



## Annex D

### Waste Management Plan

**ENGINEERING, PREPARATION, DECOMMISSIONING AND  
RECYCLE OF FLUMINENSE FPSO**

**For**

**the BIJUPIRA AND SALEMA (BJSA) DECOMMISSIONING Project**

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## VERSION CONTROL

Summary of revisions between this version and previous versions

Rev.	Date	Section	Description
02	28.06.2023		Document updated based on received comments from Company. Updates in sections: 2.1; 7.2; 7.3; 8; 10.4 and appendix 3. Section 10 removed.
01	09.06.2023		Issue for information
B	07.06.2023		<p>Issue for internal review.</p> <p>The following sections has been updated/changed/ added since tendering phase:</p> <p>Section 3.2: EWC codes updated.</p> <p>Section 4: Updated to include both hazardous and non-hazardous waste.</p> <p>Section 4.2: New section added to describe removal of all expected waste from Fluminense.</p> <p>Section 7: New section added to describe treatment of expected waste from Fluminense.</p> <p>Section 8: Waste flows added.</p> <p>Section 11: Environmental aspects added</p>
A	05.12.2022		Issue for tendering phase

## DOCUMENT HOLDS

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## References

- /1/ BJS-MAR-000-PM-PLN-0001 Inventory Hazardous Materials Prior to Recycling
- /2/ BJS-MAR-000-MA-PLN-0001 Biofouling Removal and Disposal Plan
- /3/ BJS-MAR-000-PM-PLN-0006 Ship Recycling Plan
- /4/ BJS-MAR-000-PM-PLN-0003 HSSE Management Plan

## Abbreviations

ADR	International convention carriage of dangerous goods and dangerous goods by road
AFFF	Aqueous Film Forming Foam
BAT	Best Available Technique
Company	SHELL BRASIL PETRÓLEO LTDA.
Contractor	Modern American Recycling Services Europe A/S
COT	Crude Oil Tank
DEPA	Danish Environmental Protection Agency
EHS	Environment, Health, and Safety
EWG	European Waste Codes
Fluminense FPSO	Vessel
FPSO	Floating, Production, Storage and Offloading
HAZMAT	Hazardous Materials
IHM	Inventory Hazardous Material Report
ISPS	International Ship and Port Facility Security Code
MARS	Contractor
NORM	Naturally Occurring Radioactive Material
Subcontractor	Contractor of Contractor
SRP	Ship Recycling Plan
UHP	Ultra-High Pressure
Vessel	Fluminense FPSO

# 1 Introduction

The Waste Management Plan is integrated part of Ship Recycling Plan documentation and should be read together with the Ship Recycling Plan ref. /3/, Biofouling Removal and Disposal Plan ref. /2/, and the HSSE Management Plan ref. /4/.

This Waste Management Plan follows the EU Waste Framework Directive (Directive 2008/98/EC) and are made to ensure that all waste is managed without endangering human health and harming the environment. The Waste Management Plan is in conjunction with the Contractor Environmental and Waste Management Policy, which aim to employ the 3 R's of Environmental Management:

## Reuse

- Reuse engines, storage tanks and other merchantable items.
- Reuse containers, boxes, and packaging materials.
- Reuse printed paper for drafts, sketches, and rough copies.

## Reduce

- Manage water & electric power economically.
- Reduce water consumption by using storm water for dust prevention.
- Reduce the use of disposable cups and dinnerware.
- Give preference to mugs and washable cups.

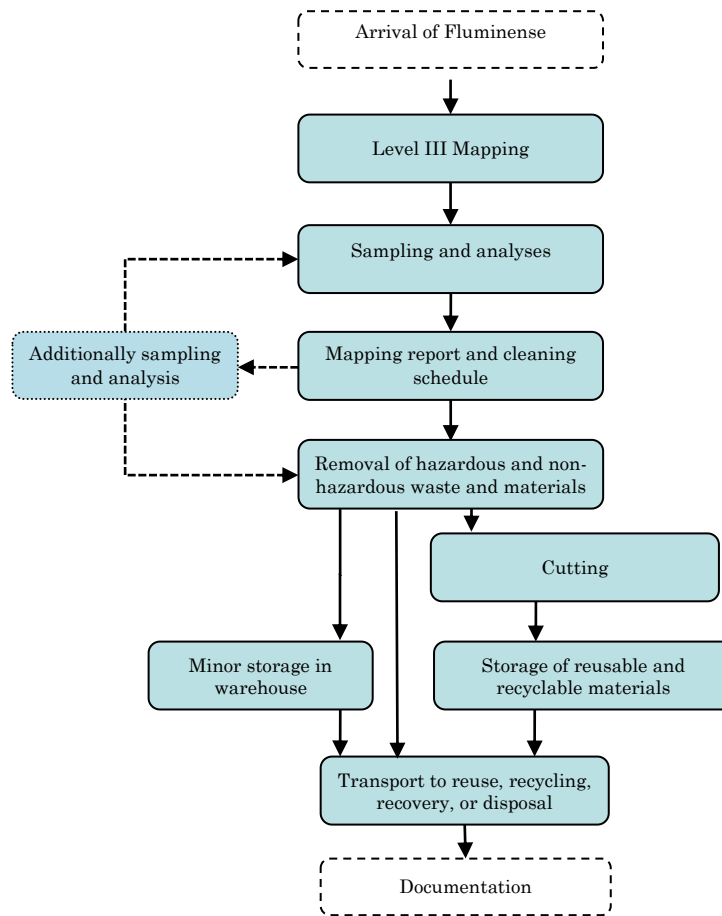
## Recycle

- Use recycled product where possible.
- Recycle metals, plastic, paper, and other material.

All waste removed from the Fluminense FPSO will be classified in accordance with the European Waste List.

This Waste Management Plan applies to all Contractor employees and Subcontractors, who must familiarize themselves with the plan.

## 2 Process Overview



The waste and material management process are considered in all Contractor's processes.

In the tendering processes, Contractor have assessed the need for supplementary activities for handling of expected waste. It has been concluded that Contractor is approved to handle all expected waste, and do not need any update on environmental approval.

If any waste is discovered during recycling that is not covered by the environmental approval the competent authorities will be immediately contacted.

### 2.1 Waste handling Subcontractors

Subcontractor Name	Address	Scope
Semco Maritime A/S	Staget 1, P/O. Box 3029 6700 Esbjerg, Denmark	on-site testing and collection of hazardous materials. Remediation and cleaning service.
Marius Pedersen A/S	Korinthvej 103 9220 Aalborg, Denmark	transportation and disposal of non-hazardous and hazardous materials.

## 2.2 Level III mapping

Contractor and waste Subcontractor will conduct a walkthrough of the FPSO and make a pre-operation hazard assessment. A level III mapping of hazardous materials present on the Vessel will be prepared or updated, and this report, along with the SRP ref. /3/, will follow the Vessel throughout the decommissioning and set a basis for work planning and performance. Refer also to Appendix 2: Mapping Protocols.

## 2.3 Sampling and analysis

If any uncertainties about the classification of waste and hazardous materials occur during the decommission process, Contractor may carry out additionally sampling and analysis.

The results of additional sampling and analysis will be used for classification of the waste and materials in relation to work planning, decommission methods as well as treatment (including final disposal) of waste fractions.

All sampling and analysis will be documented and carried out according to applicable law, Danish Executive Order No. 2512, Annex. Accredited laboratory SGS is used.

The sampling strategy for identifying hazardous waste is divided into five steps:

1. Desk top inspection of the inventory of hazardous materials (IHM) report.
2. Based on the desk top inspection a plan for analysing the hazardous waste on the FPSO is prepared.
3. Walk-through and pre-mapping of FPSO.
4. Assessment: what can be analysed directly on the FPSO by hazmat experts? What needs to be analysed in a laboratory?
5. Analysing.

Contractor is currently using subcontractors Semco Maritime A/S and Marius Pedersen as hazmat experts, along with internal EHS Team.

## 3 Work Planning

Risk assessments and job safety analysis will be conducted before any cleaning or removal of hazardous materials or waste to ensure that all possible risks are reduced and safely handled.

- Specific task description - Involved employees will help minimize oversights, ensure a quality analysis, and get workers to participate in developing and implementing the solutions. This will make the employees share ownership in their safety and health program.
- Hazard control - After reviewing list of hazards with the employees, consideration will be given to what control methods will eliminate or reduce them. The most effective controls are engineering controls that physically change a machine or work environment to prevent employee exposure to the hazard. If this is not feasible, administrative controls may be appropriate.

Contractor regularly performs hazard assessments as it is the best way to review the hazards in the workplace and protect employees from those potential hazards. Hazards change as processes change. Therefore, a hazard assessment of our facility is

performed at the beginning of every job task, and shift. Description of handling of specified hazardous materials is attached in Appendices.

### 3.1 Operations and processes

The following operations and processes will be taken into consideration when planning the work:

- Work permits:
  - o Confined and enclosed spaces.
  - o Hot work.
  - o Working at height.
  - o Competent persons.
  - o Lock Out / Tag Out.
- Atmosphere checks and preparation.

### 3.2 Expected waste quantities

Based on a thorough review of IHM report ref. /1/ and experience from previous projects, the following waste are expected to be found on the FPSO.

EWC Code	Description	QTY	UOM	Est. kg
02 01 99	Marine growth and biofouling	100	tons	100000
13 04 02*	Waste Oil (sludge) from tank	17	m3	13600
17 06 03*	Polyurethane foam, Insulation	2	tons	2000
13 02 08*	Lubricating oil	89	m3	62300
13 04 03*	Bilge oil	178	m3	142400
16 02 11*	Hydrofluorocarbon (HFCs)	500	kg	500
16 05 07*	AFFF Foam	10000	liter	10000
16 05 04*	Fire extinguishers	163	pcs	326
16 06 01*	Lead batteries	141	pcs	1410
16 06 05*	Lithium batteries	398	pcs	3980
17 09 04	Furniture	70	tons	70000
17 06 05*	Materials containing asbestos	126.035	tons	126035
20 01 01	Paper	400	kg	400
16 01 08*	Thermometers containing mercury	50	pcs	150
20 01 35*	Smoke detectors	210	pcs	210
20 01 36	Aggregate - Electrical equipment and cables	7	ton	7000
17 04 07	Ship steel, machinery steel and copper	52636.866	ton	52636866
16 05 04*	CO2 Cylinders	36	pcs	72
15 01 10*	FM200 – Fire Suppression System	8	pcs	16
16 04 02*	Fire Signals	23	pcs	35
	NORM	50	ton	50000
<b>TOTAL WEIGHT (Kg.)</b>				<b>53272300</b>

## 4 Removal of waste and materials

The removal and cleaning of non-hazardous and hazardous waste and materials, including tank and pipe flushing/cleaning, will be performed by skilled and experienced workers with the necessary training and certificates. All removal and cleaning will be carried out according to applicable laws.

All hazardous waste removed from the FPSO will be delivered to the onsite waste warehouse, under the direction of HSE Management. Refer to Appendix 1: Waste warehouse plan, for overview of the onsite waste warehouse.

As soon as there is any hazardous waste from decommissioning/cleaning it will be packed according to ADR regulations before it is removed from the sealed area. Everything will be safely packed so that it is ready to be transported on the roads outside the area. Some fractions will be transported directly to final disposal. Some fractions will be stored temporarily in a warehouse or secure location at the facility.

### 4.1 Identification

All identified hazardous waste and materials identified during the Level III Mapping will be recorded by location, type, and amount. Physical locations on the FPSO will be identified by already installed labelling or signage, which will be annotated by the inspector's permanent mark alongside the label, or by permanent labelling by the inspector at the location.

The EHS manager or team leader will inform the workers during the Toolbox Talk about the hazards of the material being used.

### 4.2 Removal of waste from FPSO

All waste that is removed from the FPSO while it is moored along the quay will be lifted off in closed containers to ensure no spill into the harbour.

Hazardous and non-hazardous waste will be removed from the structure in the following ways:

1. Marine growth and biofouling

Will be removed from the hull once the FPSO has been pulled to the ship ramp in closed area with drainage system. Refer to /2/ for detailed description.

2. Oils and contaminated water

In tanks: The oil is sucked up from the tank using vacuum pumps and transferred to approved ISO tanks. The ISO tanks are lifted off the FPSO and transferred to the onsite waste warehouse.

In utility system: the liquid is drained from the system and stored in approved ISO tanks. The ISO tanks are lifted off the FPSO and transferred to the onsite waste warehouse. Refer to Appendix 7 for Contractor draining procedure.

3. Hydrofluorocarbon (HFCs)

Certified subcontractor evacuates liquid into pressure bottles/containers and delivers to waste warehouse-

4. AFFF Foam

AFFF tank: piping is disconnected, and tank removed directly from installation as a whole unit, and the unit itself (containing AFFF) is shipped for final treatment.

All piping contaminated with AFFF is drained and piping removed and stored in closed containers and transported to waste warehouse.

5. Fire extinguishers, Lead batteries, Lithium batteries, Thermometers containing mercury, Smoke detectors, CO2 Cylinders, FM200 – Fire Suppression System, and Fire Signals

Will be collected onboard the FPSO by the Hazmat Supervisor and packed for secure transportation of waste from the FPSO to the onsite waste warehouse where it will be further prepared for treatment.

6. Furniture, Paper, Electrical equipment, Polyurethane foam, Insulation and cables

Will be collected during the initial stripping phase. Containers for proper segregation of non-hazardous waste will be lifted onboard the FPSO, where the non-hazardous waste will be directly segregated.

Cables are transported to the process field, where copper from cables is removed and packed separately.

Containers with non-hazardous waste are lifted off the FPSO continuously during the stripping process and collected by waste handling subcontractor, Marius Pedersen A/S, for final treatment.

7. Materials containing asbestos.

Insulation: Before asbestos removal can begin, the work area must be sealed off to prevent contamination of the surrounding areas. All cracks, joints, holes etc. in or around windows, doors and in masonry must be sealed. Holes or openings on ducts must be sealed with duct tape or polythene film. Removal work is completed by qualified workers and the insulation is packed in sealed special bags.

Cord, packing and jointing: The equipment/material is removed from the FPSO and transported to closed approved asbestos workshop on ground level. The equipment/material is then dismantled, and the asbestos removed by qualified workers.

Refer to Appendix 5 for Contractor asbestos procedure.

8. Steel, sandwich plates, cables (included in larger removed modules)

Sections are continuously removed from the FPSO during the demolition phase and transported to the process field, where it is cut into smaller pieces and segregated:

- i. Steel/iron
- ii. Sandwich plates
- iii. Aluminum
- iv. Cables
- v. Copper
- vi. Stainless steel

Employees will be instructed on the proper removal and disposal method for materials and waste. This will include general instructions on disposal of non-hazardous waste, trash, or scrap materials. If wastes and materials generated are classified as hazardous, employees will be trained to ensure proper removal. All handling of hazardous waste and materials will be handled on closed and sealed areas with a slope towards drainage systems with shut-off valves.

Requirements:

- Ensure the proper labels are attached, visible, and legible on any container of non-hazardous and hazardous material or waste.
- Use approved packaging material compatible for the waste. Tops of containers and funnels must remain free of debris, trash, and equipment at all times.
- Containers must remain closed (funnel lids down, bungs closed, boxes secured, etc.) at all times.
- Containers must be grounded and bonded if contents are flammable or combustible.
- Excess material spilled on top of the containers must be removed with absorbent material and properly disposed.
- Spills must be reported to the Site Manager and EHS Department.
- Spills resulting from leaking or damaged containers must be reported to the Site Manager and EHS Department.
- Notify the Site Manager immediately of any hazardous waste or trash needing disposal.

#### 4.3 NORM and Mercury in process equipment

NORM & Mercury in process equipment are removed using UHP water jet system. The piping will be flushed with the water jetting system and the water is filtrated using a filtration system with 100 and 150-micron filter bags which will ensure separate the liquid and the solid phase. The water is filtrated continuously until readings are as low as possible. These filter bags and the contaminated water will be packed and stored according to the NORM approval, safely handled, and transported to correct handling of hazardous waste.

Refer also to Appendices 3, 4 and 6 for Contractor procedures.

Removal operations for NORM (and possibly mercury) expected to concern;

- Flotation
- Hydro-cyclone
- Heat exchangers
- IP Separator

- Basket Strainer from crude oil line
- Electrostatic treaters
- Inlet heaters
- Separators
- Pig launcher/receiver
- Production Lines (Turret)
- Production Lines (Deck)
- COTs

#### 4.4 Hazardous waste security

The whole facility is ISPS compliant, and only authorized persons are allowed entry. The entrance is controlled.

Hazardous wastes and materials will be stored in a secured warehouses or approved location on site.

NORM or other radioactive material suspected contaminated material is stored in designated and secured locations to prevent personnel exposure and contamination spread.

All working areas will be maintained in a neat and orderly manner. Solid wastes, such as food, wrappings material, dunnage, scrap metal, cigarette butts and packets, Styrofoam cups and plates, and similar wastes will be disposed of in the designated waste receptacle. Any spills or leaks will be cleaned up as expeditiously as possible. Trash will be routinely collected for off-site disposal. Container storage areas will be maintained in a neat and orderly manner.

## 5 Storage

The different waste fractions will get their own designated, well-marked area. The signs set up ensure acids and bases are divided, there will be no mixing of different waste fractions (both liquid and solids) and safe handling when stored and picked up for transportation. All hazardous waste will be temporary stored in the warehouse.

Materials for recycling either waste or metals, woods etc. will be handled according to waste plan and environmental approval.

Recyclable materials are sub-fractioned and stored on hinterland areas until collection and transportation can take place.

Containers holding hazardous waste will be:

- in good condition and not leaking,
- sealed,
- properly handled so as to avoid release of the contents,
- clearly labeled "Hazardous Waste", with the Accumulation Start Date,
- kept clean and free of debris.

The Container Storage Area will:

- be inspected and logged at least weekly to look for leaking containers and for deterioration of containers and the containment system,
- containers must be stored with the identification labels visible,

- be kept clean and in good repair,
- shall be kept free of spilled waste and/or precipitation.

## 6 Transportation

Transport of hazardous waste will be done according to ADR regulations.

Only authorized transporters and facilities are used.

Table 1 Transport requirements

<i>Minimum Requirements</i>	
1	Employees shall not offer for shipment packages containing hazardous materials until they receive applicable training and ensure that the package complies with regulations.
2	Hazardous materials shall be packed to prevent spillage, leaks, or escape of product into the environment.
3	Items for shipment shall be properly identified, marked, and labeled in such a manner that any person handling these materials will be readily aware of the nature of the contents and hazards that may be present.
4	Shipping papers are required for every hazmat shipment, for all modes of transportation, unless specifically exempted by the Hazardous Material Regulations.

## 7 Treatment of waste

### 7.1 Waste hierarchy

During dismantling, the waste will be classified with the lowest possible waste code. Contractor embraces the life-cycle approach and prioritizes the waste, using the waste hierarchy.



Figure 1 Waste hierarchy

The decision on the final disposal solution will be based on a Best Available Technique (BAT) evaluation. The decision on treatment methods is made in closed collaboration with waste subcontractors.

