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Reduction of UPOPs emissions by improving waste management practices at landfills

Assessment Report on the existing hazardous waste storage

Antigua & Barbuda

Resources & Waste Advisory Group SCE

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Contents

List of Acronyms

ANU	Antigua and Barbuda
BAT	Best Available Techniques
BCRC-Caribbean	Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean
BEP	Best Environmental Practices
BFR	Brominated Flame Retardant
BM	Brian McCarthy (Team Leader)
CRT	Cathode-ray Tube
DG	Diana Gheorghiu (Deputy Team Leader)
DoE	Department of Environment (Antigua and Barbuda)
GEF	Global Environment Facility
NSWMA	National Solid Waste Management Authority
PBDEs	Polybrominated diphenyl ethers
POPs	Persistent Organic Pollutants
PTCCB	Pesticides and Toxic Chemicals Control Board
PVC	Polyvinyl Chloride (plastic polymer)
RWA	Resources and Waste Advisory
UPOPs	Unintentionally produced Persistent Organic Pollutants
ULABs	Used Lead Acid Batteries
WEEE	Waste Electrical and Electronic Equipment
WR	Wolfgang Robrecht (Key International Expert)

Background and Introduction

The RWA Group team along with representative of BCRC-Caribbean, conducted an in-country fact finding assignment in Antigua and Barbuda during the week of 8th to 11th October 2019. This report presents the findings related to project Component C “Assess existing hazardous waste facilities in three (3) countries (Antigua & Barbuda, Barbados and Saint Lucia)”. This document presents the outcomes of the following project tasks:

- ***Assess safety aspects of existing hazardous waste management facilities*** *- and recommend upgrading measures (if need be) to meet international standards. The assessment should include adequacy, relevance, location and operations.*
- ***Determine the current and future capacity needs for hazardous waste storage facilities*** *- (e.g. quantities of wastes that need to be stored, different types of wastes, storage restrictions etc.).*

The report aimed to identify gaps in compliance to international standards and recommend measures to address the gaps. Deficits are listed and explained in detail and measures for improving the situation and the current and future capacity needs for hazardous waste storage facilities are included in a separate report detailing the design upgraded for hazardous waste storage facilities.

1 International regulations for design of hazardous waste storage facilities

1.1 General

Hazardous wastes pose a greater risk to the environment and human health than non-hazardous wastes and thus require a stricter control regime. This is laid down in separate legislations for most of the larger developed economies such as United States of America, South Africa, Canada, European Union and Australia.

Reference should be made to the Basel Convention General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants, Section F - Handling, collection, packaging, labelling, transportation and storage[1].

However, if it comes to regulations regarding the design, construction and operating of hazardous waste facilities the number of publications is manageable. A selection of those regulations is listed in Annex A

1.2 Summary of requirements from international regulations

Storage facilities are used to hold hazardous wastes until they have amassed enough quantities to make treatment or disposal more economical and effective. They are not prepared for final storage of hazardous waste. A review of the regulations presented in Annex A identifies the following design criteria as being identical or similar in each and therefore we have established this as the baseline for conducting our assessment of the existing hazardous waste storage in Antigua and Barbuda:

The storage area of scheduled wastes should be designed, constructed and maintained adequately in accordance to the following criteria, as a minimum, to prevent spillage or leakage of scheduled wastes into the environment:

- The storage area should be designed to provide adequate space to store all scheduled wastes generated or managed by the premise.
- The design capacity should consider the following:
  - Providing extra storage capacity of the actual maximum amount of waste generated (e.g. 25% reserve)
  - Storage duration for a certain time (not more than 180 days or as prescribed by the Department of Environment)
  - The entire storage area must be fenced-in and regarded as restricted area. Adequate signage should be put up clearly and visible with the word “DANGER” and “SCHEDULED WASTES STORAGE”
- The floor of the storage area and loading and unloading area must be covered with concrete or equivalent suitable lining material, resistant to the physicochemical properties of stored waste andfree of cracks and gaps
- The storage place should be sheltered or roofed or covered with suitable covering material
- The entire storage area should be surrounded by a concrete dike or other equivalent structure designed to contain any spillage of the liquid waste under the worst-case scenario. The capacity of

