0	2.9	<	4.0	2.0
Dibenzo[ah]anthracene	<	<	62.0	<	<	<	<	<	<	<	<	<	<	<
Benzo[ghi]perylene	0.0	0.0	0.4	0.1	0.3	0.1	0.1	0.4	0.5	0.9	0.8	0.2	1.5	0.5
Total Bap-equivalent	6.2	5.6	116.9	23.5	26.5	12.9	15.4	53.7	60.6	63.6	125.6	44.4	173.4	69.1

■ Leckel 24-hr sampling
□ KFG approximately 2-hr sampling

Chemical analysis of PAHs in particulate matter found in air samples has been performed by RIKILT. The EU target value for air for PAHs of 1 ng/m3, as Benzo(a)pyrene (BaP), was not exceeded.

In 2018, RIVM derived a new health-based guideline value for exposure to PAHs via oral exposure (RIVM, 2018), the excess lung cancer risk. This value is lower than de EU-target value. The excess lung cancer risk per µg/m^3 -year is 0.00042 for the general population for the EFSA 8-PAH (a different selection than the 16 EPA PAHs: benzo[a]pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[ghi]perylene, dibenz[ah]anthracene, indeno[1,2,3-cd]pyrene). This value was not exceeded.

Appendix 8 PAHs in coarse dust

Table 11 Polycyclic Aromatic Hydrocarbons (PAHs) in coarse dust wipe samples ($\mu g/m^2$).

Sample number	STN08	STN26	STN45	STM1927	STN30	STN33	STN39	**STN43**	STN17	STN07	**STN43**	
Location	W. A. Nisbeth Road (3)	Sugar Hill Drive (1)	Graveyard (7)	Graveyard (7)	Sugar Hill Drive (1)	Asphalt plant - upwind (6)	VROMI yard (4)	**Graveyard (7)**	Asphalt plant - downwind (2)	W. A. Nisbeth Road (3)	**BaP equivalents**	Exposure per occasion [µg/kg lg/occasion]
Benzo[c]fluorene	0.01	<	<	v	<	<	<	**0.01**	<	<	**0.17**	0.0030
Benzo[a]anthracene	0.03	<	0.00	0.00	0.05	0.01	0.04	**0.07**	0.01	<	**0.01**	0.0002
Cyclopenta[cd]pyrene	<	<	<	<	<	<	<	**0.02**	<	<	**0.01**	0.0002
Chrysene	0.06	0.01	0.01	0.01	0.19	0.02	0.09	**0.16**	0.03	0.02	**0.02**	0.0003
5-Methylchrysene	<	<	<	<	<	<	<	**<**	<	<	**<**	-
Benzo[b]fluoranthene	0.05	0.00	0.01	0.01	0.13	0.02	0.05	**0.12**	0.03	0.02	**0.10**	0.0017
Benzo[k]fluoranthene	0.02	<	0.00	0.00	0.06	0.01	0.02	**0.05**	0.01	<	**0.00**	0.0000
Benzo[j]fluoranthene	0.02	<	0.00	0.00	0.05	0.01	0.02	**0.05**	0.01	0.01	**0.01**	0.0002
Benzo[a]pyrene	0.02	<	0.01	0.00	0.04	0.02	0.02	**0.07**	0.01	<	**0.07**	0.0012
ieno[123cd]pyrene	0.02	<	0.01	0.00	0.04	0.02	0.02	**0.06**	0.01	<	**0.00**	0.0001
Dibenzo[ah]anthracene	0.01	<	<	<	0.01	<	<	**0.01**	<	<	**0.12**	0.0020
Benzo[ghi]perylene	0.05	0.00	0.03	0.01	0.08	0.08	0.04	**0.20**	0.04	0.01	**0.00**	0.0000
Dibenzo[a,l]pyrene	<	<	<	<	<	<	<	**<**	<	<	**<**	-
Dibenzo[a,e]pyrene	<	<	<	<	<	<	<	**0.01**	<	<	**0.01**	0.0001
Dibenzo[a,i]pyrene	<	<	<	<	<	<	<	**<**	<	<	**<**	-
Dibenzo[a,h]pyrene	<	<	<	<	<	<	<	**<**	<	<	**<**	-
Som PAK4 (lb)	0.15	0.01	0.03	0.03	0.41	0.07	0.20	**0.42**	0.09	0.04		**0.0090**
Som PAK16 (ub)	0.53	0.06	0.10	0.08	0.73	0.30	0.38	**0.90**	0.27	0.26		

⬜	'Historical'
🟧	petri dish
🟦	2 weeks

For PAHs, human exposure to swipe dust is different from the exposure to air. The exposure route for particulate matter in the air is via the lungs, while the most relevant exposure route to dust on the ground is dermal contact and hand-to-mouth contact.

It was noted that some of the 'historical' samples yield lower concentrations than the 'petri dish' samples.

In general, the highest concentrations were measured in the sample obtained at the graveyard (sample no. STN 44, in bold in Table 12). As a reasonable worst-case scenario, the exposure of toddlers to elements, (including) heavy metals, was calculated based on this sample. For this calculation, the measured concentrations for the individual USEPA 16 PAHs are converted to benzo[a]pyrene equivalents and compared to a chronic health-based guideline value.

Standard assumptions for calculating hand-mouth exposure:

- Skin-soil adherence: 0.35 mg/cm^2 (child, recreation)[3]
- Hand surface from a 4.5 year-old child: 389 cm^2
- Bodyweight (4.5 year-old child): 16.3 kg
- Amount of dust per m^2: 500 mg/m^2
- Uptake of metals from dust to hands: 100% (worst-case)

Variables:

- Concentration in swipe dust: [C] in µg BaP-equivalents/m^2

Calculation of exposure:

- Exposure to dust per event: 0.35 x 389=138 mg dust
- Concentration per mg dust: C/500 µg/mg
- Exposure of child per event: 138 x C/500 µg
- Exposure per kg of bodyweight: 138 x C/500/16.3 µg/kg bw/event

The sum of the calculated BaP equivalents was compared to the Virtually Safe Dose of 0.005 µg/kg bw/day, which is a health-based guideline value corresponding to the risk of extra cancer cases of one per million per lifetime exposure. Since the sum of benzo[a]pyrene equivalents exposure per occasion is 0.009 µg/kg bw/day, the Virtually Safe Dose is exceeded by an approximate factor of 2. This may result in an additional risk of cancer cases (2 per million per lifetime exposure).

In 2018, RIVM derived a new health-based guideline value for exposure to PAHs via oral exposure (RIVM, 2018). This value is lower than the VSD; 0.0007 µg/kg bw/day for the EFSA 8-PAH (a different selection than the 16 EPA PAHs: benzo[a]pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[ghi]perylene, dibenz[ah]anthracene, indeno[1,2,3-cd]pyrene). The exposure per kg of bodyweight for these PAKs was calculated according to the method described above and resulted in an exposure of 0.0012 µg/kg bw/day. This value is exceeded by less than a factor of 2.

[3] http://www.mass.gov/eea/docs/dep/cleanup/laws/dermadhe.pdf

Appendix 9 Dioxins in PM_{10} in air

Table 13 Dioxins and dioxin-like PCBs in air (upper bound values in pg/m^3).

		WHO2005-PCDD/F-TEQ (ub)	WHO2005-PCDD/F-PCB-TEQ (ub)
Festival terrain (A) 24hr	29-jan	0.00	0.00
Festival terrain (A) 24hr	31-jan	0.00	0.00
Miss Lalie (B) 24hr	29-jan	0.04	0.04
Miss Lalie (B) 24hr	28-jan	0.02	0.02
Belair (C) 24hr	31-jan	0.00	0.00
Fire department (D) 24hr	24-jan	0.00	0.00
Fire department (D) 24hr	29-jan	0.00	0.00
Festival terrain (A) +/- 2hr	30-jan	0.20	0.22
Sugar Hill Drive (1) +/- 2hr	24-jan	0.16	0.18
W.A. Nisbeth Road (3) +/- 2hr	30-jan	0.21	0.22
W.A. Nisbeth Road (3) +/- 2hr	5-feb	0.17	0.18
VROMI yard (4) +/- 2hr	28-jan	0.17	0.18
VROMI yard (4) +/- 2hr	31-jan	0.27	0.28
Irma landfill (14) +/- 2hr	31-jan	0.58	0.60

▢	Leckel 24-hr sample
▨	KFG approximately 2-hr sample

The chemical analysis of dioxins and Polychlorinated Biphenyls (PCBs) in particulate matter in air samples were performed by RIKILT. The results have been compared to the allowable total weekly intake (TWI) of 2 pg TEQ (TCDD-equivalent) per kilogram of bodyweight (EFSA, 2018).

Assuming an average breathing volume of 1 m^3 per hour and an average bodyweight of 60 kilograms, the TWI of 2 pg TEQ/kg bw/week is not exceed if concentration TEQ/m^3 stays below 0.71 pg/m^3 (see calculation below):

Total breathing volume per week:
- 1 m^3 x 24 hours x 7 days = 168 m^3 per week
- TWI: 2 pg TEQ/kg bw x 60 kg = 120 pg TEQ/week
- 120 pg TEQ/week / 168 m^3/week = 0.71 pg/m^3

All measured values are well below this value.

Appendix 10 Dioxins in coarse dust

Table 14 Dioxins and dioxin-like PCBs in coarse dust wipe samples (upper bound values in pg/m^2).

	WHO2005-PCDD/F-TEQ (ub)	WHO2005-PCDD/F-PCB-TEQ (ub)
Sugar Hill Drive (1)	3	3
W. A. Nisbeth Road (3)	45	48
Graveyard (7)	1	1
Sugar Hill Drive (1)	30	31
Asphalt plant - downwind (2)	34	36
W. A. Nisbeth Road (3)	50	52
VROMI yard (4)	74	83
Asphalt plant - upwind (6)	31	32
Graveyard (7)	57	60

⬜ Historical' sample
🟧 Petri dish sample

Chemical analysis of dioxins and Polychlorinated Biphenyls (PCBs) in particulate matter in dust were performed by RIKILT.

The sample locations that are most relevant for this type of exposure are considered to be Sugar Hill Drive (urban setting) and the graveyard (in the middle of the village). However as in order to cover the worst-case measurements, calculations were performed with the highest measured concentration (VROMI yard).

The results were compared to the allowed total weekly intake (TWI) of 2 pg TEQ (TCDD-equivalent) per kilogram of bodyweight (EFSA, 2018).

Standard assumptions for calculating hand-mouth exposure:

- Skin-soil adherence: 0.35 mg/cm^2 (child, recreation)[4]
- Hand surface from a 4.5 year-old child: 389 cm^2
- Bodyweight (4.5 year-old child): 16.3 kg
- Amount of dust per m^2: 500 mg/m^2
- Uptake from metals from dust to hands: 100% (worst-case)

Variables:

- Concentration in swipe dust: [C] in pg TEQ/m^2

Calculation of exposure:

- Exposure to dust per event: 0.35 x 389=138 mg dust

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[4] http://www.mass.gov/eea/docs/dep/cleanup/laws/dermadhe.pdf

- Concentration per mg dust: C/500 pg/mg
- Exposure of child per event: 138 x C/500 pg
- Exposure per kg of bodyweight: 138 x C/500/16.3 pg/kg bw/event

The measured concentration at the VROMI Yard of 83 pg TEQ/m^2 resulted in a calculated exposure of 1.41 pg/kg bw. This value does not exceed the TWI.

Appendix 11 Volatile Organic Compounds in the air

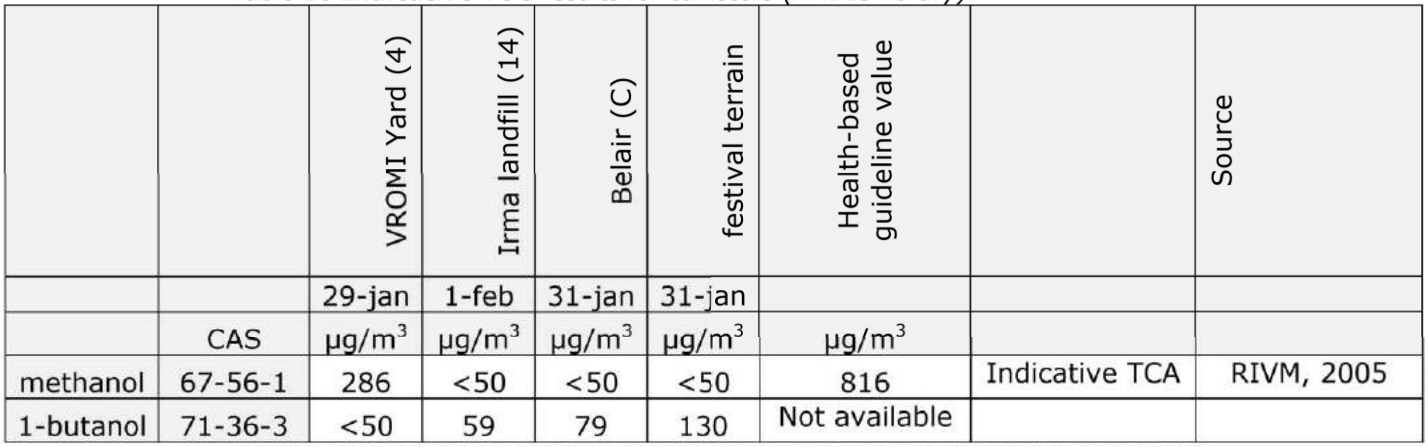
Different type of sampling techniques (canisters, charcoal-tubes, 3M badges) were used for the measurement of Volatile Organic Compounds (VOC) in the air. Different types of analysis and methods were conducted on these samples. In the end, a selection (11 in total) of the canister samples were analysed, as were a selection of the charcoal-tubes (10 in total) and all the 3M batches (18 in total). All results (above detection / reporting limit) are presented in the tables above. In most samples, no VOC were found at all. Only samples / substances with concentrations above the lower limit of detection are included (e.g. no substances were found in charcoal tubes, so no results are included in this report).

Table 15 Quantitative VOC results for canisters (TO15) in µg/m^3

		Miss Lalie (B)	Belair (C)	Fire department (D)	Sugar Hill Drive (1)	VROMI yard (4)	Irma landfill (14)	Health-based guideline value		Source
	CAS	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3		
toluene	108-88-3	<10	<10	<10	<10	20	11	400	TCA	RIVM, 2001
p,m-xylene	106-42-3	<10	<10	n.d.	<10	<10	11	210000	TWA 8-h	SER
1,2,4-trimethyl-benzene	95-63-6	<10	<10	<10	<10	<10	10	100000	TWA 8-h	SER
tetrachloroethene	127-18-4	n.d.	n.d.	<10	<10	n.d.	10	250	TCA	RIVM, 2001
carbon disulfide	75-15-0	11	**105**	18	10	<10	23	26.3 15000	Indicative TCA TWA 8-h	RIVM, 2008 SER
2-hexanone	591-78-6	13	<10	<10	<10	<10	n.d.	**Not available**		
n-heptane	142-82-5	n.d.	n.d.	<10	52	n.d.	n.d.	1200000	TWA 8-h	SER

Remark: these results are quantitative because the results can be compared to a 'standard' with known concentrations for these substances. Only components above the detection and reporting limit are presented, for example: the analysis also included benzene, but all measured concentrations were lower than the amount encountered in the blanc sample and were below or near the reporting limit. Therefore, benzene is not included in the table.

Table 16 ***Indicative*** *VOC results for canisters (AMDIS library)*



		VROMI Yard (4)	Irma landfill (14)	Belair (C)	festival terrain	Health-based guideline value		Source
		29-jan	1-feb	31-jan	31-jan			
	CAS	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³		
methanol	67-56-1	286	<50	<50	<50	816	Indicative TCA	RIVM, 2005
1-butanol	71-36-3	<50	59	79	130	Not available		

Remark: these results are indicative because the results cannot be compared to a 'standard' with known concentrations for these substances, so a theoretical calculation has to be made which results in an indicative concentration.

Table 17 Quantitative VOC results for 3M-badges

	STM1919	**Health-based guideline value**		**Source**
	Irma landfill (14)			
Component	**µg/m³**			
2-methylbutane	10	18000000	TWA 8-h	SER
m/p-Xylene	24	210000	TWA 8-h	SER
Toluene	30	400	TCA	RIVM, 2001
Benzene	16	5	TCA	EU, 1998
		700	TWA 8-h	SER

One canister sample from the location at the landfill (14) contained several VOC. Several canisters (different locations) contained carbon disulphide (the highest concentration was found at Belair, location C). Only one 3M-badge contained several VOC (location 14). In the charcoal tubes no VOC were detected.

These results were compared with health-based guideline values for chronic exposure; only for benzene was the TCA exceeded at the landfill. However, the concentrations measured in canisters at other locations indicated low concentrations of benzene.
For two substances, 2-hexanone and 1-butanol, no health-based guideline values for long-term exposure were available.

Canister sampling by the fire department during a fire on 30th March 2019.

Three canisters were left behind at the fire station for air sampling. On 30th March three samples were taken during a fire on the 'new dump' at 14:00. Two canisters were placed on Soualiga Road (± 500 meters from the fire) and one was placed on the 'new dump' (<500 meter from the fire). However, the exact location for the three individual canisters is unknown. Besides that one canister was not filled with air and could not be analyzed. The results are presented in Table 18: the concentrations are higher than the concentrations in the samples taken by RIVM.

For acute incidents with a duration of less than 24 hours acute emergency guideline values are used, where for incidents with a prolonged duration sub-chronic or chronic health based guideline values are used.

Since detailed information on the exact sampling locations and the duration and intensity of the fire were not available RIVM is unable to determine which values should be used in order to assess the potential health risks. Therefor no conclusions can be drawn based on these measurements.

Table 18 Quantitative VOC results, above detection and reporting limit of 10 μg/m^3 , for canisters (TO15) in the two samples taken by the fire department on 30 March (μg/m^3)

		Code: Can4016	**Code: Can4024**
Substance	**CAS**	**Exact sample location unknown**	**Exact sample location unknown**
benzene	71-43-2	157	422
toluene	108-88-3	82	189
ethylbenzene	100-41-4	50	109
p,m-xylene	106-42-3	97	210
o-xylene	95-47-6	23	26
styrene	100-42-5	46	152
4-ethyltoluene	622-96-8	12	13
1,3,5-trimethylbenzene	108-67-8	13	14
1,2,4-trimethylbenzene	95-63-6	47	52
naphthalene	91-20-3	39	99
chloromethane	74-87-3	162	523
bromomethane	74-83-9	<10	24
tribromomethane	75-25-2	12	<10
1,2,4-trichlorobenzene	120-82-1	276	18
ethanol	64-17-5	343	285
acetone	67-64-1	81	142
carbon disulfide	75-15-0	64	50
2-butanone	78-93-3	13	28
methyl methacrylate	80-62-6	<10	16
2-hexanone	591-78-6	179	14
propene	115-07-1	220	533
1,3-butadiene	106-99-0	17	46
n-heptane	142-82-5	<10	16

Appendix 12 Aldehydes in air

Aldehyde sampling was done with special cartridges and analysis was conducted for eight different compounds belonging to the group of aldehydes (including formaldehyde, acetaldehyde, acetone, etc.). Only positive results are included in this report. In this case, only acetone was found.

Table 19 Aldehydes found in µg/m3.

	Acetone µg/m^3
Festival terrain (A)	20.9
Sugar Hill Drive (1)	8.5
Fire department (D)	4.7
Belair (C)	7.5
Miss Lalie (B)	8.0
Festival terrain (A)	3.3
Festival terrain (A)	2.8
Irma landfill (14)	4.4

No TCA is available for acetone. However, a time-weight average concentration for occupational exposure (1210000 µg/m^3, source:SER) is available. The measured values are well below this health-based guideline value for workers.

Appendix 13 Experience with landfill fires in the Netherlands

The following is a summary of what is known about the emissions of landfill fires, based on over 30 years of experience in the Netherlands and known literature (author: Marcel Broekman).

Introduction
Based on discussions held between the RIVM field team and the various parties involved, such as VROMI, BZK, the fire brigade and EE&G (2018), it appears that the precise composition of the landfill is unknown. It is suspected that the landfill consists of various discarded goods, parts and materials, such as:

a. Plastics (including polyvinyl chloride PVC),
b. Rubber (car tyres)
c. Metals
d. Glass and ceramic materials
e. Building materials (concrete, bricks, clay, sand, etc.)
f. Wood (including treated wood)
g. Paper and cardboard
h. Textiles (natural and synthetic materials)
i. Mineral oil (lubricating oil, diesel, fuel oil, hydraulic oil)
j. Vegetable / organic materials (Vegetable fruit and garden waste, frying fats, oil etc)
k. Chemical waste (acids, alkalis, cleaning agents, batteries, paint residues, pesticides, etc.)

In the event of a large landfill fire from the materials discarded above, typical combustion products such as water vapour (H_2O), carbon monoxide (CO), carbon dioxide (CO_2), carbon dust / black carbon, particulate matter (PM) and polycyclic aromatic hydrocarbons (PAHS) are always released. In addition, substances are released that are specific to the materials involved in the fire and that depend on the combustion conditions, such as source temperature and oxygen supply. For example, heavy metals (in the presence of electrical appliances, etc.) and dioxins (in the presence of chlorine-containing plastics such as PVC). In addition to the fuel, both the temperature and the amount of oxygen supply determine the substances that are released. Moreover, the firefighting methods used can also influence the nature and amount of the substances formed.