## 7.2 Expected treatment methods

Based on a thorough review of IHM report ref. /1/ and experience from previous projects, the waste fractions removed from Fluminense FPSO is expected to be treated in the following way:

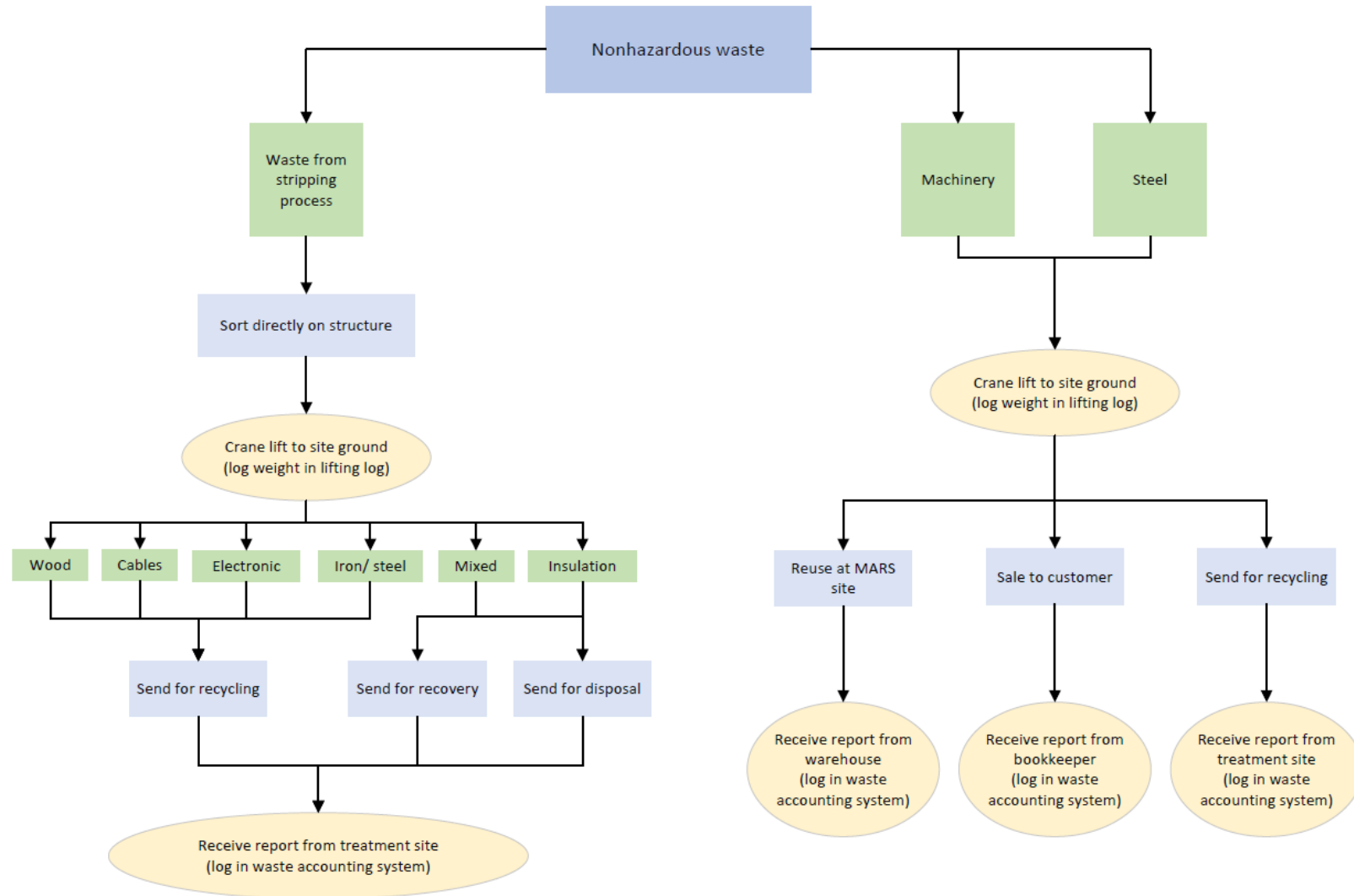
Table 2 Treatment methods

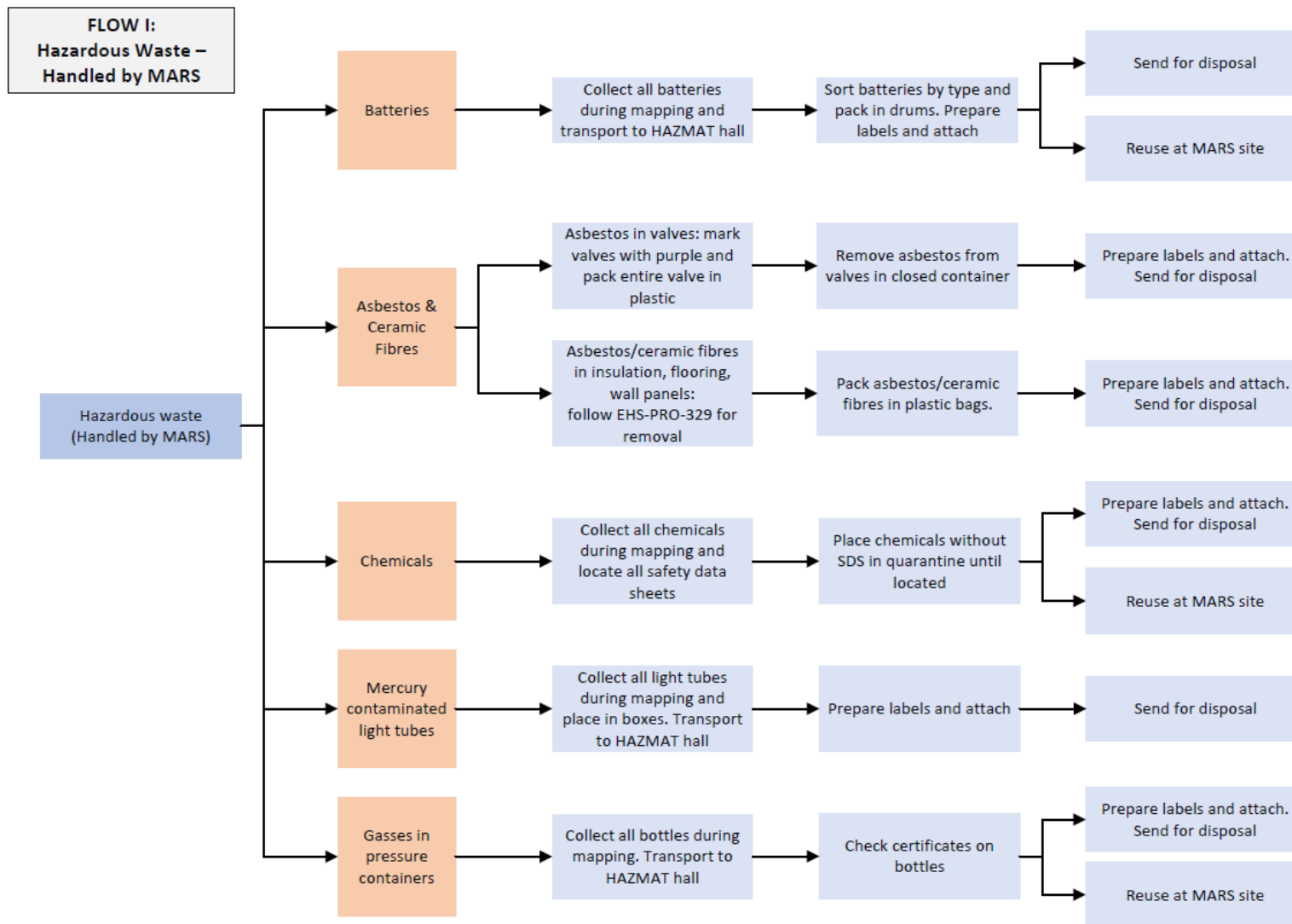
<b>EWC Code</b>	<b>Description</b>	<b>Treatment Method</b>	<b>Waste Flow reference</b>
02 01 99	Marine growth and biofouling	Deposit into or onto land, e.g. landfill	(Refer to BJSA-MAR-000-MA-PLN-0001)
13 04 02*	Waste Oil (sludge) from tank	Oil re-refining	Page #21 + #22
17 06 03*	Polyurethane foam, Insulation	Deposit into or onto land, e.g. landfill	Page #20
13 02 08*	Lubricating oil	Oil re-refining	Page #21 + #22
13 04 03*	Bilge oil	Oil re-refining	Page #21 + #22
16 02 11*	Hydrofluorocarbon (HFCs)	Incineration	Page #20
16 05 07*	AFFF Foam	Incineration	Page #21
16 05 04*	Fire extinguishers	Reclamation/regeneration, or Incineration	Page #20
16 06 01*	Lead batteries	Recycling/reclamation	Page #20
16 06 05*	Lithium batteries	Recycling/reclamation	Page #20
17 09 04	Furniture	Incineration	Page #19
17 06 05*	Materials containing asbestos	Deposit into or onto land, e.g. landfill	Page #20
20 01 01	Paper	Recycling/reclamation	Page #19
16 01 08*	Thermometers containing mercury	Incineration	Page #20
20 01 35*	Smoke detectors	Recovery	Page #20
20 01 36	Aggregate - Electrical equipment and cables	Recycling/reclamation	Page #19
17 04 07	Ship steel, machinery steel and copper	Recycling/reclamation	Page #19
16 05 04*	CO2 Cylinders	Reclamation/regeneration, or Incineration	Page #20
15 01 10*	FM200 – Fire Suppression System	Reclamation/regeneration, or Incineration	Page #20
16 04 02*	Fire Signals	Reclamation/regeneration, or Incineration	Page #20

## 7.3 NORM

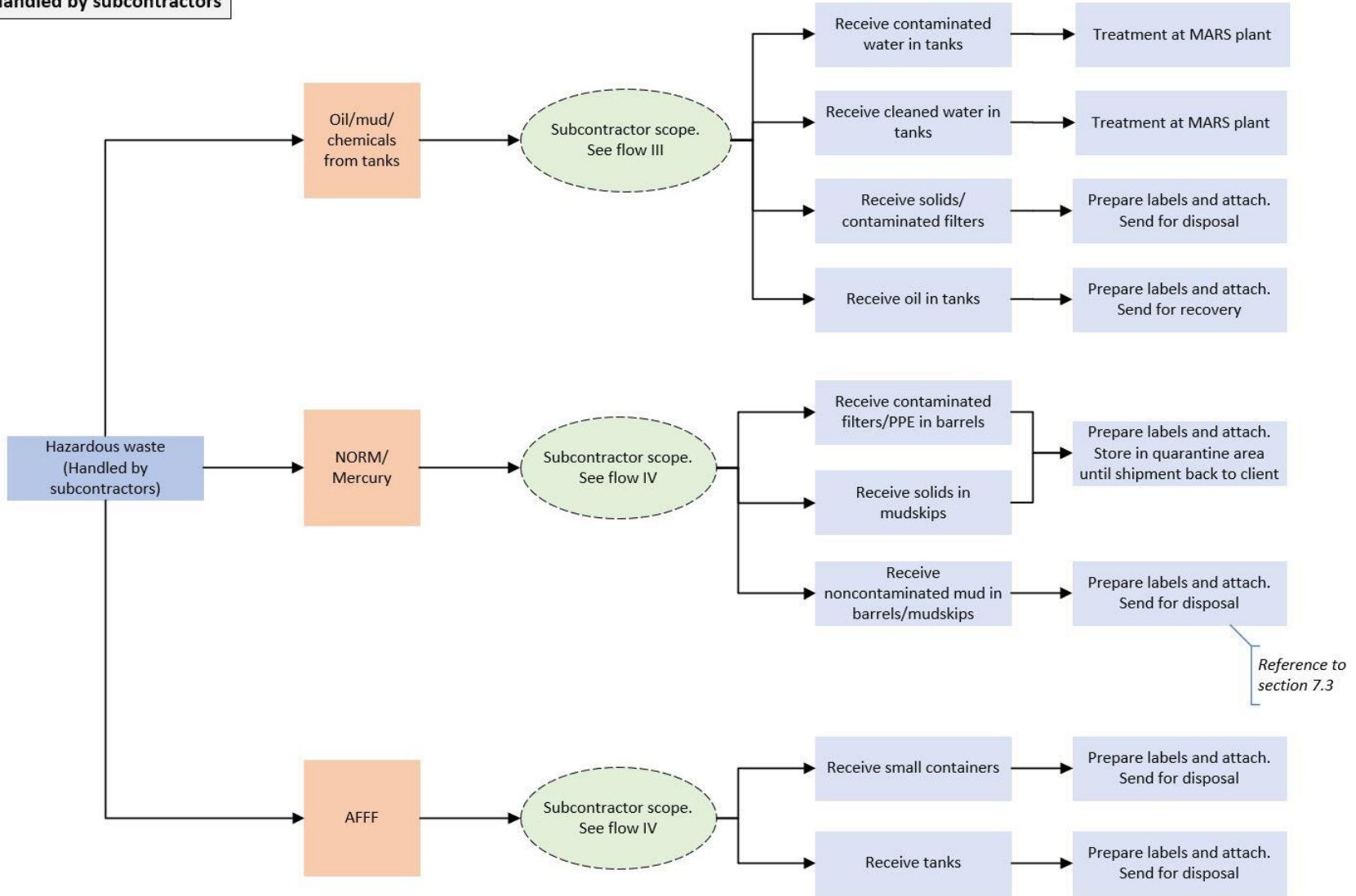
Any NORM contaminated materials and NORM scale will be packed in drums and containers, and prepared for shipment back to owner who is responsible for the treatment. The NORM waste will be shipped to a destination in USA defined by Company. Reference to Appendix 3 – NORM Procedure.

## 8 Waste flow diagrams

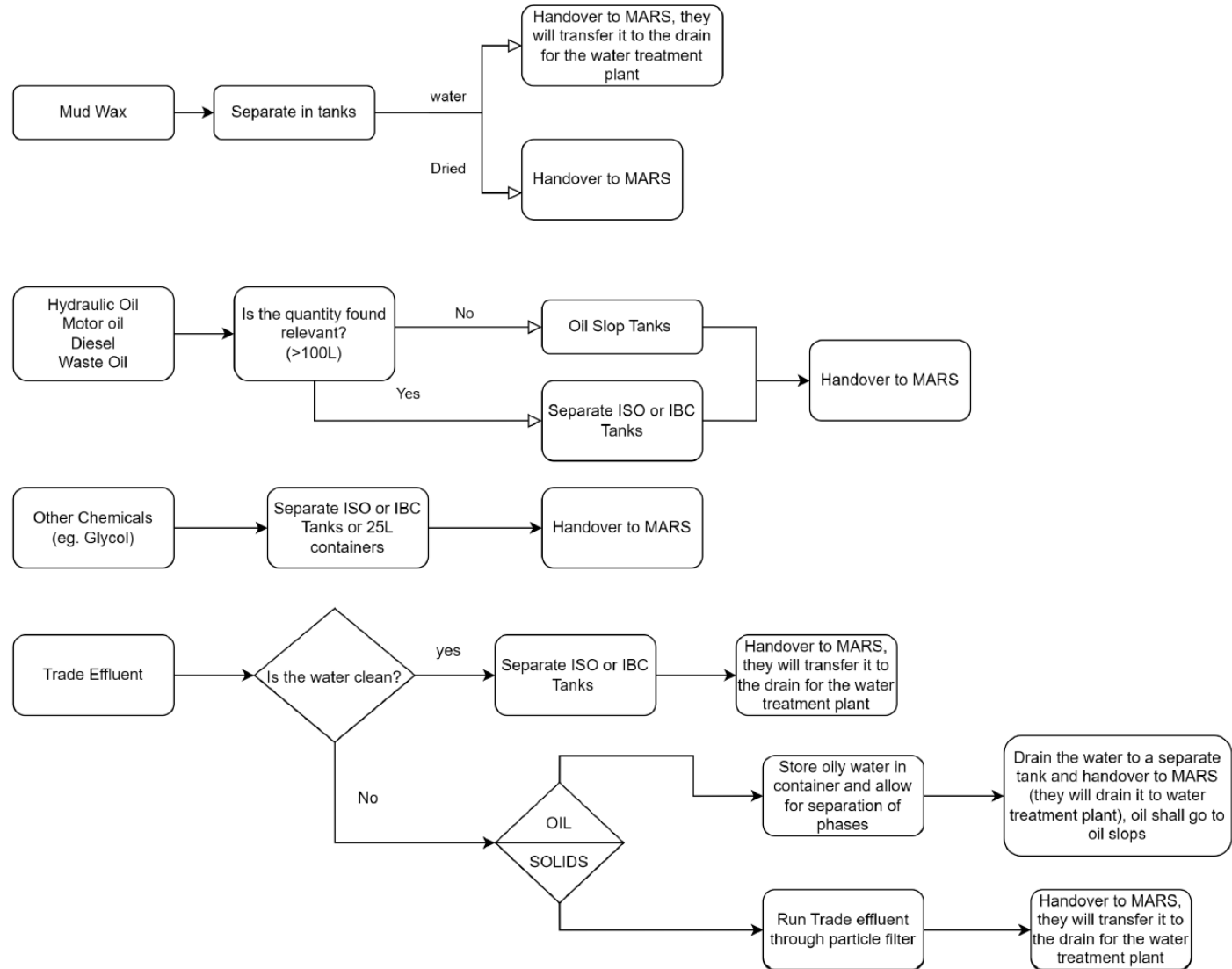


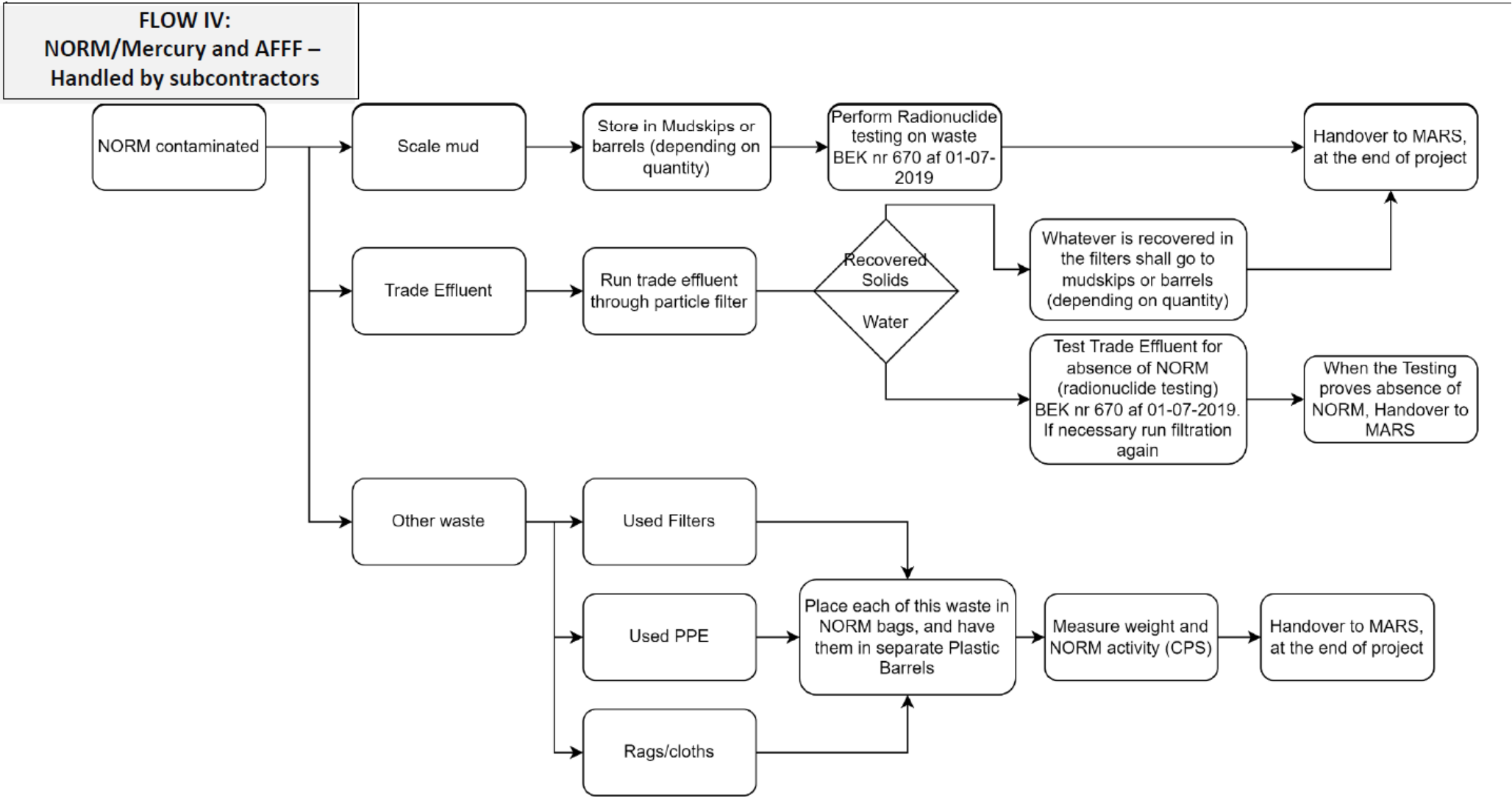


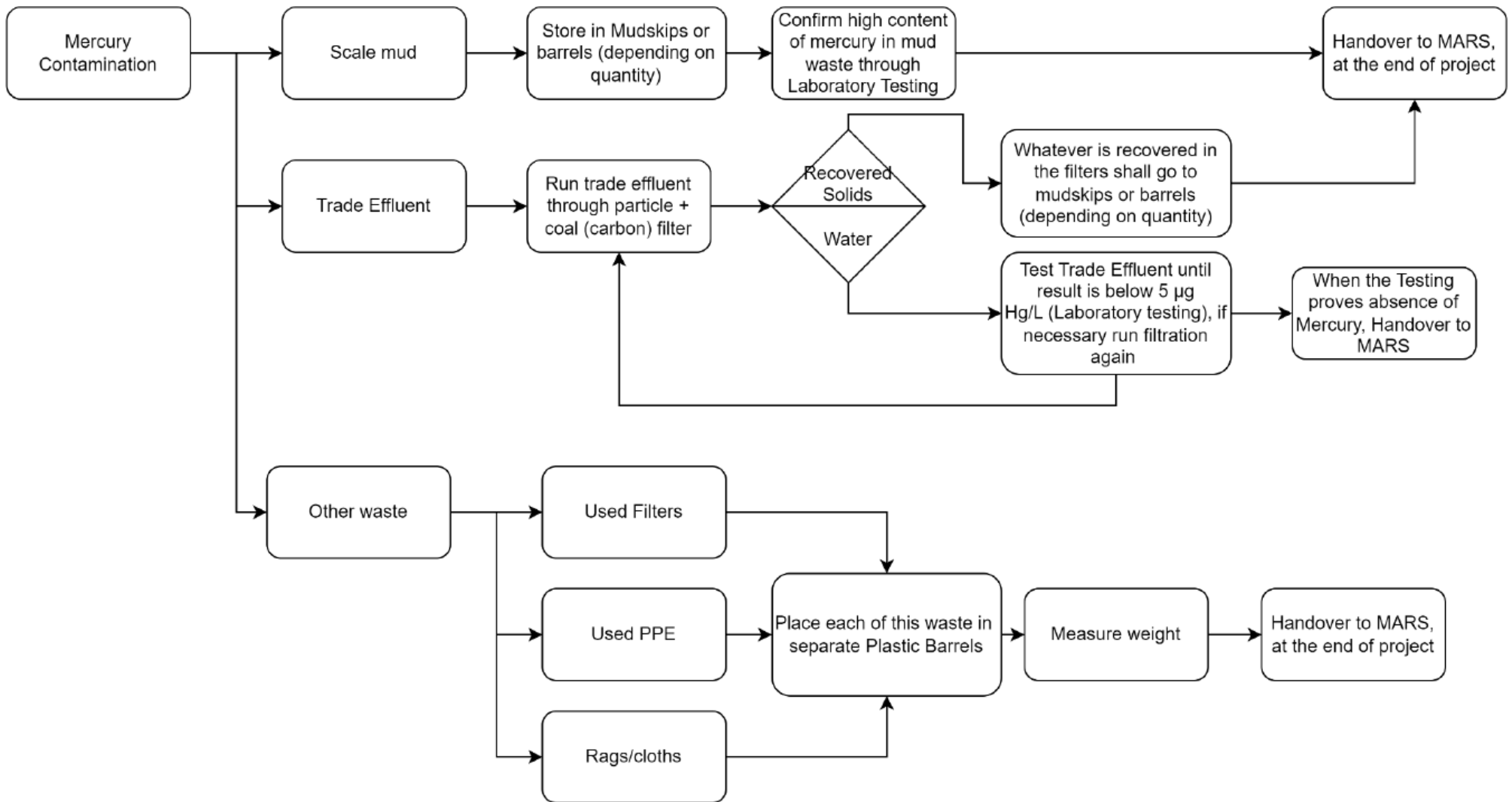
**FLOW II:  
Hazardous Waste –  
Handled by subcontractors**



**FLOW III:  
Oil/mud/chemicals from tanks –  
Handled by subcontractors**







## 9 Accounting and Reporting

The following data is logged in the waste accounting system (Refer to Appendix 8 for screenshots of data entry to waste accounting system):

1. Estimated incoming materials, divided by:
  - a. Structural material including cables
  - b. Hazardous materials
  - c. Non-hazardous materials
  - d. Sale
2. Outgoing: structural materials including cables
3. Outgoing: hazardous waste, divided by:
  - a. Disposal
  - b. Recycling
  - c. Recovery
  - d. Reuse
4. Outgoing: non-hazardous waste, divided by:
  - a. Disposal
  - b. Recycling
  - c. Recovery
  - d. Reuse
5. Outgoing: Resale

The weights, EWC codes, treatment method, and final treatment site is extracted from reports received from waste handling subcontractors on a monthly basis. The data from received reports are continuously checked against data from internal logs, e.g., crane lifting log, logs from weigh bridge, and prepared ADR waybills.