[1] http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW.14-7-Add.1-Rev.1.English.pdf, accessed March 2020

the containment should be 110% of the largest container stored in the storage area or 110 % of the total liquid waste stored
- There should not be any opening in the dike to prevent any leakage of waste from the storage area.
- The dike area should be graded to an impermeable sump that is resistant to the physicochemical properties of stored waste. This sump should not be connected to any existing drainage system
- The storage area should be properly managed to prevent rainwater or surface water from entering the storage area
- Any surface water run-off should be channelled to a proper drainage system to avoid the water from entering the storage area
- The loading and unloading area should be designed to contain any spillage
- The storage area should be equipped with ventilation system for volatile wastes
- Separate and signposted compartments should be provided for different groups of incompatible wastes
- Storage area should be designed to provide adequate emergency escape route.
- The storage area should be equipped with fire-fighting system and other emergency response equipment as well as spill kit and comply fully with the requirements of the Fire and Rescue Department of Antigua and Barbuda
- The storage area should comply with regulations on electrical installations
- The storage area should be equipped with a suitable illumination system
- The storage area should be equipped with first aid kits, emergency showers and eye wash system
- The storage area should have the following signage: operating procedures, existing risks and personal protective equipment to be used

Basel Convention Guidelines require the following:

- Location should not be at or near sensitive sites such as hospitals or other medical care facilities, schools, residences, food processing facilities, animal feed storage or processing facilities, agricultural operations, or facilities located near or within environmentally sensitive sites
- Sealing and venting a site so that only well-filtered exhaust gases are released to outside air may be appropriate when environmental concerns are paramount
- The roofs of dedicated buildings or containers and the surrounding land should be sloped to provide drainage away from the site
- A complete inventory of such wastes in the storage site should be created and kept up to date as waste is added or disposed of
- The outside of the storage site should be labelled as a waste storage site
- The storage area for POP wastes should have reasonable access roads for transportation vehicles.

In addition to the above, hazardous waste storage facilities need to have clear regulations and provisions in place on the following aspects:

- Site organizational structure
- Operations performed on site, frequency, scale and characteristics
- Watchman ship
- Wastes acceptance procedures
- Hazard communication and notification
- Inventory of wastes on site and record keeping
- Separate storage areas
- Work plan
- Job/task assignment
- Handling of hazardous wastes
- Ventilation and temperature control

- Employee training requirements and provision
- Medical surveillance
- Personal protective equipment (PPE)
- Environmental monitoring (air quality, ground water, soil contamination, etc.)
- Employee activity monitoring and Site control
- Alarm system
- Fire- fighting system
- Incident and complaint register
- Emergency response
- Other safety and health considerations as applicable under national legislation

2 Existing hazardous waste storage for Antigua and Barbuda

2.1 Description of the storage

The hazardous waste storage facility on Antigua was visited in October 2019. Findings are summarized in Tables 1 and 2. All types of hazardous waste are accepted in limited quantities (in practice mainly pesticides and toxic chemicals).

On Barbuda hazardous waste storage does currently not exist.

Table 1: Construction aspects of the storage

Item	Comment
Year Established	Unknown
Construction financing source and value	Prefabricated 20ft. steel container (approx. 6,1m x 2,4m x 2,6m) with an area of 14.9m²; Value (new) approximately 2,000$US without shipping; due to the high grade of erosion the container has no value any more
Design Capacity	No information
Remaining Capacity	Nearly no remaining capacity
Access the site	Access road to the office buildings only; no access road to the storage; no manoeuvring area for trucks

Table 2: Operational aspects of the storage

Storage racks	Not marked with the maximum loading weight per shelf unit. Likely to fall. A number of the racks are corroded.
Pallets	In poor conditions
Records of wastes	No records exist on site on sources, types and quantities of wastes stored
Containers	Waste is not stored in suitable and compatible UN approved containers. The plastic containers used are in poor conditions without cover in a number of cases.