The less complete a fire is, due to a lower source temperature and/or a reduced oxygen supply, the greater the risk of the formation of hazardous substances. This is especially the case during the smouldering phase of a fire.
The emitted substances in the smoke can also undergo changes due to their interaction with UV radiation and the reactivity of the substances present in the smoke or in the outside air. Under the influence of the prevailing meteorological conditions, air distribution and deposition on the soil then takes place. Gaseous substances will not deposit. The air concentration of these substances will dilute as a function of time, height and distance in relation to the seat of fire.

The dust-bound chemical components will eventually settle on the surface in the downwind area of the seat of the fire. Fragments and coarse dust will come closest to the source of fire. The particulate matter can be deposited at a wide range of different distances depending on the aerodynamic diameter. Ultra-fine dust (diameter <0.1 μm) will behave almost identically as gaseous substances. Particulate matter is indicated by the diameter of the largest particle in the fraction. For example, PM_{10} is particulate matter with a diameter of less than 10 μm. A distinction can also be made in the state of aggregation, namely solid.
As previously explained, the chemical composition of the coarse, fine and ultra-dust in the flue gases largely depends on the composition of the landfill and the combustion conditions during the fire and/or smouldering phase. A summary of the nature of burning materials and potentially released substances is given in Table 20.

Table 20 Hazardous substances released in the event of a fire with combustible materials

Materials	**Emitted substances**
Plastics	-aliphatic hydrocarbons (alkanes, olefins) -aromatic hydrocarbons (BETX, styrene, isobutylene, etc.) -aldehydes and ketones (formaldehyde) -alcohols, (alkyl) phenols and esters -furans -alkane carboxylic acids (formic acid, acetic acid)
Chlorinated plastics (PVC)	-hydrochloric acid -phosgene -vinyl chloride -chlorinated aliphatic and aromatic hydrocarbons -Chlorinated dioxins and furans
Nitrogen-containing plastics (PUR; ABS; nylon)	-nitrogen oxides -ammonia -blue acid -nitriles (benzonitrile) -amines -isocyanates -urea -Nitro-PAK
Fluorinated plastics (PTFE)	-hydrogen fluoride -carbonyl fluoride
Sulfur-containing plastics (PPS), polysulfone polyether sulfone	-sulfur dioxide and sulfuric acid -hydrogen sulfide and other sulfides (e.g. mercaptans) -sulfur trioxide carbon disulfide (rotten egg smell)
Additives Fire retardants, UV stabilizers, plasticizers, colour pigments	-hydrogen bromide bromobiphenyls and brominated dioxins and furans bromobisphenol-A -metal oxides (chromium, antimony, lead)
Rubber	-BETX and other alkylbenzenes

Materials	Emitted substances
(car tyres)	-aliphatic hydrocarbons (methane and other alkenes, alkynes) phenols -furans -aldehydes (including mainly benzaldehyde) alcohols and esters hydrochloric acid and hydrocyanic acid isocyanates fine dust -dioxins
Oil	-aliphatic and aromatic hydrocarbon (benzene) aldehydes -sulfur dioxide and nitrogen oxides fine dust
Wood/paper	-aliphatic and aromatic hydrocarbons (benzene, toluene) -phenol -aldehydes (formaldehyde and acetaldehyde) -sulfur dioxide and nitrogen oxides -ammonia, blue acid acetonitrile isocyanates fine dust -dioxins

As indicated, the landfill also contains non-combustible materials, including building materials, glass, ceramic materials and metals. The presence of these materials influences (indirectly) the burning temperature and the oxygen supply during the fire and/or smouldering phase of the landfill and thus also determines the nature and quantity of the emitted substances.

Effect distance (from released substances) in a fire
A RIVM study (Mennen and Belle, 2007) into the emissions of hazardous substances during large fires concluded, among other things, that in general, at distances from about 1 kilometre downwind of the seat of the fire, there are hardly any measurable quantities of hazardous substances in the air or the air. The study is based on scientific information collected from the literature and measurements of the MOD at around 50 fires. It should be noted, however, that there are exceptions to this rule of thumb: during some fires, hazardous substances are also detected at distances greater than 1 km as a result of the fire. This may, for example, be the result of a slight increase in plume because the fire has a relatively low temperature. This is certainly possible with burning waste.

Odour nuisance
Some substances are listed in the table that can cause odour nuisance at low air concentrations. This is particularly true for compounds such as hydrogen sulphide, carbon sulphide, isocyanates and mercaptans. In addition, formaldehyde, hydrocyanic acid gas, ammonia, cresols (methylphenols), formic acid and acetic acid might cause an odour-nuisance.

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Abbreviations

<	Below detection limit or reporting limit
3M	3M-badges – 3M is a brand name
AL	Aldehyde cartridge
AMDIS	Library of GC/MS with database >300,000 compounds
ATSDR	Agency for Toxic Substances and Disease Registry
BaP	benzo(a)pyrene
BZK	Ministry of the Interior and Kingdom Relations of the Netherlands
CA	Canister
CR	Carcinogenic Risk
DL	Detection Limit
DNPH	Cartridge for aldehyde sampling
EE&G	EE&G Environmental Services, LLC (EE&G)
EU	European Union
GC/MS	Gas chromatography/Mass-spectrometer
IARC	International Agency for Research on Cancer
KF(G)	Klein Filter Gerate (small filter equipment)
lb	lower bound (all analysis results '< detection limit' are not included)
LE	Leckel (24/7 filter equipment)
m3	cubic metre
µg	microgram
MOD	Milieu Ongevallen Dienst (Environmental Incident Service) of the RIVM
MTR	Maximaal Toelaatbaar Risico (Dutch equivalent to the TCA)
PA	Passive VOC sampling by 3M-badge
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorobifenyl
PE	Petri dish wipe sample
PM_{10}	Particulate Matter with diameter of 10 µm
PVC	Polyvinylchloride
TNO	Laboratory of the Netherlands Organisation for Applied Scientific Research
RIKILT	Laboratory of part of Wageningen University & Research
RPS	Laboratory of 'Rural Planning Services'
RIVM	Dutch National Institute for Public Health and the Environment
SO	Sorbent tube
TCA	Tolerable Concentration in Air
TEQ	TCDD-equivalents (TCDD is a specific dioxin)
TO15	Standard with approximately 60 volatile organic compounds for GC/MS analysis
TWA	Time Weighted Average
TWI	Tolerable Weekly Intake
ub	upper bound (all analysis results '< detection limit' are included)
US-EPA	United States Environmental Protection Agency
VOC	Volatile Organic Carbons
VROMI	Ministry of Public Housing, Spatial Planning, Environment and Infrastructure of Sint Maarten
VSD	Virtually Safe Dose
WHO	World Health Organization
WI	Wipe sample

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Annex H

Sint Maarten: Emergency Debris Management Project

Development Resettlement Action Plan

Progress report # 02

Preliminary findings: Yellow Zone within the Fire Suppression Exclusion Zone (Up to June 2019).

General Information

	No.
Dwellings counted	60
Households surveyed	59
Business surveyed	13
Households + Business (same dwelling)	11
Business	2
Household owners	29
Household tenants	30
Business owners	11
Business tenants	2

Project Affected Persons (PAPs)

	No.
PAPs - Households	102
PAPs - Households + Business	10
PAPs - Business	7
Total PAPs	119

PAPs - Households + Business	Men	Women	Total
< 12 years old	6	7	13
13 - 17 years old	0	2	2
18 - 59 years old	40	40	80
> 60 years old	9	7	16
No data	1	0	1
Total	56	56	112

PAPs - Business	**Men**	**Women**	**Total**
< 12 years old	0	0	0
13 - 17 years old	0	0	0
18 - 59 years old	7	0	7
> 60 years old	0	0	0
No data	0	0	0
Total	7	0	7

PAPs’ Nationality - Households + Business	**No.**
Dominican	86
French	2
Haitian	2
Nicaraguan	3
Dutch	12
Venezuelan	7
Total	112

PAPs’ Nationality - Business	**No.**
Dominican	6
Palestine	1
Total	7

PAPs’ residence time in the area	**No.**
< 1 year	13
1 - 5 years	32
6 - 10 years	17
> 10 years	49
No Data	1
Total	112

Business established time in the area	No.
< 1 year	0
1 - 5 years	2
6 - 10 years	5
> 10 years	6
No Data	0
Total	13

Annex I

GALLAGHER BASSETT | TECHNICAL SERVICES

DRAFT
BASELINE ENVIRONMENTAL SITE ASSESSMENT

OF

SALT POND ISLAND – "BLUE BOX" ZONE
ALONG SOUALIGA ROAD AND ADJACENT TO THE MUNICIPAL SOLID WASTE (MSW) LANDFILL AND IRMA DEBRIS SITE (IDS)
PHILIPSBURG, SINT MAARTEN

PREPARED FOR

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TABLE OF CONTENTS

SECTION 1.0 – INTRODUCTION 1

SECTION 2.0 - DISCUSSION OF CONTAMINANT COMPARISSON CRITERIA 3

SECTION 3.0 – BASELINE SURFICIAL SOIL ASSESSMENT 4

SECTION 4.0 - BASELINE SOIL VAPOR ASSESSMENT 13

SECTION 5.0 - BASELINE SURFACE WATER ASSESSMENT 17

SECTION 6.0 - QA/QC & LABORATORY VALIDATION DISCUSSION 20

SECTION 6.0 – CONCLUSIONS 23

SECTION 8.0 - ENVIRONMENTAL PROFESSIONAL STATEMENT 19

FIGURES

1 Site Location Map / World Map
2 "Blue Box" Zone & Pond Island Use Layout Map
3 Commercial vs Residential Use Layout Map
4 Sampling Locations Map
5 Background Sampling Locations and Results Map
6 Great Salt Pond Features and Surface Water Sampling Locations Map
7 Bathymetric Survey Map
8 Soil Sampling Results - TPHs
9 Soil Sampling Results – Arsenic
10 Soil Sampling Results – Other Metals
11 Soil Sampling Results – Dioxins / Furans
12 Vapor Sampling Results Map
13 Surface Water Results Map

TABLES

1 Sample Location Global Positioning System (GPS) coordinates
2 Soil Results – VOAs, TPHs and Metals
3 Soil Results – VOCs
4 Soil Results – Carcinogenic PAHs
5 Soil Results – Non-Carcinogenic PAHS
6 Soil Results – Pesticides and PCBs
7 Soil Results – Dioxins / Furans
8 Vapor Wells Results
9 Surface Water Field Data
10 Surface Water – Metals
11 Surface Water – Other Analyzed Parameters

APPENDICES

A Hazardous Substance & Waste Management Research, Inc. - *Focused Risk Evaluation*
B Laboratory Analytical Reports and Chain-of-Custody Forms
C Company Statement of Qualifications and Resumes

SECTION 1.0
INTRODUCTION

Gallagher Bassett Technical Services (GBTS), a division of Gallagher Bassett Services, Inc., has prepared this Baseline Environmental Site Assessment (ESA) to summarize the methodologies and findings of sampling activities within a designated mixed-use residential/commercial area adjoining a Municipal Solid Waste (MSW) landfill, referred to as the "Blue Box" Zone, and the surrounding Great Salt Pond (GSP). The objective of the assessment activities was to obtain an understanding of existing baseline surface soil, soil vapor and surface water conditions prior to the commencement of proposed Fire Suppression Activities on the MSW landfill and Irma Debris Disposal Site (IDDS). The scope contained herein consists of a baseline sampling regime that is intended to satisfy the conditions set forth in the Environmental Assessment (OB/BP 4.01) portion of the World Bank's Safeguard Policies

The assessment area was located within Sint Maarten, which is a constituent country of the Kingdom of the Netherlands located on an island in the Caribbean. The island's location within the Caribbean is presented as **Figure 1**. Dutch Sint Maarten comprises the southern half of the island while the French Collectivity of Saint Martin comprises the northern half. It is the most densely populated country in the Caribbean with a population of about 40,000. The island is a popular tourist destination known for its beaches and tropical weather. The islandis also a popular port for cruise ships. Tourism is the largest industry on the island, and the majority of the workforce relies on the tourism industry for employment. Philipsburg is the capital of Sint Maarten.

The Great Salt Pond is a 2.25 square kilometer saltwater pond historically used for salt production, which is located in south-central Sint Maarten and is bordered on all sides by downtown Philipsburg and its suburbs. It is the largest permanent saline lagoon saltwater pond on the island which serves as a natural water catchment basin for much of the runoff water from surrounding hills. It is unprotected, and the majority of its shorelines have been cleared of their native mangroves and grasses. The Great Salt Pond has been designated as a national monument based on its cultural and historical significance.in the central portion of Philpsburg.

The topography surrounding the MSW and IDDS is relatively flat. Stormwater flows from the MSW and IDDS directly to the Great Salt Pond or to drainage ditches that ultimately drain into the pond. The Great Salt Pond also receives sewage and stormwater runoff from surrounding neighborhoods and roadways. Water from the Great Salt Pond is periodically pumped into the Great Bay, which is located to the south.

A manmade island, named Pond Island, is located the east side of the Great Salt Pond, created sometime in the mid to late 1900s. The total area of Pond Island is approximately 48 hectares, and it is accessible via two bridges on the southern and northern ends of the island.

Pond Island has two waste disposal sites:

- The Irma Debris Disposal Site (IDDS), measuring approximately 3.8 hectares and located on a former community playfield, was utilized as a temporary storage area designated for debris from the hurricane.

- The Municipal Solid Waste (MSW) landfill, measuring approximately 14.9 hectares, is located immediately north and west of the IDDS & was designated for commercial and household waste; however hurricane debris was also deposited there.

The total area covered by the IDDS and MSW (collectively referred to as the "Landfill") was approximately 18.7 hectares. The remaining portions of Pond Island contain populated areas with residences, commercial businesses, government buildings, a university, primary roads, and a baseball field.

The Baseline ESA was conducted within an area has been referred to as the "Blue Box" Zone, which is developed with both residential structures and commercial facilities. The location of the "Blue Box" Zone and the layout & use of the remainder of the Salt Pond Island is presented as **Figure 2**. A map illustrating the residential versus commercial / industrial areas of the "Blue Box" Zone is presented as **Figure 3**. The "Blue Box" Zone measures approximately 25,000 m^2 and is located immediately adjacent and southeast of the MSW/IDDS.

The Baseline ESA assessed for the presence of potential contaminants of concern (COCs) within the "Blue Box" Zone that may be attributed to the ongoing landfill fires, historic landfilling activities (prior to development), along with ongoing and historical commercial/industrial activities apparently performed over the past 30+ years. The community within the "Blue Box" Zone appears to be at greatest potential risk from impacts related to the proposed Fire Suppression Activities at the MSW/IDDS; therefore, this Baseline ESA was intended to establish pre-suppression surficial soil, soil vapor, and surface water conditions.

SECTION 2.0
DISCUSSION OF CONTAMINANT COMPARISSON CRITERIA

According to the European Commission website, only a few European Union (EU) Member States have specific legislation on soil protection. Soil is not subject to a comprehensive and coherent set of rules in the EU. Existing EU policies in areas such as agriculture, water, waste, chemicals, and prevention of industrial pollution do indirectly contribute to the protection of soils. But as these policies have other aims and scope of action, they are not sufficient to ensure an adequate level of protection for all soils in Europe or commonwealth & territorial areas. The continued unsustainable use of soils was reported to be compromising the Union's domestic and international biodiversity and climate change objectives. For all these reasons, the Commission adopted a Soil Thematic Strategy (COM(2006) 231) on 22 September 2006 with the objective to protect soils across the EU. While the Commission in May 2014 decided to withdraw the proposal for a Soil Framework Directive, the Seventh Environment Action Programme, which entered into force on 17 January 2014, recognizes that soil degradation is a serious challenge. It provides that by 2020, the land is to be managed sustainably in the Union, the soil is to be adequately protected, and the remediation of contaminated sites conducted as warranted for use or re-use.

According to the United States Environmental Protection Agency (EPA) website, soil contamination in Europe is a widespread problem of varying intensity and significance. Cleaning up all historically-contaminated sites, commonly of industrial origin, to background concentrations or levels suitable to all uses often is not viewed as technically or economically feasible. As a result, clean-up strategies increasingly are designed to employ sustainable, long-term solutions, often using a risk-based approach to land management aimed at achieving "fitness for use" appropriate to the location.

Soil analytical results were compared to the Dutch Soil Remediation Circular 2009 which has established target values (D-TV) and intervention values (D-IV) for a limited number of compounds, along with Maximum Permissible Risk (MPR) values. In lieu of a defined set of cleanup criteria or any previously established Risk-Based Criteria (RBCs) for the EU or the Netherlands, the island of St. Maarten and/or the “Blue Box” Zone, GBTS has also included a comparison of soil cleanup criteria established by the Florida Department of Environmental Protection (FDEP) and the United States Environmental Protection Agency (USEPA). These criteria included the FDEP’s *Contaminant Cleanup Target Levels*, per Chapter 62-777, Florida Administrative Code (FAC), which regulates Soil Cleanup Target Levels (SCTLs) for *residential-use direct exposure* (SCTL-R), *commercial-use direct exposure* (SCTL-C) and *leachability* (SCTL-L) concerns. The comparison criterion also included the USEPAs Regional Site Screening Levels (SSLs) established for residential (SSL-R) and commercial (SSL-C) use.

The surface water analytical results were compared to the Maximum Allowable Concentrations (MACs) for pollutants regulated under the European Union's Environmental Quality Standards for Priority Substances under Annex I of Directive 2008/105/EC. The pollutant list within Annex I was considered limited; therefore, GBTS also compared the results to the FDEP’s Freshwater/Marine Surface Water Cleanup Target Level criteria (FWSWCTL/MSWCTL). This FDEP criterion was selected as the surface water within the Great Salt Pond would not be considered a potable source for drinking purposes.

An independent evaluation of soil quality comparison criteria was obtained from a renowned toxicologist, Dr. Chris Teaf, Ph.D., which is presented in **Appendix A**.

SECTION 3.0
BASELINE SURFICIAL SOIL ASSESSMENT

3.1 SURFICIAL SOIL ASSESSMENT METHODOLOGY

GBTS collected 40 surficial soil samples from within the "Blue Box" Zone which were designated SB-1 through SB-40. A map illustrating the soil boring locations is presented as **Figure 4**. The Global Positioning System (GPS) coordinates for the samples is provided as **Table 1**. Soil borings SB-1 thru SB-21 were located within the residential areas of the "Blue Box" Zone, while soil borings SB-22 thru SB-40 were located within the commercial/industrial areas. Two background soil samples also were collected from outside the "Blue Box" Zone and they were designated Background SB-41 and Background SB-42. These samples were collected eastern adjacent to the St. Maarten government center at the southern portion of the Salt Pond Island. A map illustrating the background soil sample locations is presented as **Figure 5**.

The soil samples were collected utilizing a stainless-steel handauger which was cleaned and decontaminated with Liquinox-brand soap & water between boring locations. The soil samples were collected from the surficial 0 to 6-inches below land surface (BLS) interval. The soils from each boring were individually homogenized within a stainless-steel bowl prior to placement within sample jars. Samples were collected from the yards of residences, playgrounds or other similar areas where children may play, along within industrial areas affected by historical commercial activities involving petroleum hydrocarbons, sanding/grinding/welding, vehicle maintenance, dumping, recycling material storage, etc.

The soil samples were laboratory analyzed for the following parameters:

- All 42 Soil Samples:
  - Total Arsenic, Barium, Cobalt, Copper, Iron, Lead, Nickel and Zinc by EPA Method 6010
  - Volatile Organic Compounds (VOCs) by EPA Method 8260
  - Polynuclear Aromatic Hydrocarbons (PAHs) by EPA Method 8270
  - Total Petroleum Hydrocarbons (TPHs) by Method FL-PRO
  - Polychlorinated Biphenyls (PCBs) by EPA Method 8082

- 16 Soil Samples also were analyzed for:
  - Total Cadmium, Chromium, Mercury, Selenium and Silver by EPA Methods 6010 and 7471

- 16 Soil Samples also were analyzed for:
  - Organochlorine Pesticides by EPA Method 8081
  - Organophosphorus Pesticides by EPA Method 8141
  - Chlorinated Herbicides by EPA Method 8151

- 14 Soil Samples also were analyzed for:
  - Dioxins/Furans by EPA Method 8290

3.2 SURFICIAL SOIL ASSESSMENT FINDINGS

Surficial Soil – Field Observations

- Field reconnaissance identified many areas throughout the "Blue Box" Zone where there had been dumping or general storage of vehicles, heavy equipment, "white goods" (i.e. air conditioners, refrigerators), drums, used tires, trash, metal & wood products, industrial drums, etc.

- Stained surface soils were noted in many areas across the "Blue Box" Zone, particularly near areas of dumped industrial items or materials which were stored for future recycling.