A report is automatically created when data is entered into the system showing the total amounts of waste and the recycling percentage.

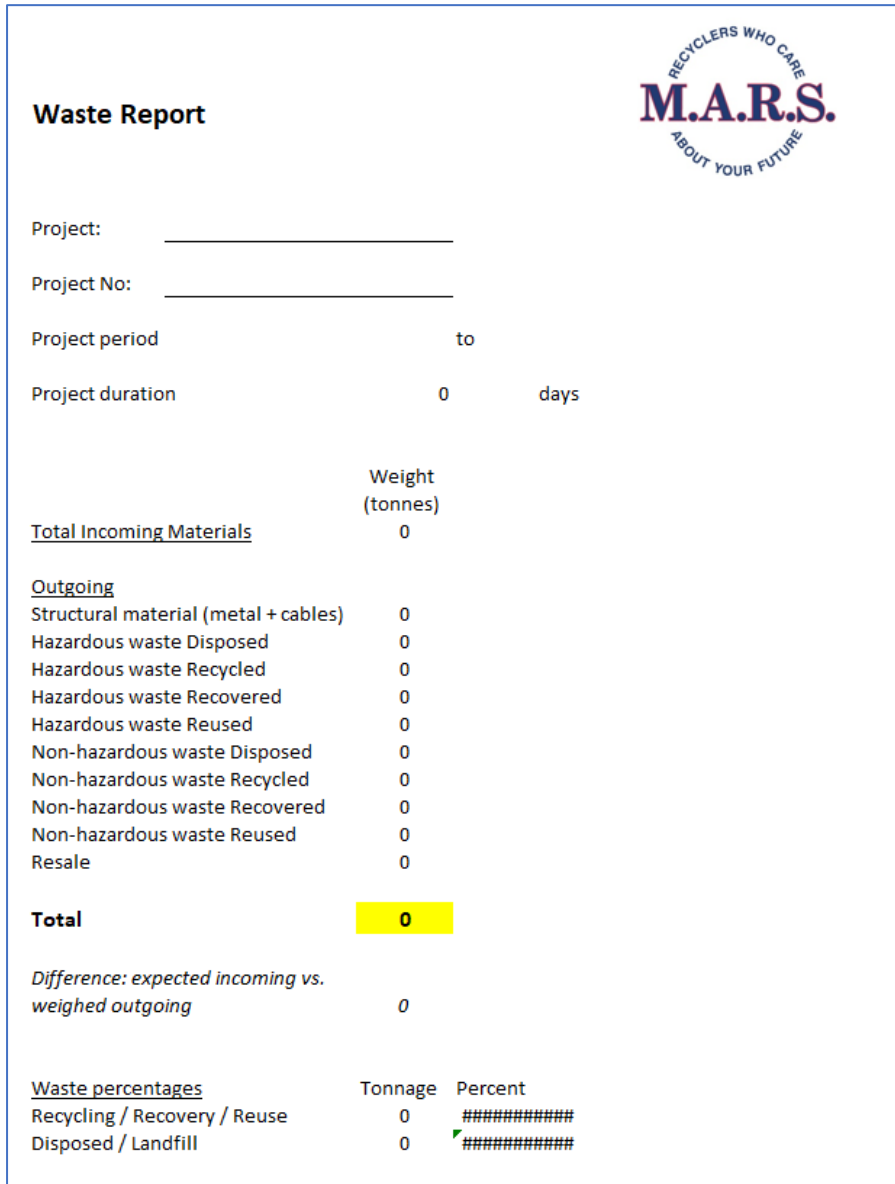


Figure 2 Waste accounting report

## 10 Environmental Aspects

### 10.1 Membrane and drainage system

The Contractor site was established in 2018 and was purpose-built for ship recycling. Therefore, layers of membrane were established below a surface of gravel layer and a drainage system of piping were installed above the membrane, which allows surface water and possible spills to percolate through the surface and bottom layers and led to onsite water treatment plant. The surface water is led through sand-traps and oil separators to the main pump well and from here to the water treatment facility. The entire area is therefore a closed/fortified area to ensure no risk of environmental spill into the harbor and/or ground water. Further, the ship ramp is built with a drainage/sewer system to allow for collection of material, e.g., biofouling. Coating that is scraped off during hauling on ramp is collected and led to direct disposal. A contamination boom will be installed around the ship.

Image 1 Membrane layer below gravel layer



Image 2 Onsite water treatment facility

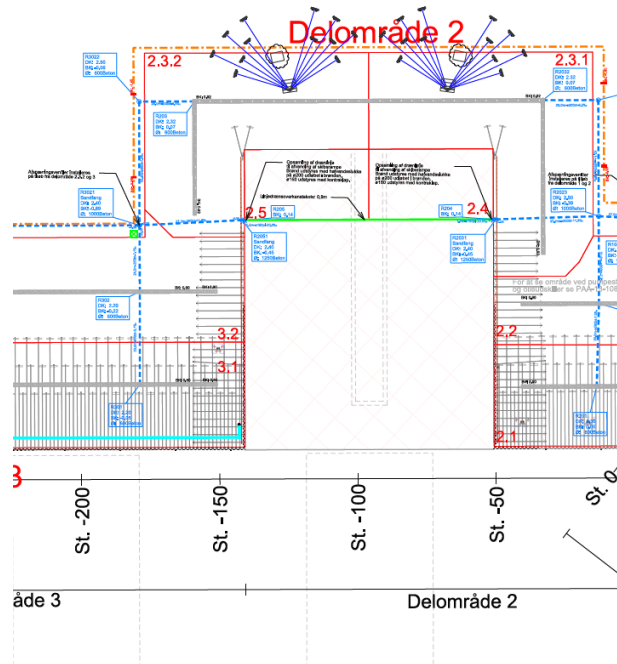


Figure 3 Ship Ramp with drainage system

## 10.2 Air Pollution

To ensure no dust nuisance outside the site area, the site is continuously sprinkled with water during dry periods. To minimize the amount of air pollution from process field, mobile shear cutting is performed, when possible, instead of flame cutting. Measurements of the air is taken 3-4 times a year, to conclude the quality of the air and determine the level of exposure to dust, fumes and heavy metals.

## 10.3 Noise

The operation on the Contractor site must not exceed the noise levels in neighbouring areas as listed below. The Contractor site is listed as an area type I – Industrial area.

	Time	Reference period (hours)	Area Types				
			I dB(A)	II dB(A)	III dB(A)	IV dB(A)	V dB(A)
Monday-Friday	07-18	8	70	60	55	50	45
Saturday	07-14	7	70	60	55	50	45
Saturday	14-18	4	70	60	45	45	40
Sundays and holidays	07-18	8	70	60	45	45	40
All days	18-22	1	70	60	45	45	40
All days	22-07	0,5	70	60	40	40	35
Peak value	22-07	-	-	-	55	55	50

Figure 4 Noise limits

Upon requirement from the supervisory authority, Contractor must perform measurement and calculations to document that the limit values in Table 1 are respected.

#### 10.4 Waste

Contractor may only receive and store the waste fractions listed in the table below. Waste fractions must not exceed the specified quantities. Alterations to the table can be accepted following written consent from the supervisory authority.

Table 3 Approved waste fractions

Type of waste		Quantity/year (tons)	Max. quantity on storage (tons)	Exp. amounts from Fluminense (tons)
<b>Hazardous Waste</b>				
Drilling muds and other drilling waste	Drilling muds and drilling waste containing oil	200	50	N/A
	Waste drilling muds and drilling waste containing oil	200	30	N/A
	Drilling muds and other water-based drilling waste containing dangerous substances	200	50	N/A
	Drilling muds and other water-based drilling waste containing hazardous substances	120	30	N/A
Waste oil	Hydrocarbons, fats and oils	500	50	N/A
	Hydrocarbons, oil residues (slop oil)	2000		13.6 (Sludge) 142.4 (Bilge)
Contaminated coatings	NORM	100	50	50
Chemicals	Discarded organic chemicals consisting of	50	30	N/A

Type of waste		Quantity/ year (tons)	Max. quantity on storage (tons)	Exp. amounts from Fluminense (tons)
	or containing hazardous substances			
Process Chemicals - Waste organic solvents, refrigerants and foam/ aerosol propellants	Methanol	10	2	N/A
	Solvents	10	2	N/A
	Rust inhibitors	10	2	N/A
	H2S removal	10	2	N/A
	Coating inhibitors	10	2	N/A
	CIP acid	10	2	N/A
	Glycol, TEG	50	50	N/A
	Other discarded chemicals	10	2	0.072 (CO2 foam) 0.326 (Fire extinguishers)
	Aqueous film forming foam (AFFF)	50	10	10
Oils and fuels	Waste oil, hydraulic oil, reusable	300	50	N/A
	Oil emulsions	10	10	N/A
	Wastes consisting of, containing or contaminated with heavy fuel or condensate	50	10	N/A
	Oil waste, not reusable	50	10	N/A
	Waste oils and lubricating oils, reusable	500	50	62.3
	Oil and fat waste	10	10	N/A
	Oil contaminated waste	50	10	N/A
	Fuel oil and diesel oil	800	150	N/A
Radioactive sources	Smoke detectors	1	1	0.21
Hazardous fibres	Asbestos	400	50	126.035
Building materials containing dangerous substances	Phthalates	200	10	N/A
	Chlorinated paraffin	50	10	N/A
	pFOS	100	30	N/A
	Flame retardants	200	10	N/A
	CFC, HCFC gases (refrigerants)	10	2	0.5
	CFC, HCFC in insulation materials	50	5	N/A
	Halon	100	5	N/A
	Jointing compound, PCB	100	50	N/A
	Substances that may be contaminated with PCBs, isocyanates, heavy metals, asbestos, etc.	600	20	2 (Polyurethane foam)
Paint	Impregnated wood	200	20	N/A
	Solvent based paints without PCB	600	20	N/A
WEE	Fluorescent tubes	10	1	N/A

Type of waste		Quantity/ year (tons)	Max. quantity on storage (tons)	Exp. amounts from Fluminense (tons)
Heavy metals	Anodes	3000	50	N/A
	Light sources/fittings (Hg)	0.5	0.1	N/A
	Light sources, tubes	9	1	N/A
	Switches (Hg)	0.5	0.1	N/A
	Mercury - solid waste, light sources/tubes	5	0.5	0.15 (Thermometers)
	Mercury in coatings	60	10	N/A
	Lead-acid batteries	200	50	1.41
	NiCd batteries	10	2	3.98
	Contaminated wash/rinse water	3000	50	N/A
<b>Non-hazardous Waste</b>				
Sewage sludge from surface water treatment/ process sing plants (heavy metals, metals, oil, etc.)	Metals, heavy metals, oils, etc.	6000	50	100 (Marine Growth and Biofouling)
Other, non- hazardous waste	Glass	200	50	N/A
	Wood	500	50	N/A
	Tyres	20	10	N/A
	Plastic	200	50	N/A
	Cables (not oil filled)	100	50	N/A
Electronic / electrical waste	Discarded equipment and parts removed from discarded equipment, transformers, etc. No PCB fraction/No WEE	10	10	7

## 11 Permits and Approvals

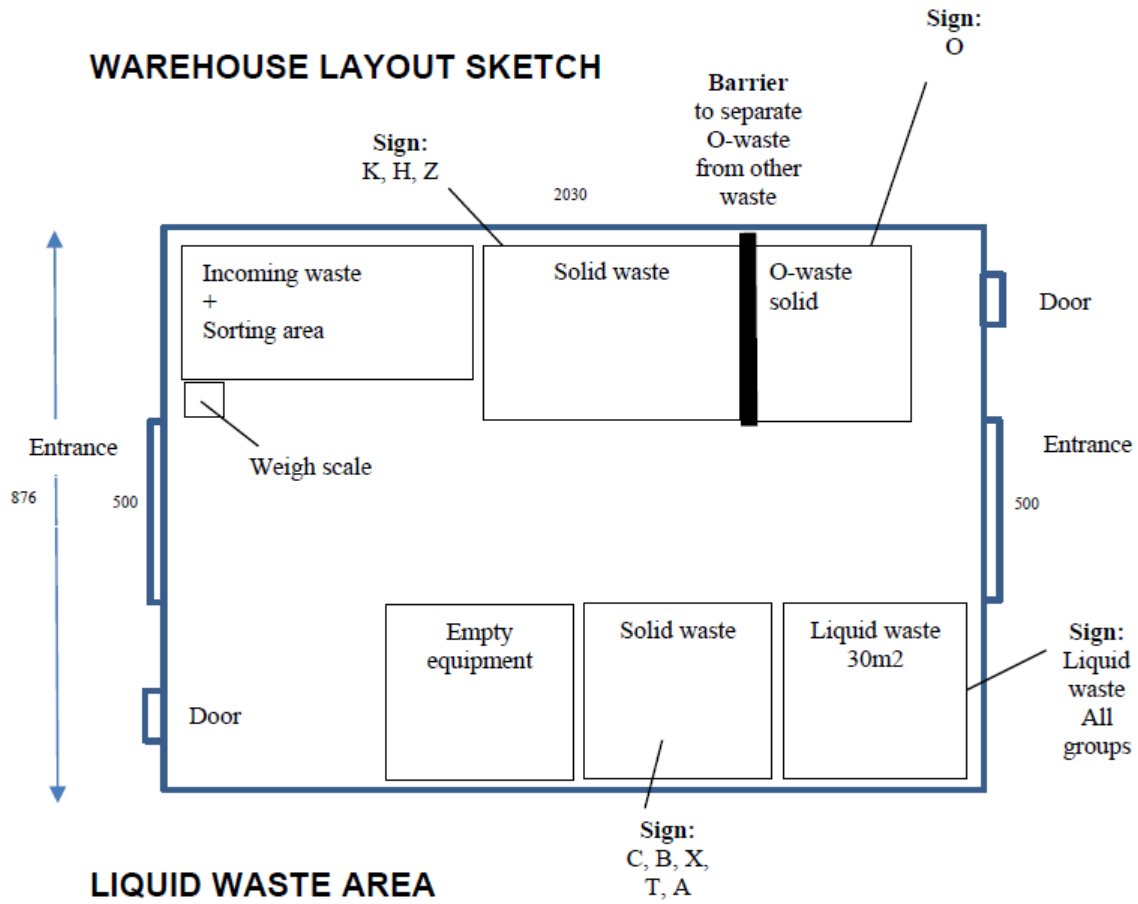
Approval/permit/certificate	Issue date	Identification Number
Environmental Approval	9 March 2018	GEO-2017-02702 Doc No. 1955124
Addendum to Environmental Approval	12 July 2022	GEO-2021-04617 Doc No. 6770892
EU-list approval	27 January 2023	GEO-2022-07138 Doc No. 7016731
NORM approval	22 July 2020	AAKTIL-00001035
Pre-approval for import	21 May 2021	2020-64100
ISO 9001:2015 certificate	4 May 2021	DK014317
ISO 14001:2015 certificate	4 May 2021	DK014319
ISO 45001:2018 certificate	4 May 2021	DK014322

## 12 Appendices

*Table 4 List of appendices*

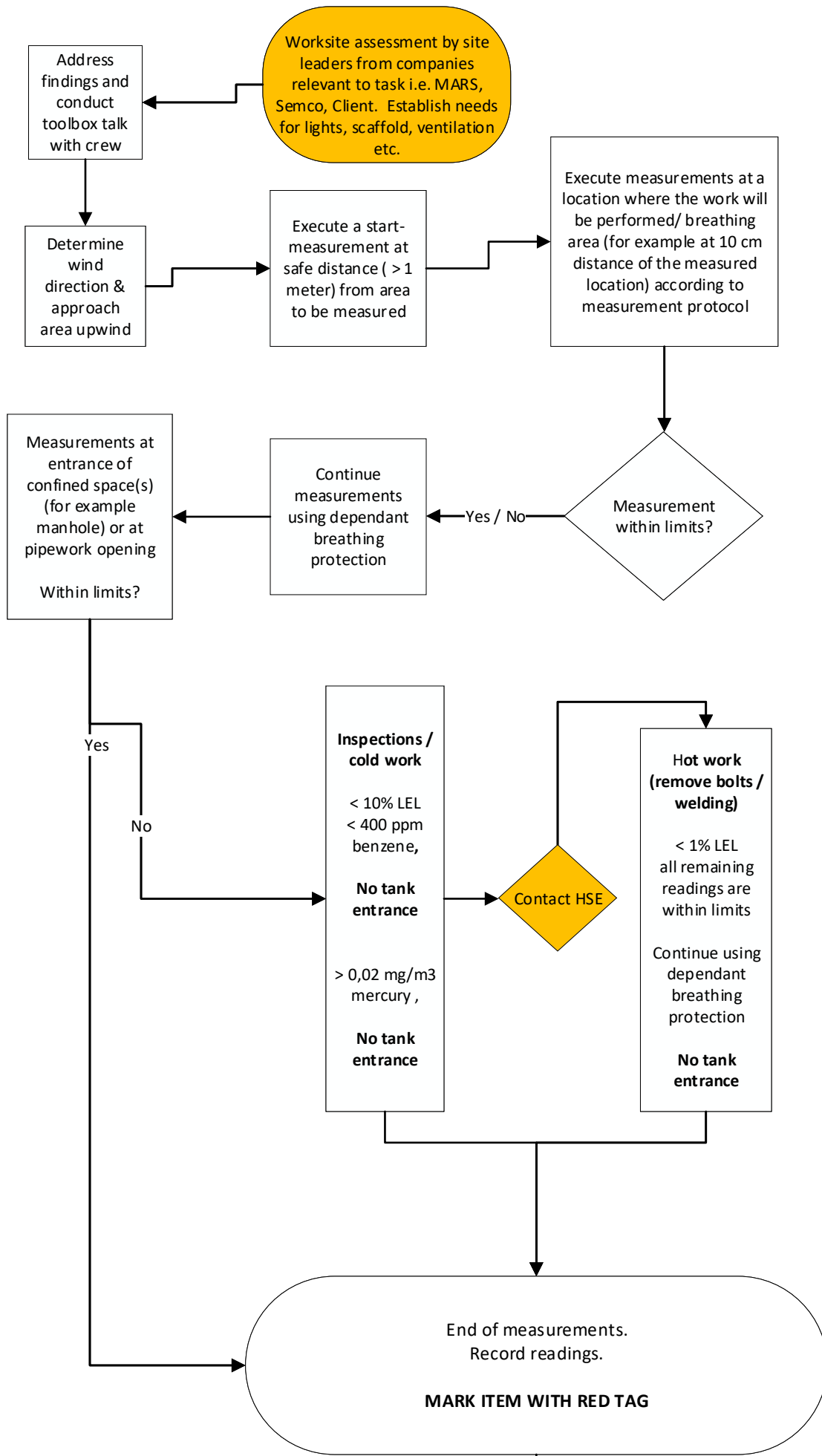
<b>Appendix #</b>	<b>Description</b>
1	Waste Warehouse Plan
2	Mapping protocols
3	NORM Procedure
4	Mercury Procedure
5	Asbestos Procedure
6	UHP and HP water jetting procedure
7	Draining Procedure
8	Data entry, waste accounting and reporting

## Appendix 1: Waste warehouse plan



## Appendix 2: Mapping protocols

## Ventilation Protocol - NORM/Mercury



- Measurement protocol**
- Start measuring H2S < 1,6 ppm (A/C)
  - Measure CH4
  - Measure O2
  - Measure VOC (if to high: measure benzene)
  - Sample Mercury
  - Measure NORM

- Cleanliness threshold**
- H2S < 1,6 ppm
  - CH4 < 10% LEL inspections / cold work
  - CH4 < 1% LEL hot work
  - O2 > 20,8 - 20,9% < VOL
  - Benzene < 0,2 ppm
  - Mercury < 1 mg/kg
  - NORM < 2x background

- Additional PPE Benzene when risk of (direct) contact**
- Disposable chemical proof suit
  - Chemical proof gloves and boots
  - Active BA equipment

- Additional PPE Mercury when risk of (direct) contact**
- Disposable chemical proof suit
  - Chemical proof gloves and boots
  - Active BA equipment

- PPE NORM**  
*Note: UHP operations require specialized PPE*
- Filter mask for dust particles
  - Gloves with rubber lining / cover
  - Glasses and safety boots
  - Slick.suit approved for dust

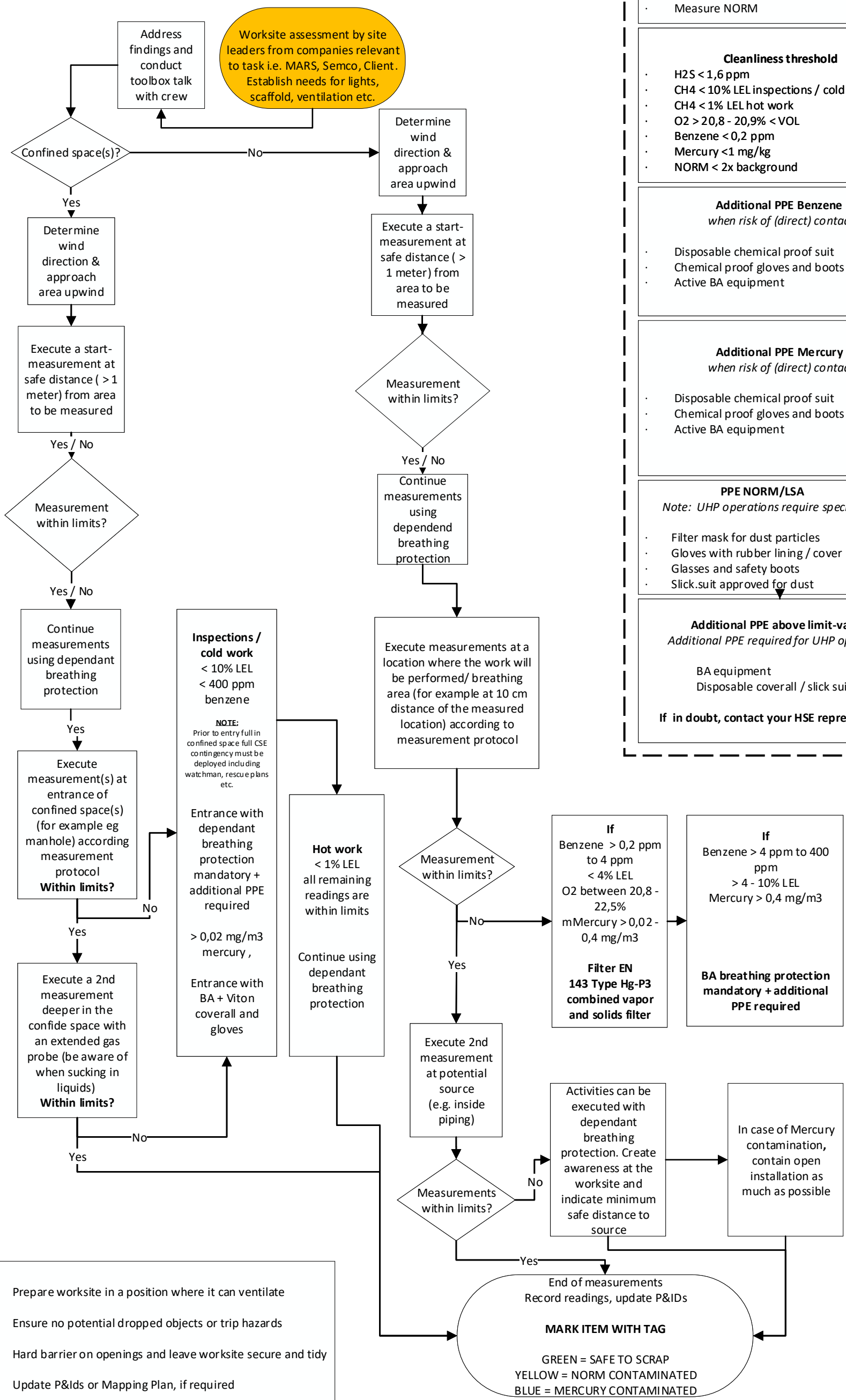
- Additional PPE above limit-values**  
*Additional PPE required for UHP operations*
- BA equipment
  - Disposable coverall / slick suit for dust
- If in doubt, contact your HSE representative**

- ⚠ Prepare worksite in a position where it can ventilate
- ⚠ Ensure no potential dropped objects or trip hazards
- ⚠ Hard barrier on openings and leave worksite secure and tidy
- ⚠ Update P&Ids or Mapping Plan, if required



# Mapping Protocol - NORM/Mercury

Worksite assessment by site leaders from companies relevant to task i.e. MARS, Semco, Client. Establish needs for lights, scaffold, ventilation etc.