Waste labels and markings	Not clearly visible or legible in a number of cases and large number of containers unlabelled
Segregation of wastes	All the materials stored have been stacked without any separation according to the different hazard classes. It appears that has been no screening exercise as even non-hazardous material are stored (presence of a container labelled as sodium bicarbonate was observed)
Fire extinguisher and fire prevention measures	None
NO SMOKING sign	None
Inspection and movement of loads	No space available for inspection and movement of loads is available
Owner	A new hazardous waste storage should ideally be under the ownership of the PTCCB
Operator	To be determined
Regulator	DoE is working with companies to give them a Pollution Permit including the handling of waste (residues) The PTCCB also deals with this subject

Figure 1: Map of Antigua with location the existing hazardous waste storage at the Department of Analytical Services

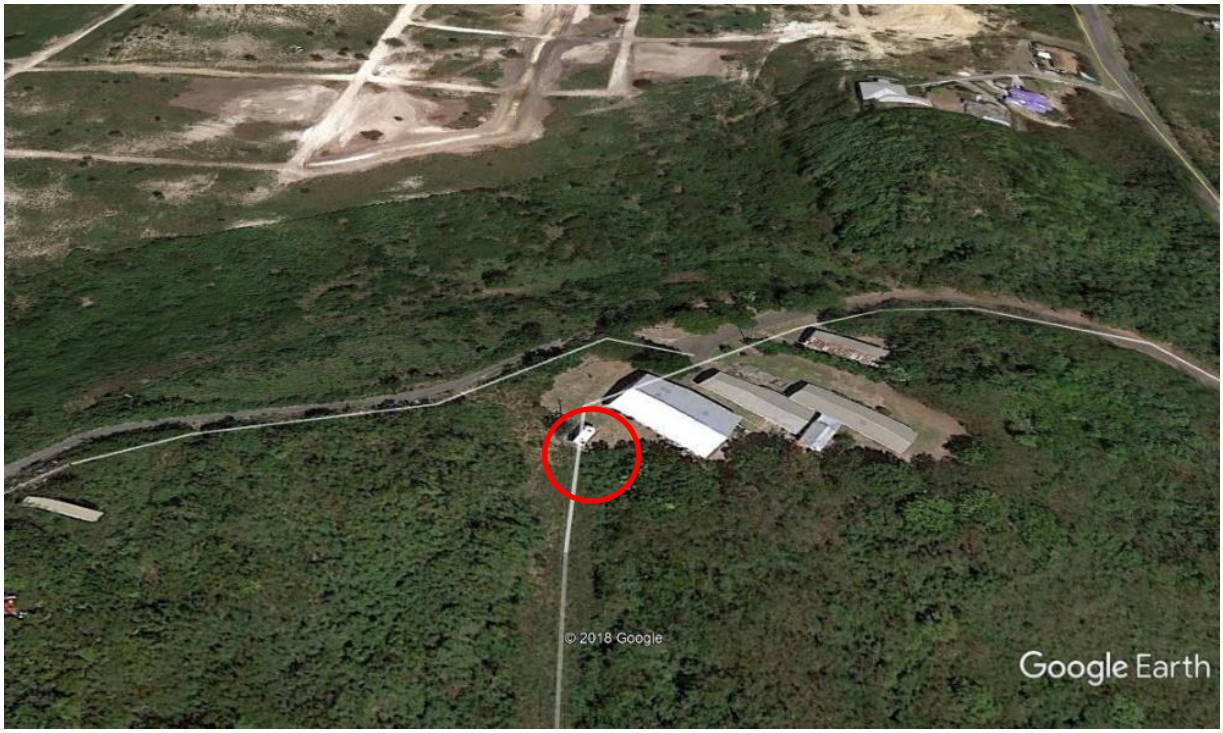

Figure 2: Location of existing hazardous waste storage at the Department of Analytical Services

Figure 3: Hazardous waste storage container during the site visit in October 2019

Figure 4: Hazardous waste storage container- Impressions from inside

2.2 Deficits of the existing hazardous waste storage

Table 3: Deficits of the existing hazardous waste storage at the Department of Analytical Services

