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PROJECT
REMOVAL OF TECHNICAL AND ECONOMIC BARRIERS TO INITIATING THE CLEAN-UP ACTIVITIES FOR ALPHA-HCH, BETA-HCH AND LINDANE CONTAMINATED SITES AT OHIS

Mickovski, A / Andonova, S

Project: Removal of technical and economic barriers to initiating the clean-up activities for alpha-HCH, beta-HCH and lindane contaminated

Beneficiary: Macedonian Government

Financing Agency: GEF, Government

National Execution Agency: POPs Unit

GEF Grant: USD 3.100.000

Co-financing: USD 12.450.000

Project duration: 2015-2022

Project Justification

In the frames of the Community Assistance for Reconstruction, Development and Stabilisation (CARDS) 2007 project for development of the National Waste Management Plan with Feasibility Studies, 16 Industrial Contaminated Sites - "hotspots" were identified and ranked according to environmental indicators.

Rank	Hot-spot	Status of operation	Municipality	Score *)
1	OHIS A.D (organic chemical industry)		Skopje	0.99
	- former chlor-alkali plant	abandoned (5 yrs)		
	- former lindane plant	abandoned (30 yrs)		
	- HCH dump site	Abandoned (covered)		
	- mixed waste dump site	operational		
2	Bucim copper mine [1])	operational	Radovis	0.96
	- flotation tailings dumpsite	recently reopened		
	- mine tailings dumpsite			
3	MHK Zletovo (lead and zink smelter)	partly closed (2 yrs)	Veles	0.89
	- oven slag disposal	reopening under		
	- coke and slag tip	negotiations		
	- diffuse cadmium contamination in surrounding village			
4	Lojane (former chromium, arsenic, antimony mine)[2]	abandoned (30 yrs)	Kumanovo	0.76
5	Sasa lead and zinc mining	closed (3 yrs)	Mak. Kamenica	0.73
6	Silmak ferro-silicium plant (former HEK Jugochrom)[3]	closed (10 yrs)	Jegunovce	0.71
7	Toranica lead and zink mining	closed (>5 yrs)	Kriva Palanka	0.63
8	Makstil (iron & steel plant)	operational	Skopje	0.61
9	Rudnici Zletovo (lead and zink mining)	closed (3 yrs)	Probistip	0.60
10	REK Bitola (Thermal power plant and coal mine)	operational	Bitola	0.53
11	Feni Industry (ferro-nickel smelter)	operational	Kavadrci	0.39
12	MHK Zletovo (fertiliser factory)	closed (2 yrs)	Veles	0.38
13	REK Oslomej-ESM (Thermal power plant/coal mine)	operational	Kicevo	0.37
14	Godel tannery [4])	closed (5 yrs)	Skopje	0.35
15	OKTA Rafinerija AD (oil refinery) [4])	operational	Skopje	0.34
16	Tane Caleski (metal surface treatment) [4])	closed (3 yrs)	Kicevo	0.34

Legend

1 Ongoing EU remediation programme "Intreat"

2 Ongoing UNDP remediation investigation

3 EAR funded remediation project (2003-2004)

4 Possible soil & groundwater contamination likely not caused by waste disposal

High risk (proven contamination to a large extent of soil & groundwater)

Medium risk (potential contamination of soil & groundwater to a significant extent)

Low risk (no or limited contamination expected to a small extent)

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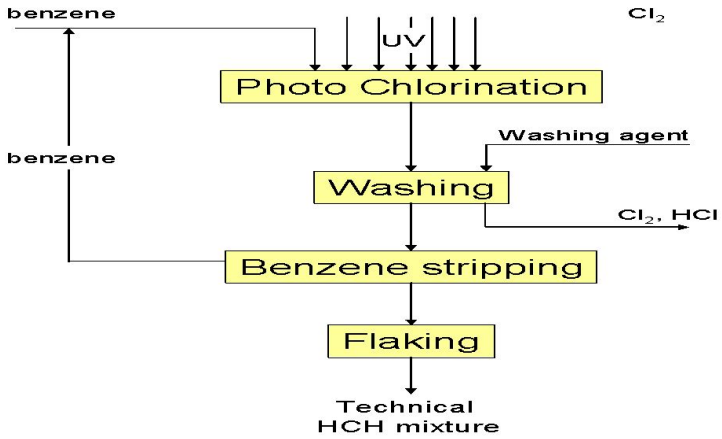
Plant history



The Lindan complex in AD OHIS–Skopje had the plants producing HCH, Lindan, trichlorobenzene (TCB) and hydrochloric acid. These plants formed a united technological circle supporting each other.

Technical hexachlorine cyclohexane with gamma isomer of 12-14% was produced with photosynthesis of chlorine and benzyl, while around 85% the non-active isomers such as alpha, beta and delta.

The rest of inactive isomers (alpha, beta and delta-isomers) were dumped on the very site. The efforts to utilize them for the production of TCB (trichlorobenzene) and HCl failed.

The Lindane was functioning from 1964 until 1977, when it was abandoned and stopped for ecological reasons and change of the market conditions.

The total Lindane production was around 2.800 tons resulting in a generation of around 25.000-30.000 tons of inactive isomers that were improperly dumped, causing secondary contamination of the soil and underground water, and emissions to air as well.

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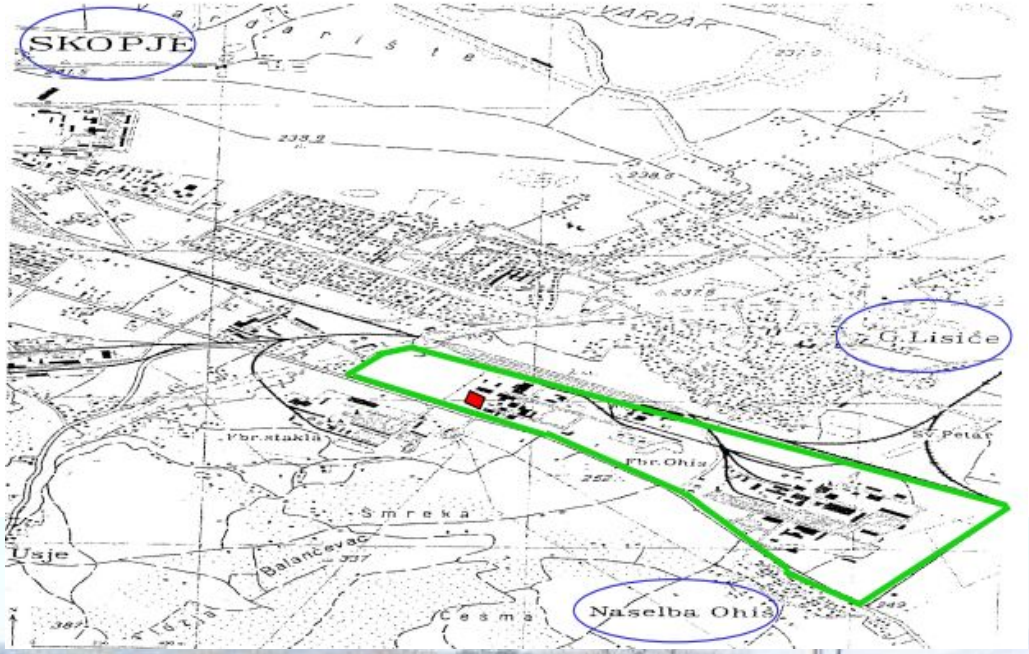
HCH on-site dumping



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Project goal

The long-term project objective is to have the OHIS contaminated site free from HCH waste and other hazardous contaminants for future industrial use. The main reason is protection of the human health and the environment from the contaminants adverse effect by reducing and/or eliminating the releases and exposure through remediation of the HCH contaminated sites.