- Measurement protocol**
- Start measuring H2S < 1,6 ppm (A/C)
  - Measure CH4
  - Measure O2
  - Measure VOC (if too high: measure benzene)
  - Sample Mercury
  - Measure NORM

- Cleanliness threshold**
- H2S < 1,6 ppm
  - CH4 < 10% LEL inspections / cold work
  - CH4 < 1% LEL hot work
  - O2 > 20,8 - 20,9% < VOL
  - Benzene < 0,2 ppm
  - Mercury < 1 mg/kg
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- Additional PPE Benzene when risk of (direct) contact**
- Disposable chemical proof suit
  - Chemical proof gloves and boots
  - Active BA equipment

- Additional PPE Mercury when risk of (direct) contact**
- Disposable chemical proof suit
  - Chemical proof gloves and boots
  - Active BA equipment

- PPE NORM/LSA**  
Note: UHP operations require specialized PPE
- Filter mask for dust particles
  - Gloves with rubber lining / cover
  - Glasses and safety boots
  - Slick.suit approved for dust

- Additional PPE above limit-values**  
Additional PPE required for UHP operations
- BA equipment
  - Disposable coverall / slick suit for dust
- If in doubt, contact your HSE representative**

- ⚠ Prepare worksite in a position where it can ventilate
- ⚠ Ensure no potential dropped objects or trip hazards
- ⚠ Hard barrier on openings and leave worksite secure and tidy
- ⚠ Update P&IDs or Mapping Plan, if required

## Appendix 3: NORM procedure

## Procedure

# Naturally Occurring Radioactive Material (NORM)

J	17-Mar-22	Updated appendix	Niras	Fabio Silva, Semco	Kim Thygesen
I	14-Dec-20	Revised Document	Niras	Cecilie Nielsen	Kim Thygesen
H	25-May-20	Revised Document	Niras	Cecilie N. Nielsen	Kim Thygesen
G	19-May-20	Revised Document	Niras	Cecilie N. Nielsen / Dan T. Christensen	Kim Thygesen
F	23-Apr-20	Revised Document	Niras	Cecilie N. Nielsen	
E	14-Feb-20	Revised Document	Niras	Cecilie N. Nielsen	
D	19-Sep-19	Revised Document	Niras	Pawel Serafinski	
C	29-Aug-19	Revised Document	Lene Larsen	Pawel Serafinski	
<b>REV</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>WRITER</b>	<b>CONTROL</b>	<b>APPROVAL</b>

**M.A.R.S. INTERNAL DOC NUMBER: EHS-PRO-336**

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## 1.0 PURPOSE

It is the policy of M.A.R.S. Europe to provide and maintain safe, healthy working conditions, safe equipment and safe work procedures for all employees and subcontractors in accordance with the company's initiative of an Incident and Injury Free Workplace.

This procedure is established to obtain a standard for identifying, labeling, maintaining, storing and disposing of equipment contaminated with Naturally Occurring Radioactive Material (NORM) during NORM handling activities undertaken at M.A.R.S Europe site in Frederikshavn.

Further, this procedure is established to ensure that the requirements from the Danish authorities; Danish Health Authorities as well as Municipality of Frederikshavn are met and that handling is in compliance with approvals issued by the Danish Health Authority (SIS).

## 2.0 SCOPE

This Procedure applies to M.A.R.S. Europe location on Port of Frederikshavn, employees and subcontractors handling NORM.

Work with NORM will be continually supervised by Semco Maritime Radiation Protection Supervisor (RPS – "Strålebeskyttelseskoordinator"), who will ensure that the given procedures and instructions and all further statutory requirements are complied with. The Semco Maritime RPS will be responsible for all work related to NORM by Semco Maritime and M.A.R.S. Europe employees.

This procedure covers process systems cleaning, descaling, desludging, contaminated equipment, transportation, decontamination, storage and service activities carried out by Semco Maritime and M.A.R.S Europe.

This procedure ensures adherence to relevant regulations covering Radiation prevention issued by SIS, which can be found here: <https://www.sst.dk/da/Opgaver/Straalebeskyttelse/Tilsyn-og-lovgivning>.

This procedure is supplied with a number of Appendices. These are to be found in section 6.0.

## 3.0 RESPONSIBILITIES

### 3.1 General Manager

The General Manager will ensure that handling of possible NORM waste contained in client assets that are decommissioned by M.A.R.S is carried out according to procedures and approvals.

To ensure, that NORM waste is handled in client contacts as to ensure compliance to both EU rules (EU clients) and outside EU rules (non-EU clients) covering waste handling of any NORM waste attained from client assets.

General Manager will ensure, that radioactive waste (NORM) resulting from decommissioning and decontamination will be returned to the company that transferred the platform / ship to M.A.R.S. This will be included in contracts between M.A.R.S. and the company transferring the asset (platform/ship)

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to M.A.R.S. If applicable, regulatory requirements for the transfer of NORM to non-EU company will be included. Hence, NORM waste cannot be directly transferred to third parties.

### 3.2 EHS Manager

It is the responsibility of the EHS Manager to:

- Maintain contracts with subcontractor (NORM subcontractor) approved by Danish Health Authority, SIS.
- Maintain a plan for follow up on work carried out by the NORM subcontractor taken by M.A.R.S regarding requirements given in approvals issued by authorities (SIS and The Municipality of Frederikshavn).
- Conduct an annual review and approve the handling of NORM waste substances handled on the Site on Port of Frederikshavn during M.A.R.S decommissioning operations.
- Review and render decisions on matters where responsibilities and authority may be uncertain.
- Ensure that any employee operating on behalf of a subcontractor on the Port of Frederikshavn site conform to the instructions given in this procedure

### 3.3 Radiation Protection Supervisor (RPS)

M.A.R.S has made long term agreement with Semco Maritime A/S to be responsible for all NORM handling on M.A.R.S. facilities in Frederikshavn.

Radiation Protection Supervisor (RPS) is appointed by Semco Maritime in Semco procedure P-SEMCO-0074 as Mr. Henrik Popp.

### 3.4 All Workers

It is the responsibility of all Workers employed by M.A.R.S or taken on by any subcontractor operating on the Site to:

- Follow and Respect the Signing at the working and storage areas assigned for Naturally Occurring Radioactive Material (NORM).
- To report any incidents, accidents, or near misses, in accordance with the Company's Incident Reporting Procedure that may occur while working alone.
- To report unsafe conditions or faulty equipment to the Worksite Manager.
- Obligated to report any kind of uncertainties regarding NORM to Semco Maritime RPS

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#### 4.0 PROCEDURE

M.A.R.S. Europe uses the subcontractor Semco Maritime for surveying and handling any NORM contaminated material at the M.A.R.S. Europe site. Semco Maritime will be present during any NORM decontamination and NORM surveillance processes on site (see [Appendix 1](#)) and will supply an approved Radiation Protection Supervisor (RPS). Any NORM matter will be stores on designated storage area ([Appendix 1](#)). The area will be fenced and marked as monitored area according to regulation (governmental order 669, 2019 - §49). Following survey, assets/matters possibly containing NORM will be dismantled by relevant method (manual dismantling, cutting or shearing) and wrapped securely according to Semco Procedures. Relevant shielding/habitats will be used, and areas marked during NORM operations. Material will be lifted ashore to Load off area (green marked area ref. [Appendix 1](#)) or handled exclusively on this area (including heavy lift area).

Methods for handling NORM (reference to [Appendix 2](#) – NORM Flow Handling Chart):

- Method A: NORM decontamination will be conducted at Semco Maritime’s NORM yard in Esbjerg at Molevej 6, 6700 Esbjerg. Method A according to Semco procedures P-SEMCO-0074.
- Method B: NORM decontamination may take place on load off area on MARS site in Frederikshavn. Any decontamination will follow Semco Maritime procedures P-SEMCO-0074 and be conducted by Semco Maritime.

Prior to shipping to decontamination in Esbjerg or decontamination on site in Frederikshavn, any NORM material will be stored in designated storage areas on MARS site (purple marking – [Appendix 1](#)) and handled in accordance to section 4.7.

Activities and responsibilities are shown in the Flow-Chart, [Appendix 2](#).

#### 4.1 Assessment of Hazards

Assessment of Hazards are under the responsibility of Semco Maritime and according to Semco procedure P-SEMCO-0074 section 6.1 including:

- Risk Assessment – 6.1.1
- Work Permit – 6.1.2
- Toolbox Talk – 6.1.3
- Accidents when working with NORM – 6.1.5

#### 4.2 Monitoring Equipment

All detection monitors will only be used by trained and competent personnel.

Monitors used by M.A.R.S. employees will only occur following Semco Maritime RPS instruction.

All radiation monitors must be tested and calibrated every 12 months by a qualified person. Valid certification will accompany all monitors. The test certificate will be retained for a minimum of two years from the date of test.

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**4.3 Designated Areas**

Works site in Frederikshavn are divided into three areas:

- Areas Without restrictions
- Monitored/Supervised area
- Controlled area

Definition of designated areas are according to Semco Procedure / P-SEMCO-0074 section 6.2

4.3.1 Without restrictions

The area around M.A.R.S worksite is ISPS secured and prohibited for non-authorized population to enter. The general areas are without restrictions.

4.3.2 Monitored/Supervised

Fenced areas for storage of NORM in Frederikshavn will be declared a “Monitored/Supervised Area” according to Regulation 669 of The Ionising Protection Regulations 2019 and according to section 6.2.1 in Semco procedure P-SEMCO-0074.

4.3.3 Controlled

Controlled areas are established on decontamination of NORM and controlled by Semco Maritime RPS. All workers entering a controlled area must be classified persons and wearing Personal Monitoring Badges (TLD). Access into controlled areas according to Semco Procedure section 6.2.2 P-SEMCO-0074.

**4.4 Point NORM Check**

4.4.1 Background Radiation Survey

A Site background Radiation Survey has been performed to ensure the background radiation measurement in Frederikshavn.

The survey covered a study of the NORM points shown in [Appendix 3](#). The results of the study can be found in [Appendix 5](#).

A sample test of the area has been conducted to analyze and determine the radionuclide composition. The sample was collected in the load-off area and the skidding area and analyzed by Force Technology. Results are shown in Appendix 5.

4.4.2 Point NORM Check Frederikshavn

Point NORM Check are according to Semco Procedure P-SEMCO-0074 section 6.2.4 and can be done monthly by RPS trained employees at M.A.R.S. Check points according to Appendix 3. A check report result form is given in Appendix 3.

All measurements from Point NORM Check must be presented to Semco Maritime RPS for approval.



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Screening process should be done according to Semco procedure P-SEMCO-0074 section 6.3.2 and only to identify assets possibly containing NORM. If measurements indicate NORM infection – Semco Maritime RPS will assess the situation before any further decontamination can commence.

4.5.2 Contamination tests of employees

Contamination tests of employees that handle NORM contaminated material at M.A.R.S. Europe site is conducted with measuring devices that are approved by the Danish Health Authority, cf. §89 of the [Executive Order no. 669](#) on ionizing radiation and radiation protection. The laboratory that performs the statutory dose monitoring is accredited by DANAK, registration no. 503, and is in compliance with ISO/IEC 17025.

The NORM subcontractor of M.A.R.S. Europe, Semco Maritime, follows an agreement on dose monitoring and submits personal dosimeters to the Danish Health Authority every 3 months on the following Semco Personnel as of January 2020:

- Henrik Popp / 0912 / TILM-00059850
- Balla Traore / 0202 / TILM-00049777
- Edgaras Skvireckas / 3103 / TILM-00056783

The dose monitoring is a monitor of the entire body that gives results for effective and skin dose.

Ionizing radiation of the concerned employee is individually registered continuously and is accumulated in order to meet the conditions of §23 in the [Executive Order no. 669](#) on ionizing radiation and radiation protection.

M.A.R.S will constantly employ optimization of radiation protection measures in accordance with regulations set in chapter 5 of the Executive Order no. 669.

TLD badges are mandatory to all workers working within controlled areas and only under supervision by Semco Maritime RPS according to Semco Maritime procedure P-SEMCO-0074

4.6 **Personal safety**

The employee who are handling NORM must be educated and trained for it. Training and education must be continuously refreshed according to given procedures and instructions. Semco RPS can be consulted.

4.7 **Requirements of PPE**

General requirements of PPE:



Anywhere on worksite on M.A.R.S. it is mandatory to use safety goggles, safety helmet, safety shoes (minimum class S3) and high visible clothing.

Specific requirements of PPE:

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Special protective work clothes and gloves, that protects against the transfer of contaminated material to body and hands, must be worn. Respiratory protection that protects against fine-grained airborne particles must be worn. If the person is exposed for more than 3 hours, an air-supplied respirator must be worn.

All PPE/RPE requirements are according to Risk Assessment / Work Permit / Toolbox Talk done by Semco Maritime RPS, and according to Semco Maritime Procedure P-SEMCO-0074. See also procedure section 4.1.

4.7.1 General Precautions

- Stay near contaminated subjects for as short time as possible
- Keep as far a distance as possible to contaminated subjects
- Stay outside any areas marked NORM work area / habitat etc.

4.7.2 Personal hygiene



Smoking, eating, drinking or applying lotion in the work area is forbidden, because this will cause an increased risk of transferring radioactive material to the face during work.

After performing work, and at the exit of the work area, the work clothes must be changed (the protective suit must be taken off). By the end of the workday the employees must take a bath in a separate area and change to their private clothes – separate areas for work clothes and private clothes.

4.7.3 Barriers and signage



The area, where the NORM is handled and stored, must have signs and barriers. The area around M.A.R.S. Europe denies access to unauthorized people, and the storage facility for NORM is further shielded with fences and gates with locks.

The storage area is clearly marked with warning signs on the four sides of the fence. Signs for ionized radiation supplied with the text “Radioactivity” is according to Danish Standard 734.1 and 734.2, and in adherence to §§37 and 38 in the governmental order no. 670/2019.

Signage is further described in instructions in Semco Procedure P-SEMCO-0074 section 6.7.17.

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**4.8 Storage, Handling, Packaging and Transport of NORM**

The NORM material will be shipped from the M.A.R.S. Europe site by road in compliance with ADR rules and in accordance with section 4.7.4. Upon shipment, the material will be handled and sealed according to section 4.7.2 and 4.7.3 and stored in the storage area ([Appendix 1](#)). M.A.R.S site is covered by ISPS regulations. Containers with NORM must be stored within the enclosed and locked designated NORM storage area until it can be returned to the company that transferred the platform to M.A.R.S. or sent to Semco's NORM yard on Molevej in Esbjerg. When the material is received in Esbjerg, the radiation value of the material will be measured.

NORM storage at M.A.R.S site in Frederikshavn refers to NORM infected materials (e.g. tubes, pumps, tanks etc.). All handling of NORM waste in concentrated form will take place at the SIS approved SEMCO site in Esbjerg, and no longer than 12 months. SEMCO will forward the concentrated NORM waste to the company that transferred the platform to M.A.R.S (third party to SEMCO) as soon as possible after decontamination. It will be ensured, that the receiving company holds a designated and accepted area.

**4.8.1 Storage**

NORM Waste at the NORM yard is secured against rain and corrosion. Smaller waste will be stored in plastic containers and bigger parts in open containers with a tarpaulin or closed containers.

Materials (i.e. Tubes/pumps etc.) that cannot be contained in a container will be stored outside the container within the designated storage area if they are not contaminated on the outside and the ends will be solid and tightly closed with plastic stoppers or double layers of strong plastic attached with correspondingly strong tape. If the pipe is contaminated on the outside ( $\mu\text{Sv/h}$  or CPS over double background level) and cannot be removed, the whole pipe will be packed in double layer of strong plastic for storage.

**4.8.2 Handling**

In order to prevent direct NORM contact with the surroundings, all material must be packed according to the instructions in Semco Procedure P-SEMCO-0074 section 6.6.1.

**4.8.3 Packaging**

On tubings, pin and box ends caps shall be fitted to prevent scale coming in contact with the surroundings.

The radiation activity on the exterior of the tubing must not be above twice the background radiation ( $\text{Bq/cm}^2$  / CPS).

If the radiation activity cannot be lowered below twice the background radiation ( $\text{Bq/cm}^2$  / CPS) by cleaning/washing down, the tubing shall be wrapped with heavy duty polythene sheet (1.000 gauge 250 micron).

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Packaging according to Semco Maritime Procedure P-SEMCO-0074 section 6.6.1

4.8.4 Transport

In connection with the transport of radioactive materials, the finished packaging shall be measured and then classified in order to ensure labelling and documentation.

All shipments must carry transport documentation (Shipping Manifest), which must include UN number, class, if present radionuclide, physical/chemical form, transport index, and Proper Shipping Name (PSN).

Semco Maritime RPS is responsible for correct packaging for transport and ensure correct measurements and information to NorSea Denmark, who are the preferred transport company of NORM by Semco Maritime A/S.

**4.9 Documentation**

All items for decontamination will receive a serial number and be photographed as documentation prior to receipt at Semco Maritime NORM Yard for decontamination.

Full traceability is ensured by use of Semco Report templates in procedure P-SEMCO-0074 section 6.7

**4.10 Accidents and Incidents**

Semco Maritime RPS is obligated to inform the Danish Health Authority immediately if there is an accident, incident or other occurrence. Occurrences as significant discoveries of radiation, theft, loss, fire, etc. must also be informed as soon as possible.

Precautions for employees in case of fire during the handling of radioactive substances:

- Stop the work and leave the fire
- Report the fire (1-1-2)
- Keep unauthorized personnel away
- Contact Danish Health Authority, SIS (open 24h/day +45 44 94 37 73)

**Contact for Emergency Response Center:**

Emergency Response Center Nordjylland  
 Simons Bakke 25  
 7700 Thisted  
 Tlf.: 97 92 32 22  
 Fax: 97 92 29 03

Email: [brcnj@beredskabsstyrelsen.dk](mailto:brcnj@beredskabsstyrelsen.dk)

Precautions for drivers and others in case of accident during the transportation of radioactive substances:

- Report the accident (1-1-2)

## M.A.R.S. Europe

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- Keep unauthorized people away from the accident
- Contact Danish Health Authority, SIS (open 24h/day +45 44 94 37 73)

Precautions for minimizing the spread of radioactive material and collection of waste at the M.A.R.S. waste area in Frederikshavn is secured against infiltration to the groundwater with a membrane connected to the water treatment facility.

### 4.11 Cooperation with NORM subcontractor

M.A.R.S. Europe tasks and obligations:

- Participate in and plan for an initial walk through of any Asset that may possibly hold NORM infected substances with subcontractor taken on for the handling process (Semco Maritime).
- Approve the Confirmatory Survey results prior to any NORM handling.
- Approve the Plan for NORM handling provided by the NORM subcontractor.
- Coordinate on-site workplace operations during operation in a matter that ensure compliance with any requirements in approvals from SIS.
- Ensure that Waste handling and Communication with Client is formalized so any NORM waste exceeding exemption levels can be returned to Client re. contract obligations given.
- Maintain and tests of an Emergency plan regarding NORM Operations under instructions from Semco Maritime RPS.
- Participate in analysis and prevention of accidents and incidents – status meetings and annual reviews.

### 4.12 Record Keeping

M.A.R.S. Europe shall maintain results of NORM Screening and Confirmatory Survey for a period of at least 10 years. Appendix 3 and 4.

M.A.R.S. Europe shall maintain NORM Manifests or Material Transfers for any movement of contaminated equipment or NORM waste within or exceeding exemption levels.