Design Criteria	Assessment for the existing storage in Antigua	In compliance with international standards
Adequate space for storing and managing the hazardous waste	The storage has a size of approximately 15m², which is sufficient for minor quantities of waste that can be handled manually	NO
Floor of storage of suitable lining material	Steel floor on a concrete platform, covered by wood planking. Steel floor likely corroded, wood planking presenting significant water damage.	YES, but likely in poor condition
Storage is sheltered or roofed	The roof of the container is completely eroded; there is no more protection against rainwater; mould present inside container.	YES, but in poor condition
Storage surrounded by a structure for containing spillage of waste	No containing system	NO
Prevent rainwater from entering the storage area	The roof of the container is leaking	NO
Loading/unloading area designed to contain any spillage	There is no loading / unloading area. Storage is placed on a greenfield. Managing of the storage only manually	NO
Ventilation system	There is a natural aeration of the container	NO
Separate compartments for incompatible wastes	There is one container with several wooden rack along the wall; no separation	NO
Adequate emergency escape route	Container is full of waste	NO
Firefighting system	No firefighting system	NO
Other emergency response systems (showers, eye washing for operational staff, etc.)	No emergency response systems	NO
Compliance with Antigua Fire and Rescue Department		NO

2.3 Required waste capacity

The design and operation of the hazardous waste storage facilities is a component of a comprehensive waste management plan at the national level. As such, there are several constraints (and assumptions involved with) surrounding a rational projection of the need for the facilities and its capacity.

The major hazardous waste groups of interest for temporary storage for Antigua and Barbuda were assessed to be a relatively targeted and include:

- Laboratory Chemicals (hazardous) / Chemical wastes (especially reactive and inorganic chemicals, organic solvents arising from laboratories)
- Agricultural pesticide residues and used containers
- Expired pharmaceuticals
- Oils and petroleum Contaminated Wastes - Used oil sludge and filters
- Acids, i.e. from Used Lead Acid Batteries (ULABs)
- WEEE comprising:
    - Plastic (PVC, BFR) housings
    - Lead from CRT monitors
    - Batteries containing Nickel-Cadmium
    - Polybrominated diphenyl ethers (PBDEs)

Hazardous medical waste, infectious waste and pharmaceutical waste (cytotoxic/cytostatic medicines) are not considered for the hazardous waste storage. Especially infectious waste should be treated at source (hospital).

Based on information made available and site visits, an estimation of the current hazardous waste generated and quantities likely to be generated during the period 2020 to 2024, using a growth of 2 % in quantities, was carried out. It is unlikely that the amount generated will all be captured. Furthermore, some other treatment outlets may be found during the period of the construction and operation of a storage facility. Based on international experience and likely percentage capture, it was assumed that in the initial years only 25 % of the hazardous wastes generated will be captured and this will increase incrementally subject to aggressive awareness campaigns and enforcement. It is thus assumed that for 2020 and 2021 the capture rate will be 25 %, whereas in 2022 onwards there will be an annual increase of 5 % to reach a capture of 40 % in 2024.

This assessment considers possible improvement scenarios through the implementation of specific plans. For example, triple rinsing of pesticide containers, promotion of the energy recovery of used oils or plastic containers, collection and export of acid-lead batteries, etc.

Consideration was also given to the potential national capacity for recycling, partial recycling of recovered materials, energy recovery, conditioning for landfill disposal, treatment or final disposal.

As regards the used oil filters, the oil will have to be removed by crushing and recycle metal or dispose to landfill.

Table 4: Summary of storage capacity for hazardous waste

Hazardous waste	Description	Annual amount requiring storage in kilograms (or litres)***				
Year		**2020**	**2021**	**2022**	**2023**	**2024**
Chemical wastes/ pesticides residues in empty containers *	Inorganic wastes, wastes organic solvents (may contain halogenated solvents) - Solutions containing heavy metals	51 00	5 202	6 367	7 577	8 832
Used oil Sludge	Organic solid	86 700	88 434	108 243	129 080	150 144
Acids	Inorganic liquid	45 90	4 681	5 730	6 819	7 948
WEEE **	Inorganic and organic solid components of the e wastes	28 050	28 611	35 020	41 673	4 8579
Total Storage requirements		**124 440**	**126 928**	**155 360**	**185 149**	**215 503**