Surficial Soil - Analytical Results

A copy of the soil laboratory results and sample chain of custody is provided within **Appendix B**. As discussed in Section 2.0, these results were compared to USEPA, FDEP and Dutch Standard criterion, as no established soil cleanup criteria was published for the entire EU. The following tables have been prepared summarizing the soil analytical results: **Table 2 – VOAs, TPHs and Heavy Metals, Table 3 – Other VOCs, Table 4 – Carcinogenic PAHs, Table 5 – Non-Carcinogenic PAHs, Table 6 - Pesticides, Herbicides & PCBs, Table 7 - Dioxins / Furans**. The soil analytical results have been summarized in below:

- **Total Petroleum Hydrocarbons (TPHs)**: TPHs is a general measurement of the aromatic and aliphatic hydrocarbon components of a sample, which are indicative of a wide-range of petroleum-containing compounds primarily associated with gasoline, diesel fuel and motor oils. Several of the analyzed soil samples contained detectable concentrations of TPHs above the laboratory method reporting limits (MRLs). Soil samples with TPHs detected above the MRLs were identified at concentrations ranging from 88.7 milligrams per kilogram (mg/Kg) to 9,170 mg/Kg. Please note the EPA does not regulate or have comparison criteria for TPHs as a total value and instead subdivides the results into oil, gas and diesel ranges, which was not conducted as part of this assessment. Of the detected TPH results, the following samples exhibited elevated values above FDEPs criteria.

  - SB-11: 3,300 mg/Kg
  - SB-22: 3,210 mg/Kg
  - SB-27: 525 mg/Kg
  - SB-31: 9,170 mg/Kg
  - SB-32: 638 mg/Kg
  - SB-38: 349 mg/Kg
  - SB-42 Background: 1,230 mg/Kg

  The seven above results exceeded the FDEPs 340 mg/Kg SCTL-L. The results from SB-11, SB-22, SB-27, SB-31, SB-32 and SB-42 Background also exceeded the 460 mg/Kg SCTL-R. Results from SB-11, SB-22 and SB-31 exceeded the 2,700 mg/g SCTL-C. A map illustrating the TPH results which exceeded the comparison criteria is presented as **Figure 8**. Although one sample (SB-11) from a residential area contained a value in excess of the SCTL-C, the pattern of TPH distribution with values in excess of the SCTL-C appeared to be in the commercial areas of the "Blue Box" Zone.

- **Heavy metals:** Heavy metals including arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, silver and zinc were detected in one or more soil samples at concentrations above their respective laboratory MRLs. Of these detected metals, the following were noted at concentrations above the FDEP SCTLs, USEPA SSLs and/or Dutch D-TV & D-IV comparison criteria:

  - **Arsenic:** Total arsenic was detected in all analyzed samples above its MRLs. The concentrations ranged from 1.0 mg/Kg to 12.1 mg/Kg. Of the 40 samples collected from within the "Blue Box" zone, 32 of the samples contained total arsenic above the FDEP's 2.1 mg/Kg SCTL-R. Of these 32 samples with elevated readings of total arsenic, only one sample (SB-1 at 12.1 mg/Kg) contained a value above the FDEP's 12.0 mg/Kg SCTL-C. The detected arsenic concentrations did not exceed the 29 mg/Kg D-TV or 55 mg/L D-IV.

    The USEPA SSLs for arsenic are much more conservative than the FDEPs. This has, in part, to do with difference in regional background levels, with Florida containing in general a higher background level than other areas of the USA. The USEPA SSL-R is 0.68 mg/Kg and the SSL-C is 3.0 mg/Kg. Based on this criterion, all 42 samples exceeded the SSL-R and 31 samples exceeded the SSL-C.

    Arsenic was detected throughout the "Blue Box" Zone, with a slight pattern of higher values being located within the residential area adjacent to the MSW/IDS. Background samples SB-41 and SB-42 also contained detectable concentrations of total arsenic consistent with those identified within the "Blue Box" Zone. A map illustrating the arsenic results within the "Blue Box" Zone is presented as **Figure 9**. Results of the background samples are provided in **Figure 5**.

  - **Barium:** Total barium was detected in all analyzed samples above its MRLs. The concentrations ranged from 13.5 mg/Kg to 142 mg/Kg. Of the 40 samples collected from within the "Blue Box" zone, four of the samples contained total barium above the FDEP's 120 mg/Kg SCTL-R (SB-1, SB-13, SB-26 and SB-36). None of the barium concentrations exceeded the FDEP's 130,000 mg/Kg SCTL-C. The total barium results did not exceed the USEPA SSLs. The detected barium concentrations did not exceed the 160 mg/Kg D-TV or 265 mg/L D-IV. A map illustrating the barium results (and other heavy metals noted below) which exceeded the comparison criteria is presented as **Figure 10**.

  - **Cadmium:** Only one of the 16 soil samples contained total cadminum above the comparrion criteria. Soil sample SB-1 contained 106 mg/Kg of total cadmium, which exceeded the FDEP's 7.5 mg/Kg SCTL-L and 82 mg/Kg SCTL-R, and the USEPA's 71 mg/Kg SSL-R. The detected values of cadmium in SB-1, SB-2, SB-8 and SB-18 also exceeded the 0.8 mg/Kg D-TV, and the result from SB-1 also exceeded the 12 mg/Kg D-IV. Cadmium was detected in the other analyzed soil samples, but the values were below the comparison criteria.

- **Chromium:** Soil sample SB-1 contained a value of chromium at 127 mg/Kg which exceeded its 38 mg/Kg SCTL-L. The value of chromium in SB-1 did not exceed the 120 mg/Kg SCTL-R or 470 mg/Kg SCTL-C. This value of chromium in SB-1 also exceeded the 100 mg/Kg D-TV, but was below the 380 mg/Kg D-IV. Total chromium was detected in the other analyzed soil samples, but the values were below the comparison criteria. Please note the EPA does not regulate or have comparison criteria for total chromium and instead utilizes hexavalent chromium, which was not conducted as part of this assessment.

- **Cobalt:** Total cobalt was detected in all analyzed samples above its MRLs. The concentrations ranged from 3.4 mg/Kg to 17.1 mg/Kg. None of the samples contained total cobalt above the 1,700 mg/Kg SCTL-R or 23 mg/Kg SSL-R. Samples SB-6, SB-14, SB-15 and SB-42 Background contained total cobalt above the 9 mg/Kg D-TV, but below the 240 mg/Kg D-IV.

- **Copper:** Total copper was detected in all analyzed samples above its MRLs at concentrations ranging from 36.0 mg/Kg to 32,900 mg/Kg. None of the detected values of total copper were in excess of the 89,000 mg/Kg SCTL-R or 47,000 mg/Kg SSL-R. However, all analyzed soil samples contained total copper above the 36 mg/Kg D-TV. In addition, approximately 60% of the samples contained total copper above the 150 mg/Kg SCTL-C and 40% exceeded the 190 mg/Kg D-IV. Further, three samples (SB-18 @ 32,900 mg/Kg, SB-21 @ 7,620 mg/Kg and SB-31 @ 5,440 mg/Kg) contained total copper above the 3,100 mg/Kg SSL-R.

- **Iron:** Total iron was detected in sample SB-5 at 89,700 mg/Kg, which exceeded the 53,000 mg/Kg SCTL-R and 55,000 mg/Kg SSL-R. This concentration did not exceed the 820,000 mg/Kg SSL-C. Total iron was detected in the other analyzed soil samples, but the values were below the comparison criteria.

- **Lead:** Total lead was detected in all analyzed samples above its MRLs at concentrations ranging from 2.9 mg/Kg to 2,670 mg/Kg. Samples SB-5 (539 mg/Kg) and SB-11 (2,670 mg/Kg) contained concentrations of total lead that exceeded the 400 mg/Kg SCTL-R and SSL-R. The concentration in sample SB-11 also exceeded the 1,400 mg/Kg SCTL-C and 800 mg/Kg SSL-C. Thirteen of the 42 samples contained total lead above the 85 mg/Kg D-TV, while samples SB-5 and SB-11 both exceeded the 530 mg/Kg D-IV. The other detected values of total lead were below the comparison criteria.

- **Zinc:** Total zinc was detected in all analyzed samples above its MRLs at concentrations ranging from 23.9 mg/Kg to 4,590 mg/Kg. None of the detected total zinc concentrations exceeded its FDEP SCTLs or EPA SSLs. However, 23 of the 42 samples contained zinc above its 140 mg/L D-TV. Of these 23 samples results, three samples (SB-1 @ 1,410 mg/Kg, SB-11 @ 776 mg/Kg and SB-25 @ 4,590 mg/Kg) contained total zinc above its 720 mg/Kg D-IV. The other detected total zinc concentrations did not exceed its comparison criteria.

- **Volatile Organic Aromatics (VOAs):** VOA compounds commonly associated with gasoline (benzene, toluene, ethylbenzene and xylenes (BTEX)) were not identified in the soil samples above the laboratory method detection limits (MDLs) or comparison criteria.

- **Other VOCs:** No VOCs were detected in the soil samples above their laboratory MDLs or MRLs with the exception of methylene chloride. Methylene chloride was detected in samples SB-1 (0.030 mg/Kg), SB-19 (0.028 mg/Kg) and SB-20 (0.020 mg/Kg). These detections only slightly exceeded the 0.02 mg/Kg SCTL-L, but were well below the other FDEP and EPA comparison criteria.

- **PAHs:** Neither carcinogenic nor non-carcinogenic PAHs were detected above their FDEP and EPA comparison criteria. The results also did not exceed the Dutch total PAHs criterion of 40 mg/kg. The majority of the PAH results were noted to be below the laboratory MDLs, with the exception of SB-29 and SB-32. These samples were collected in the commercial area of the "Blue Box" Zone (near the Soualiga Road) and contained low concentrations of PAHs well below the comparison criteria.

- **PCBs:** PCB-1260 was detected at 0.71 mg/Kg in sample SB-1. This value exceeded the 0.5 mg/Kg SCTL-R and 0.24 mg/Kg SSL-R, but was below the 17 mg/Kg SCTL-L, 2.6 mg/Kg SCTL-R and 0.99 mg/Kg SSL-C. Other samples analyzed for PCBs did not exhibit concentrations above the laboratory MDLs or FDEP and EPA comparison criteria.

- **Chlorinated Pesticides and Herbicides:** Neither chlorinated pesticides nor herbicides were detected above their FDEP and EPA comparison criteria with the exception of dieldrin (a pesticide). Dieldrin was detected in sample SB-2 at 0.0043 mg/Kg, which slightly exceeds its 0.002 mg/Kg SCTL-L, but was below the other FDEP and EPA comparison criteria.

- **Dioxins / Furans:** Dioxins / furans were analyzed for in 16 soil samples, all of which contained detectable concentrations of one or more of these compounds above the laboratory MRLs. The following soil samples contained dioxin / furan results above the FDEPs SCTL-R of 7 nanograms per kilogram (ng/Kg).

  - SB-1 at 15.94 ng/Kg
  - SB-4 at 9.24 ng/Kg
  - SB-18 at 31.40 ng/Kg
  - SB-26 at 30.34 ng/Kg
  - SB-29 at 11.10 ng/Kg
  - SB-32 at 12.22 ng/Kg
  - SB-33 at 19.5 ng/Kg

  The detected values of dioxins / furans within samples SB-18 and SB-26 also exceeded the FDEP's 30 ng/Kg SCTL-C. The Dutch Soil Remediation Circular 2009 established a maximum permissible risk (MPR) for human exposure to dioxin. The sum TEQ MPR was established at 1.8 ng/Kg. Given this comparison criteria, 12 of the 16 samples exceeded the Dutch MPR. A map illustrating the dioxins / furan results is presented as **Figure 11**.

Discussion of Surficial Soil Sampling Results

GBTS retained Mr. Christopher M. Teaf, Ph.D, a renowned toxicologist and the President & Director of Toxicology of Hazardous Substance & Waste Management Research, Inc. (HSWMR), to conduct a focused risk evaluation of the health concerns for select heavy metals and dioxins/furans detected in the soil samples collected as part of this assessment. The full HSWMR report is provided as **Appendix B**. The following is a summary of HSWMRs conclusion and recommendations:

- HWSMR indicated that the detected compounds of interest were the heavy metals including arsenic copper and lead, as well as the PAHs, TPHs and the dioxin/furan compounds.

- Although some of the total arsenic levels exceed conservative international default risk-based guidelines for residential soils (EPA SSL and the FDEPs SCTL), they do not approach other available health-protective guidelines for unrestricted use (Dutch IV of 76 mg/kg). It was further noted that the arsenic concentrations reported for the background samples (SB-41 and SB-42) are consistent with the “Blue Box” Zone sample results. HSWMR noted that it is widely acknowledged that many soil types, including those derived from marine sediments contain naturally elevated arsenic values. HSWMR concluded that the reported detections of arsenic in surface soils at the “Blue Box” Zone do not represent a significant exposure concern for residential or commercial/industrial use.

- Total copper concentrations were less than available commercial/industrial guidelines (EPA Industrial SSL) in all samples. The two background sample results both were less than 100 mg/kg. The pattern of detection (results generally greater in residential area closest to the dump) and consistent elevated concentrations compared to background results, suggest that copper impacts, particularly in the residential area of the “Blue Box” Zone, may be related to activities at the adjacent MSW/IDS. HSWMR concluded that the reported detections of copper in surface soils in the “Blue Box” Zone do not represent a major exposure concern for commercial/industrial use. Further, additional risk evaluation (e.g., residence type and location, receptor activity) may be appropriate for determining risk from copper in the residential area of the “Blue Box” Zone, although no imminent, widespread risk appeared to be evident.

- Total lead was noted in two samples (SB-5 and SB-11) collected from the residential area of the “Blue Box” Zone which were greater than default residential guidelines (EPA, FDEP and Dutch TV), with only one of the samples exceeding commercial guidelines (FDEP commercial SCTL). Both of the background sample results were less than 20 mg/kg. As with copper results, the pattern of distribution of results generally greater in residential area closest to the MSW/IDS and being consistently elevated concentrations compared to background results, the results suggest that lead impacts, particularly in the residential area, may be related to activities at the adjacent MSW/IDS. HSWMR concluded that the reported detections of lead in surface soils at the “Blue Box” Zone do not represent a pervasive exposure concern for residential or commercial/industrial use. However, two identified locations may warrant additional investigation or risk management depending on actual exposure circumstances in the areas.

- With the exception of results for soil sample SB-32, essentially all of the PAH results that were not below detectable limits were low levels located between the laboratory MDLs and MRLs.

According to the laboratory report, the laboratory flagged indicates that the result exhibited "interference present". But even those flagged results were well below default guidelines (EPA residential and commercial SSLs). The results for sample SB-32, which is in the commercial area of the "Blue Box" Zone and was immediately adjacent to a major roadway (Soualiga Road), they also were notably less than guidelines of interest (e.g., Dutch total PAHs criterion of 40 mg/kg). It is broadly understood that PAHs are ubiquitously present in urban soils ranging from 1 to tens of mg/kg (ATSDR, 1995; Teaf et al, 2008), due to vehicular traffic, backyard burning, and industrial activity. Thus, it is not surprising that low level PAHs are present in the soils throughout the "Blue Box" Zone, and they do not represent a major health risk. HSWMR concluded that the reported detections of PAHs in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use.

- TPHs (petroleum range organics) typically represent a generalized preliminary screening tool to determine if additional more detailed analysis is recommended for classes of substances such as VOCs, PAHs and PCBs. Although TPH results for several samples exceeded conservative default FDEP screening levels, no significant levels of VOCs, PCBs or PAHs were detected in the samples. For example, the maximum TPH concentration was reported in commercial location sample SB-31 at 9,170 mg/kg (which exceeded the FDEP commercial SCTL of 2,700 mg/kg). All of the VOC and PCB results for that sample were BDL and all but one of the PAHs also was BDL. The one PAH was reported at a low concentration between the laboratory MDL and MRL. Thus, HSWMR concluded that the reported TPH detections likely represent weathered, high molecular weight, low toxicity hydrocarbons that pose limited health concern. Further, the reported detections of TPH in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use.

- Seven residential and seven commercial locations within the "Blue Box" Zone and two background locations were selected for analysis of dioxins/furans. As with PAHs, arsenic, and to a certain extent TPH parameters, the dioxins/furans often are widely distributed and a component of natural background soil levels. As such, the two background locations exhibited detectable levels of dioxins/furans. Five of the seven residential samples exceeded the EPA residential guideline, and three of the seven residential samples exceeded the FDEPs guideline. None of the results exceeded the Dutch Intervention Value, but it is noted that the Dutch value is based on protection at a target cancer risk of 1 in 10,000, as compared to the 1 in 1,000,000 target risk which forms the basis for the EPA and FDEP guidelines. The Dutch value recalculated at a 1 in 1,000,000 risk target would be 1.8 ng/Kg, which is in the same magnitude as the EPA and FDEP guidelines. The default Dutch guideline, while less protective than the EPA and FDEP default screening guidelines, is consistent with the acceptable cancer risk range utilized by the EPA when they develop remedial goals (1 in 10,000 to 1 in 1,000,000), even for unrestricted residential-use purposes. HSWMR concluded that the reported dioxins/furans in surface soils at the "Blue Box" Zone do not represent a major exposure concern for residential or commercial/industrial use. This conclusion for residential areas is based on application of the Dutch cancer risk target and the EPA target risk range.

SECTION 4.0
BASELINE SOIL VAPOR ASSESSMENT

4.1 SOIL VAPOR ASSESSMENT METHODOLOGY

GBTS conducted a limited soil vapor assessment within the “Blue Box” Zone to evaluate for the presence of landfill-types gases (such as methane, hydrogen sulfide, etc.) and/or volatile compounds, which may be migrating from the MSW/IDDS or have originated from the historic landfilling or ongoing commercial/industrial operations.

GBTS installed seven vapor well points inside the “Blue Box” Zone (designated VP-1 thru VP-7), and additional two vapor wells outside the zone (designated VP-East and VP-SW). A map illustrating the vapor well locations is presented as **Figure 4**. The GPS coordinates for the vapor wells is provided as **Table 1**. The wells were installed using a stainless steel handauger to a depth of refusal. The vapor well points were constructed of 1.5-inch diameter PVC, which included 2 to 3-feet of slotted screen (located below grade) and sufficient solid PVC riser to extend above the surface. The top of the vapor well was finished with a PVC cap and valve for attaching field instruments.

Following a minimum 24-hour equilibration & stabilization period, GBTS conducted two field-screening events of the vapor well points. The first event was a screening conducted following the initial opening of the vapor port. The second screening event was following the elapse of a 10-minute venting period.

The vapor screening included measurements with a 4-gas meter that detected hydrogen sulfide (HS), oxygen levels, carbon monoxide (CO), and combustible gas (methane) as a percentage of the Lower Explosive Limit (LEL). The vapor points also were field-screened for indications of volatile compounds utilizing a Photo Ionization Detector (PID).

4.2 SOIL VAPOR ASSESSMENT FINDINGS

A summary of the vapor screening results are summarized in **Table 8** and illustrated in **Figure 12**. The following is a summary of those findings:

- During the field PID screening events, no organic vapors (which may be indicative of VOCs) were detected above the instrument’s 1 part per million (ppm) detection limit.

- Oxygen was detected in a range from 18.4% to 20.9%, which was generally within the typical 18.5% to 23.5% range for breathing space.

- Carbon monoxide (CO) was noted in 6 of the 9 screened vapor samples at concentrations ranging from 1-ppm to 4-ppm.

- H2S was not detected.

- Methane readings were below the LEL.

SECTION 5.0
BASELINE SURFACE WATER ASSESSMENT

5.1 SURFACE WATER ASSESSMENT METHODOLOGY

Prior to the initiation of baseline surface water sampling activities, a site reconnaissance & bathymetric survey was performed to determine the morphological features of the pond including: depths, general submarine topography, and inflow/outflow locations as well as storm water outfall areas from Pond Island and surrounding areas. The site reconnaissance and bathymetric surveys were conducted by GBTS, along with members of the University of South Florida Water Institute. The information obtained during the site reconnaissance was utilized to confirm and/or modify the proposed surface water sampling plan to ensure collection of representative surface water samples. A map illustrating the location outfalls, pump house, etc. is provided as **Figure 6**.

The bottom of the GSP was mapped at select intervals using a Lowrance LCX 28C Wide Area Augmentation System (WAAS) enabled with Global Positioning System (GPS) with a fathometer (bottom sounder) or equivalent to determine the boat's position and bottom depth in a single measurement. To generate the data required to create the bathymetric map, a sufficient number of transects were run in both north-south and east-west orientations to ensure reasonably adequate coverage. The data collected was utilized to create a bottom contour map that assessed the pond's area, depth, and volume. Data generated via the Lowrance LCX 28C chart-plotter was placed into a Microsoft Excel file with X, Y, Z (latitude, longitude, depth) data fields, which were them integrated into an ArcGIS mapping application for the creation of a bathymetric contour map. A map illustrating the bathymetric survey results is provided as **Figure 7**.

A map illustrating the surface water sample locations is provided as **Figure 6**. The GPS coordinates for the samples is provided as **Table 1**. In order to establish baseline surface water quality conditions within the Great Salt Pond prior to the initiation of fire suppression activities, GBTS collected the following surface water samples:

- A total of 13 shallow-interval surface water samples were collected from eight discrete sampling locations (GSP-1 through GSP-8).
- Five additional deeper-interval surface water samples also were collected from discrete locations (GSP-1D, GSP-2D, GSP-4D, GSP-5D and GSP-6D).
- The samples were located both close to the landfill and near stormwater outfall areas.
- At sampling locations, measurements of field parameters and representative water samples were collected from the surface (top 18-inches) and the bottom (bottom 18-inches) of the water column.
- Sampling locations also were located in more distal background locations, aimed at characterizing the water quality conditions throughout the GSP and away from known storm water/drainage outfall areas.