The main outcome of the project will be enhanced national policy, institutional and technical capacities for management of contaminated sites by establishing financially and technically sustainable mechanism for securing continuation of the remedial activities of the HCH contaminated site in a safe manner.

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Project components/Work Plan

Outcomes/Outputs/Activities	2015 (Mar – Dec)	2016	2017
Outcome 1: Legal framework and institutional capacities to support, justify and evaluate the clean-up of the OHIS site contaminated with alpha-HCH, beta-HCH and lindane established, enhanced and enforced			
Output 1.1: Legal acts and institutional and technical tools prepared to ensure the completion of the OHIS site clean up operations and building capacities towards contaminated sites management in general			
Output 1.2: Technical tools (guidelines, procedures, instructions) for contaminated site management prepared and approved			
Output 1.3: Environmental officers, contaminated site owners and the potential contaminated site clean up operators trained on practical usage of the prepared guidelines, procedures and instructions			
Output 1.4: Laboratory personnel trained for sampling and analyses standards and protocols for POPs/HCH			
Outcome 2: Characterization of the HCH contaminated site completed, risk assessed and risk management options defined			
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses based on the sampling plan developed during PPG			
Output 2.2: Survey of groundwater for drinking and irrigation purposes conducted			
Output 2.3: Current risk assessment analyses updated and the risk management options defined			
Outcome 3: Contaminated site clean up plan and strategies established and key stakeholders including local communities ready to cooperate			
Output 3.1: Contaminated site clean up operation/remediation plan and groundwater management plan prepared for prevention of further contamination and adverse human health impact			
Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site			
Output 3.3: City development plan and zoning of OHIS site reviewed and revised			
Outcome 4: Clean up operation initiated and the execution mechanism in place to sustain the clean up operations beyond the project period			
Output 4.1: ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared			
Output 4.2: Technology/service providers selected			
Output 4.3: Parties (private sectors, state owned companies or PPP contractual agreement form) interested as potential operators identified and investors as potential clean up operators consulted			
Output 4.4: Operating entity selected and established			
Output 4.5: Clean up operation/remediation and business plan prepared by the selected operating entity in consultation with the technical providers and all stakeholders and approved by the PSC			
Output 4.6: Needed permits for the technology treatment installation (EIA, IPPC) obtained			
Output 4.7: A monitoring program, system established in the location			
Output 4.8: Clean up operation executed			
Outcome 5: Project management structure established, and monitoring and evaluation conducted			
Output 5.1: Project results monitored and reported			
Output 5.2: Project evaluated meeting the GEF's evaluation criteria			

LEGAL FRAMEWORK AND INSTITUTIONAL CAPACITIES TO SUPPORT, JUSTIFY AND EVALUATE THE CLEAN-UP OF THE OHIS SITE CONTAMINATED WITH ALPHA-HCH, BETA-HCH AND LINDANE ESTABLISHED, ENHANCED AND ENFORCED

CHARACTERIZATION OF THE HCH CONTAMINATED SITE COMPLETED, RISK ASSESSED AND RISK MANAGEMENT OPTIONS DEFINED

CONTAMINATED SITE CLEAN UP PLAN AND STRATEGIES ESTABLISHED AND KEY STAKEHOLDERS INCLUDING LOCAL COMMUNITIES READY TO COOPERATE

CLEAN UP OPERATION INITIATED AND THE EXECUTION MECHANISM IN PLACE TO SUSTAIN THE CLEAN UP OPERATIONS BEYOND THE PROJECT PERIOD

PROJECT MANAGEMENT STRUCTURE ESTABLISHED, AND MONITORING AND EVALUATION CONDUCTED

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Component 1: Legal framework and institutional capacities to support, justify and evaluate the clean-up of the OHIS site contaminated by alpha-HCH, beta-HCH and lindane established, enhanced and enforced

- **Output 1.1: Legal acts on contaminated site management (identification, securing and protection of the contaminated sites, remediation, monitoring provisions) prepared and expected to be approved by the first quarter of 2023;**
- **Output 1.2: Technical guidelines, tools and procedures enabling contaminated site management (identification, prioritization, risk assessment, safety and risk reduction measures and remediation) prepared and approved;**
- **Output 1.3: Relevant stakeholders (environmental officers from the respective Ministries, environmental inspectors, environmental consulting agencies, specialists on waste management, potential contaminated site clean-up operators) trained on practical usage of the technical guidelines;**
- **Output 1.4: Laboratory personnel from two laboratories (Institute of Public Health and the Central Laboratory of the MoEPP) trained on eco/bio monitoring through sampling and analyses standards and protocols for POPs/HCH in different matrices.**

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Output 1.1: Legal acts on contaminated site management (identification, securing and protection of the contaminated sites, remediation, monitoring provisions) prepared and approved

Methodology for identification and prioretization of Contaminated Sites in Macedonia

1. INTRODUCTION

1.1 Background

The Methodology is prescribed by the Minister of Environment and Physical Planning for evaluating contaminated sites in Republic of Macedonia according to their current or potential adverse impact on human health and the environment. The Methodology is developed to establish a rational and scientifically based system for comparable assessment of contaminated sites. The Methodology could be used as an important management tool for prioritizing the investigation and remediation of contaminated sites in the country.

The legal base for preparation of the Methodology for identifation and prioritization of contaminated sites in Macedonia is in the Law on Environment…..

1.2 Purpose of the Methodology

The main aim of the Methodology is to provide a scientific and technical assistance to the competent authorities in Macedonia during the identification, classification and prioritization of contaminated sites based on their high, medium, low risk or without risk for the human health and the environment.

According this Methodology, contaminated sites are classified into three general categories of risk (H-high, M-medium, L-low or W-without risk) in a systematic and rational manner, according to their current or potential adverse impact on human health and/or the environment, that will lead to further action for protection (e.g., monitoring, main investigation based on risk assessment, remediation, etc.).

The Methodology introduces the Classification System that will be used to perform the identifation and prioritization of contaminated sites in Macedonia.

2. DESCRIPTION OF THE CLASSIFICATION SYSTEM

2.1 The Classification Method

The Classification System uses numerical method that assigns scores to a number of site characteristics or factors and reduce the process of assessment and evaluation using a single score intended to represent a site's present or potential hazard.

Pursuant to Article ….., paragraph (..) and paragraph (….) of the Law on …… (OG), the Ministry of Environment and Physical Planning of the Republic of Macedonia and Ministry of Health of the Republic of Macedonia adopted the

RULEBOOK

on types and levels of concentrations of hazardous substances in soil and groundwater and ecosystems

I GENERAL PROVISIONS

Article 1

Subject matter

(1) This rulebook shall regulate:

- The list of pollutants and the levels of concentrations of hazardous substances in soil, groundwater and ecosystem
- The definition of target values of hazardous substances into the soil, groundwater and ecosystem
- Intervention concentrations values as content of hazardous substances in the soil, groundwater and ecosystem which leads to disruption of its functions and is a danger to the environment and human health
- Criteria for calculating generic reference level for the protection of human health
- Criteria for calculating generic reference level for the protection of ecosystems

(2) The limit value for Groundwater shall be established in accordance with the Law on waters and related secondary legislation

Article 2

Scope of application

(1) This rulebook aims at defining the hazardous substances the related target values, as well as intervention values for the identification of potentially contaminated and contaminated sites, to protect human health and environment.

(2) The rulebook shall not be applied to the assessment of sediment contamination.