### 4.13 Training

All employees to be employed by M.A.R.S Europe to undertake work on site at Port of Frederikshavn will be made aware of the Requirements given in this Procedure during new Employee orientation. Training will be documented by M.A.R.S EHS.

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### 5.0 AUTHORIZATION

This document is reviewed at least every third year following issuing or when there are any regulatory changes to the procedure.

This procedure is signed by the COO of M.A.R.S.

Approved By:	
Date:	

## M.A.R.S. Europe

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### 6.0 APPENDIX

**M.A.R.S. Europe**

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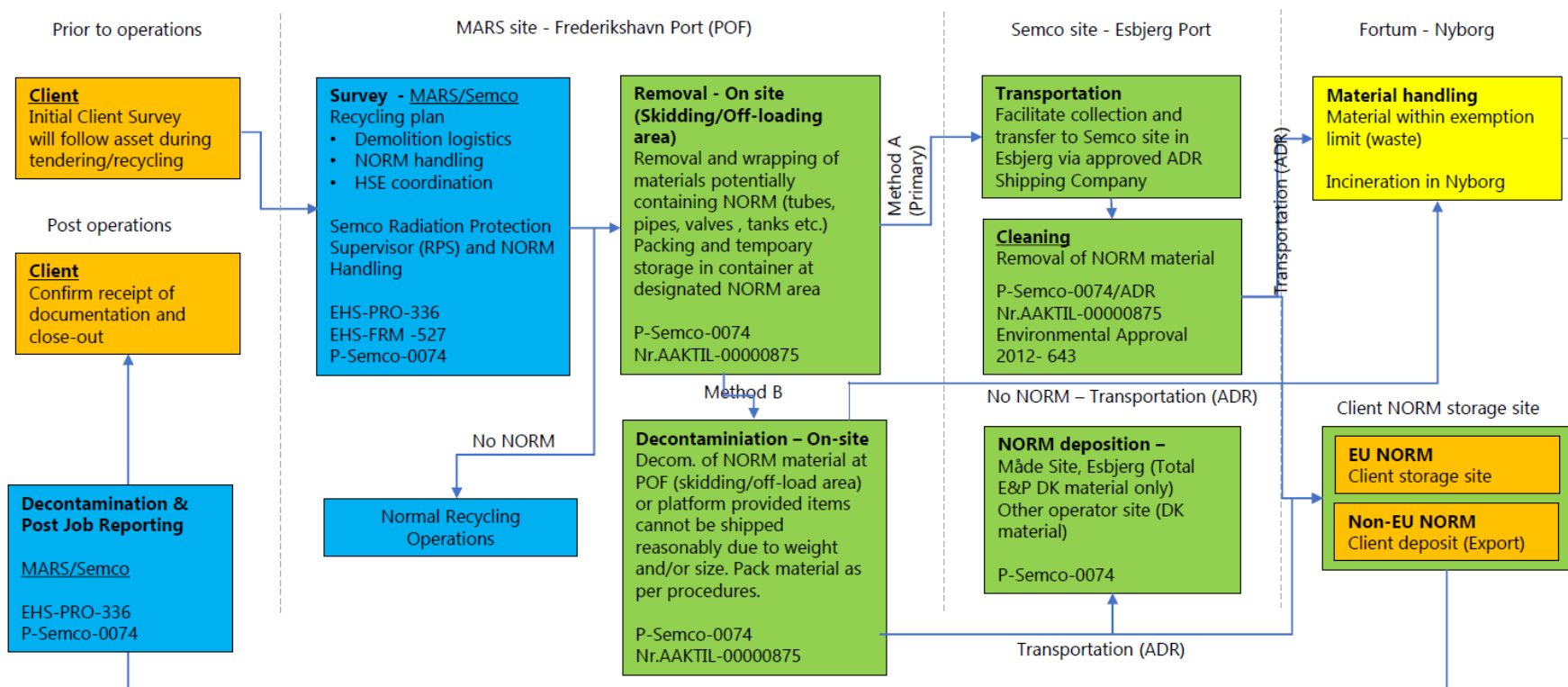
**Appendix 1: NORM handling and storage area at M.A.R.S. Europe site**



*The purple square is dedicated for NORM storage, Green areas annotate NORM handling area*

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## Appendix 2: NORM handling Flow Chart



Responsibilities:

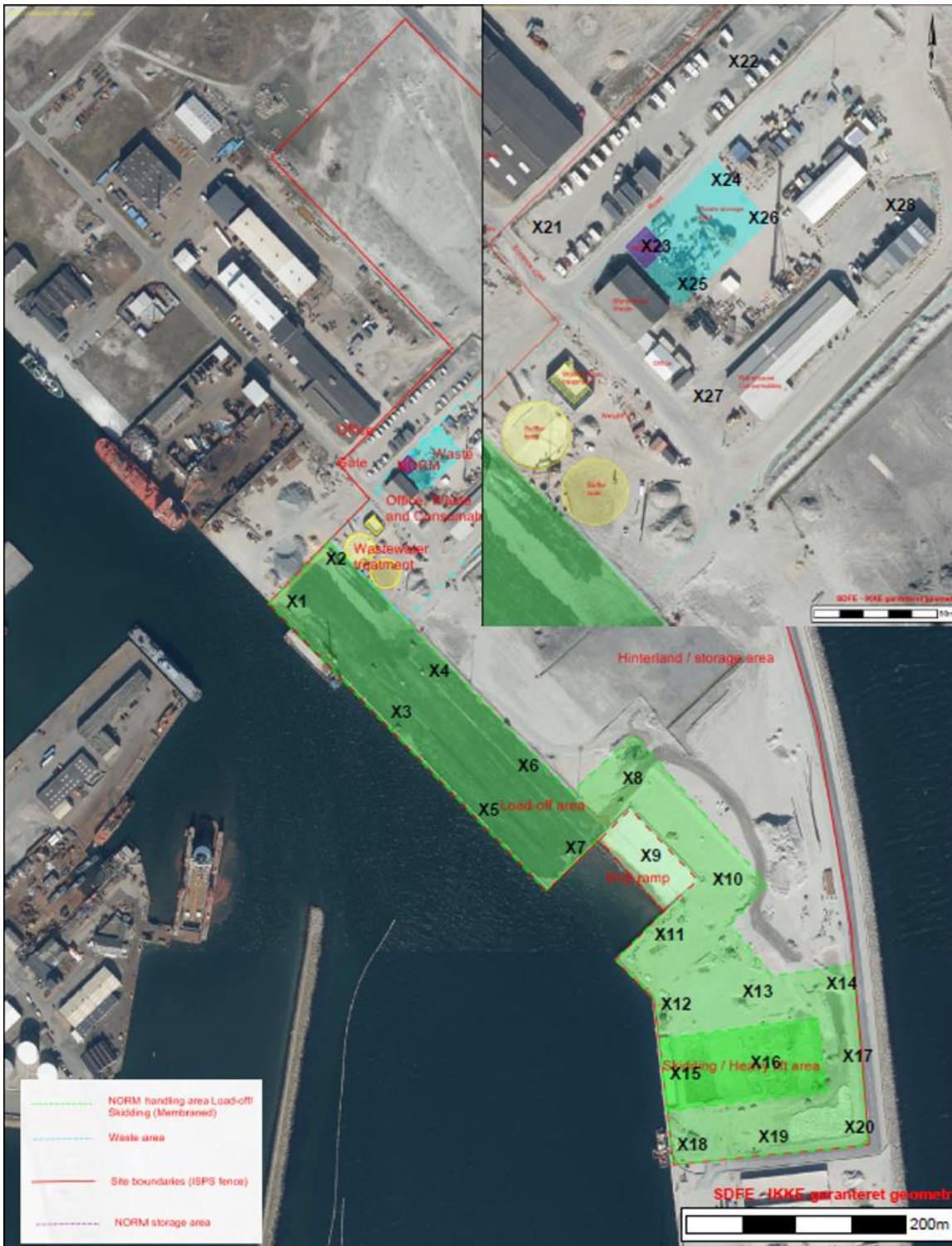


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Appendix 3: Site survey check points



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### Check report

Check point	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Background Radiation										
Activity (cps)										
Radiation $\mu\text{Sv}/\text{hour}$										
Accumulated radiation per year										
Yearly dose limit mSv/year										
Yearly hourly rate										
Yearly radiation										

Check point	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
Background Radiation										
Activity (cps)										
Radiation $\mu\text{Sv}/\text{hour}$										
Accumulated radiation per year										
Yearly dose limit mSv/year										
Yearly hourly rate										
Yearly radiation										

Check point	X21	X22	X23	X24	X25	X26	X27	X28
Background Radiation								
Activity (cps)								
Radiation $\mu\text{Sv}/\text{hour}$								
Accumulated radiation per year								
Yearly dose limit mSv/year								
Yearly hourly rate								
Yearly radiation								

Ex: Radiation  $0,2 \mu\text{Sv}/\text{hour} \times 1600 \text{ hours} = 320 \mu\text{Sv}/\text{year} \gg 0,32 \text{ mSv}/\text{year}$   
 The above measurements are without natural radiation

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**Appendix 4: Point NORM check**

Executive Order no. 669 of 01/07/2019 on ionizing radiation and radiation protection, chapter 5:

§21. A company's use of radioactive sources or radiation exposure is on the same geographical area subject to a dose constraint for effective dose on maximum 0.1 mSv/year for individuals in the population, however cf. stk. 2

Stk. 2. Where several companies use of radioactive sources or radiation exposure can affect the same individual in the population on the same geographical location, the Danish Health Authority can for each of the concerned company's determine a lower dose constraint than specified in stk. 1

§22. A company's use of radioactive sources or radiation exposure is subject to a dose constraint for effective dose on maximum 0.3 mSv/year for other employees in the company.

The above doses however will be subject to the optimization measures given in subsection 4.5.2. Hence, M.A.R.S will constantly employ optimization of radiation protection measures in accordance with regulations set in chapter 5 of the Executive Order no. 669.

Executive Order no. 669 of 01/07/2019 on ionizing radiation and radiation protection, chapter 6:

Person, Category	Limit of effective dose [mSv/year]	Limit of equivalent dose [mSv/year]		
		Eye lens	Skin <sup>1)</sup>	Extremities <sup>2)</sup>
Employee exposed to radiation, older 18 years	20	20	500	500
Person between 16 and 18, who are studying for a professional education for at least 2 years, that are regulated by law or in accordance with law, and where sources of radiation or radiation exposure is a necessary part of the designated education	6	15	150	150
Individual in the general population	1	15	50	-

<sup>1)</sup>The Dose limit of the skin is for each surface of 1 cm<sup>2</sup>

<sup>2)</sup>Extremities covers hands, forearms, feet and ankles

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**Appendix 5: Site background radiation survey**

Checkpoints refer to Appendix 3

AREA	Radiation	
	Activity [CPS]	Dose Rate [ $\mu$ Sv/hour]
Load-off Area		
X1	0,5	0,5
X2	0	0
X3	0,5	0
X4	0	0
X5	0,75	0,5
X6	0,25	0
Ship Ramp		
X7	0,5	0
X8	0	0
X9	0,25	0,5
X10	0,25	0
X11	0,25	0
Skidding Area		
X12	0,25	0
X13	0,5	0
X14	0,5	0
X15	0	0
X16	0,75	0,5
X17	0,5	0
X18	0,5	0

Median
0,375 $\approx$ 0,4 CPS
0 $\mu$ Sv/hour

Median
0,25 CPS
0 $\mu$ Sv/hour

Median
0,5 CPS
0 $\mu$ Sv/hour

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X19	0,25	0,5
X20	0,25	0
Storage Area		
X21	0,25	0
X22	0,5	0,5
X23	0,5	0
X24	0	0
X25	0,25	0,5
X26	0,25	0
X27	0,5	0
X28	0,5	0

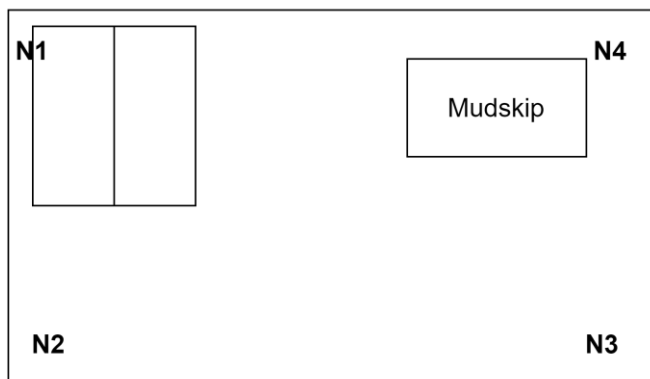
Median
0,375~0,4 CPS
0 µSv/hour

**NORM Seclusion area**

Survey points in NORM seclusion area:

N8

N5



N7

N6

**TITLE: Naturally Occurring Radioactive Material (NORM)**

AREA	Radiation	
	Activity [CPS]	Dose Rate [ $\mu$ Sv/hour]
NORM Area		
N1	0,5	0,5
N2	0,25	0,5
N3	0,25	0
N4	0,5	0,5
N5	0,5	0
N6	0,75	0,5
N7	0,25	0
N8	0,5	0

Median
0,5 CPS
0,5 $\mu$ Sv/hour

**Ex-situ area**

AREA	Radiation	
	Activity [CPS]	Dose Rate [ $\mu$ Sv/hour]
<i>Ex Situ Area</i>		
X29	0,5	0
X30	0,25	0
X31	0,25	0
X32	0,25	0
X33	0,25	0,5
X34	0,25	0
X35	0,5	0,5
X36	0,5	0
X37	0,25	0
X38	0	0

Median
0,25 CPS
0 $\mu$ Sv/hour

## M.A.R.S. Europe

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<b>X29</b> (future cleaning area)
--------------------------------------

**X34**

<b>X33</b>	<b>X30</b>
storage area	
<b>X32</b>	<b>X31</b>

**X35**

**X36**

**X37**

**X38**

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**FORCE Technology**  
 Dept. Plastics, Composites and Surface characterization  
 Radioactivity analysis group  
 Park Alle 345, 2605 Brøndby, Denmark  
 http://forcetechnology.com, phone: (+45) 43 25 00 00

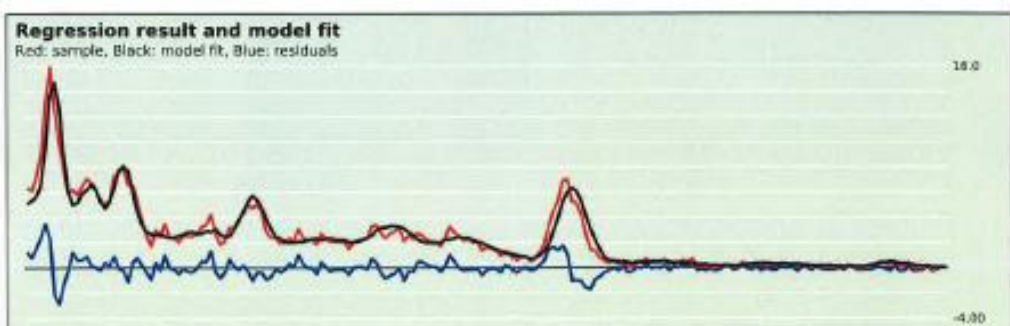
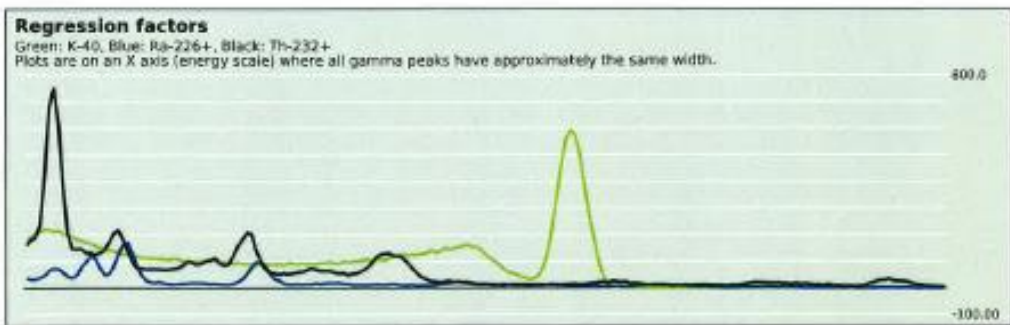
**Gamma spectroscopic analysis**  
 K-40, Ra-226+ and Th-232+ by spectral regression

Material received : 2020-01-30  
 FORCE material number : 012829

Customer : Modern American Recycling Services Europe  
 FIT# : -  
 Text1 : Skærver, gråt ler, fugtigt  
 Text2 : Overfladebelægning af plads  
 Text3 : -

Material analyzed : 2020-02-10  
 Protocol : 3  
 Spectrum Id : 003958

K-40 : 1000 Bq/kg  
 Ra-226+ : 135 Bq/kg  
 Th-232+ : 68 Bq/kg



Signed: *Dijsch*  
 2020-02-10 Niels Hald Pedersen

Pooled sample

## Appendix 4: Mercury procedure

**Procedure**

**Mercury**

C	16-FEB-21	Initial Document	Karen M Andersen	Carsten J. Nielsen	Kim Thygesen
B	25-JAN-21	Initial Document	Karen M Andersen	Carsten J. Nielsen	Kim Thygesen
A	14-JAN-21	Initial Document	Karen M Andersen	Carsten J. Nielsen	Kim Thygesen
REV	DATE	DESCRIPTION	WRITER	CONTROL	APPROVAL

**M.A.R.S. INTERNAL DOC NUMBER: EHS-MAN-201**



# M.A.R.S. Europe

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- 2 Mercury in the oil and gas industry..... 3
  - 2.1 Categorization of equipment – Upstream Petroleum Industry..... 4
  - 2.2 Hazards of mercury ..... 5
- 3 Regulation and how M.A.R.S. adhere..... 6
  - 3.1 Occupational health and safety..... 6
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    - 4.3.1 In-situ mercury cleaning set-up..... 9
    - 4.3.2 Ex-situ mercury cleaning station ..... 9
  - 4.4 The cleaning for mercury..... 10
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Appendix 1: Workflow for mercury cleaning at M.A.R.S site.

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## 1 Introduction

The purpose of this memo is to demonstrate regulations are adhered to in the planned and controlled cleaning for mercury at M.A.R.S. EU.

Mapping and cleaning for NORM is described in separate procedure and not in this memo. Cleaning for NORM and mercury may be combined taking demands for both into account.

## 2 Mercury in the oil and gas industry

Mercury<sup>1</sup> is a naturally occurring metal found in the bedrock in most formations but mostly as mercury sulfide. Reservoirs with a low H<sub>2</sub>S/CO<sub>2</sub> content and high temperature/pressure appear to have the highest mercury concentration. Oil and gas production involves complex multiphase flows, which vary substantially because of temperature, pressure, phase, pH, and redox potential as they move through the production system. While mercury chemistry in the system is not fully understood, it is known to be able to move between the various phases in the hydrocarbon system (oil/condensate/gas) when conditions change. Metallic mercury may particularly occur in the light hydrocarbon fractions (C3-C5) and in sludge. It will normally concentrate at the low points in a process area because of its high density. Scrubbers and separators may contain metallic mercury. Deposition/scale can typically contain mercury, primarily as mercury sulfide but also in metallic form. Mercury generally accumulates in the scale that accumulates on the inside of piping, vessels<sup>2</sup>, etc. And to a lesser extent mercury has been known to penetrate the metal matrix of the pipe/vessel walls. This fraction will potentially be non-mobile on site and will be handled according to limit values set by steel-to-steel company.

All production flows (crude oil, condensate, gas and produced water) in petroleum operations should be assumed to contain some mercury, and that this will accumulate in process equipment and waste (see figure 1). Big differences may exist between wells, and differences in mercury content of the individual well can also be expected over time.

---

<sup>1</sup> Report 132 - Norwegian Oil and Gas recommended guidelines for identification, assessment, control and follow-up of mercury exposure.

<sup>2</sup> Vessel: Container

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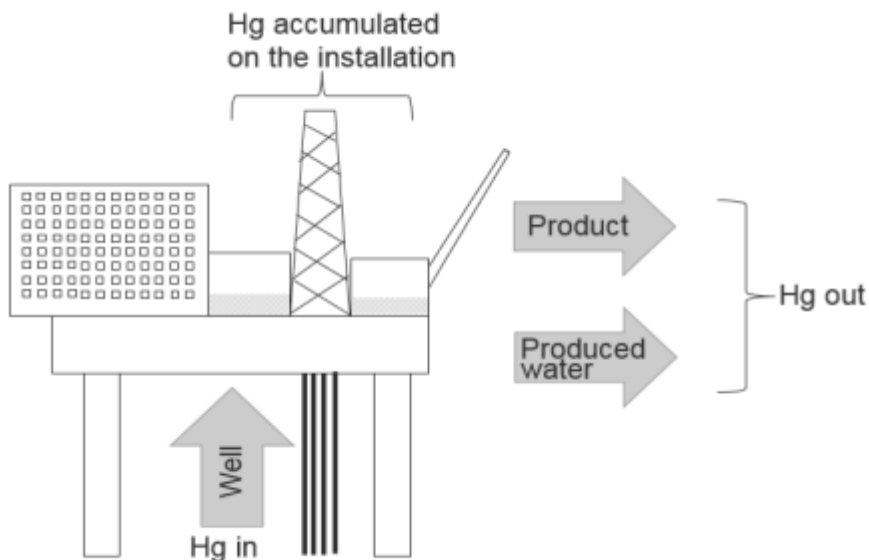


Figure 1 Outline of the mercury mass balance - Upstream Petroleum Industry

### 2.1 Categorization of equipment – Upstream Petroleum Industry

The list of systems and equipment below can be used as a basis for installation-specific assessment offshore. This equipment is known to have a high potential for mercury accumulation due to deposition:

- gas systems (tanks, gas dehydrators, amine plants, scrubbers, heat exchangers, demisters, condensate)
- pipeline scraper receivers
- separators
- mercury traps
- drain systems/sludge/waste
- produced water systems (including hydro cyclones).

Associated piping/pipes may also be contaminated with mercury, normally mercury salts. An overview of systems possibly contaminated with mercury is provided in figure 2: Example of mercury polluted system – upstream (source: Norsk Olje & Gas report 132).