The depth of the water column was measured with a weighted tape and recorded. Field parameters including: temperature, dissolved oxygen (DO), pH (as Standard Units), and conductivity (micro Siemens, ug/S) were collected with a calibrated water quality probe. The salinity also was measured using a hydrometer. Turbidity was measured with a nephelometer. Field parameters were measured in separate containers than those used for the collection of samples for laboratory analysis. Field probes were submerged in containers containing samples to be analyzed at the laboratory.

A discrete depth sampler was utilized to collect the surface water samples at depth. A discrete depth sampler consists of a plastic cylinder with rubber stoppers that leave the ends of the sampler open while it's being lowered into the water column. Once the sampler reached the intended depth, a metallic messenger was sent down a rope which caused the cylinder to close and which then allowed for the collection at the desired depth.

Surface water samples were analyzed for the following parameters:

- Total and Dissolved Target Analyte List (TAL) Metals: Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium and Zinc by EPA Methods 6010, 6020 and 7470
- Volatile Organic Compounds (VOCs) by EPA Method 8260
- Polycyclic Aromatic Hydrocarbons (PAHs) by EPA Method 8270
- Chlorinated Pesticides by EPA Method 8081
- Chlorinated Herbicides by EPA Method 8151
- Ammonia (as Nitrogen) by EPA Method 350.1
- Nitrite (NO2) and Nitrate (NO3) by EPA Method 353.2
- Chloride, Fluoride and Sulfate by EPA Method 300.0
- Chemical Oxygen Demand (COD) by EPA Method 410.4
- Total Dissolved Solids (TDS) by EPA Method 2540C
- Perfluoroalkyl Substances (PFOAS) by EPA Method 537.1

5.2 SURFACE WATER ASSESSMENT FINDINGS

A copy of the surface water laboratory results and sample chain of custody is provided within **Appendix B**. As discussed in Section 2.0, these results were compared to USEPA, FDEP and Dutch Standard criterion, as no established soil cleanup criteria was published for the entire EU. Due to a lack a comparison criteria, GBTS included the State of Florida FDEP criteria for both Fresh Water and Marine Water Surface Water Cleanup Levels (FW/MWCTL) The following tables have been prepared summarizing the soil analytical results: **Table 9 – Field Parameters, Table 10 – Heavy Metals, Table 11 - Other Lab Parameters**. The following is a summary of the surface water assessment findings:

- The general appearance of the surface water within the Great Salt Pond was noted to be a bright green with noticeable levels of suspended algae / chlorophyll within the water column. GBTS did note the presence of dead fish floating within different areas of the pond.

- The following is a summary of the field measurements. The field parameter readings are summarized in **Table 9**.

- The pH values ranged from 8.16 Standard Units (SU) to 9.16 SU.
- Turbidity readings ranged from 45.2 Nephelometric Turbidity Units (NTU) to 85.0 NTUs. Higher readings were generally noted at 1 m below surface.
- Dissolved oxygen readings varied at depth intervals. The surface water readings (0.1 m) ranged from 102.1 % saturation to 320.5 %. The deeper interval readings (1 m) ranged from 34.9 % to 335.3%.
- Conductivity readings were generally high due to the effect of the brackish / salt water and ranged from 9,025 micro Siemens per centimeter (µS/cm) to 14,346 µS/cm.

- Total aluminum was detected in the 13 surface water samples at concentrations ranging from 110 micrograms per liter (ug/L) and 1,140 ug/L. All of the total aluminum results exceeded the 13 ug/L FWSWCTL and the 1.5 ug/L MWSCTL. The dissolved aluminum readings were reported by the lab at a concentration below the MDLs; however, the detection limit was noted at 30.7 ug/L, which exceeded the FW/MWSCTL.

- Total copper was noted in surface water samples GSP-1D (6.0 ug/L) and GSP-5D (3.7 ug/L), which exceeded the 3.7 ug/L FWSWCTL and 0.3 ug/L MWSCTL. Dissolved copper was not exhibited in the 13 samples above either the lab MDL or FW/MSWCTL.

- Total iron was noted in all 13 surface water samples at concentrations ranging from 182 ug/L to 1,300 ug/L. These total concentrations exceeded the 0.3 ug/L FWSWCTL. Dissolved iron was only detected in one sample above the FWSWCTL which was in GSP-4D at 46.8 ug/L. The other analyzed samples did not exhibit dissolved iron above the laboratory MRLs; however, the laboratory MRLs and MDLs were both at values above the FW/MWCTL.

- Other analyzed total and/or dissolved metals including arsenic, antimony, barium, calcium, magnesium, manganese, potassium, sodium, and vanadium were detected in one or more samples above their respective laboratory MRLs; however, not comparison criteria was available for these metals. It should be noted that the concentrations ranges detected for each of these metals was fairly consistent, suggesting that these are likely to be naturally-occurring background levels.

- Neither the chlorinated pesticides, chlorinated herbicides nor the VOCs were detected above their respective laboratory MRLs or applicable FW/MSWCTL.

- PAHs were not detected above their respective laboratory MRLs in the analyzed surface water samples with the exception of GSP-4D. The sample GSP-4D contained detectable concentrations of the 18 PAH compounds above the laboratory MRLs. The detected concentrations of anthracene (2.2 ug/L) and benzo(a)pyrene (2.3 ug/L) were exhibited above their 0.4 ug/L and 0.1 ug/L MACs, but were both below their FW/MSWCTL. Fluoranthene was detected at 2.3 ug/L, which exceeded its 1 ug/L MAC and 0.370 ug/L FW/MSWCTL. The other detected PAHs in GSP-4D did not exceed the comparison criteria.

- Total dissolved solids (TDS) were detected in the 13 samples at concentrations ranging from 5,520 milligrams per liter (mg/L) to 9,640 mg/L. All 13 samples exceeded the 500 mg/L FWSWCTL. The presence of high TDS values was likely due to the high turbidity associated with the presence of salt in the water and large amounts of algae in the samples.

- Chloride and fluoride was detected above the laboratory MRLs in all 13 surface water samples. The concentrations of chloride ranged from 2,450 mg/L to 4,200 mg/L. All 13 samples exceeded the 250 mg/L FWSWCTL. Fluoride was detected at concentrations which ranged from 0.77 mg/L to 2.1 mg/L. None of the detected concentrations of fluoride exceeded its 5 mg/L.

- Nitrogen (as N) was detected above the laboratory MRLs in all 13 surface water samples at concentrations which ranged from 0.47 mg/L to 2.0 mg/L. None of the detected concentrations exceeded the 2.1 mg/L FWSWCTL.

Detectable concentrations of sulfate, nitrate/nitrite and chemical oxygen demand (COD) were detected above the laboratory MRLs in most of the 13 surface water samples. No comparison criterion was available for these parameters.

SECTION 6.0
QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) & LABORATORY VALIDATION DISCUSSION

The following is a discussion of the project's limitations, the QA/QC of the sample collection & shipping procedures, and the quality and validation of the laboratory analytical data.

- During the sampling event the lithology included large rocks as well as significant debris used to in-fill and create Pond Island. Therefore, the lithology was not considered to be homogeneous, and analytical results may not necessarily be representative of the entire assessment area. Furthermore, logistical challenges were encountered during the collection of samples, including access to parcels, limitations due to concrete, storage, and surface debris obstacles. The data is considered to be a general representation of the conditions within the "Blue Box" Zone and Great Salt Pond.

- The QA/QC of the field sampling event was conducted in accordance with the Sampling Plan and the FDEPs Standard Operating Procedures (SOPs) per Chapter 62-160, FAC. Sampling equipment was properly decontaminated between locations. Dedicated latex gloves also were used between each sampling point.

- Soil and surface water samples were collected into laboratory-supplied containers with appropriate preservatives (when applicable). The containers were labeled, placed on ice, and delivered via international courier (Amerijet) to Pace Analytical Services, Inc. in Pompano Beach, Florida USA, a National Environmental Laboratory Accreditation Conference (NELAC)-certified laboratory. Samples were placed under appropriate chain-of-custody upon collection which includes unique sample IDs, collection date and time, container size and material, preservatives, and requested analyses. Appropriate chain-of-custody documentation accompanied the samples from field collection through laboratory delivery. A Custody Seal was placed on the coolers and the lab was instructed to make note if the Custody Seal was intact upon receipt. A temperature blank was shipped with the samples to ensure that samples were kept below 4 degrees Celsius.

- Due to overnight shipping & courier conditions associated with the international island location, sample shipment back into the USA was delayed by the courier. This delay resulted in a select number of samples arriving at the laboratory in Pompano Beach, FL in a condition which was outside the sample's hold-time and/or temperature guidelines. The following is a summary of the samples which were out-of-hold (OOH) or out-of-temperature (OOT) guidelines:

  <u>Surface Water – Collection Date Oct 16, 2019</u>
  Total Dissolved Solids (TDS) - OOH
  Polycyclic Aromatic Hydrocarbons (PAHs) - OOH
  Pesticides - OOH
  Herbicides – OOH
  GSP-1, GSP-1D, GSP-2, GSP-2D, GSP-5, GSP-5D - OOT

Surface Water – Collection Date Oct 17, 2019
GSP-3, GSP-4D and GSP-7 - OOT

Soils – Collection Date Oct 17, 2019
VOCs – OOH (and not frozen)

- Holdings times for EPA analytical methods were set to ensure that analysis are performed before degradation of samples could impact the analytical results. In most cases, this was established for water and waste samples that are typically not obtained from surficial environments where they are naturally-located daily in the sun & UV rays and exposed to the humid tropical atmosphere. For these reasons, it does not appear that a minor 24-hour exceedance of a 7-day holding time for the collected samples resulted in a significant variation in the results.

- When sample holding times are exceeded, the analytical results may be considered questionable or qualitative due to possible degradation of compounds of interest. That is very important when analyzing samples for drinking water analytics or determining if a waste is hazardous by characteristic. However, the purpose of the Salt Pond surface water and “Blue Box” surficial soil assessment objectives, the results of samples that were slightly past holding times or arrived with an elevated cooler temperature are still considered representative of surface water and surficial soil conditions.

- Upon review of the overall analytical data sets, samples which were out of recommended hold and/or temperature guidelines, generally did not exhibit the analyzed parameter above either its comparison criteria or were below the laboratory’s method detection and/or reporting limits. Therefore, these QA/QC items did not appear to create any significant concerns that would invalidate the data for the health-based assessment purposes they are being used for on this project.

GBTS also contacted Pace Analytical Laboratory’s QA Department who noted the following general comments regarding the sample holding and temperature guidelines:

- Volatiles results may be biased low, if they are out of hold or out of temperature guidelines. These would be the most likely impacted of the analysis that was performed in the current assessment.

- Surface water samples out of temperature holds would not affect metals, chloride, or fluoride analysis.

- Soil samples out of temperature holds would not affect metal values except potentially for mercury.

- Samples that are unpreserved are likely more vulnerable to hold time and temperature exceedances than those that have some sort of chemical preservation in addition to thermal preservation. The purpose of thermal (and/or chemical) preservation in the samples is to inhibit or slow biological activity and chemical breakdown. Therefore, samples that are out of temperature hold could be biased low. For degradation due to bacterial activity, the bacteria most commonly encountered in environmental samples have a significant decline in growth and activity around 10 C. So a sample over 10 C may be more impacted than a sample at 7 C.

- With the exception of short holds, most hold times do not have much scientific basis. Without a comparison study though the laboratory cannot say with any certainty that the data is biased or not. If it were biased, it most likely would be biased low.

SECTION 7.0
CONCLUSIONS

GBTS was retained to conduct a Baseline ESA to evaluate current conditions of soil and surface water prior to a fire suppression event to address fires in the MSW landfill and IDDS staging areas. The Baseline ESA sampling event was conducted in October 2019, which included collection of surface water samples from the Great Salt Pond, which surrounding the MSW landfill, along with soil and soil vapor samples from the “Blue Box” Zone, a residential/commercial area located adjacent to the MSW landfill.

Surficial Soil Quality

Surficial soils tested in the “Blue Box” Zone contained detectable concentrations of heavy metals, PCB, TPHs and dioxins/furans. The heavy metals identified above this assessments comparison criterion included arsenic, barium, cadmium, chromium, cobalt, chromium, copper, iron, lead and zinc. Of these heavy metals, elevated arsenic, copper and zinc were persistent in nearly all of the analyzed soil samples. Concentrations of heavy metals including arsenic, copper and zinc were noted in select samples above their commercial criteria and/or Dutch Target & Intervention Values.

The source of these constituents was attributed to a combination of runoff & ash deposition from the MWS/IDDS, ongoing discharges from commercial activities ongoing in the “Blue Box” Zone (i.e., leaking oils/grease from stored/dumped vehicles & equipment, along with the storage and recycling of metals in the general assessment area), runoff from the adjoining Soualiga Road, the creation of the island using landfilled materials, along with naturally-occurring processes.

The data was reviewed by a renowned toxicologist, Dr. Chris Teaf, Ph.D., who concluded that the concentrations of arsenic, lead, PAHs, TPHs, and dioxins/furans detected in the surficial soils did not represent a major exposure concerns for the existing residential and commercial uses ongoing in the “Blue Box” Zone.

- HSWMR concluded that the reported detections of copper in surface soils in the “Blue Box” Zone do not represent a major exposure concern for commercial/industrial use. However, further evaluation (e.g., residence type and location, receptor activity) may be appropriate for determining risk from copper in the residential area of the “Blue Box” Zone, although no imminent, widespread risk appeared to be evident.

Surface Water Soil Quality

The surface water within the Great Salt Pond contained detectable concentrations of aluminum, copper and iron, along with Total Dissolved Solids (TDS) and chlorides. One sample also contained a detectable concentrations of PAH compounds. None of the analyzed samples were found to contain elevated values in excess of the few compounds listed in the EU’s Maximum Allowable Concentrations (MACs) established in the Directive 2008/10/EC Annex 1, except for PAH compounds anthracene, fluoranthene and benzo(a)pyrene. However, the comparison criteria was limited; therefore, GBTS also compared these concentrations to the State of Florida FDEP Fresh and Marine Surface Water Cleanup Criteria, of which the aluminum, iron, copper, fluoranthene, TDS and chloride concentrations exceeded. The levels of elevated concentrations of chlorides and TDS do not appear to warrant significant concern given the saltwater/brackish environment and the amount of stormwater runoff directed into the pond. Further, a review of the field readings showed that there are typically low dissolved oxygen levels at just 1 m below surface. Given the levels of COD noted in the analytical results and the high turbidity at depths, the general water quality appears to be poor and likely the main influence in the fish kills observed during the site reconnaissance. The source of the aluminum, copper, iron and PAHs are likely the results of runoff from the MSW/IDDS and Soualiga Road, as well as the large metal recycling facility located east of the landfill, and also may be an indication of naturally-occurring processes. The water within the Great Salt Pond does not appear suitable for consumption; therefore, the presence of these constituents does not appear to pose a significant exposure concern.

Vapor Quality

This assessment did not identify significant landfill-type gases or VOCs in the vapor wells placed inside and outside the “Blue Box” Zone. Very low concentrations of carbon monoxide and LEL were noted in one sample location (VP-3) located in the center of the commercial / industrial portion of the “Blue Box” Zone. These results were likely from industrial activity in this area and do not appear to warrant further assessment or monitoring. Other vapor wells spread throughout the “Blue Box” Zone also had very low carbon monoxide readings – but these results did not warrant additional assessment.

SECTION 8.0
ENVIRONMENTAL PROFESSIONAL STATEMENT

The company statement of qualifications and the resumes for the professional who completed this report is are provided in **Appendix C**.

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Annex J

EE&G DISASTER RESPONSE, LLC

FIRST CONSULTATION REPORT

FOR

SINT MAARTEN

EMERGENCY DEBRIS MANAGEMENT PROJECT

ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT (ESIA) OF FIRE SUPPRESSION ACTIVITY

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Table of Contents

1. Introduction, Objectives and Purpose 1
2. Methodology 2
2.a. Public Notification 2
2.b. Meetings/Sessions Conducted 2
2.b.1 First Consultation (June 25 & June 26) 3
2.b.2 NRPB, RINA and World Bank Meeting on Monday June 24, 2019 3
2.b.3 Community Outreach Wednesday June 26, 2019 3
2.c. Key Topics Addressed in Meetings/Sessions 3
3. Results – Data Collected 6
3a. Input from Stakeholders From Public Consultation 6
3b. Input from the other Meetings/Sessions 6
3.b.1 NRPB, RINA and World Bank Meeting on Monday June 24, 2019 6
3.b.2 Community Outreach Wednesday June 26, 2019 7
4. Findings 8
4a. Statistics 8
4b. Key Concerns of the Stakeholders 8
5. Conclusions/Recommendations 9
Preparation of the ESIA 10
Fire Suppression Activity Project Design 10
Preparation for the Second Consultation 11

FIGURES

FIGURE 1 – Plan View of Landfills and Blue Box Zone

ANNEXES – Documentation of First Consultation

Annex A - Call Materials (Flyers, Newspaper Article, and Electronic Screen Shot)
Annex B - Power Point Presentations (English & Spanish)
Annex C - Photographs of Public Consultation
Annex D - Notes from First Consultation
Annex E - Community Outreach Report
Annex F - Attendee Sign In Sheets for English/Spanish Sessions
Annex G - Questions from Public Consultations and Answers Given

1. INTRODUCTION, OBJECTIVES AND PURPOSE

EE&G Disaster Response, LLC (EE&G) was retained by the National Recovery Program Bureau (NRPB) of Sint Maarten to prepare an Environmental and Social Impact Assessment (ESIA) for an upcoming Fire Suppression Activity Project to be performed at Sint Maarten's solid waste landfill sites in Philipsburg. The ESIA is being prepared to assess potential environmental and social impacts that may result during the execution of fire suppression activities that are anticipated to be performed at the Great Salt Pond Landfill Facility and the Irma Debris Disposal Site (hereafter referred to as "the Landfills").

As part of the ESIA, EE&G is required to assist the NRPB in gathering feedback from the Public and Stakeholders that may be affected by the proposed Fire Suppression Activity Project. The first step in that process was to conduct the first of two public town hall consultations in Sint Maarten. This report presents the details and findings of the First Public Consultation that was performed on June 25 (presented in English) and June 26, 2019 (presented in Spanish).

The purpose and objectives of this Public consultation were as follows:

- Notify the Public and area Stakeholders of the anticipated Fire Suppression Activity Project at the landfills.
- Conduct a limited community outreach in conjunction with RINA, the consultant retained by the NRPB to perform the census of the potentially impacted community and develop a Resettlement Action Plan.
- Gather Social Census data to be collected by RINA for consideration in the ESIA preparation.
- Make a technical presentation via PowerPoint of the anticipated Fire Suppression Activities and the components of the ESIA that will be performed for the project.
- Conduct the Public Consultation in English and Spanish to accommodate both communities that could be impacted.
- Facilitate in an open forum to the Public and Stakeholders a dialogue to freely and openly ask questions regarding the materials presented, and to encourage further inquiries.
- Answer as many questions as feasible during the Public Consultation.
- Gather the questions and concerns from the Stakeholders and Public and prepare written answers that can be published.
- Summarize the questions and answers into appropriate categories.
- Advise the Stakeholders and Public of the preliminary area of the community that is being considered for temporary relocation/evacuation (Exclusion Zone) and for Caution (or Notification) Zones that are being established for Public health and protection of nearby businesses.

- Provide details regarding where the Public and Stakeholders can submit further questions or comments for consideration.

- Include the concerns and issues brought forth from the Public and Stakeholders into the preparation of the ESIA where appropriate.

- Summarize the Findings and Conclusions of the First Public Consultation and provide Recommendations for continuing the Public outreach and preparing for the second Public Consultation after a draft ESIA has been prepared and is ready to be released to the Public.

2. METHODOLOGY

2.a. Public Notification

NRPB provided Public notification of the First Public Consultation in several media:

1. Community Flyer Handout (in-person performed by NRPB, RINA and EE&G representatives). This activity involved handing out a flyer that was prepared in English and Spanish notifying the community of the upcoming Public Consultation meeting. A copy of that notification flyer is presented in Annex A. Representatives of NRPB handed out copies of the flyer on June 24, 2019 and a second handout was performed by NRPB and EE&G in the predominantly Spanish speaking community on June 26, 2019. The representatives physically walked the community adjacent to the landfill and handed out flyers to residences and businesses.

2. Online Platforms. NRPB provided electronic notification of the project on Facebook, Linked-In and on their Webpage (www.nrpbsxm.org). A screen shot of that notification is presented in Annex A.

3. Newspaper (Daily Herald). NRPB published a copy of the flyer in the Daily Herald in Sint Maarten on June 24, 2019 notifying the Public of the First Consultation. A copy of the Daily Herald page with the flyer is presented in Annex A.

2.b. Meetings/Sessions Conducted

Throughout this document the participants engaged in this First Consultation have been referred to as the “Public and Stakeholders”. The various groups and entities that comprise the “Public and Stakeholders” are:

- The general public in Sint Maarten
- The community of residences and businesses located on Great Salt Pond Island.
- The National Recovery Program Bureau (NRPB)
- Sint Maarten Ministry of Public Housing, Spatial Planning, Environment, and Infrastructure (VROMI)
- Sint Maarten Ministry of Public Health, Social Development and Labor (VSA)
- The Government of Sint Maarten
- The World Bank Group
- RINA
- EE&G

2.b.1 First Consultation (June 25 & June 26)

The NRPB and EE&G conducted the First Public Consultation on June 25 and 26, 2019 at the University of Sint Maarten at approximately 6:00 pm to 8:00 pm both evenings. The June 25th presentation was conducted in English and the June 26th presentation was conducted in Spanish. The same PowerPoint presentation was utilized to present the information both evenings, in the language of that night. Copies of the English and Spanish PowerPoint Presentations are included in Annex B. Photographs taken during the First Consultation are presented in Annex C. Videos of the English and Spanish sessions were taken that will be provided to NRPB. These videos serve documentation purposes only and will not be made public.

