







#### MERCURY (HG) SOIL AND GROUNDWATER ASSESSMENT AT HAK 1, CHEMICAL INDUSTRIAL COMPLEX, TUZLA, BOSNIA & HERZEGOVINA

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### EXPECTED ACCOMPLISHMENT(S):

 THE OBJECTIVE OF THE PRESENT SMALL SCALE FUNDING AGREEMENT (SSFA) IS TO CONTRIBUTE TO THE IMPLEMENTATION OF THE UNEP/MAP PROGRAMME OF WORK (POW) AND BUDGET FOR THE BIENNIUM 2022/2023 AND THE GEF MEDPROGRAMME-CHILD PROJECT 1.1
ENTITLED REDUCING POLLUTION FROM HARMFUL CHEMICALS AND WASTES IN MEDITERRANEAN HOT SPOTS AND MEASURING PROGRESS TO IMPACTS (HEREINAFTER REFERRED TO AS CHILD PROJECT 1.1 OR CP 1.1).





### **OUTPUT(S):**

 THE MAIN EXPECTED OUTPUT OF THIS ASSESSMENT IS TO IDENTIFY POSSIBLE MITIGATION MEASURES AND VIABLE TECHNICAL AND FEASIBLE REMEDIATIONS/TREATMENT PLANS. THIS HG ASSESSMENT ALSO PROVIDES A PREPARATORY STEP TOWARDS THE NATIONAL RATIFICATION OF THE MINAMATA CONVENTION.

# ELECTROLYSIS PLANT



- CHLORINE, LIME, AND PROPYLENE WERE USED AS BASIC RAW MATERIALS FOR THE PRODUCTION OF PROPYLENE OXIDE.
- CHLORINE PRODUCTION ITSELF WAS CARRIED OUT IN THE ELECTROLYSIS PLANT, AND A CERTAIN AMOUNT OF HCL ACID AND NAOH ALKALI WAS CREATED AS A SIDE PRODUCT FROM THIS PLANT.
- ELECTROLYSIS REQUIRED A LARGE AMOUNT OF SALT WATER AND ELECTRICITY.
- MERCURY CELLS WERE USED IN THE PROCES OF NACL DISSOCIATION.
- BASED ON AVAILABLE DOCUMENTATION 4 TONNES OF MERCURY WERE LOST ANNUALY ON AVERAGE DUE TO LEAKAGES. WHICH IS A SIGNIFICANT ENVIRONMENTAL PROBLEM.

# **AERIAL VIEW OF THE SITE**

HAK Tuzla Write a description for your map.

> Former electrolysis unit

Deposition site of barrels with mercury residues Crude propylene oxide tanks

Legend

Ehtylene oxide tanks

Depot of non-conformed products

# ELECTROLYSIS PLANT









#### OUTPUT 1: PREPARATION OF THE HG ASSESSMENT AT HAK1, CHEMICAL INDUSTRIAL COMPLEX, TUZLA

- A NATIONAL TEAM AND/OR CONTACT PERSON IS DESIGNATED AND EFFECTIVE COORDINATION WITH MEDPCU AND ALL CONCERNED STAKEHOLDERS IS ENSURED.
- A DETAILED WORK PLAN INCLUDING TIMETABLE, ROLES, AND RESPONSIBILITIES, IN AGREEMENT WITH MEDPCU, IS PREPARED.
- NATIONAL/INTERNATIONAL LABORATORIES ARE IDENTIFIED, AND A RELATED DETAILED LIST IS PREPARED.
- NATIONAL LEGAL FRAMEWORK FOR THE MANAGEMENT OF MERCURY, INCLUDING NECESSARY STEPS TO RATIFY THE MINAMATA CONVENTION, IS IDENTIFIED AND ANALYZED.
- SUMMARY OF MEETINGS (IN-PERSON, REMOTE, PHONE, E-MAIL) WITH RELEVANT STAKEHOLDERS, INCLUDING DATE, PURPOSE, RESULTS (INCLUDING DOCUMENTATION), AND FOLLOW-UPS ARE DOCUMENTED
- AVAILABLE TECHNICAL INFORMATION (INCLUDING GEOLOGICAL AND HYDROGEOLOGICAL DATA) OF THE CONTAMINATED SITE IS ANALYZED.
- PRELIMINARY SITE VISITS TO HAK 1 ARE CONDUCTED AND REPORTED.
- A DETAILED SAMPLING PLAN IS PREPARED AND APPROVED BY THE MEDPCU.
- QA/QC PLAN
- HSE PLAN
- INCEPTION REPORT (PRELIMINARY SITE INVESTIGATION REPORT) IS PREPARED AND DELIVERED TO THE MEDPCU FOR REVIEW AND APPROVAL.

### OUTPUT 2: EXECUTION OF THE MERCURY (HG) ASSESSMENT IN PERMEABLE SOIL AND GROUNDWATER AT HAK 1, TUZLA

- A REPORT ON THE SAMPLING/HG ANALYSIS ONLY OF SOIL AND GROUND WATER IN HAK 1 IS PREPARED AND DELIVERED TO THE MEDPCU FOR REVIEW AND APPROVAL.
- A DETAILED DRAFT SITE INVESTIGATION REPORT FOR HAK 1 WITH A SUMMARY TABLE IS PREPARED AND DELIVERED TO THE MEDPCU FOR REVIEW AND APPROVAL.
- AN ONLINE MEETING TO PRESENT THE HG ASSESSMENT REPORT TO THE STAKEHOLDERS AND THE MEDPCU IS PREPARED, HELD, AND DOCUMENTED.
- A FINAL REPORT IS PREPARED, BASED ON THE FEEDBACK RECEIVED FROM STAKEHOLDERS, REVIEWED AND APPROVED BY THE MINISTRY OF ENVIRONMENT AND THE MEDPCU.