Article 3

Definitions

(1) The following definitions shall apply for the purposes of this rulebook:

i "Soil" is three-dimensional dynamic natural body, friable/loose layer of the Earth's surface, naturally changed by mutual influence of pedo-genetic factors and processes;

ii Potentially Contaminated Site: "a site where the concentrations of one or more chemicals in the environmental media (soil, sub-soil and groundwater) exceed „target values and needs *a main site investigation* followed by a site-specific risk assessment to evaluate the contamination level

iii Contaminated Site: a site where *Intervention values*, derived by a site-specific risk assessment carried out on the basis of a detailed site investigation, are exceeded"

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Output 1.2: Technical guidelines, tools and procedures enabling contaminated site management prepared and approved;

Technical instructions on all phases of the contaminated site management:

- **Preliminary site assessment**
  (desktop study, site visit, ICSM, preliminary risk assessment,….)
- **Detailed site assessment**
  (gap analysis, investigation plan, field investigation, CSM, risk assessment,….)
- **Remediation assessment**
  (selection of feasible remediation techniques, MCDA, selection of best remedial option, preliminary design of the preferred remedial option, H&S plan, risk management,…..)
- **Remediation management**
  (tendering process, detailed remediation design, site preparation: zoning, site work analysis, administrative tasks, remediation evaluation, remediation closure,…..)
- **Monitoring and aftercare**
  (monitoring and aftercare plan, organization of monitoring and aftercare, costs, ……)
- **SOPs**
  (personnel health and safety, preliminary site assessment, ICSM, site assessment; gap analysis, field investigation, soil profile description, data management, CSM, drilling methods, installation of monitoring wells, field testing, soil and groundwater sampling, remediation assessment, remediation supervision, monitoring aftercare,…..)

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Output 1.3: Relevant stakeholders (environmental officers from the respective Ministries, environmental inspectors, environmental consulting agencies, specialists on waste management, potential contaminated site clean-up operators) trained on practical usage of the technical guidelines

Training for the relevant stakeholders including theoretical and practical part covering all phases of contaminated site management. Twenty eight participants have been trained.

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Output 1.4: Laboratory personnel from two laboratories (Institute of Public Health and the Central Laboratory of the MoEPP) trained on eco/bio monitoring through sampling and analyses standards and protocols for POPs/HCH in different matrices

Stockholm Convention
Regional Centre for Capacity Building
and the Transfer of Technology

Annex 1 Training Agenda

This annex contains a detailed training agenda that was followed during the training between 11 and 14 September 2017. Contents of the agenda does rigorously follow the requests in the ToR and in the margins of the meeting consultations with relevant RECETOX experts were provided to interested Macedonian participants of the training.

DRAFT AGENDA for Training on Toxic Compounds in the Environment for laboratory technicians from fYRoM

Date: 11 – 15 September 2017

Venue: Research Centre for Toxic Compounds in the Environment (RECETOX), Faculty of Science, Masaryk University, Kamenice 753/5, 625 00 Brno, Czech Republic

PROGRAMME		
Sunday, 10/09/2017		
	Arrival of participants to Brno, Czech Republic	
Monday, 11/09/2017 Kamenice 5, lecture room, 4th floor		
8:30 - 9:00	Registration	
	Session: Introduction	
9:00 - 9:20	Jana Klánová, Kateřina Šebková	Welcome and introductory remarks
9:20 - 10:45	Ivan Holoubek	Introduction to Environmental chemistry – measures to prevent and control releases of toxic chemicals to the environment
10:45 - 11:00	Break – coffee	
11:00 - 12:30	Ivan Holoubek	Sources and fate of chemicals in the environment – myths and reality
12:30 - 14:00	Break - lunch	
14:00 - 15:30	Ivan Holoubek	Introduction to human and ecological risk assessment
15:30 - 16:00	Break – coffee	

Project components/Work Plan

Outcomes/Outputs/Activities	2015										2016												2017											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
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CHARACTERIZATION OF THE HCH CONTAMINATED SITE COMPLETED, RISK ASSESSED AND RISK MANAGEMENT OPTIONS DEFINED

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Component 2: Characterization of the HCH contaminated site completed, risk assessed and risk management options defined

- **Output 2.1: Detailed site investigation conducted and the level of contamination for the different environmental media (soil, groundwater and air), as well as the vegetables defined;**
- **Output 2.2: Groundwater surveyed and the level of contamination of the groundwater at the contaminated site and at the nearby resident area defined;**
- **Output 2.3: : Current risk assessment analyses updated and the risk management options defined.**

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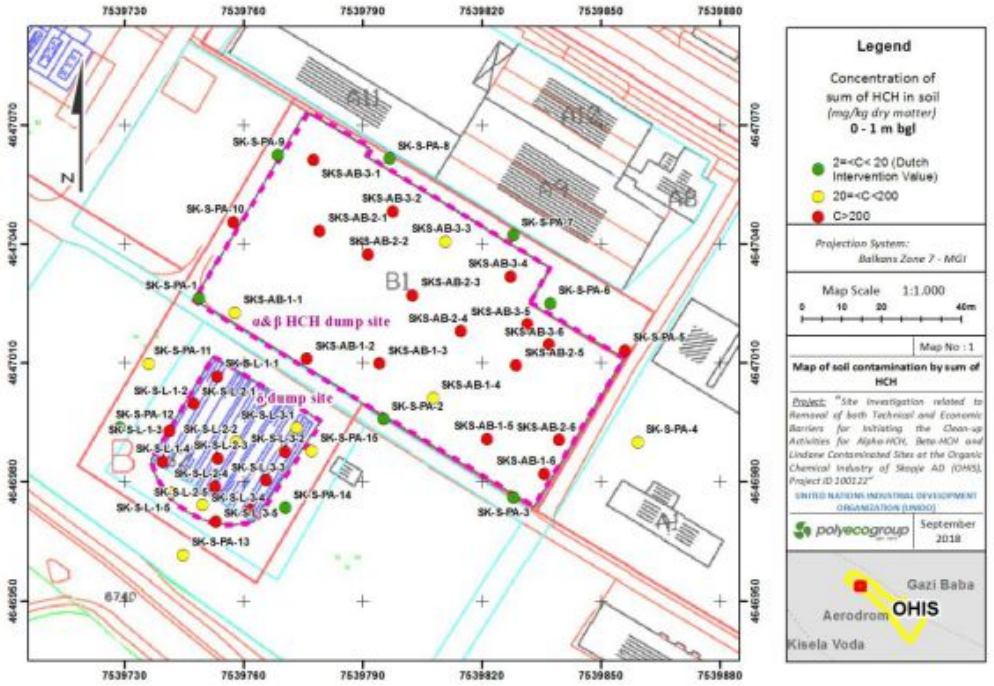
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

48 boreholes were drilled on the big and small HCH dumps and the perimeter of the same; 146 soil/waste samples were collected



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Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

Waste properties of the δ-dump		
Dark Brown Paste	Volume [m³]	223
	Bulk density [kg/m³]	988
	Mass [tn]	**220**
Light Brown Paste	Volume [m³]	562
	Bulk density [kg/m³]	1034
	Mass [tn]	**581**
White powder	Volume [m³]	427.4
	Bulk density [kg/m³]	1870
	Mass [tn]	**799.3**
Total	Mass [tn]	**1600.3**
Soil properties of the δ-dump		
Overlying soil	Volume [m³]	1490
	Bulk density [kg/m³]	1480
	Mass [tn]	**2205**
Underlying sand and clay properties of the δ-dump		
Underlying sand and clay	Volume [m³]	**>742.6**
	Bulk density [kg/m³]	1800
	Mass [tn]	**>1336.7**