Mr. Thijn Laurensse and Mr. Claret Connor of NRPB and Mr. Timothy Gipe and Dr. Christopher Teaf of EE&G presented the English version. Ms. Hanneke Spaans of NRPB and Mr. Jose Basulto of EE&G presented the Spanish versions, with English/Spanish translated assistance for Mr. Laurensse, Mr. Connor and Mr. Gipe. In both sessions, questions from the audience were addressed by the appropriate representative. Notes from this meeting are presented in Annex D.

2.b.2 NRPB, RINA and World Bank Meeting on Monday June 24, 2019

EE&G met with representatives of NRPB, RINA and World Bank in the NRPB offices on Monday June 24th at 9 am to discuss the upcoming Public Consultation, ESIA preparation and Fire Suppression Activity project to obtain their input. Notes from this meeting are presented in Annex D.

2.b.3 Community Outreach Wednesday June 26, 2019

On Wednesday June 26, 2019 EE&G met with residents and business owners in the community adjacent to the landfill during the flyer handout activities described above in Section 2.a.1. During the approximately 5 hour period EE&G's bilingual Social Specialist walked through the community and spoke with numerous residents and business owners about the ESIA and upcoming Fire Suppression Activities EE&G also encouraged the residents and business owners to attend the Spanish Public consultation that evening to learn more and to be able to voice their concerns. A summary of the results of this community outreach is presented in report presented Annex E.

2.c. Key Topics Addressed in Meetings/Sessions

During the course of the various meetings, sessions, Public meetings and community outreach, the key topics that were discussed were as follows:

- ESIA. The Public and various Stakeholders were notified of the components of the ESIA, why it is being performed, that EE&G has been hired by the NRPB to perform it, and that a draft will be available for review prior to the 2nd Public Consultation. Care was taken to provide a preliminary indication of the various environmental and social concerns that would be addressed during the ESIA process. Presented in Figure 1 is a layout of the Landfill sites and the preliminary area being considered for Evacuation (Blue Box Zone). In descriptions that follow, the "perimeter" of the landfills is essentially the bottom of the slopes of the landfills (outlined in Green in Figure 1). The community within the Blue Box Zone is considered to be at increased risk of potential exposure to smoke and fumes emissions during implementation of Fire Suppression Activity due to its close proximity to the landfill perimeter. Much of the Blue Box community will be located downwind or cross wind of a significant portion of the Fire Suppression Activity. Therefore, a critical aspect of the ESIA and the environmental and health and safety components of it, will be to assess risks to that community and recommend appropriate measures to mitigate identified risks. Much of the discussion regarding the ESIA focused on the following major issues:

- Air Quality Impacts. A summary was presented from the results of the EE&G and the Dutch National Institute for Public Health and the Environment (RIVM) Air Quality assessments. The key conclusion of the EE&G air quality report was that the data showed that workers on the landfill near smoke/fumes are at risk of exposure to chemicals of concern in some areas and should be wearing appropriate Personal Protective Equipment (PPE). The key conclusion of the RIVM air quality report was that subsurface landfill fires and current landfilling practices did not appear to be affecting air quality of the community beyond the perimeter of the landfill at concentrations that warranted concern. It was noted that the EE&G and RIVM studies did not take place during active surface fires, and therefore were representative of the landfills with smoldering subsurface fires. The concept of nuisance odor was discussed, indicating that the human nose can detect odors of many chemical substances at concentrations far below where a health exposure risk is present; therefore, the presence of odors downwind of the landfill does not correlate to a public health alert. The Public was advised that extensive air monitoring would be performed as part of the Fire Suppression Activity and action levels will be set at the landfill perimeters to be conservative and protective of public health during the project. Air quality and emissions control are deemed the most significant environmental risk to be managed as part of the Fire Suppression Activity.

- Storm Water Runoff/Surface Water Quality. It was discussed that engineering controls would be utilized by the Fire Suppression Contractor to minimize the potential for water/foam that was being utilized to quench the fires to enter the Great Salt Pond. It was reported that a baseline surface water sampling event would be conducted to assess current surface water quality in the Great Salt Pond. Environmental impacts to the Great Salt Pond are deemed the 2nd most significant risk to the environment to be managed as part of the Fire Suppression Activity.

- Dust Control. It was discussed that the Fire Suppression Contractor would be employing dust control measures to minimize the dust emissions from the Landfills during the use of heavy equipment and trucks during fire suppression activities.

- Incident Command/Community Reporting. It was discussed that the Fire Suppression Activity would likely be conducted according to an Incident Command Management Structure. This would include a significant public communication component and expedited disclosure of air quality data.

- Social Management. Most of the discussions quickly evolved to the potential impacts to residents and businesses living/working adjacent to the landfills. The preliminary area of potential temporary relocation/evacuation (i.e., the Blue Box Zone) as shown in Figure 1, was presented to the Public and Stakeholders. This led to discussion and questions regarding temporary versus permanent relocation/evacuation, resettlement, business interruption, compensation/restitution, long term housing, short term lodging, public health, and timeline concerns. The Social risks to the Blue Box Zone are a significant concern of this ESIA. The residents and businesses in this zone will be affected by this project should temporary or permanent evacuation/resettlement be implemented.

- Fire Suppression Activity. The basic components anticipated to occur during the Fire Suppression Activity were presented to the Public and Stakeholders. The key fire suppression methods that will be considered as part of the ESIA are: Excavation and quenching of smoldering wastes with water and/or foam, oxygen starvation via capping/sealing of waste cells, and injection of water/grout into smoldering wastes to extinguish fires. There are varieties of these methods that could be employed by the Fire Suppression Contractor, with the objective of removing one aspect of the Fire Triangle to extinguish the fire: fuel, oxygen or spark. Since the buried waste is the fuel, the Fire Suppression Activity will focus on removing the spark/heat with foam, water or grout; or removing the oxygen through capping or sealing. Key topics discussed regarding the Fire Suppression Activity were as follows:

  - An explanation was requested as to why the Fire Suppression Activity is necessary. It was articulated that as long as the fires continue to smolder in the waste beneath the surface of the landfills, that heat and sparks could ignite future surface fires. It also was indicated that smoke and fumes emanating from cracks and fissures in the landfills can create nuisance odors downwind of the landfills, and represent a potential air quality exposure concern to workers and salvagers on the landfills and residents in communities immediately adjacent to the landfills. The Subject Matter Experts explained that subsurface smoldering of wastes eventually leads to subsurface voids in the landfill that could collapse, resulting in safety concerns for workers/salvagers on the landfill and residents/businesses near the landfill side slopes. Furthermore, it was indicated that closure of the landfills in the future would be more difficult or unmanageable if the subsurface fires continued.

  - It was explained that excavations into the landfills to expose and quench smoldering wastes would likely occur as part of the Fire Suppression Activity. Subject Matter Experts indicated that opening the landfill to quench fires could result in the temporary increased risk of dust/smoke/fumes, despite the best efforts of the contractors to manage emissions control. Such excavations could result in fire flare ups, possible explosions, heavy smoke, etc. It was explained that when opening a landfill to attack smoldering wastes many unknown or unforeseen conditions could arise that could potentially increase emissions from the landfill sites temporarily.

  - EE&G professionals indicated that protection of the public health and environment are key components of the project design and engineering controls during Fire Suppression. It was indicated that Air Monitoring would be conducted to assess concentrations of chemicals of concern in the area of the work, at the perimeter of the landfills, and in the community downwind of the fire suppression activities. It was also indicated that the project would be shut down if emissions exceeded action levels set for the project in the Air Monitoring Plan.

  - The concepts of an Exclusion Zone that would require temporary evacuation and a Notification Zone were discussed (See Figures 1 and 2). It was indicated that the project would be managed in a conservative manner to minimize emissions emanating from the landfill into the communities; however, due to the unpredictable nature of this type of work it could not be guaranteed. Therefore, in an abundance of caution, to be protective of Public health, the area in the Blue Box Zone shown in Figure 1 was designed as the preliminary area being considered for relocation/evacuation during the time period of the project.

3. RESULTS – DATA COLLECTED

3a. Input from Stakeholders From Public Consultation

The sign-in sheets from the English and Spanish Public Consultation sessions are presented in Annex F. The questions/answers that were raised in the Public Consultation in the English and Spanish sessions are presented in Annex F. Questions that have been submitted to NRPB since the First Public Consultation also are presented in Annex G. The questions were combined into the following seven major categories, which are presented below:

1. Air Quality and Public Health
2. Environmental Impacts (Soil, Surface Water, Fish)
3. Fire Suppression Methods
4. Evacuation/Resettlement
5. Business Interruption in Evacuation Areas
6. Waste Management
7. Miscellaneous Concerns

Summaries of the concerns of the Public and Stakeholders are presented in the Findings in Section 4 below.

3b. Input from the other Meetings/Sessions

3.b.1 NRPB, RINA and World Bank Meeting on Monday June 24, 2019

This meeting focused on the upcoming First Consultation and progress of the ESIA, Relocation Action Plan (RAP) and census of the Blue Box Zone. A summary of key topics that were discussed is presented below:

- First Consultation – There is a need for a clear and accurate message to share with the Stakeholders within the Blue Box Zone

- The ESIA is progressing but there is need for the census information from the Blue Box Zone as this is an important input

- The census of the Blue Box Zone was still a work in progress. This information will be critical since this is the area where relocation/evacuation is likely to occur during the Fire Suppression Activity

- As part of this meeting RINA shared some preliminary input from Stakeholders within the Blue Box Zone:

  - Some residents were willing to move, but they expect compensation. Some people have moved into the area in order to take advantage of anticipated relocation money

  - There were no homeless people observed, residents interviewed have places to live

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- There was a mix of residents consisting of St. Maarten citizens and people from other countries.

- The fires were not a concern to some residents, they asserted that the Fire Department can manage them

- There was a rumor that the Government of St. Maarten wants the land within the Blue Box Zone back and that they are using Fire Suppression as an excuse to repossess it, another rumor was that the World Bank was purchasing the land

- Stakeholders want a good plan for relocation and want to be made aware of it

- Stakeholders want to know if they can repair their homes in anticipation of the upcoming hurricane season

- The predominant demographic in the Blue Zone is Hispanic, with Spanish being their first language.

Notes from this meeting are presented in Annex D.

3.b.2 Community Outreach Wednesday June 26, 2019

The interviews performed during the community outreach are summarized in Annex E. The discussions were combined into the following seven major categories, which are presented below:

1. Air Quality and Public Health
2. Environmental Impacts (Soil, Surface Water, Fish)
3. Fire Suppression Methods
4. Evacuation/Resettlement
5. Business Interruption in Evacuation Areas
6. Waste Management
7. Miscellaneous Concerns

Summaries of the concerns of the Public and Stakeholders are presented in the Findings in Section 4 below.

4. FINDINGS

4a. Statistics

Census information was gathered during the First Consultation Activities. The census was approximately 75% complete at the time this report was being prepared. Some locations were not surveyed due to the following conditions:

- No one was present at the property
- Occupants refused to cooperate with the surveyors
- The property was used by Sint Maarten Power Company (GEBE) as an equipment yard

Below is a preliminary summary of the information that was gathered during the surveys:

- Total number of households in Blue Zone – 79

- Total Number of Businesses in Blue Zone - 11 households that were also businesses and 2 businesses for a total of 13.

- Total number of people residing in Blue Zone - 147

- Total Number of people who attended the English Public Consultation Session - 32

- Total Number of people who attended the Spanish Public Consultation - 71

- Total number of questions made by the Public in both the English and Spanish Public meetings - 29

- Total number of questions submitted post Public consultation as July 15, 2019: 0 (no questions were received)

4b. Key Concerns of the Stakeholders

The following were the key concerns of the Public and Stakeholders as identified during the First Public Consultation Process:

- Impacts to the community from air quality and emissions from the Landfills during the Fire Suppression Activities. They were concerned about smoke and chemicals blowing downwind and impacting their health. Residents that work on the landfills or are employed through associated waste management activities, were concerned about their health impacts working on the landfills. Numerous residents and Stakeholders inquired about how the monitoring would be performed during the project to be protective of Public health.

- Impacts to businesses that make their livelihood from the Landfill. Business Owners in the potential evacuation zone (Blue Box Zone) were concerned about where their business and when applicable, personnel would be relocated to should evacuation be necessary. Residents within the Blue Box Zone that make a livelihood working on the landfill (gathering recyclables) were concerned about how evacuation would impact their ability to continue working.

- Historical Environmental Impacts to the Great Salt Pond water (and fish), and impacts to the soils in the community. Questions were raised as to whether the water quality in the Great Salt Pond had been impacted by the landfill. Also there were comments that local residents fish in the pond and eat the fish, and concerns were expressed about the risk of eating those fish. One resident raised concerns about the soil quality in the Blue Box community as a result of historical landfilling and fires.

- Evacuation, resettlement, relocation of residents and businesses located in the Blue Box Zone. The majority of comments, questions and concerns raised by the Public and Stakeholders were related to the potential relocation/evacuation of the Blue Box Zone area. Residents and business owners were concerned about when they would be asked to relocate, how much advance notice they would be given, where they would be resettled, and what their compensation would be for their homes and/or loss of business. Some residents expressed that they have lived in that area their whole lives and they did not wish to leave. Some residents complained that the Government had not done enough to address the health and safety issues associated with the Landfills and they were skeptical that anything would change. There was much anxiety within the community as it relates to this topic, and the complexities of how evacuation and/or resettlement would logistically be performed were a concern to many. Residents were particularly concerned that they be given plenty of notice before relocation/evacuation so it is not sudden and too fast to plan their lives.

- Yellow Zone residents and how they will be managed relative to Blue Box Zone. Residents in the Yellow Zone expressed concerns regarding on how could they be treated differently simply because of a line on a map where their neighbors could be resettled and they would not.

- Waste management, numerous comments were raised about the long term plans for waste management and whether or not there would be an alternative to landfills. Others expressed concerns about waste separation and recycling, and the proper removal of hazardous wastes from the incoming waste stream. Concerns were raised about fiberglass from boat salvaging and marina wastes getting into the landfills.

- Fire suppression methodology, several questions were raised in regards to why the Fire Suppression Activity was necessary considering no visible surface fires presently were observable. Other questions revolved around the method that would be employed to extinguish the fires.

- Miscellaneous questions, issues were raised about the possible presence of a volcano beneath the landfills, the experience of the professional team, past projects that never got started (no funding), and the treatment of the “community” and its poor infrastructure conditions.

5. CONCLUSIONS/RECOMMENDATIONS

Based on the Findings presented above, the following Conclusions and Recommendations are made as the preparation of the ESIA continues, the Fire Suppression Activity is planned, and preparations are made for the Second Consultation.

Preparation of the ESIA

- A preliminary soil assessment in the Blue Box Zone is recommended to assess whether surface soils have been impacted by historical landfill operations and fires, or by activities unrelated to the landfills (e.g., petroleum releases, metal storage, fires, trash burning, etc.). The objective will be to develop a baseline of soil quality in the Blue Box Zone, and assess if the lateral migration of landfill gases has impacted that community.

- A preliminary surface water quality assessment of the Great Salt Pond water is already part of the ESIA scope. However, it was revealed during the First Consultation that residents fish in this pond and eat the fish. Catching the fish for consumption represents a public health concern and may already be a prohibited activity. It is suggested that NRPB proceed with the following recommendations: (1) Confirm with the Government that fishing in the pond is prohibited and signs are adequately posted around the perimeter in English and Spanish prohibiting fishing for consumption and sale. If this not the case, recommend that this is done or (2) Expand the scope of work of the Pond assessment to include some preliminary toxicity testing of Tilapia (and any other fish species that are being caught and eaten) in Great Salt Pond to obtain a preliminary indication if those fish are safe for human consumption.

Fire Suppression Activity Project Design

- The Public is interested in and concerned about the air quality monitoring and how that will be managed during the Fire Suppression Activity. Their level of trust in how this will be handled is low based on their past experiences. EE&G recommends that a separate public meeting be held after the Second Public Consultation and before the project is started. This meeting should be geared towards explaining emissions control, air monitoring, incident command, and how the air quality data will be managed and communication will occur with the Public. It will be important for the community to be informed and educated on how the process will be managed and how it may impact their lives. Since this aspect of the project is technical in nature, having it addressed in a separate session appears warranted.

- The most complicated aspect of this project will be the temporary or permanent evacuation/relocation/resettlement of the residents and businesses living and working in the Blue Box Zone. This is the critical decision that will need to be made before the 2nd Consultation. We understand that space is limited on Sint Maarten for both temporary housing and construction of permanent housing. EE&G sees this issue as the limiting factor in moving the Fire Suppression Activity forward in an expeditious manner. To overcome that, we recommend that residents and businesses be temporarily relocated during the Fire Suppression Activity for a minimum of 6 months. During this time, the NRPB and Government of Sint Maarten can explore one or more permanent solutions, so that re-habitation of that area is not necessary. Temporary relocation of approximately 150 people can be accomplished in an accelerated manner using one of two methods: (1) Erection and operation of a temporary “man camp” that can provide temporary housing, or (2) Deployment of a live-aboard vessel that can be docked in the port or anchored in a safe location where residents can be lodged for 6 months, this temporary lodging option should only be considered outside of hurricane season, which typically is from June 1 through the end of November. Upon request, EE&G can research availability and costs of implementation of these two options. Option 1 will require the use of some land temporarily, and Option 2 will require space at the port or an agreed anchorage and ferry boats to move people back and forth to shore. In both options it will be necessary to provide security, mess facilities to provide meals, and an operations team to manage the camp or vessel. The "Man Camp" would be similar to those utilized in oil field projects or in post-hurricane disaster projects in the U.S. (Examples have been provided to NRPB and the Secretary General of VROMI via separate email). In our opinion, utilization of either of the above options is likely the most practical way this Fire Suppression Activity will be accomplished in the next 12 months. Otherwise, the project is likely to get bogged down in a permanent relocation/resettlement effort that probably will take years to accomplish in Sint Maarten due to the reported unavailability of land to construct permanent housing and the apparent complicated process that is contemplated.

- The issues of compensation of residents for leaving homes and compensation to business owners for business loss also were hot topics that came out in the various information gathering events. This will need to be an individual by individual matter to be managed by the NRPB. This likely will continue to be a sensitive issue that is vocalized in public. It is recommended that a plan of action be developed to address these issues so during the next Public Consultation we have some specific answers to how those matters are being managed, and where the affected Stakeholders can go to get answers.

Preparation for the Second Consultation

- We recommend that the Second Consultation not be performed until the results of the soil and surface water quality testing are available, and the Government of Sint Maarten has made a decision on Evacuation/Resettlement of the Blue Box Zone. Without this information and strategy at our disposal, we will be unable to answer the key questions that undoubtedly will come up, and having another Public meeting prematurely may not be productive.

FIGURE 1

PLAN VIEW OF LANDFILLS AND BLUE BOX ZONE

ANNEX A

CALL MATERIALS (FLYERS, NEWSPAPER ARTICLE AND ELECTRONIC SCREEN SHOT)

Public Consultation / Consulta Pública

PUBLIC CONSULTATION

Important Community Meeting to discuss Fire Suppression Project at Landfill and receive community feedback.

Meeting held by **National Recovery Program Bureau**

One Meeting:

Date/Time	June 26th, 2019 from 6 to 8 pm - In Spanish (only)
Place of Meeting	At St. Maarten University Room – 202

CONSULTA PUBLICA

Reunión importante para discutir el Proyecto de Supresión de Incendio en relleno sanitario y recibir comentarios de retroalimentación de parte de la comunidad hacia el programa nacional de recuperación.

Reunión presentada por la **Oficina del Programa de Recuperación Nacional**

Una Reunión:

Fecha/Hora	26 de Junio, 2019 de 6 a 8 pm - En Español (solamente)
Lugar de Reunión	En St. Maarten Universidad Sala –202

EE&G

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IAPA regrets new Cuban Constitution continues restricting press freedom

MIAMI, Florida–The Inter American Press Association (IAPA) expressed regret that the new Constitution of Cuba, which came into effect on April 10, deepens the limitations of freedom of expression, the press and the civil and political rights of the country's citizens. The organisation also agreed with the information in the recent report of the Inter-American Commission on Human Rights (IACHR) on the deterioration of human rights and press freedom in the Caribbean nation.

The IACHR report, made public last week in Miami, Florida, establishes that democracy and respect for human rights in Cuba have not benefited from the presidency of Miguel Díaz-Canel since he took office in April 2018, nor from the new Constitution, considering that "there persist the same conditions denounced for decades now, among them the selective and deliberate persecution of journalists ... who disseminate information and opinions on matters of public interest."

The IAPA agreed with the IACHR and declared that both the Constitution, the Gag Law (Law 88) and the Penal Code continue to be instruments that enable the regime to censor freedom of expression, limit the right to protest and restrict the activity of the independent press.