# DRILLHOLE POSITIONS - PLAN



# DRILLHOLES POSITION- FINAL LAYOUT



Position of drillholes adapted to site conditions (underground installations, concrete plates, etc)

# **DRILLING AND SAMPLING**





### **DRILL CORES**

- 19 drillholes completed (total 280 m')
- Piesometer construction installed in 5 drillholes
- Drilling of plant foundation and concrete sampling perfomed from floor plates, foundation and plant construction items.



## SAMPLING IN THE ELECTROLYSIS PLANT





# WATER SAMPLING POSITIONS



# **LIMIT VALUES**

	EARTH/SEDIM	IENT		GROUNDWATER						
	(mg/kg dry mat	tter)		(µg/l in solution)						
	national	target	intervention	target	national	target	intervention			
	background	value	value	value	background	value	value			
	concentration			shallow	concentratio	deep				
					n deen					
	(BC)	(incl. BC)			deep (BC)	(incl. BC)				
l Metals										
antimony	3	3	15	-	0.09	0.15	20			
arsenic	29	29	55	10	7	7.2	60			
barium	160	160	625	50	200	200	625			
cadmium	0.8	0.8	12	0.4	0.06	0.06	6			
chromium	100	100	380	1	2.4	2.5	30			
cobalt	9	9	240	20	0.6	0.7	100			
copper	36	36	190	15	1.3	1.3	75			
mercury	0.3	0.3	10	0.05	-	0.01	0.3			
lead	85	85	530	15	1.6	1.7	75			
molybdenum	0.5	3	200	5	0.7	3.6	300			
nickel	35	35	210	15	2.1	2.1	75			
zinc	140	140	720	65	24	24	800			

0

# WATER ANALYSES RESULTS

	Limit V	'alue	SHAFT 1	SHAFT 2	SHAFT 3	CHANNEL 1	CHANNEL 2	SEPARATOR	PIESOMETER 1 (old)	PIESOMETER 2 (B10)	PIE SOMETER 3 (B19)	PIESOMETER 4 (B3)	PIE SOMETER 5 (B13)	CHANNEL 3	CHANNEL 4	CHANNEL 5	CHANNEL 6	
Test method	Target Value (µg/l)	Intervention value (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (μg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	Test results (µg/l)	
EPA 245.7:2005	0,01	<mark>0,</mark> 3	9,6	2,3	1,2	10,9	6,80	1,10	0.85	3,30	178,00	0,50	5,84	2,81	3,58	4,26	1,46	
Land																		
Legend	Satisfies	Monitoring required	Intervention required															

The target and intervention values for soil remediation of heavy metals are in accordance with the Dutch Target and Intervention Values, Soil Protection Act (Stb, 2005a) issued by the Dutch National Institute for Public Health and the Environment

## CONSTRUCTION MATERIALS ANALYSIS

		Limit	value	435/23 Concrete 2	436/23 Concrete 1	DRILLHOLE B15 (0-30 cm)	
12	Test method	Target value (mg/kg)	Intervention value (mg/kg)	Test results (mg/kg)	Test results (mg/kg)	Test results (mg/kg)	
	EPA 7474:2007	0,3	10	10 0,1825		1240	

egend	Satisfies	Monitoring	Intervention		
		required	required		

#### Remark:

After excavating the floor and material from the concrete pillars where mercury cells were situated at the premise of the hall of electrolysis plant, the collection of drops of elemental mercury was noticed which indicates large concentration of mercury in the concrete. Therefore, the collection of samples was not possible due to concentration of Hg in liquid elemental form that is mobile.

# **HG SOIL TESTS- HAK1**

		Limit values		BOREHOLE B10	BOREHOLE B11	BOREHOLE B20	BOREHOLE B19	BOREHOLE B12	BOREHOLE B13
Depth borehole	Test Method	Targeted values (mg/kg)	Intervention value (mg/kg)	Test results (mg/kg) d.m.					
0-30 cm	EPA 7474:2007	0,3	10	0,36	17,69	15,32	44,57	121.33	16,33
30 cm -3 m	EPA 7474:2007	0,3	10	0,04	1,13	0,99	2,53	75,20	15,61
3-6 m	EPA 7474:2007	0,3	10	0,02	0,02	0,40	2,33	4,47	2,46
6-9 m	EPA 7474:2007	0,3	10	0,02	0,02	0,04	2,19	1,05	N/A
9-12 m	EPA 7474:2007	0,3	10	<0,001	0,01	0,02	0,71	0,20	0,72
12-15 m	EPA 7474:2007	0,3	10	<0,001	<0,001	0,01	0,02	0,17	0,71

Targeted and intervention values for heavy metal remediation in accordance with Dutch Target and Intervention Values, Soil Protection Act (STB, 2005a) issued by the Netherlands National Institute for Public Health and the Environment

