OVERVIEW
Air Screening Results
at Pond Island Municipal Waste Disposal and Temporary Debris Sites, Sint Maarten

Through the Sint Maarten Irma Reconstruction, Recovery, and Resilience Trust Fund (SXMTF), the World Bank is supporting the government of Sint Maarten in finding a solution to put out the fires at the Pond Island waste disposal sites. To that end, EE&G Disaster Response, LLC (EE&G) was assigned to perform a preliminary screening of smoke emanating from subsurface fires at the Pond Island municipal waste disposal site and temporary debris site (collectively referred to as the "debris and disposal sites") on August 28-30, 2018 in preparation for the fire suppression operations to be undertaken through the Emergency Debris Management Project under the SXMTF funded by the government of the Netherlands.

The purpose of the tests was to identify the chemical composition of the smoke and fumes that are being released into the air and based on that, to provide occupational health and safety recommendations to ensure adequate protection measures are provided to personnel working on the sites. These health and safety recommendations also cover the fire fighters who will join in the summer of 2019 to suppress the landfill fires.

Preliminary results were presented to representatives from the World Bank and governments of the Netherlands and Sint Maarten on Tuesday, December 4, 2018.

Highlights of the report:

I. Methodology

The testing was performed over three consecutive days from August 28 – 30, 2018. Each day the testing was performed in a different general location of the disposal sites, which were as follows:

- Day 01 (August 28, 2018) – The northwest portion of the municipal waste disposal site (MWDS).
- 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.

Tests were in the following locations each day:

- Upwind of smoke plumes ("upwind" samples), to establish background levels of the chemicals of concern (COCs) in the air. These samples were collected approximately 1 foot (30 cm) above the surface of the landfill.
- From the smoke plumes ("smoke" samples), to obtain the maximum levels of the COCs at their originating source. These samples were collected approximately 1 foot (30 cm) above the surface of the landfill. (Figure 2: right)

- In the cabs of vehicular equipment driven by operators performing normal operations at the active face of the MWDS and similarly at the temporary disposal site. These cabs were reported to be part of a typical work day ("personnel" samples) and were used as samples to gauge COC levels relative to occupational limits. (Figure 2: left)

Figure 1 shows a schematic of the testing locations.

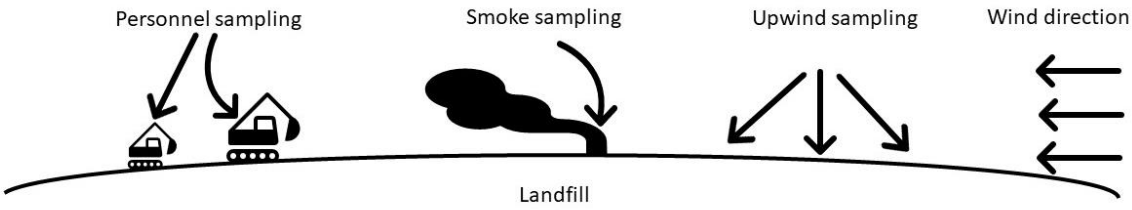

Figure 1. Schematic of the locations where the samples were collected

Figure 2. Pictures indicating the locations of the monitoring equipment
(left: in the cabs of vehicular equipment driven by operators, and right: in the smoke plumes)

Samples were not collected outside or along the perimeter of the sites, as the intent of the testing was to find out what COCs were present in the smoke and fumes at the disposal site.

COCs selected for testing were determined by selecting the usual chemicals found in smoke emanating from burning waste, as well as typical landfill gases. 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.

- Volatile Organic Compounds (VOCs), gasses that can be produced by the breaking down/decomposition of waste. Common examples may include benzene, ethanol, acetone, chloroethane, formaldehyde, methylene chloride, tetrachloroethylene, and toluene etc.

- 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), tiny solid particles or dust that are less than 2.5 micrometers in size, generated by mechanical action (such as landfill activities) or burning. The composition of PM 2.5 depends on the parent material: they can be non-organic (such as silica, asbestos, metals or plastics) or organic (such as cellulose, mold or bacteria).

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

- Dioxins and Furans, by-products of combustion of plastic 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

In addition, the Lower Explosive Limit (LEL) of the emissions, namely the level at which gases have the potential to explode, was also measured.

The air testing results were compared to the most stringent (or lowest) of the threshold levels among those 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).

II. Results

Below is a summary of the results of the testing:

- Upwind samples showed that only concentration of respirable particulates, PM 2.5 (related to the dusty conditions at the sites), exceeded occupational exposure limits. This was expected given that the samples were collected near the ground where dust and landfill gasses are likely to be present.

- Smoke samples showed that concentrations of several COCs exceeded occupational exposure limits. These results were also not surprising given that the samples were collected directly from within the smoke/fumes near the ground.

- Personnel samples, taken in the cabs of vehicles operating at the site, showed that only concentrations of respirable particulates PM 2.5 (dust) exceeded occupational exposure limits. This was likely due to the dusty conditions at the sites.

III. Conclusions

Based upon the testing results it was concluded that:

- Several COCs were exceeding limits in the smoke;
- All COCs except PM2.5 were found within safe levels in upwind and personnel samples.

It is important to note that the impacts of COCs in the smoke/fume sources would be different for people working at the sites versus people in the surrounding communities. The test results are not useful in assessing potential impacts to the surrounding population. Additional testing will be conducted specifically for that objective starting in early 2019.

IV. Recommendations

Recommendations have been made for safeguarding the workers at the site. Before fire suppression can start, interim controls have been recommended at the sites, including:

- Improving security and dust control
- Issuing personal protective equipment, such as respirators, disposable suites and gas monitors (equipped with alarms) to workers at the sites who may have potential occupational exposure to the smoke and particulates (dust).
- Training for workers, including personal protective equipment use and hygiene practices to be followed prior to eating, drinking, taking breaks or leaving the sites.

In addition, when the fire suppression activities start, proper measures will need to be put in place for controlling smoke/fume emissions during the work. Further air pollution monitoring will be carried out at the following locations:

- On workers.
- At the boundaries of the disposal sites.
- In the populated areas outside of the landfill.