IAPA President María Elvira Domínguez declared that following the 2014 agreements between Presidents Barack Obama of the United States and Raúl Castro of Cuba, with Pope Francis as intermediary, "there was the hope that there would be substantial changes towards tolerance of freedom of expression and of the press."

"Unfortunately, this new Constitution points out that the State is master and patron of the freedom of its citizens and is the supreme repressor of press freedom," said Domínguez, editor of the Cali, Colombia, newspaper *El País*, in reference to Article 55 which states that "the State establishes the principles of organisation and functioning for all the social news media."

Chairman of IAPA's Committee on Freedom of the Press and Information, Roberto Rock added, "The independent press is constantly suffering intimidation by the authorities through their political police that invoke, among other resources, the Penal Code which includes a variety of punishments of those who have a different opinion than that of those in power."

One of these is the offence of "misappropriation of legal capacity" which penalises the practice of journalism if it does not count with an obligatory certification, something ruled out by the IAHRC since 1985 and eliminated since then in numerous countries of the Americas, explained Rock, editor of the Mexican online news portal La Silla Rota.

The IAPA officers mentioned that the Gag Law containing legal definitions of crimes to punish independent journalists, was applied in 2003 to imprison 75 opponents, among them 27 journalists, during the repressive operation known as the Black Spring.

Domínguez and Rock warned that in recent months there was an increase in harassment of journalists and independent media that continue reporting despite the atmosphere of total lack of legal protection.

Among the events they cite are the following:

Woman looks out from the balcony of a poorly maintained building in Cuba. Photo credit: Ismario Rodríguez Pérez of IPTC Photo Metadata

* The ban on leaving the country was reinstalled on Henry Constantín, founder and editor of the magazine *La Hora de Cuba* and vice chairman of the IAPA Committee on Freedom of the Press and Information for Cuba. During almost two years and up until March this year he was prohibited from leaving the country. He discovered the new sanction when he

Continued on page 25

ANNEX B

POWER POINT PRESENTATIONS (ENGLISH & SPANISH)

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SINT MAARTEN – LANDFILL FIRE SUPPRESSION ACTIVITY STAKEHOLDER CONSULTATION

25 June 2019

INTRODUCTION OF PRESENTERS

NRPB	Claret Connor, Thijn Laurensse, Hanneke Spaans
EE&G	Tim Gipe, Kirk Smith, Jose Basulto, Erika Morales, Tadzio Bervoets, Christopher Teaf, PhD.

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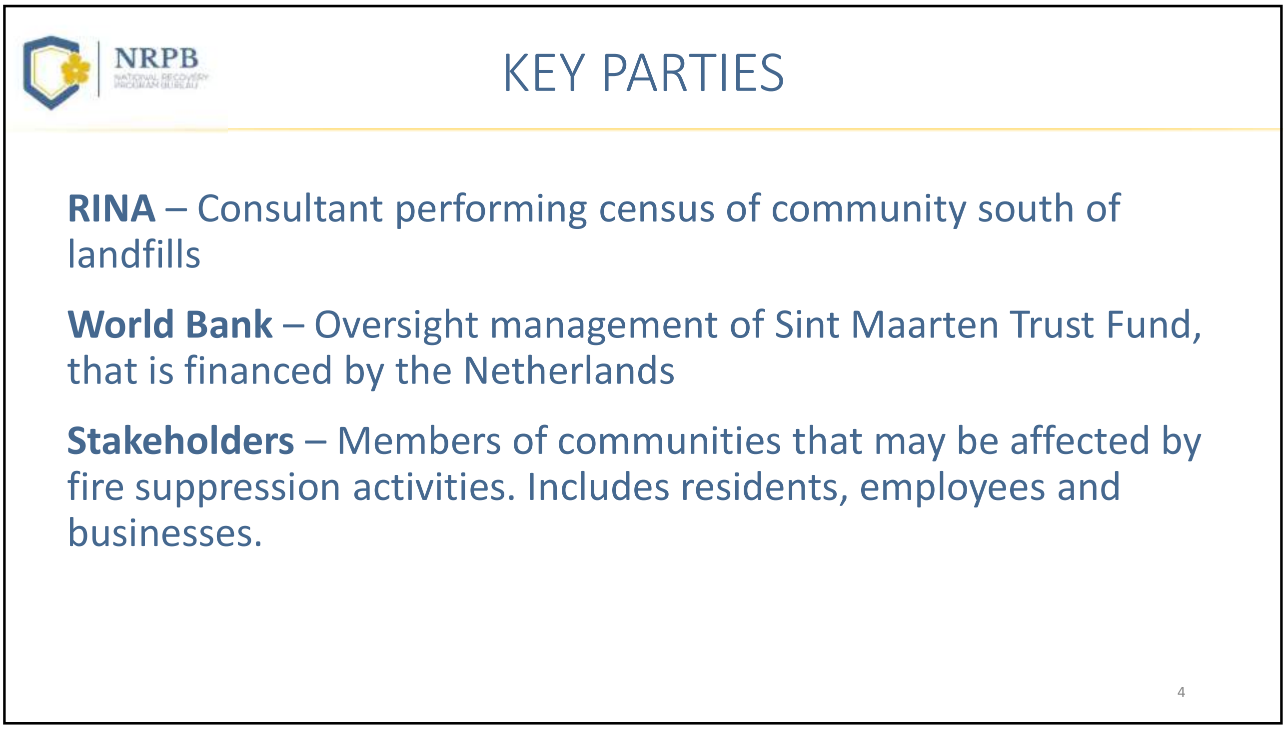
EE&G

KEY PARTIES

- **NRPB** – National Recovery Program Bureau as an agency responsible :
  - Implementation of Sint Maarten National Recovery Plan.
  - Overall management, supervision, and execution of project.
  - Establishment of a Grievance Redress Committee (GRC) to address stakeholders concerns throughout project implementation.
- **VROMI –** Ministry responsible for waste management
- **EE&G** – Preparing Environmental and Social Impact Assessment for fire suppression activity



KEY PARTIES

RINA – Consultant performing census of community south of landfills

World Bank – Oversight management of Sint Maarten Trust Fund, that is financed by the Netherlands

Stakeholders – Members of communities that may be affected by fire suppression activities. Includes residents, employees and businesses.

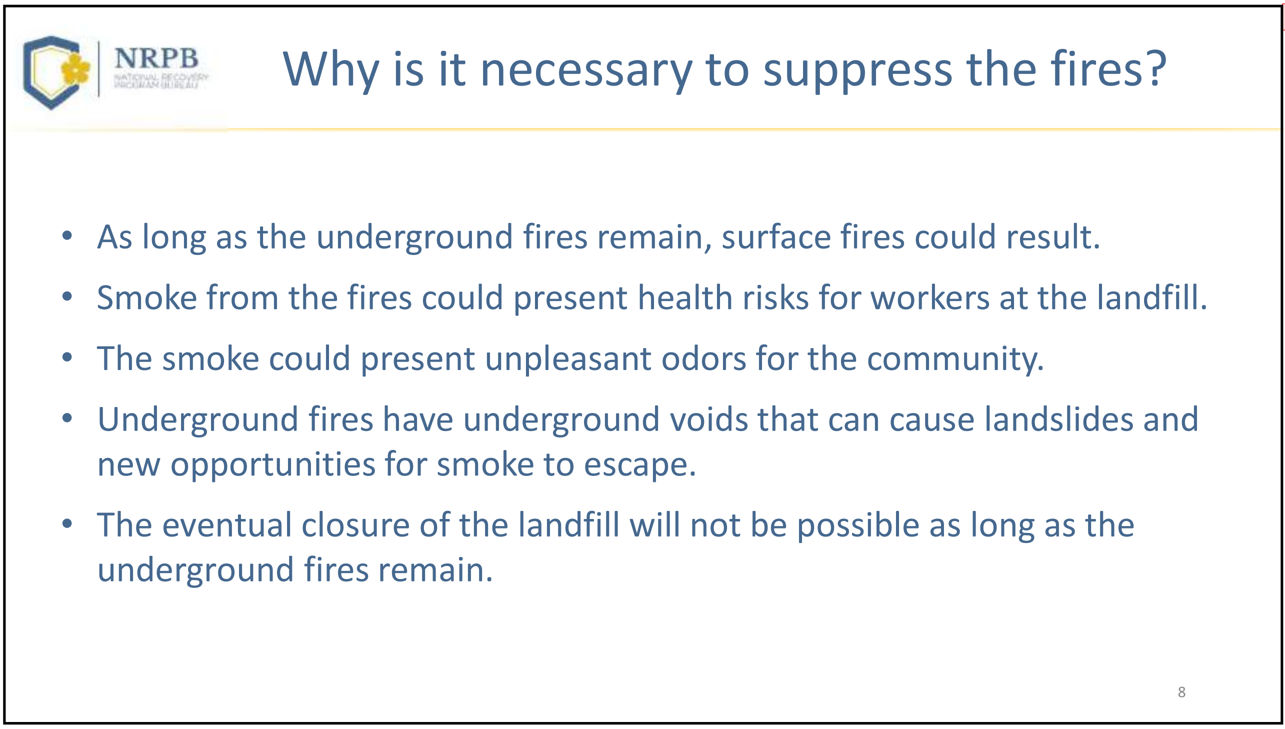
PURPOSE OF CONSULTATIONS

- Discuss upcoming Fire Suppression Activity
- Identify risks and impacts associated with Fire Suppression Activity
- Obtain feedback from stakeholders in community regarding project

A WORD FROM THE DIRECTOR

BACKGROUND

HS1



Why is it necessary to suppress the fires?

- As long as the underground fires remain, surface fires could result.
- Smoke from the fires could present health risks for workers at the landfill.
- The smoke could present unpleasant odors for the community.
- Underground fires have underground voids that can cause landslides and new opportunities for smoke to escape.
- The eventual closure of the landfill will not be possible as long as the underground fires remain.

BACKGROUND

Surface and subsurface fires occurring on landfill and Irma debris site

- Landfill has reported fires for "Decades"
- Irma debris site has reported fires since November 2017
- Both landfill and Irma debris site have mixed waste (burnable and non-burnable) and garbage
- Irma debris site has vegetation, construction debris and other waste (appliances, boats, furniture, etc.)

BACKGROUND

Surface and subsurface fires occurring on landfill and Irma debris site

- Surface fires extinguished but smoke still observed on both
- Extent of fire below surfaces unknown
- Fires below surfaces and smoke likely will continue until extinguished
- New fires remain a concern – Improved landfill management is KEY

BACKGROUND

Air quality testing has been performed

- Smoke/Fumes from landfill "vents" can contain chemicals of potential health concern
- Byproducts of waste burning or incineration and typical landfill gases

BACKGROUND

Results of preliminary air monitoring

- Smoke/fumes on landfill at vents did contain chemicals
- Risk of potential exposure to chemicals in smoke/fumes may increase during fire suppression
- Odors are nuisances but may not correspond with health risks
- Perimeter monitoring by RIVM (Dutch Institute Environmental Agency) did not show levels of chemicals above health-based comparison criteria

BACKGROUND

Conclusions of preliminary air monitoring

- As long as fires remain, potential for smoke/fumes will continue
- Workers on landfill should minimize exposure to smoke/fumes and dust and wear protective equipment
- Air sampling results may not be the same during fire suppression activity – Perimeter/community levels may change

ACTIVITY DESCRIPTION

Fire Suppression Activity

- Extinguish burning waste, may use multiple approaches
  - Water
  - Foam
  - Grout
  - Oxygen starvation

ACTIVITY DESCRIPTION

Possible Fire Suppression Activities

- Excavation/quenching of smoldering wastes may be necessary
- Smoke/dust emissions control a priority – some approaches result in more or different emissions than others

ACTIVITY DESCRIPTION

Fire suppression mitigation measures

- Air monitoring will be performed at boundaries of work zones
- Work will be stopped if air monitoring demonstrates risk offsite or wind direction warrants

SCOPE OF THE ESIA

Environmental and Social Impact Assessment (ESIA)

- How will project affect community and environment?
- Review existing conditions
- Evaluate potential impacts of fire suppression
- Recommend safety zones during work
- Recommend air monitoring program
  - Workers, landfill
  - Perimeter of work areas
  - Community, schools, hospital, government buildings

ESH&S RISKS AND IMPACTS

Environmental, social, health and safety risks – dust and chemicals of concern

- Emissions/Air Quality
- Storm Water and Runoff to Great Salt Pond
- Groundwater/Leachate/Surface Water/Sediment
- Impacts to Aquatic and Land Ecosystems
- Expected to Persist as Long as Fires Remain
- May Increase During Fire Suppression

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ESH&S RISKS AND IMPACTS

Health and safety risks

- Worker (including salvagers and recyclers) Health & Safety – burns, struck by equipment, slips, trips and falls, exposure to constituents of concern, improper hygiene
- Community health risks - potential exposure from emissions/dust

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ESH&S RISKS AND IMPACTS

Other environmental, social, health and safety risks and impacts:

- Mobilization of large equipment may affect traffic
- Fire suppression may temporarily affect waste acceptance at landfill and employees/salvagers work schedules
- Location and methods of fire suppression may impact adjacent communities (residents, employees and businesses) and relocation/evacuation may be considered

PRELIMINARY AREA TO BE EVACUATED

N

GROUP DISCUSSION

Questions to Consider :

1. What are your most significant concerns about the project?
2. Did we miss potential risks, other than those identified?
3. Suggestions on keeping stakeholders informed on project activities

GROUP DISCUSSION

What will be done with your feedback:

- All feedback is recorded and taken into account
- Discuss with the project team: analysis: Applicability, Viability, and Adjust
- Inputs will be incorporated and discussed in second consultation (date to be decided). Second consultation will present mitigation measures and seek stakeholders input

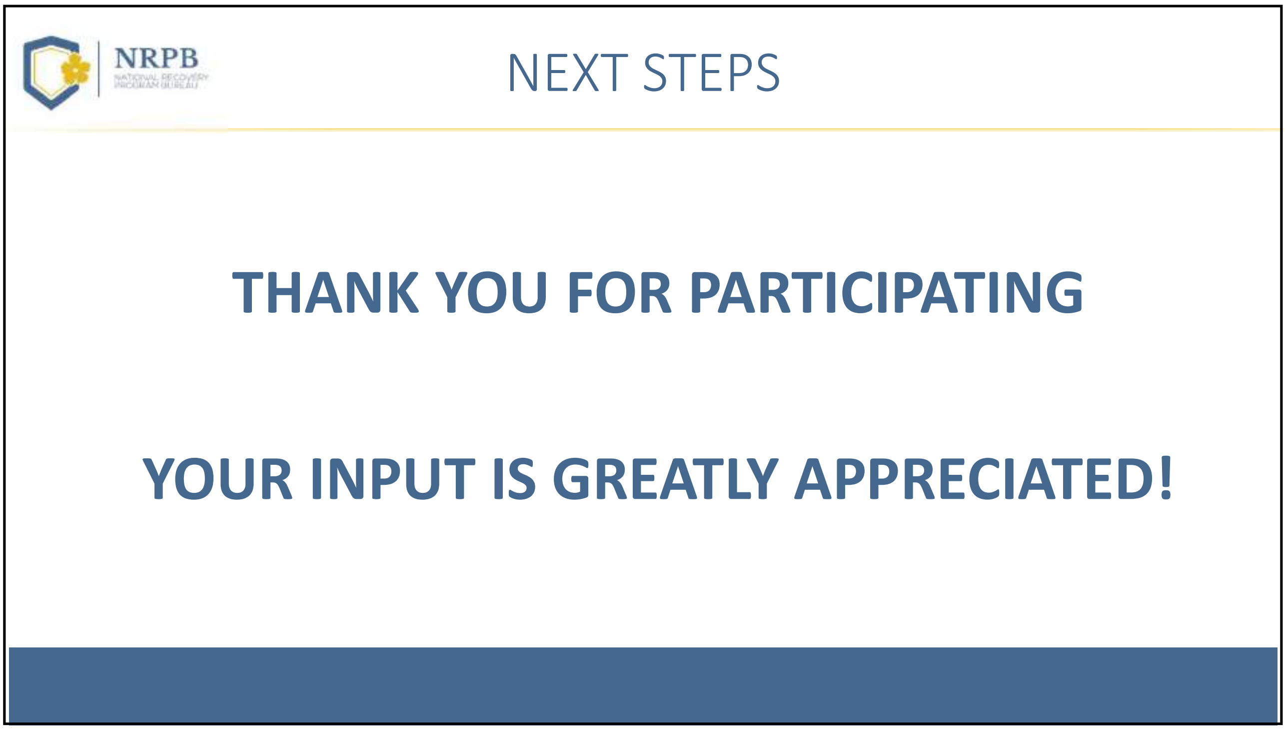
NEXT STEPS

Period for further feedback on the presentation is 2 weeks from Disclosure on Website. **Deadline**: 10 July 2019 12h00 AST

How:

- By Email To: landfillproject@nrpbsxm.org
- Drop Off Comments to Mailbox at NRPB Office, #57 W.A. Nisbeth Road, next Carl & Sons

NRPB Has Developed a Grievance Redress Mechanism (Complaint Procedure) available at www.nrpbsxm.org



NEXT STEPS

THANK YOU FOR PARTICIPATING

YOUR INPUT IS GREATLY APPRECIATED!

SINT MAARTEN – ACTIVIDAD DE APAGADO DE FUEGOS EN EL RELLENO SANITARIO: CONSULTA CON LOS PRINCIPALES INVOLUCRADOS CON EL PROYECTO

Junio 26, 2019

INTRODUCCIÓN DE PRESENTADORES

NRPB	Claret Connor, Thijn Laurensse, Hanneke Spaans
EE&G	Jose Basulto, Erika Morales, Tadzio Bervoets, Tim Gipe, Kirk Smith, Christopher Teaf, PhD.

ACTORES CLAVES

- **NRPB** – Oficina Nacional de Recuperación - agencia responsable por:
  - Implementación de plan de recuperación nacional Sint Maarten.
  - Gestión general, supervisión y implementación del proyecto.
  - Establecimiento de comité de gestión de riesgos (GRC) para abordar las preocupaciones de las partes interesadas durante la implementación del proyecto.
- **VROMI –** Ministerio Responsable de manejo de desechos.
- **EE&G** –Preparación de la evaluación de impacto ambiental y social de la actividad de Eliminación de Fuegos.

ACTORES CLAVES

RINA – Consultor realizando el censo de la comunidad al sur de el relleno sanitario de basura.

World Bank (Banco Mundial) – Administra el manejo del Fondo Fiduciario de Sint Maarten de Recuperación, Reconstrucción y Resiliencia que es financiado por el gobierno de los Países Bajos.

Partes Interesadas– Miembros de las comunidades que pueden verse afectadas por las actividades de Apagado de Fuegos. Estas incluyen residentes, empleados, negocios y empresas.

OBJETIVO DE CONSULTAS

- Discutir el proyecto propuesto de Apagado de Fuegos.
- Identificar riesgos e impactos asociados con el proyecto.
- Obtener comentarios de la comunidad en cuanto al proyecto.

UNAS PALABRAS DEL DIRECTOR

Mr. Claret Connor

ANTECEDENTES

¿ Porque es necesario apagar los fuegos?

- Mientras permanezcan los fuegos subterráneos, podrían resultar incendios en la superficie.
- Humo de los fuegos podría presentar riesgos de salud para los trabajadores en el relleno sanitario.
- El humo podría presentar olores desagradables para la comunidad.
- Fuegos subterráneos presentan huecos subterráneos que causan derrumbes y nuevas oportunidades de escape de humo.
- El cierre eventual del relleno sanitario no será posible mientras permanezcan los fuegos subterráneos.

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ORIGEN

Fuegos superficiales y subterráneos ocurren en el relleno sanitario y en el sitio de desechos de Irma

- Relleno sanitario ha reportado fuegos por décadas.
- Sitio de desechos de Irma ha reportado fuegos desde Noviembre del 2017.
- Tanto el relleno sanitario así como el sitio de desechos de Irma tienen residuos mixtos (inflamables y no-inflamables) al igual que basuras de bolsas negras (plásticas).
- El sitio de desechos de Irma tiene vegetación, desechos de construcción y otros tipos de basura (electrodomésticos, lanchas, muebles, etc.).

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ORIGEN

Fuegos superficiales y subterráneos ocurren en relleno sanitario y en el sitio de desechos de Irma

- Fuente de los Fuegos – Combustión interna o fuente externa.
- Los Fuegos superficiales han sido extinguidos pero aún se observa humo en ambos.
- Se desconoce la expansión de fuegos subterráneos.
- Los fuegos subterráneos y el humo probablemente continuarán hasta que estos sean extinguidos.

ORIGEN

Se han realizado pruebas de calidad de aire en el origen y en el perímetro

- El humo de los respiraderos (aperturas) del relleno sanitario pueden contener productos químicos.
- Derivados de la quema de desechos o incineración típicamente encontrados en rellenos sanitarios.

ORIGEN

Resultados Preliminares del Monitoreo de Aire

- El humo saliendo de las aperturas de respiración del relleno sanitario contenía químicos.
- El riesgo potencial de exposición ocupacional a químicos encontrado en humo/vapores puede aumentar durante el Apagado de Fuegos.
- Monitoreo de perímetro no mostró niveles de químicos que pudieran causar efectos en la salud pública.