* it is assumed that 90% is in the solid state

**assuming that the hazardous constituents are only 10 % of the total WEEE generated

***it is assumed that 1 litre is equivalent to 1 kilogram

Table 5: Estimated volume of hazardous solids and liquids that require storage for 2020 to 2024

Description	Amount solids, tonnes	Amount liquids, Cubic metres	Total amount of solids and liquids	Approximate number of 210 litre drums
Wastes collected annually, 2020	119.3	5.1	124.4	593
Wastes collected annually, 2021	121.7	5.2	126.9	605
Wastes collected annually, 2022	148.9	6.4	155.3	740
Wastes collected annually, 2023	177.5	7.6	185.1	882
Wastes collected annually, 2024	207.2	8.8	216	1029

3 Summary and recommendation

Within the GEF project for Caribbean countries to improve waste management practices at their landfills to reduce site contamination by POPs and Unintentional POPs (UPOPs) emissions, Antigua and Barbuda was visited in October 2019.

The existing hazardous waste storage location on Antigua was assessed. The storage, including equipment and general operation aspects, have been compared with the international standards for hazardous waste storage facilities.

It shows that the existing storage does not fulfil the minimum construction and operation criteria regarding health and safety aspects as well as protection of the environment.

In comparison of the size of the existing storage (around 15m²) with the expected hazardous waste quantities for the years between 2020 and 2024 of 215 tons (respectively 1000 storage bins of 200 litre) it becomes obvious that the container is not a sufficient solution for those waste quantities.

Repair, improvement and extension of the existing facility would not achieve sufficient results.

It can be concluded that the current storage conditions are inappropriate and not in accordance to the Best Available Techniques (BAT) reference document on Waste treatment Industrial Emissions Directive 2010/75/EU 2018 (Integrated Pollution Prevention and Control).

Hence it is recommended to construct a new hazardous waste storage facility for Antigua, favourable at the Cooks landfill site because all infrastructure (access road, weighbridge, electricity etc.) are already available there. The landfill is operated or guarded throughout day and night which would increase the safety of a new hazardous waste storage facility significantly. A location was proposed by the NSWMA and RWA Group team during the site visit in October 2019, this location is indicated in Figure 5. Site selection has considered the following criteria:

- Risks to human health and the environment are minimal.
- The proximity to residences and drinking water sources, discarding flood areas is sufficient.
- Easy access, especially for vehicles that have to remove waste.
- Electricity, drinking water and communications services are available.
- Buffer zones are sufficient
- Operational controls to handle noise, odor and dust are feasible.
- Aesthetic needs compatible with the surrounding environment