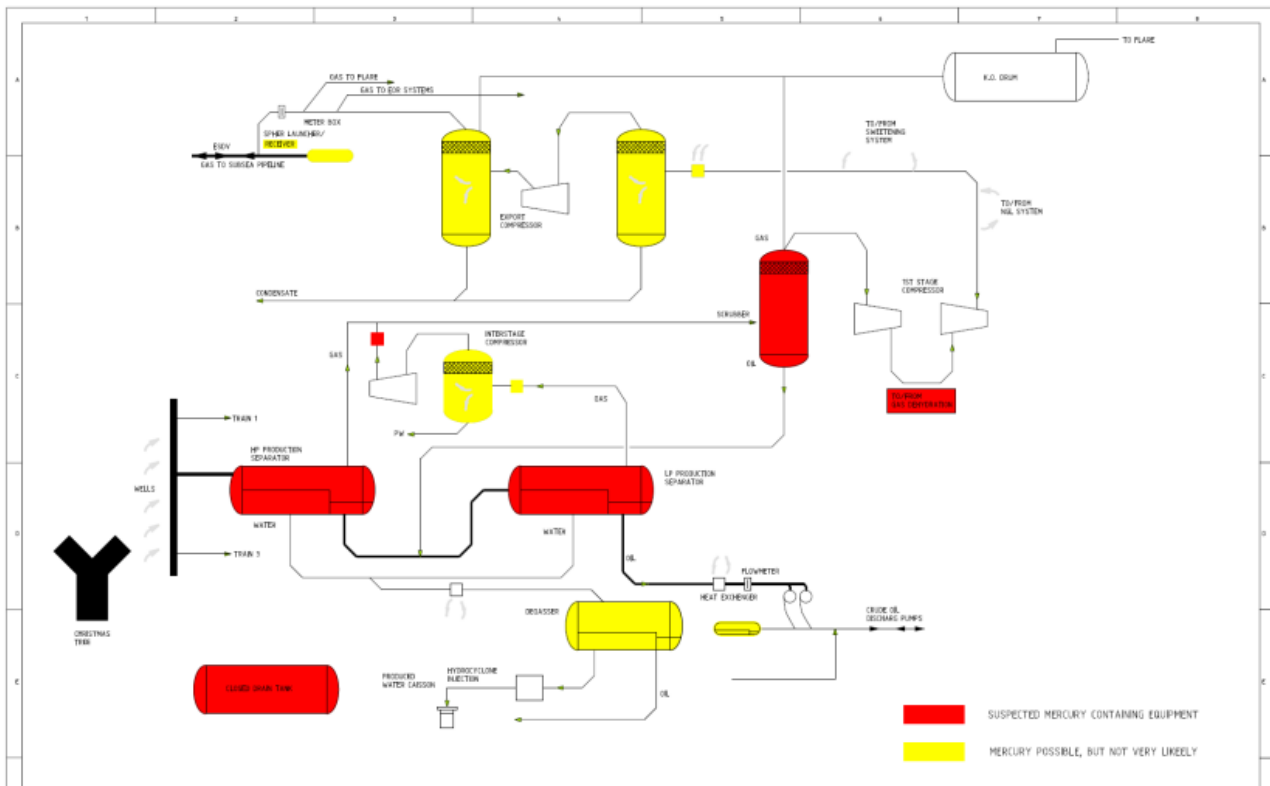


Figure 2 Example of mercury polluted system – upstream

## 2.2 Hazards of mercury

According to ECHA and Miljøstyrelsen mercury (CAS 7439-97-6) is classified:

- Acute toxicity: Toxic when inhaled (H330)
- Able to accumulate in the body from repeated exposure
- Ecotoxic: Highly toxic for aquatic organisms, may cause undesirable long-term effects in an aquatic environment (mercury is an environmental toxin since it accumulates in the food chain). (H410)

Metallic mercury is absorbed in the body through inhalation, skin contact and swallowing. Inhalation is the primary absorption route (75-80 percent). The rate of absorption through the skin is limited and very low via the digestive system (0.01 percent). Absorption of mercury sulfide via digestion is lower than for metallic mercury because of its low solubility in water and is therefore not regarded as toxic for humans and aquatic organisms. Easily soluble mercury salts (such as mercury chloride,  $HgCl_2$ ) and methyl mercury can be readily absorbed through the digestive system and are highly toxic.

For both classifications Acute toxic (inhalation) (H330) and Ecotoxic (H410) the cut off value is 0,1% (1 g/kg).

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### 3 Regulation and how M.A.R.S. adhere

The main scopes of regulation for M.A.R.S. site concerning mercury are occupational health and safety, environment, and transport.

#### 3.1 Occupational health and safety

The Danish working environment authorities state that any work with chemical substances and materials must at all stages be planned and organized in such a way that it can be carried out in a completely safe manner from a health and safety point of view. The risk of exposure to hazardous substances and materials must be eliminated or reduced to a minimum. Unnecessary exposure to substances and materials must be avoided.

The Danish working environment authorities in addition state an air pollution limit value in breathing air for mercury and inorganic chemical substances inclusive vapors of 0,002 mg Hg/m<sup>3</sup>.

Occupational health and safety - Air pollution	Mean concentration 8-hour workday
Limit of airborne mercury in breathing air	0,002 mg Hg/m <sup>3</sup>

The mercury cleaning is executed according to M.A.R.S. mercury cleaning procedure. Before the cleaning starts, exploratory measurements of the mercury vapor exposure level in designated working positions are made. No hot work will be performed on mercury contaminated piping or vessels. Cleaning of mercury contaminated piping and vessels are performed wearing full PPE including breathing apparatus. After the cleaning has finished follow-up measurements are made. The results are successively assessed according to the occupational health and safety limit value and the risk reducing actions.

#### 3.2 Environment

The municipality of Frederikshavn environmental approval states the terms on which M.A.R.S operates to adhere to the environmental regulation on list points and discharge. The approval refers to the Environmental Protection Act list point K210: Ship recycling. The environmental approval terms are also inspired by terms set for K212 and K203 on waste management.

The municipality of Frederikshavn has approved M.A.R.S. site for a maximum waste amount of mercury in scale of 10 tons on site and 50 tons per year. The waste code stated by the municipality for mercury in scale is 13 05 02. Revisions of the executive waste order has not changed the waste list as to mercury in scale. However, at the time of memo conclusion discussions with the waste company of Frederikshavn and the Municipality are ongoing. The results will be integrated in the final procedures.

Furthermore, a wastewater discharge to the harbor with a mercury content of up to 0,0014 mg Hg/l is approved by the municipality of Frederikshavn. This is based upon environmental limit values for water organisms.

Sampling and analysis must be in accordance with executive orders and metals as mercury must be in solution.

Max mercury in scale waste (waste code 13 05 02)	Maximum	10 tons on site
	Per calendar year	50 tons

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Max mercury in wastewater discharged to the harbor	-	0,0014 mg Hg/l (max)
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During the execution of the cleaning, the filtered-out scales with mercury will successively be weighed and compared to the maximum amounts. The waste will be handled according to classification. Hazardous waste is stored under cover and on seal surface on M.A.R.S. site. Before the amount of scale waste on M.A.R.S. site reaches the maximum, Fortum Waste Solutions will ship the scale waste to incineration. The total amount per year of mercury in scale waste will be followed in the same process.

The wastewater from the mercury cleaning will be collected, filtered for mercury, and transferred to a holding tank. The water from the holding tank will then be analyzed and handled according to classification.

The M.A.R.S. wastewater plant includes a water treatment system. With a feed-in concentration of up to 0,005 mg Hg/l the manufacturer of the water treatment system is guaranteed to discharge water with a mercury concentration below the limit of 0,0014 mg Hg/l stated by the municipality of Frederikshavn.

Mercury filtering in M.A.R.S water treatment plant	Inlet to water treatment plant	Resulting outlet to harbor from water treatment plant
Max. mercury concentration	< 0,005 mg Hg/l	< 0,0014 mg Hg/l

### 3.3 Transport

Packing and carriage of dangerous goods is regulated in ADR (Agreement concerning the International Carriage of Dangerous Goods by Road). Fortum Waste Solution is sub supplier to M.A.R.S. within waste handling, and Fortum handles packing and shipment of mercury in scale (13 05 02 or final categorization as mentioned above) according to ADR. Fortum Waste Solution handles hazardous waste on site and is skilled for the task.

When the scale has been cleaned out, sample measurement will be taken prior to shipment from M.A.R.S. site to determine the mercury concentration. The scale containing mercury will be stored in closed containers to avoid release into the environment and work environment. Fortum Waste Solution will see to that the storing, size, packing and labelling of the shipments will be determined adhering to ADR.

Normally, if the mercury concentration is less than 2.500 mg Hg/kg scale, the local district heating & waste treatment plant of Frederikshavn will accept receiving the scale waste. The actual limit concentration, however, is under clarification in Frederikshavn. As soon as actual limit value is concluded, this will be integrated in the procedures.

Following this, waste with mercury concentrations >500 mg/kg TS will most likely be either deposited locally or incinerated if possible. This limit value is normally the limit for building waste suitable for incineration. Otherwise, this waste may be deposited.

Otherwise, Fortum ships to its own district heating & waste treatment plant in Nyborg.

Apart from mercury, the waste may also include heavy metals etc. in concentrations that exceed the limits for hazardous waste. As no separation is possible, a cumulative approach will apply to the entire waste fraction.

Waste fraction	Concentration	Destination
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Clean waste – non contaminated	< 1 mg/kg	Can be reused on land (clean)
Lightly contaminated waste	>1 to <3 mg/kg	Deposit for lightly contaminated waste, reuse
Waste that may be incinerated	>3 - <500 mg/kg	Frederikshavn waste treatment plant
Waste that may not be incinerated - Hazardous waste	>500 mg/kg <2.500 mg/kg	Frederikshavn waste deposit
Non-hazardous waste	< 2,500 mg Hg/kg	Frederikshavn waste treatment plant
Hazardous waste	>/= 2,500 mg Hg/kg	Fortum Nyborg waste treatment plant

## 4 Cleaning process

The process of cleaning a vessel/pipe for mercury is:



### 4.1 Mapping and starting

The mapping is made according to procedure. Mapping of mercury concentration in the processing systems are made to determine the scope of mercury cleaning.

The process systems within scope are isolated. Access to the area with mapped mercury contamination is limited.

The physical dimensions of the vessel/piping part determine whether the cleaning is to take place in-situ or ex-situ. Accessibility for cleaning the scales with mercury is also an important factor.

Pre-task inspection of PPE: Performing visual examination of respiratory protective equipment (RPE) and inspecting air moving system.

Preparation of toolbox talk that includes mercury awareness information.

### 4.2 Isolation

Applying PPE in form of full-face breathing apparatus (BA) and protective suit.

Measuring and recording mercury content in vapor at the entrance to vessel/pipe (manhole or pipe opening) in question. Measuring short term according to manufacturer guidance. After measurement closing off the entrance and blinding the vessel/pipe. Next measurement is made in the inhalation zone of the cleaner while cleaning.

Sealed vessels/piping to be cleaned ex-situ are moved to a storage area for mercury contaminated objects. The storage area is situated next to the mercury cleaning station. The stored vessels/pipes are then moved into the mercury cleaning station when needed.

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### 4.3 Cleaning setup

Establishing an in-situ mercury cleaning setup and/or ex-situ mercury cleaning station on M.A.R.S. site is made in advance.

#### 4.3.1 In-situ mercury cleaning set-up

Set-up for in-situ mercury cleaning consist of drainage system with wastewater tank, mercury filter and filtered water holding tank. The system is regarded as a closed system, no mercury will be emitted to the ambient surroundings and mercury will only be in the water phase. Hence, there will be no need for air filtration.

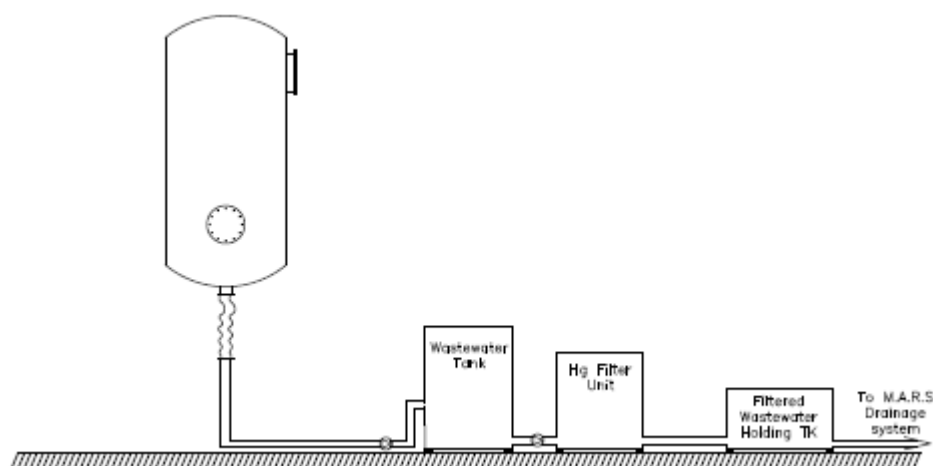


Figure 3 In-situ mercury cleaning station

Wastewater is transferred to a Mercury Filter Unit by a wastewater collecting tank for mercury filtering.

Cleaned wastewater is transferred to a holding tank for final analysis before transferring to M.A.R.S. spillage system. Depending on mercury content the cleaned wastewater is then transferred for further cleaning in M.A.R.S water treatment plant.

Filtered scales are collected and disposed as HAZ MAT by Fortum or regular waste depending on mercury content.

#### 4.3.2 Ex-situ mercury cleaning station

Simple ventilated building with metal profile wall and roof, established on coated concrete flooring. Exhaust ventilation system designed with particle filter minimum class F7 (EN779) as to protect the up-flow active coal filter suited for filtering out mercury from the vapor. See figure 3.

Following input from filter supplier, the use of CKV Sulfree with 10% impregnation with potassium permanganate is recommended. Under normal situations, this should be able to adsorb about 20% of its own weight, i.e., 1 kg of CKV Sulfree can adsorb 200 g of mercury. Filter documentation can be seen in annex 2 and includes both security data sheet and the technical data sheet for the filter media. The data cover 1.5 and 2% impregnation. However, other parameters/properties will be identical to the proposed 10 % impregnation.

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Mercury contaminated equipment and piping enter the building through a service gate and is placed onto a spillage tray.

Washdown of equipment and piping takes place on an elevated spillage tray with minimum 0,5-meter sidewalls and closed drain for collecting wastewater.

As for in-situ mercury cleaning wastewater is transferred to SEMCO’s Mercury Filter Unit via a wastewater collecting tank for mercury filtering.

Cleaned wastewater is transferred to a holding tank for final analysis before transferring to M.A.R.S. drainage system.

Filtered scales are collected and disposed as HAZ MAT or regular waste depending on mercury content. Used filter cartridges are disposed of as HAZ MAT.

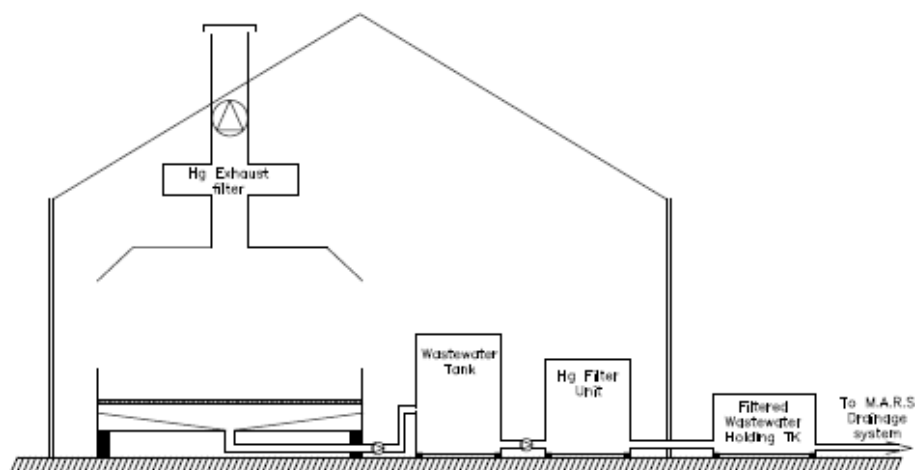


Figure 4 Mercury cleaning station ex-situ

#### 4.4 The cleaning for mercury

Toolbox talk is held before cleaning start-up. The cleaners wear full-face mask with breathing apparatus supplied with fresh air. The cleaners dress in full cover protective suit.

The cleaning is done by pressure washing surfaces in cold water according to procedure. Both for cleaning in-situ and ex-situ at M.A.R.S. site, wastewater is collected, filtered, and stored for analysis.

#### 4.5 Verification

The collected and filtered wastewater is analyzed for mercury to verify efficiency of the cleaning. And then assessed for entrance to M.A.R.S. wastewater treatment system.

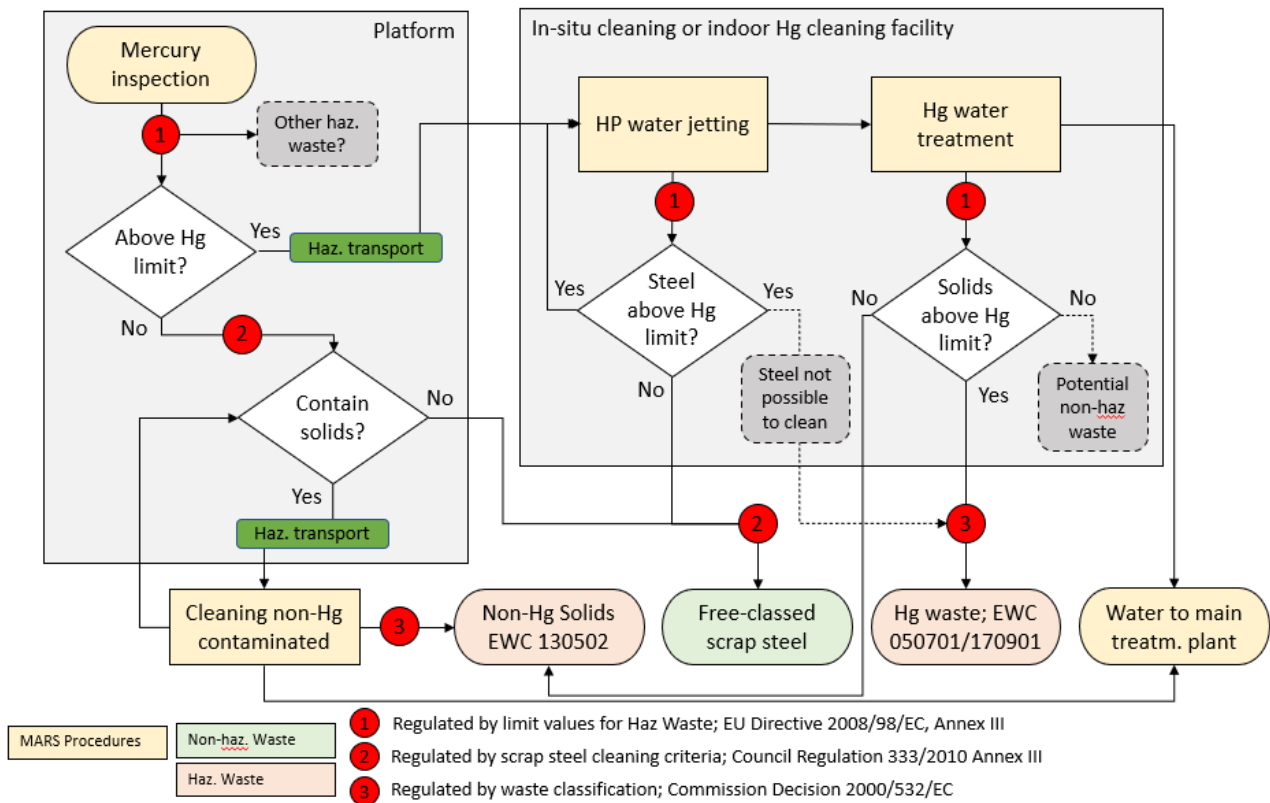
Both used air filters and wastewater filters are handled according to waste plan when they have been exchanged. Solids from wastewater filter and exhaust filters are collected and kept in marked closed waste containers. The waste is sorted and disposed of according to M.A.R.S. waste plan.