ORIGEN

Conclusiones Preliminares del Monitoreo de Aire

- Mientras permanezcan los Fuegos, continuará el potencial de humo/vapores.
- Los trabajadores/personal deberán minimizar la exposición al humo/vapores/polvo y deberán utilizar equipos de protección.
- Los resultados de muestreo de aire puede que no sean lo mismos durante el proyecto de Apagado de Fuegos– El perímetro alrededor de la comunidad pueden cambiar.

DESCRIPCION DEL PROYECTO

Actividad de apagado de fuegos – proceso aún no definido

- Extinguir combustión de residuos puede requerir múltiples métodos.
  - Agua
  - Espuma
  - Cemento
  - Ahogo de oxígeno

DESCRIPCION DEL PROYECTO

Posibles actividades de apagado de fuegos

- Puede ser necesaria la excavación de residuos humeantes.
- Los desechos pueden esparcirse para poder apagarlos.
- Es prioridad el control de emisiones de humo/polvo – Algunos métodos crean mas o diferentes emisiones que otros.

DESCRIPCION DEL PROYECTO

Medidas de mitigación de apagado de fuegos

- Se llevará a cabo un monitoreo aéreo en el perímetro de las zonas de trabajo.
- El trabajo se detendrá si el monitoreo aéreo muestra riesgos fuera del lugar o advertencias sobre direcciones del viento.

ALCANCE DE LA ESIA

Evaluación de Impactos Ambientales y Sociales (ESIA por siglas en inglés)

- ¿Cómo afectará el proyecto a la comunidad y al medio ambiente?
- Evaluación de condiciones existentes.
- Evaluación de impactos potenciales de la Apagado de fuegos.
- Recomendaciones de zonas de seguridad durante el trabajo.
- Recomendaciones del programa de monitoreo de aire.
  - Trabajadores, relleno sanitario.
  - Perímetro de zonas de trabajo.
  - Comunidad, escuelas, hospitales, edificios gubernamentales.

RIESGOS E IMPACTOS

Riesgos ambientales, sociales, de salud y seguridad – polvo y productos químicos

- Emisiones/calidad del aire.
- Aguas de de Tormentas y escorrentía al Salty Pond (al estanque).
- Aguas subterráneas/lixiviado/aguas superficiales/sedimento.
- Impacto acuático y de ecosistemas terrestres.
- Se espera que persista mientras continúen los fuegos.
- Pueden aumentar durante el apagado de fuegos.

RIESGOS E IMPACTOS

Riesgos de Salud y Seguridad

- Público y trabajadores (incluyendo socorristas y recicladores).
- Salud y seguridad – quemaduras, accidentes con equipos, deslizamientos, tropezones y caídas, exposición a riesgos significativos, higiene inadecuada.
- Peligros de salud para la comunidad - exposición potencial de emisiones/polvo

RIESGOS E IMPACTOS

Otros riesgos ambientales, sociales, de salud y seguridad

- La movilización de grandes equipos podría afectar el tráfico.
- Apagado de fuegos podría afectar temporalmente la aceptación de la basura en el relleno sanitario y horarios de trabajo de empleados/socorristas.
- El lugar y métodos de apagado de fuegos podrían afectar comunidades adyacentes (residentes, empleados y negocios) y la reubicación podría ser considerada.

ZONA PRELIMINAR PARA SER EVACUADA

N

Vientos prevalente del Este

DISCUSION DE GRUPO

Preguntas a Considerar:

1. ¿Cuáles son sus preocupaciones más significativas sobre el proyecto?
2. ¿Hemos olvidado algún riesgo potencial, aparte de los mencionados?
3. Sugerencias para mantener informados a las partes interesadas sobre las actividades del proyecto.

DISCUSION DE GRUPO

¿Qué se hará con sus Comentarios?

- Todos los comentarios serán registrados y tomados en cuenta.
- Discuta con el equipo del proyecto. Análisis: aplicabilidad, viabilidad, y ajuste.
- Los aportes serán incorporados y discutidos en la segunda consulta (Fecha por determinar). La segunda consulta presentará medidas de mitigación específicas y buscará conseguir aportes de las partes interesadas.

SIGUIENTES PASOS

El Período para recibir más Comentarios Sobre la Presentación será dos semanas después de la publicación en el sitio web. **Fecha Limite**: Julio 10, 2019 12:00pm Hora local.

Como:

- Por correo electrónico a : **landfillproject@nrpbsxm.org**
- Dejando sus comentarios en el buzón de correo de la oficina de la NRPB, #57 W.A. Nisbeth Road, al lado de Carl & Sons.

También **www.nrpbsxm.org** contiene un link para el proceso de quejas: ‘Complaint Procedure’.

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GRACIAS POR SU PARTICIPACION

¡SU CONTRIBUCIÓN ES MUY APRECIADA!

ANNEX C

PHOTOGRAPHS OF PUBLIC CONSULATION


NRPB
ZONA PRELIMINAR PARA SER EVACUADA
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NRPB


NRPB


BACKGROUND


BACKGROUND


PRELIMINARY AREA TO BE EVACUATED
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UNAS PALABRAS DEL DIRECTOR


NRPB
ZONA PRELIMINAR
N
Vientos prevalente del Este

ANNEX D

NOTES FROM MEETINGS WITH NRPB, WB, VROMI AND RINA

June 25, 2019

First Consultation Meeting Notes – D. Kirk Smith, EE&G Project Manager

NRPB performing the introduction, disclosing that there will be a video of slides/presenters, and photos for documentation. They asked that attendees advise if they had objections to a photo being taken of them.

Following EE&G presentation, NRPB - opens floor for questions and discussion. Questions and answers are presented below, questions are in bold print.

Are we monitoring the water quality of the pond? People fish there and eat the fish. NRPB - yes water sampling is being performed to establish baseline; water quality will be monitored during project as well. Third party will be performing monitoring and results will drive mitigation measures. EE&G - stormwater management control will be critical as well, Contractor will have to include stormwater control in their plan to ensure that pollutants don't impact the pond.

Speaker was born and raised on pond, the water was clear and beautiful. In the 70s when decision was made to turn it into a landfill, it was devastating. The WHO (World Health Organization) came to the island and the government was advised to halt the landfill. Speaker gets the impression that we are trying to protect the people from becoming scared. What exactly are the risks associated with the emissions? NRPB - we don't want to make people frightened, we are trying to prevent the perception that anyone is going to be in harms way. We may expect that there may be other chemicals of concern that may be released during the fire suppression; and want to minimize risk. EE&G – regarding potential effects, we don't think that the situation is not currently dangerous for offsite residents and businesses, based on the data available. Some precautions may apply to on-site workers. That is why a monitoring plan is being put in place during fire suppression operations, to support decisions about whether work needs to be altered or stopped. Substances identified in air were typical of a landfill and expected to be found. The objective of the monitoring is to protect human health. Decisions will be made to support that goal.

Have we done this in another country? NRPB - it is the first time their organization has dealt with this. They have learned that fires are very common in similar situations elsewhere. EE&G - yes we have been involved in numerous projects with LF fires and elsewhere that are similar to this one. This is why we are presenting a highly conservative and protective approach. We cannot eliminate all risks, but we can do our best to mitigate most of them. This will be done slowly, methodically and carefully to eliminate potential for allowing this to become a hazard, including managing emissions. We will put in place a plan using expertise to manage these risks. NRPB – when we have identified a site for temporary evacuation, consultation will take place with people in community to make sure that they have somewhere to go. RINA will be performing census to find out who is living in areas that will be affected.

Is purpose of this group for fires only and nothing else? NRPB - yes, this activity is focused on the fires. Other challenges are being faced in other projects; the suppression of underground fires needs to be addressed first.

How are we publishing these meetings? I didn't know about meeting. NRPB –there was notice published in the newspaper, billboard, website, Facebook, etc. It is acknowledged that the communication process needs to be improved. NRPB - Fire Suppression is a single activity part of the Emergency Debris project, others include residual shipwreck cleanup, debris collection, insect vector control, strengthening of VROMI's overall waste management plan. At the same time long term waste management solutions are being looked at. Hopefully a follow-up project will occur.

I have lived all my years over there; it used to be so clean and nice. Do you think the dump is affecting the soil? Note - she lives in the Blue Box. EE&G - the answer is that it could have been, a study would be required to determine it. There are a variety of possible sources for the common materials found in soils (e.g., metals, PAHs, volatiles, dioxins). It would be useful to have a preliminary sampling activity prior to starting the landfill excavation and fire suppression activities. The subsequent sampling can help determine whether that activity has had any effect.

Regarding the baseball field, it is near the Irma dump when the kids are practicing there, do they need to not be there when work is occurring? NRPB - it may be the case that this area would be shut off during certain activities. Right now, a problem does not exist. But that question will need to be reconsidered as more data are gathered.

Blue Box Area - Fumes go up in the air and travel and will affect the whole island. Will we evacuate the whole island? Wherever we work the fumes will travel? EE&G - you are correct they will travel because air circulates; air monitoring will determine if something else needs to be done.

It has happened already, how will we prevent it? How will fire suppression be performed? EE&G - mitigation measures will be addressed in the second consultation. Downwind impacts need to be evaluated, monitored concentrations will dictate whether there is a public health issue or whether other measures are appropriate.

Two Comments - Go to marinas and tell them to separate the hazardous materials; don't wait to tell the people (in the Blue Box Area) when to go, don't provide lip service, the people need to know when they need to go. NRPB - separation of hazardous materials from waste is a key. Regarding the evacuation - everything will be done in close communication with affected areas; it will not be a last minute decision. Temporary evacuations may be required to exceedances, a plan will be prepared to accommodate this; this plan is being prepared. A date cannot be determined at present; it is difficult to say, as the processes are ongoing. NRPB will do their best to keep lines of communication open with stakeholders.

Question concerning potential fire suppression activities, alternative waste disposal will need to occur. What is plan for that? EE&G - fire suppression will be performed in one area at a time. Flare ups will be localized, instantaneous, and will be dealt with quickly. The experience should be different from that in previous experiences. This same presentation will be given in Spanish tomorrow night.

Objective is to clean up site? What are we going to do with the garbage? NRPB – tonight's meeting deals with fire suppression, future projects will deal with waste management. **Most people don't understand what we are doing with this activity.** NRPB – this a $25M project for debris management. A larger project which addresses the waste management situation is coming but will cost more money. We only want to do each of these activities once.

Why do we need to do fire suppression? Why are we doing it? NRPB - The problem is that a large area of the facility has smoldering vents that are affected by subsurface fires. The Irma debris site has been used against the will of the people of SXM, who want to put it to a better use; thus, putting out subsurface fires is critical. Landfill requires re-contouring. Unless fires are put out this cannot happen. EE&G – A misconception is that if people don't see flames, they perceive that there is no fire. That is not the case, the landfill is on fire. NRPB - we have been reactive, responding to flare-ups. The objective is to get ahead of this and put them out. Waste management will be improved later. EE&G - one other factor is that eventually these sites need to be properly closed; you cannot effectively close a landfill that is on fire. Structural and engineering reasons in addition to environmental, smoke, fire, etc., make this necessary as well.

Speak to the question regarding what else is involved in the project related to the management of debris that is coming into the dump - NRPB there are several components of the project, 1 - debris clearance 2 - improvement of landfill operations in short term manner; 3 - purchasing of heavy equipment . Funds are being made to strengthen the capacities of VROMI to get quick results in improving landfill management. As of right now, there are not other immediate options for landfilling; TDSR will be put in place to process space.

Boats will be coming to landfill? Won't that be counter-productive? We need a better way of managing debris. NRPB - you are correct. VROMI - part of this project is to look for long term solution recycling, sorting, reduction of debris are being evaluated. Regarding boat wrecks, the contractor will not be allowed to bring fiberglass to dump, which is a condition of the project. NRPB - objective of this project is to have these types of consultation, there are problems that are self-created. All of us use styrofoam, plastic, glass and throw them away, this goes to the landfill. If we can solve the fire problem, if we come up with improved waste management system, it still will not be maintainable if people don't get behind it. One of the big issues that they don't have is funding. Everyone needs to understand their role in waste management.

In regards to starting from home, a lot of people don't know what to do. Where do separated wastes go? VROMI - that is part of the strategy that they are designing, if waste to energy is used separating is not needed it all goes to the oven; if sorting and recycling is used then curbside separation is needed; people can still send separated materials to recycling facilities; white goods are a concern – they are bulky and have hazardous materials. The Government is busy establishing a ban on single use plastics and styrofoam.

Community member really appreciates that we are taking the time to do this. They are glad they stopped in to attend, they didn't know about this.

What is timeline to start? NRPB - ESIA and evacuation will dictate that. Need to know where they are going to go, they don't want to break up the community; need find a place for relocation.

Evacuation Zone is small part of this project; if you don't start you never will get it done. NRPB – while that is true, there are a number of safeguards that must be implemented.

Another hurricane season has started, yet we have not figured this out. NRPB - planning is needed, we must take as long as it takes to get it right; a lot of people share the frustration

I live in the blue box area; will we be coming back after project is complete? NRPB - we need to get this figured out. There is a lack of data regarding the options for this process, RINA is going to engage in conversations with the community to find out who is living there, what is livelihood, etc. There is a need to make informed decisions.

Person is happy that something has started, they live on Mt. William Hill and see the flare-ups. Thinks that if persons were to be evacuated, it would be good for them to know their fate. Don't execute the plan, implement it! EE&G - Second Consultation will be in 6 weeks, inputs will be implemented. Draft of ESIA will be posted, mitigation measures will be included. Answers to some questions will be provided.

June 25, 2019

First Consultation Meeting Notes – Erika Morales, EE&G Social Specialist

Are you monitoring the water in the pond? Everything you do to extinguish the fires may put more toxicity in the water and people fish there and eat the fish. NRPB - EE&G will be doing water sampling of the current situation in advance of field activities to understand condition before it is started. We will continue to sample the water throughout the project. An external party will be monitoring and we will need to stop and adjust/mitigate if the levels in the water show changes so that procedures are addressed quickly. EE&G - stormwater management controls will be key to the project. Water, foam, and grout or a combination of these and other techniques will be used for firefighting controls. The contractors' responsibility is to provide proper storm water control so that it doesn't end up in the pond.

First, I was raised in the backstreets near the pond area and on certain days when the salt shined, it was so beautiful. In the 70's when the Politicians decided to put a landfill in the area, it was devastating to us. Sometimes I become emotional. At about that time I finished school and got a job in public health and the gov't was advised to stop the landfill and it was ignored. I was about 19. The way you are presenting it tonight, I get the impression that you are trying to protect us from becoming scared and overwhelmed. Based on the risks, what exactly are the emissions of dust, how dangerous and what could be the symptoms and what could happen to the public? NRPB - let me support what you said, we do not want people to be frightened. The only thing we are doing at the moment is to prevent anyone in this area from being in harms way. We expect in the smoke fumes on the landfill that there may be other toxins released. We are taking a conservative approach. In the end we want to prevent any potential risks. Toxicological questions, Chris will discuss. EE&G - the answer is based on the information from sampling at the landfill and around the perimeter. The current situation is not dangerous but once excavation begins, it is uncertain and a monitoring program will be implemented. The substances that were measured include volatile organic compounds such as from oil, gasoline, and metals, CO2, hydrogen sulfide associated with odors you could smell, but more monitoring will need to be done during the process. The guidelines we have used are the ones that tell you what levels are protective of human health. These were compared to the measured air data to draw the conclusion that there are not off-site health risks.

Have you done this in another country or island? Has this been done before and are you aware of the repercussions? NRPB - this is my first time here. Landfill fires are very common and happen in every landfill. EE&G - very good questions, we've been involved in numerous projects where landfills are on fire and are causing concern to a local community. Our approach will be very conservative. The Blue Box shows the area that is believed to be most likely at risk and therefore being considered for evacuation, as we don't want it to affect the people. It's hard to eliminate every risk but we can take the conservative approach which avoids putting people in harms way. The landfill fire suppression activities will take 3-6 months and will be done slowly, methodically, and carefully. We will protect those working in the landfill and around the landfill. TL - the Blue Box is the preliminary site for evacuation, for those potentially affected. RINA is experienced with resettlement. We just need to know who is living and working in that area so we can engage with them. We don't want anyone to be affected by smoke or fumes.

Is this about fires only? Is there a more general solid waste management issue as well? NRPB - yes, the fire suppression plan is the reason we are here tonight. The government is looking at long term solutions for the solid waste. We need to address the fires first.

How did you publicize the meeting in the community? NRPB - The Daily Herald, flyers in households and in businesses. The NRPB also has Facebook and Linked-in. Company website (Nrpbsxm.org) is where most of our meeting information is publicized. Nrpbsxm.org is the website, most meeting info is publicized there.

I have lived near the pond all my life, in the past everything was clean and nice. Now the dump is there and do you think the soil could be affected where I live? (Question from Blue Box resident) EE&G - A study has to be done first to test the soil, but there are many potential sources of common materials often found in soil, perhaps including household activities, commercial activities, automobiles, etc. All this would need to be considered to answer the question.

There is a baseball field near the dump. If there are kids there, are they affected when they use it? Do they need to relocate? NRPB - the surroundings including the ball field will be monitored for fumes. Yes, it may need to be closed for a certain period especially if there are fire outbreaks. The current fumes are from the smoldering subsurface fires. There are not hazards beyond the landfill boundaries, and it's just an odor issue from time to time.

The Blue Box Area you pointed out is only one part of the issue. Fumes go up and travel, so it's not only that area but it is the entire island affected at some times. Are you going to evacuate the whole island? EE&G - Fumes do travel by air currents, but engineering controls are planned to minimize such airborne releases. The monitoring program will determine what levels of gases are leaving the landfill. We are trying to prevent it from happening by using different approaches.

What are you doing to prevent surface fires? EE&G - we will discuss the measures in the mitigation consultation. When you have a release in black smoke, those likely will be transported by different wind currents. Multiple monitoring stations will be added to provide information to protect human health from potential exposure.

The marinas have to separate the waste, such as batteries and fuels. When do you tell the people they have to move? Please tell us in advance. NRPB – separation of the waste (e.g., batteries and fuels) is key to properly manage the landfill. If there is need for evacuation/relocation, everything will be coordinated with the affected area; we will not wait until the last minute to evacuate residents. If temporary evacuation is needed for a couple of hours or days, the only way to prepare is to have a plan ready. Apart from the ESIA document, we will have instruments on how to respond to this.

What are the plans in place if there is a flare-up during excavation and fire suppression? NRPB - Fire suppression activity will be concentrated in one area at a time. A flare-up is a localized area where we are currently working and thus it will get put out immediately. NRPB - any other concerns? The information gathered here tonight will be apart of the ESIA. We will address any concerns to the best of our knowledge. Please provide more comments in writing, July 10, 2019 is the deadline. You can send by email or mailbox at the NRPB office.

Is the process meant to clean-up the dump site? Or just to address the fire suppression process? NRPB - this is only for fire suppression. We are looking at alternatives ways to manage the solid waste as a separate project. Current funding is just for the fire suppression project.

Why do we need to do fire suppression? NRPB - first, because a large area has fumes coming out of the landfill, there is the possibility to expose workers at the landfill. 2nd, the Irma debris site is to be used as a soccer field in the future; thus, we need to extinguish the fires in order to repurpose the area. We cannot permit the fires to persist. If there are no visible fires, that does not mean there is not a fire at the landfill. These are internal fires which have potential to flare up. The approach is to extinguish the fires so the flare-ups don't happen again moving forward. We need to eliminate the elements below the surface. EE&G - the fires need to be put out in order to close the landfill and debris site in the future. These facilities need to be closed once a solid waste solution is found.

What else is involved in the project? NRPB - we have a project document, which has several components of additional waste management actions to come including:
- debris clearance /shipwrecks
- improvement of landfill operations & management
-s trengthen the capacity of VROMI to manage the solid waste
- purchasing of heavy equipment to manage the solid waste
- setting up a temp facility (TDSR) to handle certain streams of waste, ex: tires, demolition debris from hotels, housing construction.

VROMI is also looking to the long term solution of solid waste. We recognize the need to develop a long term strategy. The contractor hired for that project will have to find alternatives, e.g., fiberglass is a potentially toxic material that you do not want in a landfill. NRPB - we have to think about the solutions as a whole. If we can have a sustainable management of our waste, we all have to contribute to maintain it going forward.

We need to be informed on how to manage all the different types of waste coming from our homes and businesses. VROMI: That's part of the long term solution and strategy that we are currently designing, e.g., bans on plastic and styrofoam are part of the strategy. EE&G - iIn approximately 6 weeks we will be prepared to discuss mitigation methods.

Conclusion of the Meeting.

June 25, 2019

First Consultation Meeting Notes – Tadzio Bervoets, EE&G Social Specialist

Will the water quality be monitored to account for the toxic leachate? Will be doing water quality (QQT) sampling to establish a baseline - and to be able to account for current WQT levels and will also be able to account for an increase of toxicity for the WQ levels during fire suppression activities. Also it will be useful for evaluating potential impacts to marine biodiversity. (Environmental aspect should be a component of communication and outreach).

Mention of the aesthetic value and historical value of the Great Salt Pond (GSP). The issue was discussed of seeing GSP degrade due to presence of the landfill. Mention the ongoing or previous recommendations to stop the landfill. Impression is that presentation was screening important questions. Question raised regarding what the risks are with relation to dust and toxic emissions and how dangerous and what could the symptoms be as to what could happen due to the fire suppression activities (Should be communicated extensively). The aim is not to frighten people. The focus right now is to prevent that anyone will be in harms way when project is being implemented and to avoid the potential risks. The aim is to mitigate and prevent the risks as much as possible.