Sum HCH range at different statigraphy δ-dump

Description	Color	Sum HCH (mg/kg) - individual samples				Sum HCH (mg/kg) - composite samples	Comments
		Min	Max	Average	Median		
Overlying Soil		71,3	30871	2531,3	508,3	1508,9	
Liquid-oil sludge		8904	131144	44729,3	19434,5	-	
White powder		22284	25222	23753	23753	18012	
Dark brown paste		18013	179470	96148,8	105145,5	256230	
Light brown paste		36849	269648	102047,5	65789	970330	
Clay		8,8	3342	1113,4	522,1	32653	with tar
						2070,8	with chemical odour
						2,4	composite
Sand		2,2	222,3	132,3	128,25	998,6	

Parameter	Value	Note
Planar area	1,240 m²	
Surface area	1,250 m²	
Total dump volume	2,630 m³	
Volume of δ-HCH waste	620 m³	
Mass of δ-HCH waste	590 t	Density of 0.95 g/cm³ used for calculation
Character of δ-HCH waste	16% of a-HCH, 1% of β-HCH, 44% of γ-HCH and 39% of δ-HCH	In comparison, EPTISA (2007) states 22-26% of a-HCH, 5-7% of β-HCH, 16 – 19% of γ-HCH and 38-50% of δ-HCH
Volume of dumped contaminated soil and other waste	2,010 m³	
Mass of dumped contaminated soil and other waste	3,620 t	Density of 1.8 g/cm³ used for calculation

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Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

Waste properties of the α&β-dump		
Waste (white powder)	Volume [m³]	**22261**
	Density [kg/m³]	1870
	Mass [tn]	**41628.1**
Soil properties of the α&β-dump		
Overlying soil	Volume [m³]	**5812.7**
	Density [kg/m³]	1800
	Mass [tn]	**10462.9**

Description	Sum HCH (mg/kg) - composite samples			
	Min	Max	Average	Median
Overlying Soil	65,01	2762,2	1146,5	1006,8

Parameter	Value	Note
Planar area	5,140 m²	
Surface area	5,270 m²	
Total dump volume	20,200 m³	In comparison, EPTISA (2007) states 25,000 m³
Volume of HCH waste	15,000 m³	
Mass of HCH waste	28,100 t	Density of 1.87 g/cm³ used for calculation. In comparison, EPTISA (2007) states 13,900 t
Character of the waste	88% of a-HCH, 11-12% of β-HCH and 1 – 2 % of γ-HCH	Source: EPTISA 2007
Volume of the overlying contaminated soil	5,200 m³	
Mass of the overlying contaminated soil	9,400 t	Density of 1.8 g/cm³ used for calculation. In comparison, EPTISA (2007) states 14,000 t

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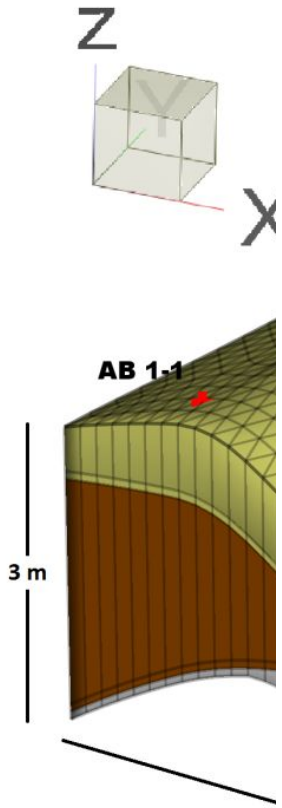
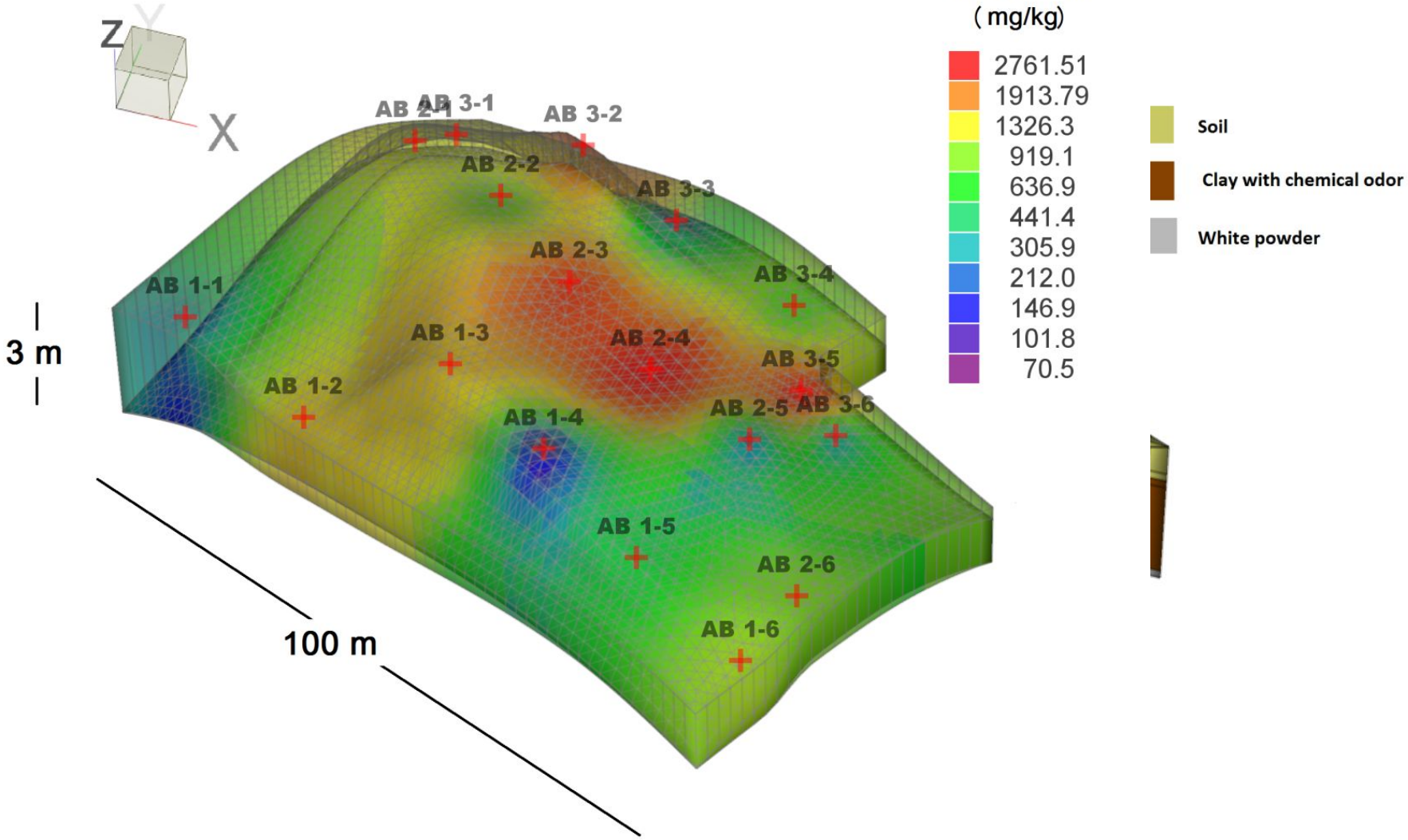
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses





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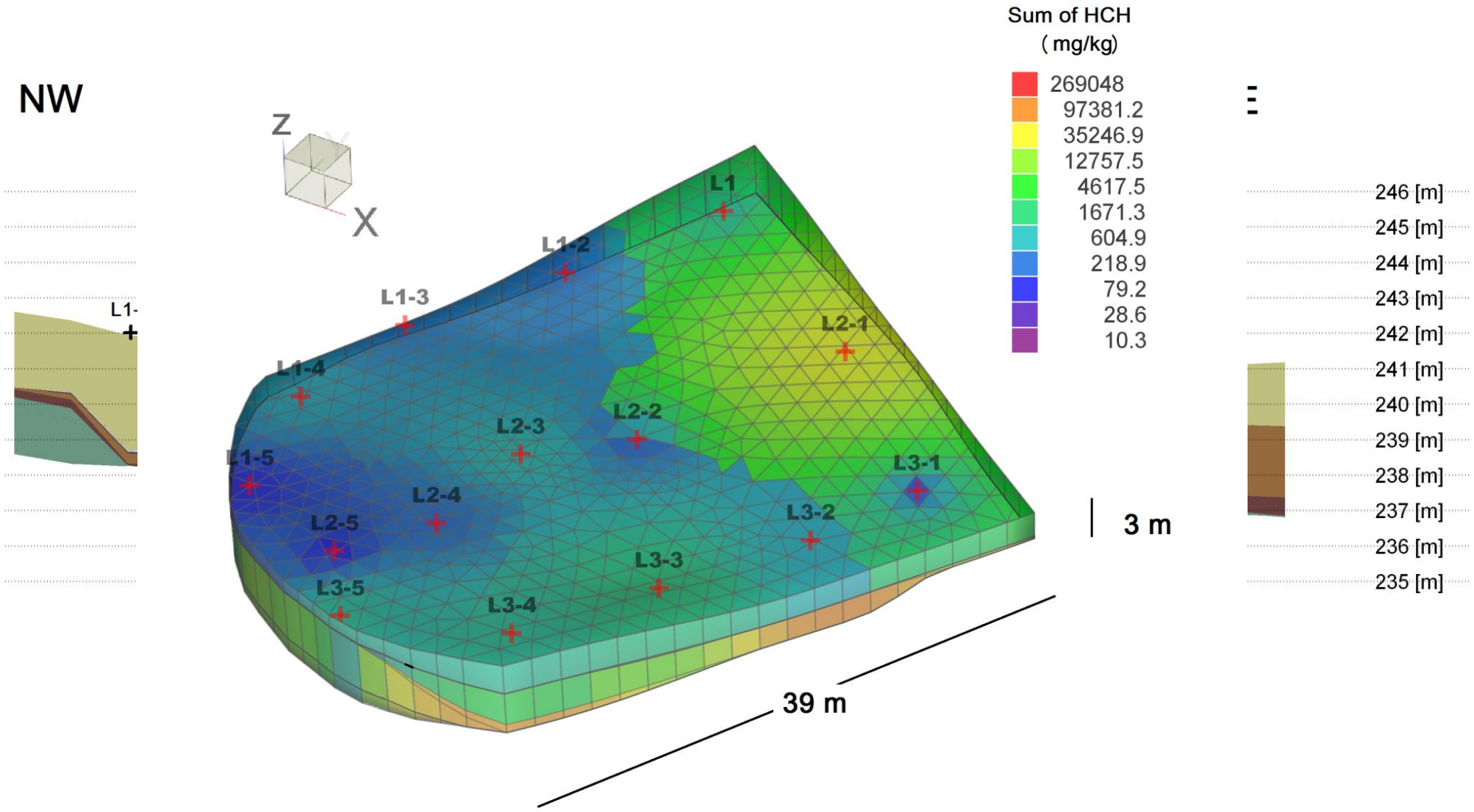

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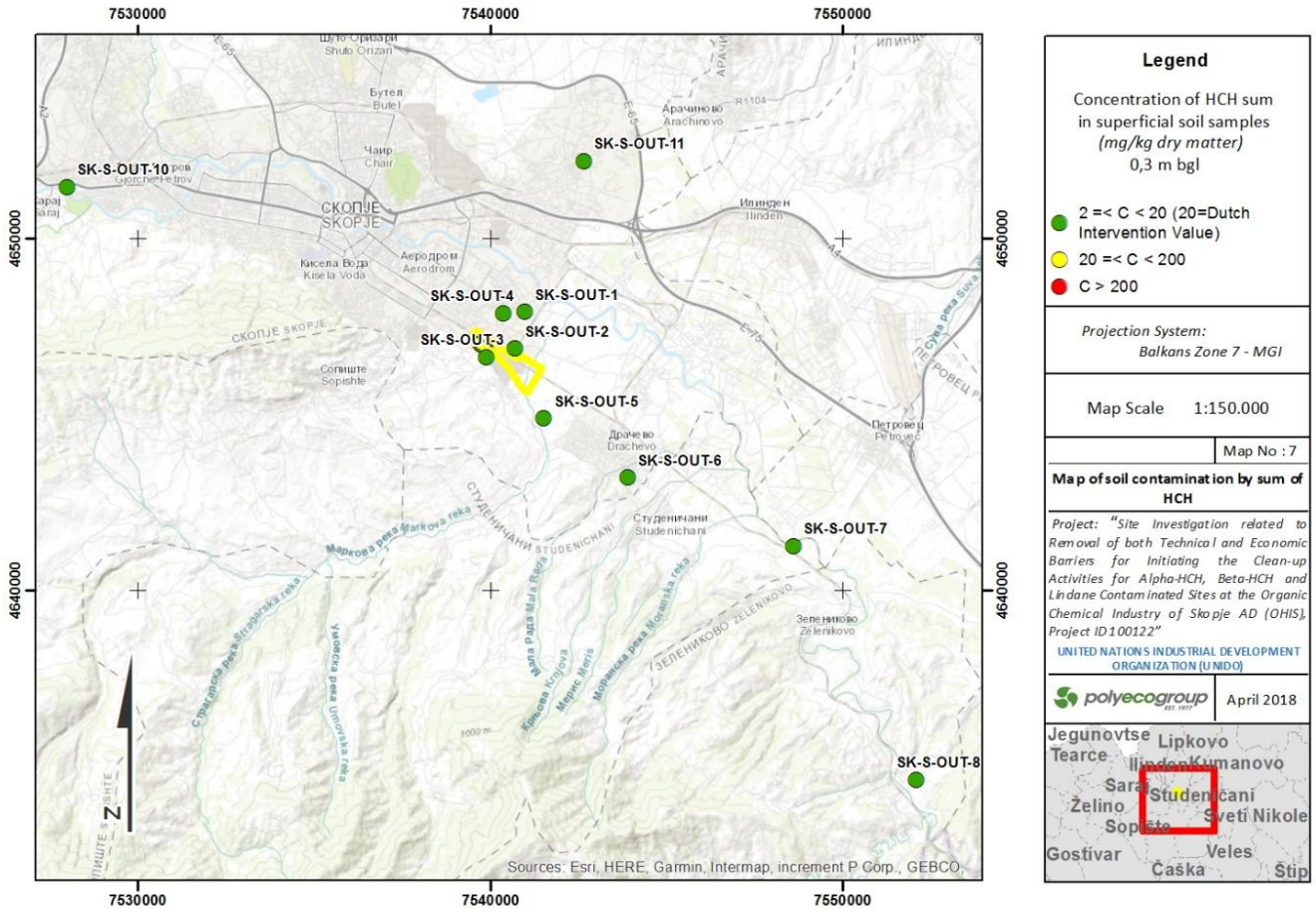

10 superficial soil samples for the determination of the background HCH concentration were collected at ten locations of the surroundings of OHIS site and the city of Skopje (from 0.7 km up to 17 km).

Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

Sample no.					171164962	171164963	171212792	171212793	171212794	171212795	171212796	171212797	171212798	171212799
Sample label					SK-S-OUT-1 sk-s-pa-borko-1	SK-S-OUT-2 sk-s-lis-1	SK-S-OUT-3	SK-S-OUT-4	SK-S-OUT-5	SK-S-OUT-6	SK-S-OUT-7	SK-S-OUT-8	SK-S-OUT-10	SK-S-OUT-11
Parameter	Unit	Standard LOQ	Method	Intervention (mg/kg)	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Dry mass	w-% ar	0.1	DIN ISO 11465		91.2	91	99.3	99.1	99.1	99	99.2	99.3	99.2	99.2
Moisture	w-% ar	0.1			8.8	9	0.7	0.9	0.9	1	0.8	0.7	0.8	0.8
Hexa chloro benzene	mg/kg d	0.005	DIN 38407-2	2	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
alpha-HCH	mg/kg d	0.005	DIN 38407-2	17	1	2.3	0.073	< 0,005	< 0,005	< 0,005	0.016	< 0,005	< 0,005	< 0,005
beta-HCH	mg/kg d	0.005	DIN 38407-2	1.6	< 0,05	< 0,05	0.014	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
gamma-HCH	mg/kg d	0.005	DIN 38407-2	1.2	< 0,05	0.34	0.008	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
delta-HCH	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	0.84	0.011	0.007	< 0,005	0.04	0.008	0.019	0.013
epsilon-HCH	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
Aldrin	mg/kg d	0.005	DIN 38407-2	0.32	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
Dieldrin	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
Endrin	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
Heptachlor	mg/kg d	0.005	DIN 38407-2	4	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
cis Hepta chloro epoxide	mg/kg d	0.005	DIN 38407-2	4	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
trans Hepta chloro epoxide	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
alpha Endosulfan	mg/kg d	0.005	DIN 38407-2	4	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
beta Endosulfan	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
o,p´-DDE	mg/kg d	0.005	DIN 38407-2	2.3	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
p,p´-DDE	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
o,p´-DDD	mg/kg d	0.005	DIN 38407-2	34	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
p,p´-DDD	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
o,p´-DDT	mg/kg d	0.005	DIN 38407-2	1.7	< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
p,p´-DDT	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005
Methoxychlor	mg/kg d	0.005	DIN 38407-2		< 0,05	< 0,05	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005	< 0,005

Intervention values in accordance with Dutch Soil Remediation Circular 2009

Result > Intervention value

None of the external superficial soil samples taken during Polyeco's campaigns exceeded Dutch Intervention Values, although in most of them (9 out of 10) some minor concentrations of HCH isomers were detected. Other analyzed pesticides were below detection limits

Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

10 vegetables samples (2 cabbage, 2 beetroot, 2 potatoes, 2 parsley, 1 onion and 1 pumpkin) were collected at three different locations, i.e. from the locations of the 3 domestic wells

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Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

The results of the tested vegetables were within the maximum residue level (MRL) of pesticides as defined by Regulation (EC) No 396/2005, except for α-HCH parameter for 2 samples of parsley (27 µg/kg and 26 µg/kg) and 1 sample of cabbage (23 µg/kg) when the MRL is 10 µg/kg. The rest of the samples and parameters (DDE, DDE, DDT, aldrin, dieldrin, endosulfans, other HCH isomers, heptachlors, methoxychlor, PCB and others) were below the detection limits.

SGS IF sample no.	171164964	171164965	171164966	171164967	171164968	171212801	171212802	171212803	171212804	171212805	Limit EC 396/2005
Sample label	SK-VEG-BOR-1 beet root	SK-VEG-BOR-2 cabbage	SK-VEG-LIS-VEG-1 beet root	SK-S-LIS-VEG-2 Pumpkin	SK-S-LIS-VEG-2 cabbage	SK-VEG-BOR-3, Potatoes	SK-VEG-BOR-4, Parsley	SK-VEG-LIS-3, Potatoes	SK-VEG-LIS-4, Parsley	SK-VEG-LIS-5, Onion	
Parameter											
o,p'-DDD	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
o,p'-DDE	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
o,p'-DDT	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,05
p,p'-DDD	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
p,p'-DDE	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
p,p'-DDT	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
Aldrin	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,01
Dieldrin	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,01
alpha-Endosulfan	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
beta-Endosulfan	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,01
Endosulfansulfat	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
alpha-Hexachlorcyclohexan	< 0,01 (B)	0,023	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	0,027	< 0,01 (B)	0,026	< 0,01 (B)	
beta-Hexachlorcyclohexan	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	0,01
gamma-Hexachlorcyclohexan	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	
delta-Hexachlorcyclohexan	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	< 0,01 (B)	
Heptachlor	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
Heptachlorepoxid	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,01
Heptachlorepoxid	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
Hexachlorbenzol	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	
Methoxychlor	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	0,01
PCB 101	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	
PCB 138	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	
PCB 153	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	
PCB 180	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	0,2-3*
PCB 28	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	
PCB 52	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	

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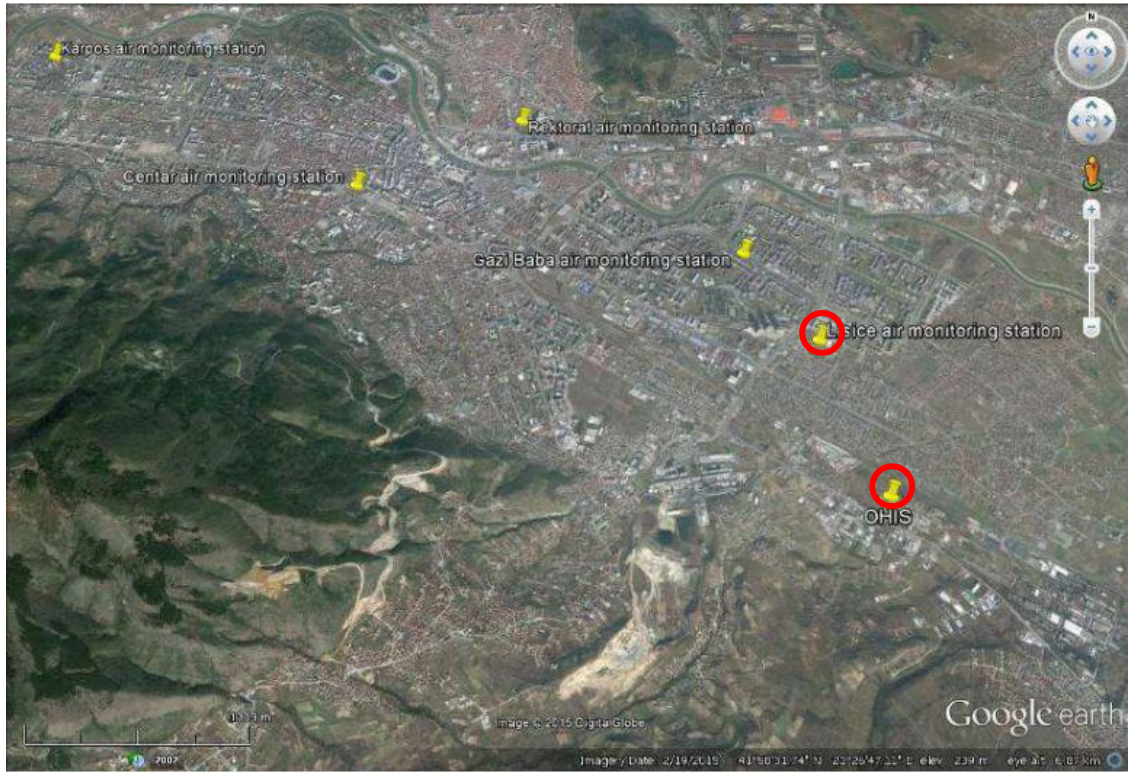
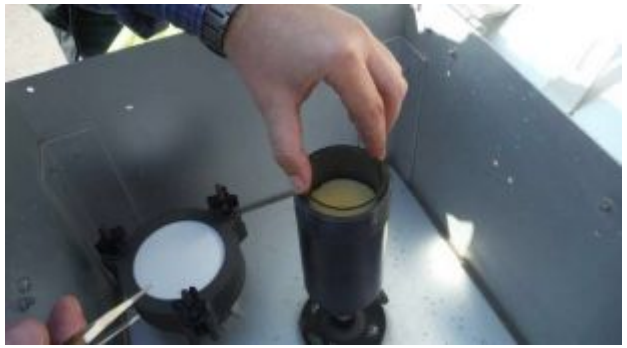
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

Two air monitoring locations: one pump was set at OHIS site, next to the site where the drilling of boreholes took place and the second one in the city of Skopje, close to Novo Lisice and next to a school. In both places air samples were collected before (1 sample), during (2 samples) and after (1 sample) the completion of the drilling works. In total eight (8) air samples were collected: four (4) samples at OHIS and other four (4) in the city of Skopje.