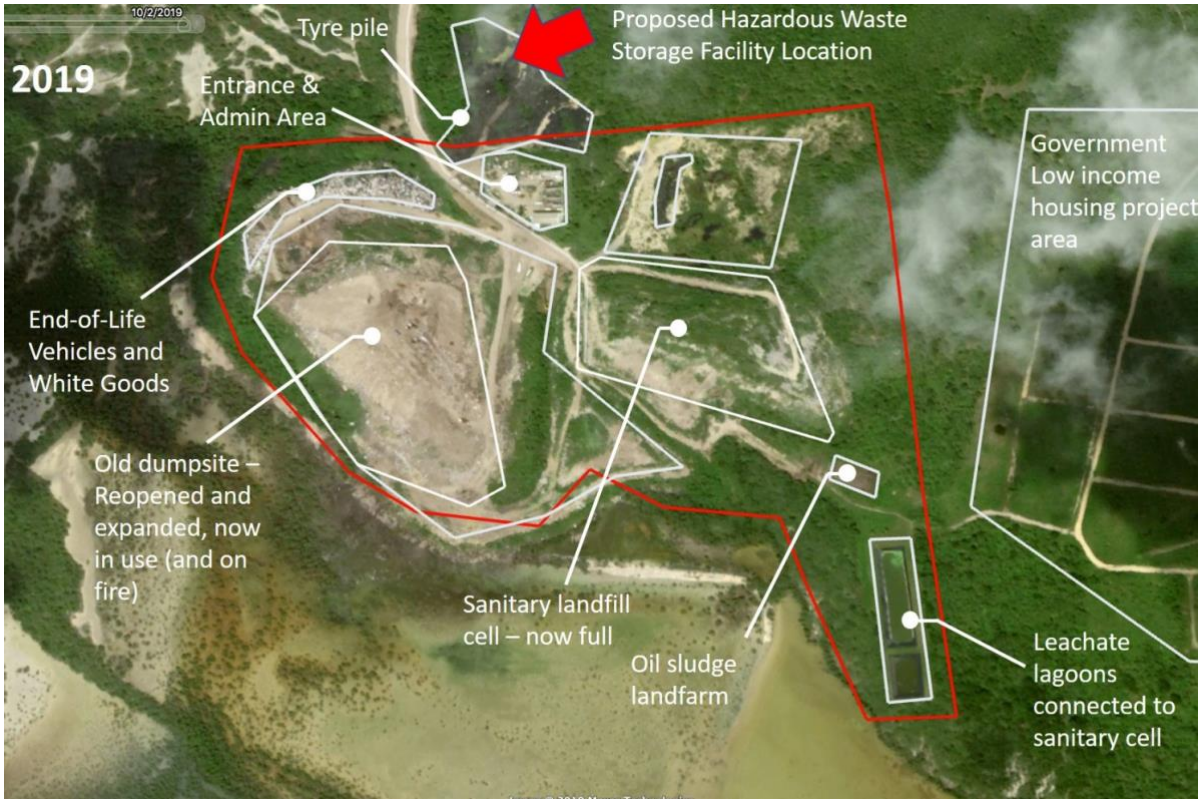

Figure 5: Proposed location of Hazardous Waste Storage Facility in relation to Cooks Landfill site infrastructure

Details of the location and specific design factors for the proposed Hazardous Waste Storage Facility will be further elaborated on in a subsequent report related to Deliverable 9: Design upgrade reports for 3 hazardous waste storage facilities.

Currently Barbuda has no hazardous waste storage and it should be discussed if a minimum solution with container and equipment could be installed in the future as a stand-alone facility or a transfer point to consolidate items for regular transfer to the Antigua facility prior to onward treatment / disposal.

APPENDIX 1: Selection of regulations for hazardous waste storages

The following list is a selection of regulations regarding technical specifications for the design, construction and operation of hazardous waste storages. The list makes no claim to be complete. The regulations are listed in alphabetical order of the publishing country

Country	Title
Worldwide	Basel Convention General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants, Section F - Handling, collection, packaging, labelling, transportation and storage
Australia	National Occupational Health and Safety Commission, Sydney Storage and Handling of Workplace Dangerous Goods NATIONAL CODE OF PRACTICE [NOHSC:2017(2001)] March 2001
Australia	Western Australian Waste Management Board Collection and Storage Facilities for Household Chemical Waste at Landfills and Solid Waste Depots - **Draft Design Guidelines -** SEPTEMBER 2006
Australia	Government of Western Australia, Department of Environment Regulation Guidelines for the design and operation of facilities for the acceptance and storage of household hazardous waste 2013
European Union	Council Directive 75/442/EEC of 15 July 1975 on waste (Waste Framework Directive);
European Union	Council Directive 91/689/EEC of 12 December 1991 on hazardous waste (Hazardous Waste Directive);
European Union	Council Directive 94/31/EC of 27 June 1994 amending Directive 91/689/EEC on hazardous waste;
European Union	List of Waste consolidated by the Commission from the Hazardous Waste Directive in Decision 200/532/EC
Belize	Hazardous Waste Regulations, 2009 Arrangement of regulations
Malaysia	Guidelines for Packaging, Labelling and Storage of Scheduled Wastes in Malaysia
United States of America	Environmental Protection Agency EPA Introduction to Containment Buildings (40 CFR Parts 264/265, Subpart DD) September 2005
United States of America	Unified Facilities Criteria (UFC) 16. January 2004 Design: Hazardous Waste Storage - **INACTIVE -**
South Africa	Ministry of Water and Environment, Department of Environmental Affairs 29.11.2013 National Environmental Agreement; Waste Act, 2008 National Norms and Standards for the Storage of Waste

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