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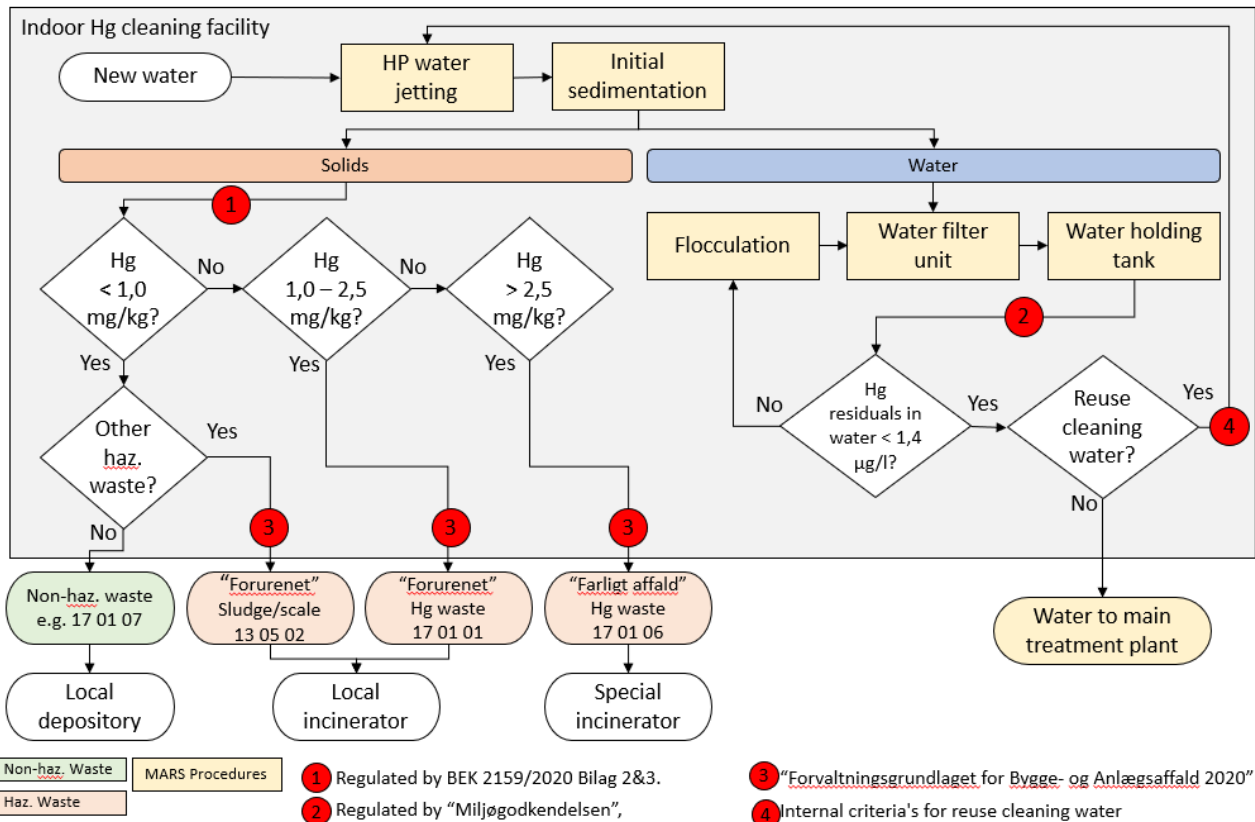
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Appendix 1: Workflow for mercury cleaning at M.A.R.S site

Proposed work flow for handling mercury in pipelines and equipment at MARS site



**TITLE: Mercury Procedure**



## Appendix 5: Asbestos procedure



# Procedure

## Asbestos

D	23-Mar-21	Revised Document	Cecilie Nielsen	Alexandru Simion	Kristian Krebs
C	26-Mar-20	Revised Document	Cecilie Nielsen	Cecilie Nielsen	Kim Thygesen
B	14-Jun-18	Revised Document	Terry Overland	Cecilie Nielsen	Kim Thygesen
REV	DATE	DESCRIPTION	WRITER	CONTROL	APPROVAL

**M.A.R.S. INTERNAL DOC NUMBER: EHS-PRO-329**

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## PURPOSE

It is the policy of M.A.R.S. Europe to provide and maintain safe, healthy working conditions, safe equipment and safe work procedures for all employees in accordance with the company's initiative of an Incident and Injury Free Workplace. The purpose of this standard is to establish guidelines and procedures in reference to asbestos containing materials and to protect all employees, contractors, visitors and suppliers from potential health hazards of asbestos related diseases.

### 1.0 SCOPE

This procedure will apply to all buildings, vessels, and barges at the M.A.R.S. Europe yard, to all employees and subcontractors, and to occupants of Company buildings and to external organizations that may come into contact with or disturb asbestos-containing material. It applies to routine work during which an employee might encounter asbestos, as well as work undertaken to repair or remove asbestos-containing material. This procedure applies to all M.A.R.S. Europe employees and subcontractors.

### 2.1 Hazard

When working with asbestos and materials that contain asbestos, dust is created that contains fine, needle-like fibers. At the maximum safety limits set, the dust cannot be seen with the naked eye. Because of the structure of asbestos, the fibers can constantly split along their length, ultimately becoming very thin. There is a risk that if inhaled, they can pass all the way down into the most delicate branches of the lungs where they can accumulate. Exposure to asbestos fiber involves the risk of developing asbestosis and various forms of lung and bowel cancer. Asbestos and smoking can amplify the damaging effects of each other, increasing the risk of lung cancer.

### 2.0 RESPONSIBILITIES

It is a policy of M.A.R.S. Europe that only certified and qualified asbestos removal contractors (3rd party) shall be involved in any asbestos repairs, maintenance, or removal. All unqualified employees shall be protected from exposure to asbestos fibers by isolating and controlling access to all affected areas during asbestos work. All tasks involving the disturbance of asbestos containing material will be conducted only after appropriate work controls have been identified and implemented. A qualified supervisor shall be available at asbestos controlled work sites during all activities. Proper personal protective equipment, vacuums, and High Efficiency Particulate Air (HEPA) filters shall be used and properly maintained. The contractor shall ensure that all contractor employees have been properly trained and have been issued proper equipment and protective gear.

Asbestos consists of thousands of tiny individual fibers that can be spun into threads, woven, or be finely separated. Because asbestos cannot burn and tolerates temperatures up to 900 °C, it is ideal for reinforcement, insulation, and fireproofing, and has therefore been used for years in a number of building materials.

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**3.1 Responsibilities of Asbestos Removal Contractor**

**Management**

- Ensure all Asbestos Containing Material (ACM) is identified and labeled
- Ensure training is effective for authorized employees
- Conduct medical surveillance of affected employees
- Establish engineering controls for all work with ACM
- Provide adequate and proper equipment and personal protective gear
- Ensure proper disposal of all ACM

All general contractors on a construction project which includes work covered by this standard shall be deemed to exercise general supervisory authority over the work covered by this standard, even though the general contractor is not qualified to serve as the asbestos "competent person". As supervisor of the entire project, the general contractor shall ascertain whether the asbestos contractor is in compliance with the standard and shall require contractors to come into compliance with this standard when necessary.

**Supervisors**

Qualified supervisors shall provide effective on-site management during work with ACM. Supervisors will notify the EHS Department immediately upon discovering damaged asbestos material.

**Employees**

Qualified contractor employees must follow the exact procedures for repair or removal of asbestos containing material, including proper use of containment equipment, clean up equipment and personal protective gear.

Unqualified employees are to stay clear of all asbestos work areas and report any suspected damaged asbestos containing material to their supervisor.

**Multi-employer worksites**

On multi-employer worksites, an employer performing work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

Asbestos hazards at a multi-employer work site shall be abated by the contractor who created or controls the source of asbestos contamination. For example, if there is a significant breach of an enclosure containing Class I work, the employer responsible for erecting the enclosure shall repair the breach immediately.

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In addition, all employers of employees exposed to asbestos hazards shall comply with applicable protective provisions to protect their employees. For example, if employees working immediately adjacent to a Class I asbestos job are exposed to asbestos due to the inadequate containment of such job, their employer shall either remove the employees from the area until the enclosure breach is repaired; or perform an initial exposure assessment.

All employers of employees working adjacent to regulated areas established by another employer on a multi-employer work site, shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the primary asbestos contractor to assure that asbestos fibers do not migrate to such adjacent areas.

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**3.0 PROCEDURE**

**4.1 Asbestos Safety Plan**

4.1.1 Exposure

Every employer shall maintain records of any asbestos exposure of all employees for whom personnel monitoring is required and advise each of his employees of his individual exposure on at least an annual basis.

4.1.2 General Rules

When in doubt, treat all material as containing asbestos and comply with all applicable rules and regulations and protective measures.

All M.A.R.S. Europe employees, sub-contractors, and visitors on a site with ACM or PACM will be instructed in the location or the material, the signs and labels used to identify the material which is present and procedures to notify supervisory personnel of any suspected damage to the material.

All ACM will be handled only by certified and licensed asbestos removal contractor personnel. The friability of the ACM will dictate the type of removal/maintenance required.

Employees who are uncertified and unlicensed will not handle any ACM. This will include encapsulation projects, renovation/removal and/or demolition of any type of structure. This will prevent the potential for accidental exposure from the mishandling of any ACM.

When an uncertified, unlicensed employee question whether they may be handling suspect ACM, the employee will immediately contact their supervisor. The employee shall not resume working at the site until the area has been checked to verify the material is not ACM.

Uncertified, unlicensed employees will not cross over a barrier/containment area where asbestos projects are in progress.

Any employee who discovers ACM or suspects ACM in damaged or poor condition must report it to their supervisor, so the identified material is repaired.

Signs and labels shall identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that Asbestos Containing Material (ACM) and/or Presumed Asbestos Containing Material (PACM) will not be disturbed. M.A.R.S. Europe Supervisors shall ensure that employees working in and adjacent to regulated areas comprehend the warning signs.

No work activity that could disturb suspected ACM in any suspected or known areas shall be carried out without the prior written approval of the EHS Manager and the Site Superintendent under M.A.R.S. Europe's Safety Management System (SMS)

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## 4.2 Definitions

### 4.2.1 Asbestos

Asbestos is a generic term describing a family of naturally occurring fibrous silicate minerals. As a group, the minerals are noncombustible, do not conduct heat or electricity and are resistant to many chemicals. Although there are several other varieties that have been used commercially, the most common asbestos mineral types likely to be encountered are chrysotile (white asbestos), amosite (brown asbestos), and crocidolite (blue asbestos). Among these, white asbestos is by far the most common asbestos mineral present in building materials.

**ACM** - Asbestos Containing Material

**PACM** - Presumed Asbestos Containing Material

### 4.2.2 Hazard Control

#### 1. **Engineering Controls**

Engineering controls include the use of enclosures such as monitoring equipment, glove bags, tenting, negative pressure work areas, HEPA filters, controlled vacuums, water misters and other equipment to ensure containment and clean up of asbestos work areas.

#### 2. **Administrative Controls**

All qualified workers shall be issued proper personal protective equipment, such as respirators, disposable coveralls, gloves, etc. Written procedures and management authorizations are required for all work dealing with ACM.

#### 3. **Training Controls**

All qualified employees, supervisors and managers shall receive the proper level of training, as outlined in this program's definitions.

## 4.3 Before starting the work

### 1. Registration of asbestos.

Working Environment Authority Executive Order no. 993 of 1 Dec. 1986

### 2. Drawing up a work plan.

A plan is required to provide brief details of the location, date/time the work is to be performed, its scope, safety precautions taken, methods used for demolition and cleaning. The plan can be the result of the special APV to be performed for asbestos work.

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3. Project review with the developer or his representative.  
The plan is submitted to the developer or his representative. The contents of the plan, customer requirements and specifications of invitation to tender documents must be coordinated. Access and external facilities must be shown to the asbestos contractor and agreement reached on access for his personnel to the developer's property. The location of a waste container and sanitation trailer must be agreed, along with where power and water can be connected.
4. Notification to the Working Environment Authority  
Notification along with the plan must be sent to the authority. Refer to Dansk Industri's guidelines. <https://www.danskindustri.dk/medlemsforeninger/nedrivningssektionen/vejledninger-og-viden>
5. Notification to local municipal environment offices.  
Notification with an application for a permit to deposit asbestos waste at a special depot (depending on waste type) must be sent to the local municipal environment office, and contain all details of quantity, type and whether the waste is packed.
6. Safety personnel and building users must be informed.  
The contractor must offer to inform local safety personnel and building users of the scope of the work, and what safety precautions will be in place.
7. Project review with the asbestos contractor.  
The contractor will review the work plan and local agreements with his personnel, including informing them on how freestanding items in the work area will be dealt with.
8. Permit to work system  
Risk assessment, JSA and toolbox talks will be conducted prior to asbestos operations with all parties involved in attendance. The permit to work system will be considered open when all documents are signed by the site EHS Supervisor.

#### **4.4 Demolition inside buildings**

##### **4.4.1 Preparatory work and sealing off the area**

Before asbestos removal can begin, the work area must be sealed off to prevent contamination of the surrounding areas.

All cracks, joints, holes etc. in or around windows, doors and in masonry must be sealed. Ventilation plant must be stopped. Any holes or openings on ducts must be sealed with duct tape or polythene film.

The same applies to fixtures and fittings that could be difficult to remove asbestos fiber from later, such as cabinets, radiators, and very rough surfaces. Carpets should be covered by rigid sheets taped along all joints.

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If asbestos is being removed from boiler rooms with oil or gas boilers in use and with air-cooled pump motors, a fresh air supply must be rigged to the boilers and motors via pipes leading outdoors. Contaminated freestanding items should be vacuum cleaned and wiped off with a damp cloth before being removed.

Contaminated fittings, electrical installations, cable trays etc. must be vacuum cleaned and wiped off with a damp cloth before being sealed/enclosed using polythene film.

When construction is complete, tools needed are placed in the sealed of area. An access airlock consisting of 3 compartments is added to the construction.

*Asbestos work* warning signs will be placed in designated areas around the asbestos work site to prevent unauthorized personnel entering the work space.

#### 4.4.2 Negative air pressure and air purifying

In addition to sealing off the contaminated area, constant negative pressure must be established and maintained to prevent the spread of asbestos fiber.

Negative air pressure is established using one or more air purifiers fitted with 'absolute filters', also known as 'microfilters' or 'HEPA filters'.

The air purifiers, while maintaining negative pressure, will filter the air in the contaminated area and catch the asbestos fibers in the HEPA filters.

If the contaminated area is large, multiple air purifiers will be required to ensure good air circulation, avoiding 'dead' zones with high dust concentration.

An air replacement rate of 10 times per hour for the whole of the contaminated area is the ideal. Polythene sheets on dust walls and air locks must show clear signs of negative air pressure. The sheeting should billow inwards towards the contaminated area.

Exhaust air from the purifiers is conducted outdoors via plastic tube ducts.

Regular checks of the efficiency of all machines must be performed. HEPA filters from the purifiers should be replaced as required and in accordance with the manufacturer's recommendations.

#### 4.4.3 Access to contaminated area

To prevent the spread of asbestos fiber outside the contaminated area and to maintain negative air pressure, access to the area must be strictly via an airlock access system. The structure can consist of a wooden frame covered with thick polythene sheeting. The air lock is normally divided into 3 chambers separated by polythene curtains weighted at the bottom by lengths of wood. Hinged doors can also be

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used. If existing building elements such as walls form part of the air lock system, they must be properly covered. Carpeted floors must be covered with rigid sheets taped at the joints.

If the air lock can be exposed to external mechanical forces, the polythene walls must be protected with hard sheeting.

The air lock can be built and used in 2 different ways: 1) with a shower 2) without shower.

- 1) If it has a shower, a shower tray and hand-held shower head are fitted in chamber 2. Dining, personnel and changing facilities should be provided elsewhere according to the rules in force.
- 2) If an airlock has no shower, 2 changing rooms for work clothes and one for personnel clothing should be provided in the immediate proximity of the contaminated area, separated by a shower room. These facilities could be provided in a special mobile shower/changing unit with dining and personnel facilities.

#### 4.4.4 Preliminary work

Asbestos contractors should always wear suitable respirator and special work clothes when working inside the contaminated area. The removal of asbestos-containing materials should be performed carefully to reduce dust (avoid the materials breaking up).

Air purifiers and recirculation machines should be placed as close to where the work is being performed as possible. Materials that have been removed should be placed directly in polythene sacks or boxes lined with polythene sheets. Sharp edged waste should be double-bagged or put in polythene-lined cardboard boxes. Nails and screws should be removed or doubled over.

The contaminated area and air lock should be continuously kept clean by vacuuming. All materials removed that cannot be cleaned should be treated as asbestos waste and taken to a special depot for disposal. Polythene sacks or sheeting used in the contaminated area for packing waste should be minimum 170  $\mu$  thick. Sacks should be sealed by folding the neck over, taped and vacuumed before being moved to air lock chamber 3 and placed in another thick polythene sack sealed and cleaned as above before being taken out through the air lock.

Polythene sacks and packaging must be clearly marked "ASBESTOS"

A transit air lock can be placed on the side of chamber 3 through which waste can be removed, depending on the volume and type. All asbestos containing waste removed from the contaminated area must be stored in a locked room or container marked "ASBESTOS".

Preliminary work should be concluded by thoroughly vacuuming the entire contaminated area. Tools and materials used are vacuumed and wiped off. Visual inspection should be performed before detailed work or final cleaning is started.

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#### 4.4.5 Final cleaning

Contractors should use the same personal protection as used for preliminary work.

Before cleaning, the area must go through a purification period of 24 hours.

After the purification period the area should be thoroughly cleaned by vacuuming and wiping off all surfaces.

Joints and cracks that appear during preliminary work should be thoroughly cleaned by vacuuming. All tools and material not used for cleaning should be cleaned thoroughly.

Once cleaning is completed, a visual inspection of the area should be performed. Negative air pressure should be maintained until the final inspection has been performed and approval given.

#### 4.4.6 Final inspection

The standard of cleaning is approved by a visual inspection that can be supplemented by taking gel tape samples if required. The inspection method should be agreed before starting work in each instance between developer and contractor.

- Visual inspection:  
Once work is completed, the contaminated area should be inspected by the parties involved. No dust should be found in the area during inspection.
- Gel tape samples:  
A piece of rectangular polythene sheet with an adhesive gel applied is used for this method. When applied to surfaces, dust is picked up and the tape can be analyzed under a microscope to determine the amount of asbestos fiber present.

#### 4.5 **Demolition outside buildings**

The demolition of asbestos materials outdoors can be roughly divided into two types of work:

1. Work that creates less dust - demolishing roofing and facade sheets made of asbestos cement.
2. Work that creates a lot of dust - demolishing roof tile sheets containing asbestos or asbestos cement sheets of which a high proportion are broken.

The following rules must be observed:

- A plan must be devised for the work. Contractor personnel must have been trained and received special instruction.

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- The contaminated area must be sealed off to prevent unauthorized access, and warning signs set up.
- Where scaffolding is necessary, box screens must be erected according to the scaffold rules, supplemented by polythene to catch any falling debris.
- Windows and external doors should be kept closed. Grilles, ducts etc. must be covered. Ventilation plant should be shut down.

During work that can create asbestos dust, contractor personnel should wear suitable suits and masks. Every effort must be made to avoid damaging ACMs. It can be necessary to dampen the materials for work that creates a lot of dust.

Once removal work is complete, the exposed surfaces and covering materials must be cleaned.

Cleaning should be performed as follows:

- A. Vacuuming (with HEPA filter fitted)
- B. Wet-wiping down if possible.

Shower and personnel facilities will be provided for the contaminated area.

All asbestos-containing waste must be collected and placed in sealed, lockable containers. The waste is delivered to a special depot.

If new materials are to be mounted on top of asbestos-containing cladding, the above precautions must be observed, as asbestos fiber will be released by drilling or other mechanical work.

#### 4.6 Registration

According to the Danish Work Authorities' Executive Order No. 993 it is required that all companies that detect asbestos in buildings, ships, etc. registers the discovery.

1. According to §1 all damaged asbestos must be registered, and the necessary removal or encapsulation shall be initiated.
2. According to §2 repairer, craftsmen, workers, etc. must have a register of where all asbestos or asbestos contaminated material is found.

#### 4.7 Training

The personnel undertaking indoor removal of asbestos-containing materials must have undergone special training approved by the Working Environment Authority.

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Examples of such work:

- Encapsulation and enclosure of asbestos containing materials that are in poor condition
- Dismantling water pipes made of asbestos cement in the ground, a significant amount of which are broken.
- Taking down flat cement sheeting (tile sheets) containing asbestos
- Clearing up large amounts of crushed asbestos-containing materials after a fire or serious storm damage
- Clearing up after demolition work
- Outdoor demolition of a building behind partial/total enclosure

New rules also came into force on 15 April 2006 on the training and instruction of personnel involved in non-indoor demolition of asbestos-containing materials if they can be exposed to asbestos dust. They must undergo a training and instruction course on prevention and safety (unless they have taken a special course approved by the Working Environment Authority).

Training or instruction must contain details of:

1. The properties of asbestos and its implications for health, including the fact that smoking exacerbates the hazardous effects of asbestos
2. Materials that can be expected to contain asbestos
3. Activities that can imply exposure to asbestos and the importance of preventive measures to reduce such exposure
4. Safe working methods and personal protection
5. The purpose of and correct choice of respirator, their respective limitations and correct use
6. Emergency measures
7. Cleaning procedures
8. Disposal of refuse
9. Health checks.

## **4.8 Personal Protective Equipment**

### **4.8.1 Indoor work creating a lot of dust**

A fresh air-supplied respirator connected to a compressor must always be worn for demolition work that creates a lot of dust. No more than 4-6 hours per day can be worked wearing such a respirator with regular breaks, depending on type of work. Special suits and footwear must be worn at all times. Reusable suits must be washed as frequently as the type of work requires. Disposable suits must be treated as asbestos-contaminated waste and disposed of after use. Disposable suits used must be approved for asbestos removal.

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#### 4.8.2 Indoor work creating minimum dust

A full-face mask with air supplied by a battery-driven turbo unit must be worn for work that creates less dust, such as cleaning. Such masks should be fitted with P3 filters. No more than 4 hours per day can be worked with regular breaks. The use of filtered respirators must be limited to 3 hours unless fitted with a turbo unit. Special suits and footwear must be worn at all times.

#### 4.8.3 Indoor repair and encapsulation work

Half masks with a P3 filter and approved disposable suits should be worn for work that creates little dust.

#### 4.8.4 Outdoor demolition

Half masks with a P3 filter and approved disposable suits should be worn for work that creates very little dust outdoors, such as dismantling/demolition. More stringent precautions should be taken for work that creates a lot of dust. Safety equipment in general. Safety equipment (suits, masks, machinery etc.) should not be removed from the work - area and airlock doors before it has been thoroughly cleaned or packed in airtight polythene sacks.

### 4.0 Asbestos Waste

The Ministry of the Environment recommends that asbestos-containing materials that can create any level of dust should be classified as hazardous waste, whilst any such materials that do not create dust should be classified as non-hazardous waste. According to the ministry's recommendations, examples of hazardous asbestos waste will be asbestos dust (fiber), filters, soft ceiling, and wall sheets, broken, damaged or cut roofing sheets that contain asbestos. Whole and undamaged roofing sheets can be categorized as non-dust creating, and thus non-hazardous waste.

However, individual assessment in each situation will always be required. Joined asbestos sheets that do not create dust can be considered as non-hazardous waste.

Type 1: Asbestos waste that creates severe levels of dust, filters and the like should be kept damp in sealed packaging marked "ASBESTOS". The waste should be delivered to an approved collection station.

Type 2: Waste containing asbestos that can create dust, e.g., electrical/mechanical insulation, soft ceiling and wall sheets, crushed Eternit and the like must be stored and transported whilst damp and packed in double polythene sacks or film to prevent dust being released to the environment. Such waste must be delivered to an approved special depot.

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Type 3: Asbestos waste that does not create dust, or in which the asbestos is contained, e.g. large pieces of Eternit sheets and the like. Can be delivered to a special depot approved for handling waste of this type.

**5.1 Sealing**

Sealing asbestos materials can only be considered as a temporary measure. All asbestos materials should be removed in the long term.

**5.2 Bagging**

The removal of asbestos-containing materials by bagging is only permitted to a limited extent, e.g., in the event of damage and minor removal in houses and boiler houses.