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Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses

Ambient air samples analysis results were compared with the applicable threshold limit values (TLV) and the Maximum Acceptable Toxic Concentration (MATC) of Dutch Soil Remediation Circular (2009). In all samples collected in OHIS dump sites area, α-HCH parameter exceeded the MATC (Dutch Soil Remediation Circular 2009). PCB concentrations were within the levels for industrial areas, while PAH presented levels above environmentally degraded areas.

Sample label				1	2	3	4	5	6	OH before drilling	OH during drilling 1	OH during drilling 2	OH after drilling		LIS before drilling	LIS during drilling 1	LIS during drilling 2	LIS after drilling
Parameter	Unit	Standard LOQ	Method	TLV-TWA Denmark	TLV-TWA Germany	TLV-TWA USA	TLV-TWA Greece	TLV-TWA Other Country	MATC	Result	Result	Result	Result		Result	Result	Result	Result
alpha-HCH	µg/m³	0.005	VDI4301	500	100				0.25	0.45	0.61	0.3	1		< 0,005	< 0,005	< 0,005	< 0,005
beta-HCH	µg/m³	0.005	VDI4301	500	500				0.25	0.020	0.007	0.009	0.010		< 0,005	< 0,005	< 0,005	< 0,005
gamma-HCH	µg/m³	0.005	VDI4301	500	100	500			0.25	0.032	0.041	0.088	0.15		< 0,005	< 0,005	< 0,005	< 0,005
delta-HCH	µg/m³	0.005	VDI4301	500						0.022	0.01	0.038	0.074		< 0,005	< 0,005	< 0,005	< 0,005
Chlordane	µg/m³	0.01	VDI4301				500		0.02	< 0,01	< 0,01	< 0,01	< 0,01		< 0,01	< 0,01	< 0,01	< 0,01
o,p-DDT	µg/m³	0.005	VDI4301	1000	1000	1000				< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
p,p-DDT	µg/m³	0.005	VDI4301							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
o,p-DDD	µg/m³	0.005	VDI4301							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
p,p-DDD	µg/m³	0.005	VDI4301							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
o,p-DDE	µg/m³	0.005	VDI4301							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
p,p-DDE	µg/m³	0.005	VDI4301							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
Naphthalene	µg/m³	0.005	DIN ISO 12884				100			< 0,005	< 0,005	0.011	0.01		< 0,005	< 0,005	0.019	< 0,005
Acenaphthylene	µg/m³	0.005	DIN ISO 12884							0.005	0.009	0.014	0.041		< 0,005	0.015	0.037	0.033
Acenaphthene	µg/m³	0.005	DIN ISO 12884							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
Fluorene	µg/m³	0.005	DIN ISO 12884							0.009	0.010	0.010	0.025		0.014	0.018	0.032	0.041
Phenanthrene	µg/m³	0.005	DIN ISO 12884					800 (Latvia)		0.019	0.016	0.025	0.058		0.049	0.035	0.063	0.110
Anthracene	µg/m³	0.005	DIN ISO 12884							< 0,005	< 0,005	< 0,005	0.010		0.005	0.006	0.010	0.020
Fluoranthene	µg/m³	0.005	DIN ISO 12884							0.005	0.005	0.009	0.021		0.010	0.013	0.021	0.037
Pyrene	µg/m³	0.005	DIN ISO 12884				5			< 0,005	< 0,005	0.005	0.020		0.009	0.010	0.020	0.034
Benzo(a)anthracene	µg/m³	0.005	DIN ISO 12884				5			< 0,005	< 0,005	0.005	0.014		< 0,005	< 0,005	0.010	0.018
Chrysene	µg/m³	0.005	DIN ISO 12884				5			< 0,005	< 0,005	0.005	0.014		< 0,005	< 0,005	0.011	0.017
Benzo(b)fluoranthene+Benzo(k)fluoranthene	µg/m³	0.005	DIN ISO 12884							< 0,005	0.005	0.011	0.034		0.007	0.009	0.026	0.044
Benzo(a)pyrene	µg/m³	0.005	DIN ISO 12884		0.7			0,55 (The Netherlands)		< 0,005	< 0,005	0.005	0.013		< 0,005	< 0,005	0.012	0.016
Indeno(1,2,3-c,d)pyrene	µg/m³	0.005	DIN ISO 12884				5			< 0,005	< 0,005	< 0,005	0.008		< 0,005	< 0,005	0.007	0.008
Dibenzo(a,h)anthracene	µg/m³	0.005	DIN ISO 12884							< 0,005	< 0,005	< 0,005	< 0,005		< 0,005	< 0,005	< 0,005	< 0,005
Benzo(g,h,i)perylene	µg/m³	0.005	DIN ISO 12884							< 0,005	< 0,005	< 0,005	n.a.[5]		< 0,005	n.a.[5]	0.005	n.a.[5]
Sum of PAH (EPA)			DIN ISO 12884							0.038	0.045	0.100	0.268		0.094	0.106	0.273	0.378

MATC = Maximum Acceptable Toxic Concentration (Dutch Soil Remediation Circular 2009)