Will this activity be focused only on the fire suppression? Yes, this consultation will be specifically focused on fire suppression. Need to address fires first and then work towards a sustainable waste management approach for the landfill.

Does the dump affect the soil or soil composition of the areas? Person posing the questions has had some health concern (itchy skin). It could have been but the area needs to be sampled and tested in order to determine if it has been. Many potential sources for common substances found in soils, including residential and commercial activities, automobile traffic, and potentially landfill activities. It may not be possible to distinguish various contributions.

Will the children at the Little League Ballpark be affected when in use? It is outside of the area where risk of being impacted is likely. However, yes it may be the case that this area needs to be closed off for certain types of activities which may be implemented from time to time.

Will areas outside of the identified areas be affected in the various districts? There should be engineering controls in place that would seek to suppress the fumes from being released and transported through the air. The monitoring program will also determine what is leaving the landfill and where. This information is gathered very quickly during the process.

Have to go to the Marinas to tell them to separate materials and to separate wastes. Acknowledged.

If there is a bad flare-up what is the plan in place for the ongoing disposal of waste being delivered to the landfill while activities are ongoing? Need to highlight the fact that activities will occur at one particular area at a time and will not be the entire surface of the landfill. By working in localized areas, fires or flare-ups can be quickly extinguished if they occur.

Notes:

- Based on the information from sampling the current situation is not dangerous but there is an uncertainty with regard to what conditions will be when suppression activities are being carried out. Will take into consideration health parameters to ensure that health is of paramount importance. Explanation given on some of the parameters measured and basis for health-protective criteria. A robust monitoring program pre- and during activities should occur.

- There is a need for more outreach to spread the information to the public to ensure wider awareness and understanding of activities and schedules. The fire suppression activity is part of the emergency debris management project - this point should be highlighted and reinforced.

- Information on the process should be highlighted especially as it relates to the second round of consultations and establishing of an air monitoring plan.

- There is a perception that this stage is related to the comprehensive cleanup of the dump. It should be highlighted that this is limited to the fire suppression activity.

- There is also the perception that there is no fire ongoing at the moment if there is no visible flame or no visible smoke. It should be highlighted that this particular activity is related to the suppression of internal fires and internal hotspots which need to be addressed. Just because fire or smoke is not seen does not mean that there is not deeper fire activity or smoldering in the landfill. We know that there is.

June 26, 2019

First Consultation Spanish Meeting Notes – D. Kirk Smith, EE&G Project Manager

Start 6:25 pm

Intro by NRPB then EE&G performs the presentation.

EE&G - wraps up discussion at 650 pm

EE&G - taking questions

I have lived there for 20 years, for the elderly what can they expect for this relocation process. NRPB - everything being done for preparation for fire suppression has to be performed in stages. So, in order to address this specific question, we need to know what is needed and how it is needed. The assessment being performed by EE&G will determine what will need to happen within the area before fire suppression begins. Whoever is in the area that needs to be relocated temporarily or otherwise, will need to be dealt with. NRPB - I noticed a specific element in your question, the elderly; the objective is to not treat as a community but as individuals; solutions will be made with this in mind.

What is this project for? EE&G - only for the fire. **Juan has lived there for 17 years, through that he has helped reduce the amount of garbage located all over the island. What can the community expect from this project?** NRPB - good question, two companies are doing assessments that interact with one another EE&G is doing the ESIA and RINA is performing a census to find out composition of the community. When we have that information detailed approaches can be determined. Important part of statement that is raised, the Blue Box community has been involved in waste management in one way or another. We don't want to take away peoples livelihoods because they are being relocated; it is not about moving people but also putting them in a situation where they can maintain themselves. We don't want to hurt anyone during this project; the do no harm principal is important to follow. It is a WB principal. Let me end this by asking "if you provide information on your livelihood, it is helpful in determining the way forward.

I have lived in the area for 30 years and not within boundaries of Blue Square. What about us? Do we fall within plan for relocation? EE&G - there are multiple zones of protection that are being visited during this assessment; the first zone that we are talking about tonight that is in the area of most danger is the blue box. This particular area is within 100 meters of where the work is anticipated to be performed on any given day. So as it relates to potential risks, the businesses and residents within this area would be considered. Additionally there is a second area 300 m from the work. That area would be informed of the project and there could be temporary evacuations depending on work conditions. However we do not envision at this time the need to evacuate outside of this blue box. During the course of the project, there will be air monitoring that will be performed at the perimeter of where we are working to ensure human health is protected. The concept would be that the levels of substances that are being tested exceed human exposure levels; the work would be halted or changed. It is important to understand that the project will be designed that emissions control will be in place. To be conservative, since the community is downwind of the works, it is being recommended that it be evacuated for the duration of the project.

Rosa - that community has heard those comments/promises before, she has concerns. NRPB - has been in SXM for more than 30 years he understands the problem with the Landfill. They understand that promises have been made before. The difference now, is multi-dimensional - 1 - they have the money, finances limited the ability of Government to do anything 2 -they have support from World Bank and Dutch Government to fix the problem, what is important is the way that it gets done protect the Environment and People; this is why they will take the time to make sure that the people are correctly taken care of.

This is a nice project the WB needs to approve the money; yes the money is in the bank and I cannot go get my money. NRPB - the decision to implement this project has been made and the money to do it has been approved. We are in the implementation process. Getting money will be determined by who lives there; access to the funds will be determined by the information gathered by the consultants. Plus information gathered will be handled confidentially. They are making decisions for each individual; permanent vs temporary relocation will be determined for each individual.

Juan supports the project, he and others like him like their lifestyle (he is a recycler). The area they live in is not treated as a real community, no street lights, utilities, etc. He wants to know what is in store with him. NRPB - we need to know more info about the community in order to craft a good situation for them. How we deal with what we are facing will not be made by one agency, it can only be done in close consultation with the community. This is first consultation of 2 but NRPB expects much more face to face feedback with the community. Community involvement and feedback is important to make sure an equitable situation is established. Information gathered tonight will be part of impact assessment and lead to response to what we are facing.

Owner of recycling company has 10 employees, how will project affect his business? NRPB asks how many other people are in this situation. **One other person is self employed and has been doing this for 30 years**; NRPB - this is important information to gather this information. Again it will be confidential

Woman states that she lives in the blue box and likes her house, what she does not like is her view….trash piles. $20k is not going to buy her house because it is worth more than that.

Comment/request lives 31 years grateful to government and island of SXM, for being there ….but needs a roof over her head.

The dump is a volcano? Smoke goes where the breeze is blowing, wants a sketch of where it could go. “You never know where it will go”. Sand used to make concrete comes from the volcano. A volcano is located beneath salt pond. EE&G – This will be looked into.

Comment – a man states that he has lived here for 8 years and likes this forum; it is out of character and he is happy to see that community is being engaged. SXM is an importer which is why there is so much waste; the LF is poorly managed and could use outside help/experts to improve it.

NRPB thanks the group for information, participation, etc. Stated that this info will help with how to proceed, especially within the blue box. This consultation will be done again, next time we will show questions and solutions; Thank you.

8 pm. - wrap up.

ANNEX E

LIMITED COMMUNITY OUTREACH SUMMARY REPORT

June 28, 2019

INTRODUCTION

The goal of the limited community outreach effort was to engage with Stakeholders, distribute flyers to the residents and businesses pertaining to the upcoming Fire Suppression Activity, and establish awareness about the environment and social impacts that the project may have on their families and themselves. The participation of the Stakeholders in this process is central to gathering reliable community input and preparing the Environmental and Social Impact Assessment (ESIA) report. That ESIA report will address the study methods, potential hazards, potential risk mitigation measures, community concerns, and potential solutions for the community.

METHODS

EE&G's Social Specialist visited the community on Wednesday June 26, 2019 to perform a limited community outreach. These activities were performed in conjunction with the Community Flyer Handout activities, which were led by NRPB representatives. The area visited was the community located within the "Blue Box" area as identified during the First Public Consultation (Figure 1). Additionally, areas within the "Yellow Zone" (Figure 2) were also visited immediately south of the Blue Box zone. EE&G's representative visited with residents and business owners, apprised them of the Spanish version Public Consultation that was scheduled to occur that evening at the University of Sint Maarten, and encouraged them to speak about their concerns. The outreach was performed during normal business hours; therefore, many residents were not home (some presumably working). This brief report contains a summary of concerns that were orally gathered during that outreach event. Additionally, observations of the environmental setting and conditions of the community also are summarized herein.

SUMMARY OF INTERVIEWS

The following is a summary of the concerns orally expressed by residents and business owners in the community:

- Stakeholder's comments were primarily related to unsanitary conditions, resettlement/evacuation concerns, air quality impacts to their community, and the Government's performance on managing the landfill.

- Some elderly Stakeholders, primarily from the Dominican Republic, indicated that they were grateful to the Government of Sint Maarten for permitting them to reside at the landfill for the last 20-40 years. While they acknowledged that resettlement is possible, the Stakeholders were hopeful that the Government will take action to ensure that proper health and safety measures will be taken accordingly during the Fire Suppression Activity to protect them and their neighbors.

- There was apprehension about the project in general in particular about resettlement, some expressed that they would prefer not to be evacuated or relocated from their homes. They conveyed disappointment on resettlement, as they feared sufficient response time would not be provided, and the unknown location where they would be relocated will affect aspects of their daily living (i.e. proximity to work, school, hospital, family, and friends).

- Stakeholders perceived a lack of effort and urgency on the part of the local Government. They felt that the local Government was not effectively addressing significant issues within the community, particularly (1) the air quality control at the Irma Debris Site, which was once a football field used by the community and (2) uncertainty regarding the resettlement process for residents living near the landfill.

- The Irma Debris Site (IDS), as distinct from the main Landfill site, raised concerns for one Stakeholder regarding air quality (smoke and dust). This Stakeholder stated her view that the air quality in the community has dramatically declined since the Irma Debris Site was implemented and she has now been diagnosed with asthma. This Stakeholder resides and also owns a business immediately downwind of the IDS. She has been a resident in the vicinity of the landfill since 1995. The Stakeholder highlighted her view that the Government has not taken sufficient measures to reduce and/or eliminate the issues causing the decrease in air quality at the site, and is skeptical that they will take the necessary measures going forward.

- A number of uncooperative individuals were encountered during the community engagement that denied living at the landfill. This could create an issue for RINA to collect an accurate census of those living in the area. These Stakeholders were skeptical that anything will actually get done in the landfill area and they had little or no interest for the project.

- Some Stakeholders stated that the landfill fires did not significantly affect them due to the wind and dilution, and when significant surface fires occurred, precautions were taken by closing all windows and doors until the fire ceased.

- Some Stakeholders did not understand or did not believe the Government would mitigate the issues at the landfill.

OBSERVATIONS

EE&G made the following observations of the community during the community outreach event:

- The infrastructure in the neighborhood was in a dilapidated condition. Roads had large potholes and were unpaved. Stormwater ditches were clogged with debris/trash and contained stagnant water, creating a breeding ground for mosquitos and other vectors. Electrical service and portable water appeared “community rigged” and not Government installed. Sewage collection or septic systems were not evident.

- Debris was littered throughout the community and included junk cars and heavy equipment, abandoned roll off dumpsters, stacked metal vehicle parts, and piles of recyclables (plastics, broken glass, aluminum window frames, etc.)
- A large population of stray dogs that appeared to have mange or some other skin diseases.

- Fly infestations, which at some points were extreme due to trash and leftovers and/or spoiled food left on the ground, also represent a health concern.

CONCLUSIONS

Community outreach is vital to the success of the Fire Suppression Activity as it provides the opportunity for residents and business owners to share their ideas and concerns about the project with representatives from the responsible Government and the technical experts. This allows the Government and EE&G to incorporate the concerns of the community into the ESIA Report and into future projects. It also helps guide decisions on priorities for the project(s) and identifies potential challenges.

During this limited community outreach effort, EE&G focused primarily on the Fire Suppression Activity. Although there was a general positive outlook by the residents, the Fire Suppression Activity subject matter evolved into discussions showing a significant concern about resettlement/relocation, rather than focusing on extinguishing the fires, as the Stakeholders feared being displaced.

RINA is responsible for the Resettlement Action Plan (RAP) and community census. We presume they will be in the forefront of continued communication and outreach to the residents and business owners. We encourage continued communication and education to the community on the Fire Suppression Activity and the impacts it may have to their community.

ANNEX F

SIGN-IN SHEETS

SIGN IN SHEET

Consultations ESIA

June 25, 2019

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Consultations ESIA

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Consultations ESIA

June 25, 2019

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Consultations ESIA - Spanish

June 26, 2019

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June 26, 2019

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Consultations ESIA - Spanish

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June 26, 2019

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Consultations ESIA - Spanish

June 26, 2019

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ANNEX G

Questions & Answers from 1st Consultation

The questions from the English and Spanish presentations and have been arranged into 7 categories:

- Air Quality and Public Health
- Environmental Impacts (Soil, Surface Water, Fish)
- Fire Suppression Methods
- Evacuation/Resettlement
- Business Interruption in Evacuation Areas
- Waste Management
- Miscellaneous Concerns

Questions are presented in the following table. Unless the question was technical in nature, responses were by NRPB.

ANNEX G - Questions & Answers from First Consultation

Category	Question	Answer
Air Quality and Public Health	1. What exactly are the risks associated with the emissions? And how does this affect us?	a. The data identified are from sampling at the landfill and around the perimeter. These substances detected in the air were typical of landfills. The current conditions at the landfill represent a reduced risk of concern; however, once excavations begin the conditions will be uncertain and further monitoring will be implemented for the duration of the project. b. The substances that were measured include volatile organic compounds from sources such as oil, gasoline, and also metals, carbon dioxide, and hydrogen sulfide were evaluated, which can be associated with odors you can smell. The guidelines we have used are the ones which tell you what levels are protective of human health. These were compared to the measured air data to draw the conclusion that based on one sampling event, current conditions (no surface fires) do not appear to represent an off-site health risk.
	2. Will areas such as the baseball field outside of the identified Blue and Yellow zone be affected and require closure during the project?	It is possible but at this time it is uncertain. The monitoring program will determine this.
	3. Does the entire island need to be evacuated for the Fire Suppression Activity Project, as we smell the smoke long distances from the landfills?	No. There will be engineering controls in place that would seek to suppress the emissions from being released and transported through the air. The monitoring program will also determine what is leaving the landfill.
	4. How will the fire suppression activities be performed at the landfill?	Mitigation measures will be addressed in the second consultation. Downwind impacts need to be evaluated and monitored concentrations will dictate whether there is a public health issue or whether other measures are appropriate.

ANNEX G - Questions & Answers from First Consultation

Category	Question	Answer
	 5. Is the landfill a volcano? The smoke goes where the wind is blowing, are you going to provide a sketch of the wind direction?	The Volcano issue was not answered definitively, but the general consensus was "no" as Sint Maarten is presently does not have active volcanism. We are looking at the wind direction and how that impacts dispersion of emissions, which is part of the plan for the project.
Environmental Impacts (Soil, Surface Water, Fish)	1. Are we monitoring the water quality of the pond for toxicity? Is it safe to eat the fish	Yes, water sampling is being performed to establish a baseline and the water quality will continue to be monitored during the entirety of the project by a third party. No testing of the fish has been performed as of yet and we do not recommend that you consume fish caught in Great Salt Pond, to be safe.
	2. Do you think the landfill has impacted the soil in our community?	It may have, however, it would be useful to have a preliminary sampling activity prior to starting the landfill excavation and fire suppression activities which can help determine whether the landfill has had an effect on the soil that would result in a Public health concern.
Fire Suppression	1. How will the fire suppression activities be performed at the landfill?	Mitigation measures will be addressed in the Second Consultation. Downwind impacts need to be evaluated and monitored concentrations will dictate whether there is a Public health issue or whether other measures are appropriate.
	2. What are the plans in place for a potential flare-up?	Flare ups are expected to be localized, instantaneous, and will be dealt with quickly. By working in localized areas, flare-ups can be quickly extinguished if they occur.
	3. Why do we need to do Fire Suppression at the landfills?	1. There are multiple reasons:

ANNEX G - Questions & Answers from First Consultation

Category	Question	Answer
		(1) A large area of the facility has smoldering vents that are affected by subsurface fires and thus exposing laborers at the landfill (2) To properly manage waste, the subterranean fires must be extinguished before we can re-contour the landfill. (3) The Irma Debris Site is destined to likely return to its previous use for recreational purposes (4) Lastly, another factor is that eventually these sites need to be properly closed; we cannot effectively close a landfill that is on fire. Structural and engineering reasons (in addition to environmental, smoke, fire, etc.) make this necessary as well.
Evacuation/Resettlement	1. Sufficient time will be needed to evacuate the areas of concern, how much time will be provided to those affected?	NRPB will be in close communications with those residents living in the affected area. If there is a need for relocation or temporary evacuations it will be coordinated accordingly with the affected parties. A plan is currently being prepared to accommodate both relocation and temporary evacuation.
	2. What is the timeline to start this project?	The ESIA and evacuation will dictate the start date of the project. We do not want to break up the community and we are working on potential resettlement locations.
	3. Where will those affected be relocated to?	A relocation plan is currently under review, we do not yet have a date determined of when the activity will begin as the processes are still on-going.
	4. What can the elderly expect of the relocation process?	The intention is to treat not only the area as a community but also individually. There is no one solution that would work for everyone.
	5. Will relocation affect those residents living outside of the blue box area?	At this time we do not envision the need to evacuate outside of the blue box area.
	6. Will the residents relocated due to the Fire Suppression Activity return to the	RINA is collecting data of the community (i.e. census to find out how many residents are living in the neighborhood affected by the Fire

ANNEX G - Questions & Answers from First Consultation		
Category	**Question**	**Answer**
	landfill after the project is complete?	Suppression Activity). We need to collect more data in order to make informed decisions.
Business Interruption in Evacuation Areas	1. Some of us work at the landfill. What is the Government's proposal for the community?	The project is not about simply relocating people, but moving in a way so they are out of harm's ways, and can earn money to support their lives. Both Social and Environmental Assessments are being performed. If you have information to provide on how you operate, if you are currently in waste management, then it is important information we need for deciding a path forward.
	2. How will this project affect my recycling business?	This information needs to be communicated to RINA who will be visiting the community over the weekend and the information will be held confidential.
Waste Management	1. What are the plans for alternative waste disposal while the project is on-going?	Fire Suppression activities will be performed in one area at a time, thus waste will continue to be disposed at the landfills.
	2. Is the objective to clean-up the landfill? What are we going to do with the garbage?	No, this project is to eliminate the subterranean fires. Future projects will deal with waste management; however, this is the first step towards managing the Island's waste in the future.
	3. The marinas need to separate their hazardous waste.	This is important as separation of hazardous and petroleum wastes is a key component to properly manage the landfill.
	4. What other methods will be used for the management of debris entering the dump?	There are several components of the project, (1) debris clearance (2) improvement of the landfill operations in a short term manner, (3) the purchasing of heavy equipment for improved operations and (4) the set up of a temporary facility to deal with the increased streams of debris. Funds will be allotted to strengthen the capacities of VROMI to get quick results in improving landfill management but at this time, there are no other immediate alternatives to landfilling of the Island's waste.
	5. If boats continue to come into the landfill, won't that be counter-productive? We need a better way of managing debris.	Yes. Part of this project is to look for long-term solutions of solid waste, recycling, sorting, and reduction of debris. Regarding, boat wrecks, the contractor that will handle the remaining shipwrecks in the Simpson Bay Lagoon will not be allowed to bring fiberglass to the landfill, which is a condition of that project.

ANNEX G - Questions & Answers from First Consultation		
Category	**Question**	**Answer**
	6. How do we manage the separation of waste materials?	The Government is working on establishing a ban on single use plastics and Styrofoam. A recycling area is being planned to remove recyclables from the waste stream to save landfill space.
Miscellaneous Concerns	1. Have you performed this type of work in another country?	Yes, our team has been involved in numerous projects with landfill fires and elsewhere that are similar to this one. This will be done slowly, methodically and carefully to eliminate potential for allowing this to become a Public health hazard, including managing emissions.
	2. Will this project focus on the Fire Suppression Activity only?	Yes, this public consultation only focuses on the activity of Fire Suppression. The suppression of underground fires needs to be addressed before other measures can be taken at the landfills.
	3. What communication platforms are you using to inform the Public of future meetings?	We published using the Daily Herald, Facebook, LinkedIn, NRPB billboard and the NRPB website. We will do so in the future as well.
	4. The community has heard such promises on numerous occasions about projects to improve Sint Maarten. What makes this one different?	The decision to implement this project has been approved and we now have the funding; we are currently in the process of implementation. Money is not an issue that will prevent this project from proceeding.
	5. The landfill community is not treated as a “real community”. We do not have street lights street names, or utilities. What is in store for our community?	Street lights, street names and utilities are not the responsibility of NRPB and are outside of the scope of this Project. How we will deal with the challenges we are facing related to the Fire Suppression Activity is not a decision made only by NRPB, WB and the Government. It is something that we can do in close collaboration with the community. This is the first consultation of two that are scheduled, and we expect a lot of face to face conversation between members of our teams and the community. Please consider the first outreach to the community as a unit, where we try to get as many people as possible involved. The information gathered during this First Consultation is going to be part of the environmental and social assessment and will lead to the planning of the project.