Drawing up a work plan. Notification to the Working Environment Authority (and for members of the association, to the control function) is mandatory.

Special bags must be used. The contaminated area must be screened off and warning signs set up.

Contractor personnel must have undergone mandatory training and instruction on use of the bagging method. Dustproof suits and respirators with P3 filters must be worn. Before and after removal, the building elements around the contaminated area must be thoroughly vacuumed.

**5.0 AUTHORIZATION**

This document is reviewed at least every three years.

This procedure is approved by Asbestos Removal Specialist

## Appendix 6: UHP and HP water jetting



# Procedure

## Ultra-High Pressure and High-Pressure Water Jetting

B	30-06-22	Revised Document	Cecilie Nielsen	Cecilie Nielsen	Alexandru Simion
A	18-05-21	Initial Document	Cecilie Nielsen	Alexandru Simion	Tonny Popescu
REV	DATE	DESCRIPTION	WRITER	CONTROL	APPROVAL

**M.A.R.S. INTERNAL DOC NUMBER: EHS-PRO-382**

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## ABBREVIATIONS

UHP	Ultra high pressure
M.A.R.S.	Modern American Recycling Services
EHS	Environment, Health and Safety
NORM	Naturally Occurring Radioactive Material
ERT	Emergency rescue team
COSHH	Control of Substances Hazardous to Health
PPE	Personal Protective Equipment
RPE	Respiratory Protective Equipment

## 1.0 PURPOSE

The purpose of this procedure is to cover the safe working standards to be adopted by M.A.R.S. Europe, personnel and all its subcontractors, when carrying out all types of high pressure, and ultra-high pressure water jetting applications.

## 2.0 SCOPE

This procedure applies to all work at the M.A.R.S. Europe yard where water jetting and water abrasive cold cutting is used as cleaning method.

The procedure applies to all high pressure and ultra-high pressure water jetting applications as defined above, where there is a risk of injury.

There is a serious potential for accidents relating to the direct impact of a water jet on the body. The pressure required to penetrate the skin is in the region of 7 bar (100 PSI). Once at the level of 7 bar (100 PSI) a UHP Safety suit MUST be worn and sufficient risk assessment is required to be carried out. Once completed, the risk assessment should be forwarded on to the EHS department.

## 3.0 RESPONSIBILITIES

### 3.1 EHS Department

EHS Department shall:

- Ensure that all its employees have undergone the training and instructions. Training platform shall be provided covering how to operate all equipment safely and accident prevention.
- Ensure that all subcontractor employees involved are familiar with the contents of this procedure.
- Ensure that all subcontractor employees involved are aware of all EHS requirements at the M.A.R.S. Europe yard
- Confirm that all required equipment for these tasks is on site and in good working order.
- Retain a record of all equipment inspections, maintenance and certifications on a regular basis.

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- Impose a system of proper storage and cleaning of equipment to avoid cross contamination and damages to equipment
- During toolbox talk on the start of each shift, supervisor shall do review of the procedures and risks with the personnel.

### 3.2 M.A.R.S.' EHS Manager

- Shall ensure that this procedure is issued to locations where appropriate.
- Shall make sure that this procedure is followed at all times by the M.A.R.S. personnel and work with the subcontractor's EHS representative to make sure that subcontractor personnel do the same.
- Shall ensure that the M.A.R.S. supervisor is aware of the contents of this procedure prior to any work scope commencing.
- Shall ensure that both rescue teams operating on site, M.A.R.S.'s and subcontractor's ERT, have received training in first aid for injuries related to UHP operations.

### 3.3 M.A.R.S. Site Supervisor

Must ensure that the procedure is available on location and that he is familiar with its content and requirements.

Ensure that all employees, under their supervision, are aware of the contents of the procedure including correct PPE, equipment, associated risks, etc., by means of PPE risk assessment, site risk assessments and regular toolbox talk briefings before commencement of any work. Only competent trained personnel will operate the equipment and carry out the work scope.

Shall monitor working conditions to ensure compliance with the procedure.

Report to the EHS Manager, any situation which may arise that is not covered by this procedure.

### 3.4 HR Department

Responsible for ensuring that personnel involved in high pressure and ultra-high pressure water applications are trained and have all valid certifications.

### 3.5 M.A.R.S. Employees

Must ensure that they are aware of the provisions of this procedure and its requirements to effectively control the inherent risks associated with the working arrangements of the procedure.

Have a duty to themselves and others not to contravene, or allow to be contravened, the safeguards of this procedure and to ensure that the requirements of the permit to work are met in full.

Shall report to their Supervisor of any damaged or inadequate PPE / RPE equipment and/or work practice not in line with this procedure.

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**4.0 PROCEDURE**

4.1 Definitions

Within this procedure, the term high pressure water jetting will include all pressures up to 1400 bar, while pressures above 1400 bare are referred to as ultra-high pressure (ISO 8501-4:2020). The procedure is applicable to all high-pressure water jetting applications in which hot or cold water is mechanically/hydraulically propelled at pressures from 0-1400 bar. High pressure water jetting covers all water jetting processes including those using additives or abrasives where there is an energy input to increase the pressure applied to water.

Ultra-high-pressure water applications operates at pressures more than 21,000 PSI (1,400 bar) to 60,000 PSI (4,000 bar). Most ultra-high-pressure machines operate in the 2,000-2,800 bar range (30,000-40,000 PSI) which delivers ultra-high-pressure water at volumes ranging from 16 liters per minute to 25 liters per minute. The water is delivered to the tool via purpose designed ultra-high-pressure hoses. Potable water shall be used with all ultra-high-pressure machines.

High pressure and ultra-high pressure water applications are used to carry out a various range of tasks, quickly and efficiently. At M.A.R.S., the range of applications include:

Surface preparation of steel prior to recycling

- Removal of coating
- Tube bundle cleaning/decontamination
- Pipe cleaning/decontamination (including internal retro-jetting and the internal rotating pipe cleaning system)
- Tank/vessel cleaning
- Decontamination and extraction of naturally occurring radioactive material (NORM) and Mercury.
- Simple washdown for cleaning

4.2 Routine Maintenance

All HP and UHP jetting equipment shall be electrically bonded and earthed before work starts and throughout the whole operation to prevent the “Build Up” of electrostatic discharges between the lance, cutting head and the workpiece. Units which are containerized, the container must be electrically bonded to the installation or site superstructure. Any equipment found to be defective must be reported to the Site Manager immediately.

4.3 PPE and RPE

**1. Eye Protection**

Regardless of pressure, flow rate or application, COSHH regulations require at bare minimum for the jetting operator to wear helmet with visor, but best work safety practices recommend a full-face mask with visor integrated when operating UHP. Additionally, a risk assessment should also be

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completed, and this will highlight if any further eye protection is required, i.e., safety goggles to be worn along with the full-face mask with visor.

**2. Respirator Protection**

Covered under the risk assessment for the scope, where COSHH regulations requires per minimum respirator filter masks, but best work safety practices recommend using a fresh air supply through a full face mask.

**3. Head Protection**

Adequate head shall be worn as a combined unit, i.e. helmet, safety goggles and full face visor.

**4. Ear Protection**

Most HP water jetting operations produce noise levels in excess of 90dB (Higher in a confined space). Nozzles working at UHP can generate noise levels in excess of 120dB (Higher in a confined space). Hearing protection should be selected which is capable of protecting against these noise levels i.e., ear plugs, and ear defenders shall be worn.

**5. Body Protection**

There is a serious potential for accidents relating to the direct impact of a water jet on the body. The pressure required to penetrate the skin is in the region of 7 bar (100 PSI). Once at the level of 7 bar (100 PSI) a UHP Safety suit MUST be worn.

It is the responsibility of the EHS supervisor to identify a solution (perhaps an alternative suit) that will mitigate and safety concerns that may arise for particular assignments as a result of the protective suit. A new suitable and sufficient risk assessment must follow in this event and be delivered to EHS department for review.

All operators shall wear suitable waterproof protective clothing having regard to the type of hazards identified by the risk assessment i.e., 2-piece waterproofs, chemical all in one waterproof suit or just waterproof bottoms.

**6. Breathing apparatus**

Where necessary breathing apparatus protection which conforms to an approved standard shall be worn. It shall be selected and used in accordance with the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations. All personnel using breathing apparatus must be trained and be competent in the use of selected breathing apparatus. It is mandatory that an assessment of breathing air quality is carried out as per Danish Regulations. This is to ensure that any compressed air used for breathing does not contain any contaminants harmful to health. The initial test shall be carried out on completion of initial set-up, further retest shall be conducted annually regardless of if system changed, moved, serviced or if there is any doubt as to the quality of the air. It is essential that lines are tagged particularly the supply point with notice to state that it is a breathing air system and must not be disconnected. All tests shall be carried out by a competent person and shall be recorded.

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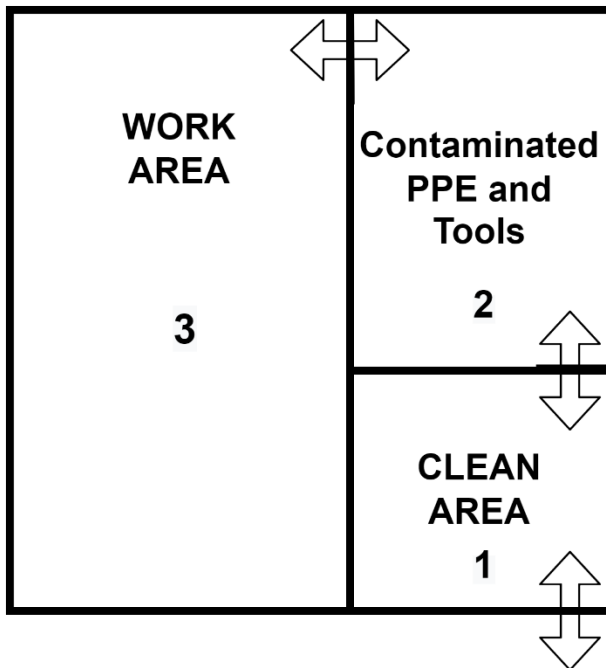
4.4 Worksite preparations

- Risk Assessment and environmental impact assessment
- Job Safety Analysis
- Permit to Work
- Toolbox Talks

**Safety barrier and notices**

Area relevant to the work scope shall be barriered off to prevent access by unauthorized personnel. Barriers shall be red/white chain or red/white warning tape as a minimum. No entry signs shall be displayed and always clearly visible. They should state No Unauthorised Entry – “High Pressure Water Jetting in Progress” or “Ultra High Pressure Water Jetting in Progress”. The onsite M.A.R.S. and/or subcontractor Supervisor shall ensure that access to any such areas is prohibited without knowledge and approval. Electrical Equipment, and fire and gas detectors e.g., smoke, gas and ultraviolet detectors will be required to be protected from water ingress prior to commencing of the work scope. The protection of the above equipment should be inspected by a competent authority prior to the work scope commencing.

Independently for HP or UHP operations, 3 zones must be created as illustrated in below picture:



On are 1 both cleaning and the watchman will make entry and remove all the unrequired PPE or tool they might have.

On Area 2 they will put on the additionally required PPE and get the required equipment.

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After the cleaning operations are finished all dirty/contaminated PPE stays in that area to be disposed properly at a later stage and all equipment used shall remain in that area to be stored properly and safely afterwards.

On Area 3 is where all cleaning operations with the HP or UHP proceed.

#### 4.5 Teams

Regardless of the nature of the activity, at least two roles must be assigned during operations, while best practices tell us that three roles offer significant time savings.

A site survey and risk assessment is used to establish the number of people assigned to each role and number of equipment. The working teams must consist of and never fall below 50% ratio of experience to inexperienced operatives. Before commencing the task, the team members must agree a code of signals to be used so that instructions may be passed while the equipment is in use. Team members shall work strictly to a pre-arranged work plan and the division of duties between the members.

The operator that uses the HP and UHP cleaning lance is responsible for playing the primary role of cleaner.

The “watchman”, who fills the secondary role, is responsible for the following tasks:

- If necessary, use the foot pedal or switch to activate safety controls.
- Keep an eye out for signs of distress, such as the cleaner's tiredness. In order to prevent fatigue from building up on both, the cleaner and the watchman should alternate tasks.
- Must forbid anyone else from entering the work area.
- If the HP/UHP machine is close by, the watchman can manage it. However, if there is a break in the line of sight between the watchman and cleaner, the watchman must instruct the cleaner to leave the cleaning area or confined space.
- The watchman's travel to check the HP/UHP unit and the cleaner's exit from the cleaning area/confined spaces both take time, which is why best practice suggests having a third role, the “fitter”. During operations, the person in this position keeps an eye on all HP/UHP units. If all HP/UHP units are located together, this function can be given to just one person since this person can manage numerous machines at once.

#### 4.6 Use of Lances and Nozzles (Jets)

Lances which are rigid or semi-rigid having nozzles (Jets) fitted to them with any combination of forward, backward or 90 angle jets, must be used with a safety shut off device. If necessary, the workpiece entry point should be cleared by other methods e.g. by using the HP or UHP gun. With restricted visibility, the lance, hose must be clearly marked in a manner which enables the operator to judge how far the nozzle is in the workpiece before pressure is applied and, conversely, so that pressure is released before the apparatus is completely withdrawn from the workpiece. The length

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of a rigid lance or combination of lances must be such that the operator can maintain control at all times.

The minimum recommended exposed length of a lance or barrel (excluding the hand hold coupling) is one meter. In a very restricted work area where it is necessary to use a lance or barrel that is shorter than one meter, a trigger operated handgun shall be attached to the lance or barrel and a safe system of work established to overcome any increase in risk, in such circumstances, operators shall receive further specific training to this effect.

The correct nozzle and minimum operating pressure must be selected by the operators to allow for a safe, effective, and efficient water jetting operations to be carried out.

Note: Where reasonably practicable automatic jetting systems should be used.

4.7 Work in Confined Space

Entry of personnel into confined spaces for HP and UHP water jetting shall only be allowed when there is no reasonably practicable alternative. HP and UHP water jetting will only be permitted within a confined space after consideration has been given to the possibility that harmful materials might accumulate in the atmosphere as deposits are dislodged during the work scope process. This applies to operators working within and outside the space.

The wearing of approved full face mask with fresh air supply and additional precautions may be necessary against the developments of hazardous atmosphere.

Ideally the operator(s) inside an enclosed space should be able to verbally communicate (with or without using a radio) with the watchman in addition to a direct line of sight, but in the unideal situation where verbal communication is not possible a system of signals or light cues must be introduced to cover an emergency situation where all members must leave the confined space.

Work Must Stop in Confined Spaces If:

- Leaks or damage to the equipment and hoses becomes apparent.
- Any person becomes aware of any change in conditions, or any hazards be introduced or exist.
- The platform/site emergency alarms are sounded.
- Refer to the M.A.R.S. procedure EHS-PRO-324 Confined Space Entry

5.0 **TRAINING**

Manual HP and UHP water applications if not handled competently, is a potentially hazardous process due to the power of the jet and the proximity of the operator to the jetting equipment.

Only personnel trained in accordance with these procedures shall operate HP and UHP water jetting equipment, for which they are trained on.

Any involvement with water jetting operations regardless of the activity, the EHS department must be consulted in the first instance.

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Training must cover, in addition to applicable safety requirements, the principles and correct operation of all HP/UHP equipment, in addition to knowing how to proceed in an emergency situation.

A register of training of each operator, including all refresher courses, shall be kept by M.A.R.S. Europe (Human Resources Department) and be available for inspection on request. Only a recognized body and instructor will carry out all training requirements.

The supervisor of any water jetting activities must also be competent in water jetting.

**6.0 REFERENCES**

International Organization for Standardization. (2020). ISO 8501-4. *Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 4: Initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting*. Retrieved from <https://www.iso.org/obp/ui/#iso:std:iso:8501:-4:ed-2:v1:en>

**7.0 AUTHORIZATION**

This document is reviewed at least every 3 years.

This procedure is signed by the M.A.R.S. Europe EHS Manager.

Approved By:	
Date:	

## Appendix 7: Draining procedure



# Procedure

## Draining

A	18-11-2021	Initial Document	Cecilie Nielsen	Alexandru Simion	Kim Thygesen
REV	DATE	DESCRIPTION	WRITER	CONTROL	APPROVAL

**M.A.R.S. INTERNAL DOC NUMBER: EHS-PRO-388**

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## Abbreviations

HSEQ	Health, safety, environment and quality
PTW	Permit-to-work
TBT	Toolbox Talk
M.A.R.S.	Modern American Recycling Services
EHS	Environment, Health and Safety

## 1.0 PURPOSE

The purpose of this document is to provide instructions and direction on how to proceed when draining operations are required within the scope of the work at M.A.R.S. Europe yard.

The information contained within this document is generic; when a situation arises where specific drained fluids are unfamiliar or unknown to the team performing draining operations then the HSEQ department shall be consulted.

## 2.0 SCOPE

This procedure shall be adhered to on any site / installation where draining operations to achieve the objective of the job.

M.A.R.S. Europe is particularly aware of our responsibilities to protect our employees and the environment, as such there is a continuous review process of this procedure and the control measures detailed within.

## 3.0 RESPONSIBILITIES

### 3.1 EHS Manager

Shall ensure that this procedure complies with existing legislation.

Shall review and update the procedure as and when new legislation is issued.

Shall make sure all EHS requirements by M.A.R.S. Europe yard are well known to all personnel. Together with the Supervisor, shall ensure all employees follow the requirements.

Shall ensure that employees have undergone the training and instructions.

Shall ensure that employees are aware of their obligation to report any problems.

Shall ensure that all environmental protection measures are being conducted by employees

Shall schedule periodic exercises to ensure all personnel involved is well-versed and trained on how to act.

### 3.2 M.A.R.S. Employees

Shall undergo all training programs deemed necessary by M.A.R.S.

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Shall disclose any information which may adversely affect their health or performance in carrying out their duties.

Shall take reasonable care of their own health and safety.

Shall make full and proper use of PPE and equipment provided ensuring it is maintained in condition and any observed or notable defects are reported immediately.

Shall promptly report any complication to a supervisor/Project Manager.

Shall act promptly in the event of an error during operations to either correct or mitigate the situation.

## 4.0 PROCEDURE

An effective system's draining operations avoids the complication of the presence of fluids and other foreign materials that potentially might pose a risk to workers and environment during scrapping performed by M.A.R.S. A thorough cleaning of the vessels and pipes and other elements throughout the whole installation for the work is always essential.

A systematic approach is to be adopted prior to decommissioning when the tanks, pipe work and other components are flushed and proved clear by observation and physical inspection.

All tanks are to be inspected and cleaned to remove all build-up-of-residues. The pipes used for different systems on the installation are to be drained separately.

### 4.1 Preparation before draining

Planning and preparing for the whole operation prior to draining is vital because lack of planning can result in delays, increased costs and technical difficulties.

The following are some items to consider during the planning stage:

- a. Ensure all people in the vicinity and others who may be affected, are aware of the draining operations.
- b. Fluid type
- c. The need to dismantle or cut an opening to access the fluid
- d. Right equipment for the job
- e. Pumping duration
- f. Control of the pumping rate
- g. Frequency of checking the level of volume of fluid in destination tank.
- h. Discharge of fluid (if possible)
- i. Collection of samples for control analysis

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A permit-to-work (PTW) document must be issued before any action (other than planning) is performed, which should cover the need for cutting and dismantling if it is applicable to the job at hand. M.A.R.S. Europe EHS department must approve PTW before operation.

After the PTW has been issued and all involved parties are informed during the Toolbox Talk (TBT) then all personnel must check if all equipment is installed correctly and secured before starting operation. It is highly recommended to ensure all hoses are well fitted and secured and that all valves are open to ensure correct control of the fluid.

It goes without saying that in environments where there is an elevated risk of fires, any tool that can produce a spark (e.g. Angle Grinder) is forbidden so alternative means are

**4.2 Draining**

**4.2.1 Start-up**

After planning and toolbox talk has happened, all staff should know all the steps that are planned and the duties for each employee.

If dismantling or cutting is required to access the fluid, then it shall be done before proceeding with pumping. It must be done in the most organised way possible to keep the workplace controlled and to avoid any spillage.

Before any possible spillage might happen, the personnel shall have access to spill kits and possibly a vacuum cleaner for fluids.

For the pumping procedures, start the pump either by opening air or by turning on its power supply. The pump should be started gradually, not at full rotational speed initially.

In the event of the hoses get clogged, then the lines must be flushed with the aid of a pressure washer to help loosen any foreign matter that may be present. All hoses used during the operation must be inspected and possibly cleaned periodically to ensure the operation is able continue without any issues arising.

In the event of a filtration system being connected to the equipment before discharging the effluent into a designated tank, then periodically the content inside the filters must be cleaned, which is where dirt and other elements will also accumulate.

Periodic control of the volume in the tank accumulating the effluent must be done by the watchman.

In case the operators are not able to connect a suction hose directly to the source of the fluid, then a clean intermediary container must be used where the fluid will accumulate and later be pumped out of location.

**4.2.2 Shutdown**

The shutdown procedure shall be the reverse of the start-up procedure, which will start by gradually closing the inlet air valve powering the pump or reducing the rotational speed of the pump until it

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is no longer rotating. If the pump is electrically powered then the power supply must be switched off and in case the pump is pneumatic, then the compressor must be powered off.

All equipment, including angle grinder, hoses and pumps must be cleaned and made ready for future operations in a way that there will not be any possible contaminants in the gear.

A full account of fluids drained shall be recorded and kept for future reference. Samples may be collected for testing.

4.2.3 Inspection and storage of equipment

Keeping all equipment in a prime, healthy state can be a difficult task, but a system must be implemented to ensure a constant state of readiness for all gear.

Having all the gear cleaned and separated based on the fluids they are used for, while keeping a record of the inspection, largely minimizes the possibility of problems occurring. Problems can lead not only to delays in operations but also in possible leaks that might lead to environmental problems or even cross contaminations of fluids.

Equipment displaying severe wear which might lead to failure must be separated and replaced.

An easy way to ensure a good control system with the equipment is by using colour coded strips to know when the last time was the equipment inspected. Please see appendix A for reference.

**5.0 AUTHORIZATION**

This document is reviewed at least every 3 years.

This procedure is signed by the company EHS Manager.

Approved By:	
Date:	

Revision: A

Date: 08NOV21

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### APPENDIX: Tag color chart