Result > MATC value

Considered high compared to values detected in industrial areas

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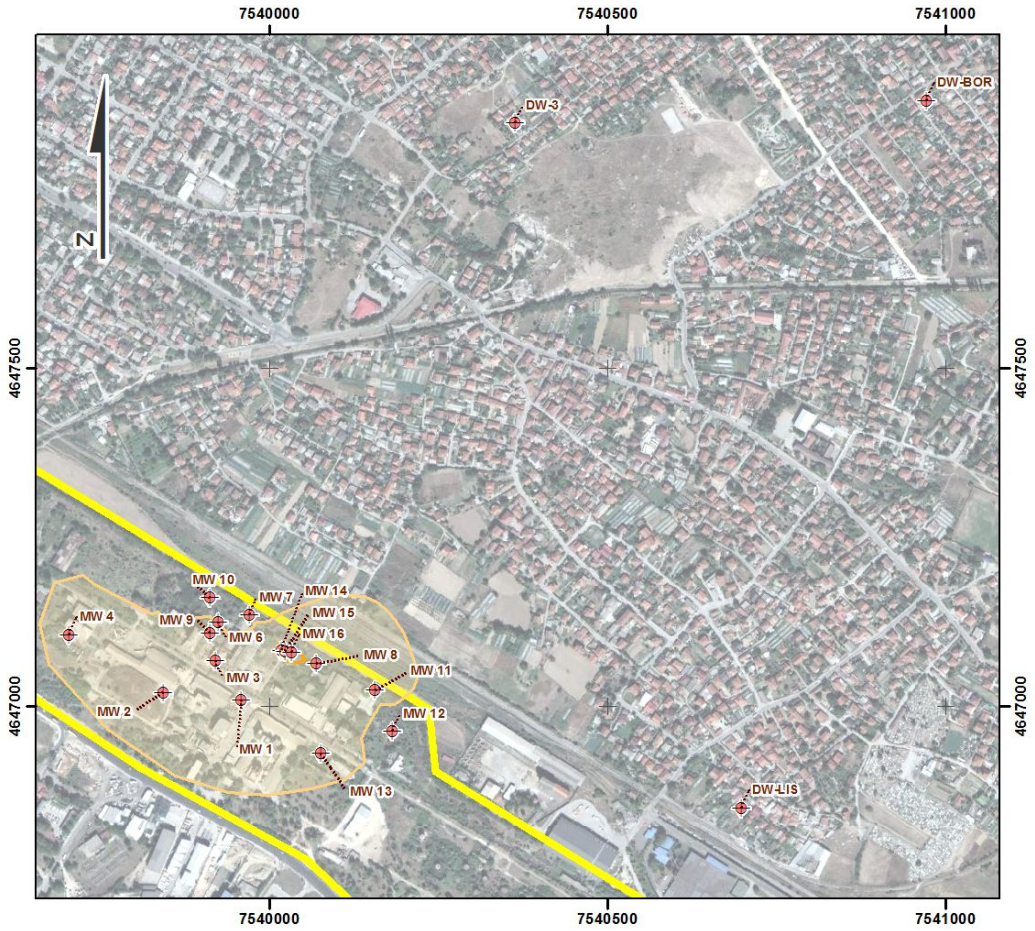
Output 2.2: Survey of ground water for drinking and irrigation purposes conducted including installation of boreholes where needed

36 groundwater samples taken from 15 monitoring wells and 3 domestic wells in the course of 2 sampling campaigns and the samples analyzed



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Output 2.2: Survey of ground water for drinking and irrigation purposes conducted including installation of boreholes where needed

The results of the groundwater taken from the monitoring wells exceeded the intervention values for HCH (1 µg/l) at all 15 monitoring wells; then exceeded the intervention value for mercury (0.3 µg/l) in the majority of the wells, and the levels of chlorobenzenes, chloroethenes and ethanes are mainly between the target and intervention values, while for the domestic wells the levels of HCH, chlorobenzenes, chloroethenes and ethanes are between the target and intervention values.

Sample no.						171149891	171149892	171149893	171149894	171149895	171149896	171149897	171149898
Sample label						MW 1	MW 2	MW 3	MW 4	MW 6	MW 7	MW 8	MW 9
Parameter	Unit	Standard LOQ	Method	Intervention (µg/l)	Target (µg/l)	Result	Result	Result	Result	Result	Result	Result	Result
Mercury	µg/l	0.1	DIN EN 1483	0.3	0.05	< 0,1	< 0,1	< 0,1	< 0,1	< 0,1	0.4	71	< 0,1
Selected chloro organic parameters:													
alpha-HCH	µg/l	0.01	DIN 38407-2	1	0.05	0.89	2.9	0.26	4.5	0.59	0.27	0.19	2.1
beta - HCH	µg/l	0.01	DIN 38407-2			2.9	5	1.4	4.1	1.5	1	3.5	0.43
gamma-HCH	µg/l	0.01	DIN 38407-2			0.1	0.74	0.11	0.12	0.16	0.16	0.16	0.07
delta - HCH	µg/l	0.01	DIN 38407-2			0.23	7	0.14	0.51	0.14	0.11	0.36	0.19
Aldrin	µg/l	0.01	DIN 38407-2		0.000009	0.06	< 0,01	0.63	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Dieldrin	µg/l	0.01	DIN 38407-2		0.0001	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Endrin	µg/l	0.01	DIN 38407-2		0.00004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Heptachlor	µg/l	0.01	DIN 38407-2	0.3	0.000005	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
cis-Heptachloro epoxide	µg/l	0.01	DIN 38407-2	3	0.000005	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
trans-Heptachloro epoxide	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
alpha Endosulfan	µg/l	0.01	DIN 38407-2	5	0.0002	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
beta Endosulfan	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDE	µg/l	0.01	DIN 38407-2	0.01	0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
p, p´ - DDE	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDD	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
p, p´ - DDD	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDT	µg/l	0.05	DIN 38407-2		0.000004	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
p, p´ - DDT	µg/l	0.05	DIN 38407-2		0.000004	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
Methoxychlor	µg/l	0.05	DIN 38407-2			< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
Chloro benzenes:													
Chloro benzene	µg/l	1	DIN 38407-9-1	180	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichloro benzene	µg/l	0.05	DIN 38407-2	50	3	< 0,05	0.35	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
1,3-Dichloro benzene	µg/l	0.05	DIN 38407-2			< 0,05	0.47	5	< 0,05	< 0,05	< 0,05	1	< 0,05
1,4-Dichloro benzene	µg/l	0.05	DIN 38407-2			< 0,05	< 0,05	2	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
1,2,3-Trichloro benzene	µg/l	0.01	DIN 38407-2	10	0.01	0.15	1.1	1.3	< 0,01	< 0,01	< 0,01	0.57	< 0,01
1,2,4-Trichloro benzene	µg/l	0.01	DIN 38407-2			0.11	1	2	< 0,01	< 0,01	< 0,01	0.79	< 0,01
1,3,5-Trichloro benzene	µg/l	0.01	DIN 38407-2			0.07	0.52	7.5	< 0,01	< 0,01	< 0,01	1.7	< 0,01
1,2,4,5-Tetrachloro benzene	µg/l	0.01	DIN 38407-2	2.5	0.01	0.16	0.24	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
1,2,3,4-Tetrachloro benzene	µg/l	0.01	DIN 38407-2			0.05	0.36	1.2	< 0,01	< 0,01	< 0,01	0.59	< 0,01
Pentachloro benzene	µg/l	0.01	DIN 38407-2	1	0.003	0.08	0.03	0.67	< 0,01	< 0,01	< 0,01	0.28	< 0,01
Hexachloro benzene	µg/l	0.01	DIN 38407-2	0.5	0.00009	0.13	< 0,01	0.22	< 0,01	0.53	0.43	0.24	< 0,01
Chloro ethenes and ethanes:													
Chloro ethene (Vinyl chloride)	µg/l	1	DIN EN ISO 10301	5	0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloro ethene	µg/l	1	DIN EN ISO 10301	20	0.01	< 1	< 1	59	< 1	< 1	< 1	2	< 1
trans-1,2-Dichloro ethene	µg/l	1	DIN EN ISO 10301			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloro ethane	µg/l	0.2	DIN EN ISO 10301	300	0.01	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2
Trichloro ethene	µg/l	0.1	DIN EN ISO 10301	500	24	0.6	0.4	470	< 0,1	21	26	200	12
Tetrachloro ethene	µg/l	0.1	DIN EN ISO 10301	40	0.01	1.5	5.3	270	0.2	24	10	18	0.7
Trichloro methane	µg/l	0.5	DIN EN ISO 10301	400	6	1.7	< 0,5	1.9	< 0,5	< 0,5	< 0,5	0.6	< 0,5
1,1,2-Trichloro ethane	µg/l	0.2	DIN EN ISO 10301	130	0.01	< 0,2	< 0,2	1.4	< 0,2	< 0,2	< 0,2	1	< 0,2
1,1-Dichloro ethane	µg/l	1	DIN EN ISO 10301	900	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichloro ethane	µg/l	1	DIN EN ISO 10301	400	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-Dichloro ethene	µg/l	1	DIN EN ISO 10301	10	0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloro ethane	µg/l	0.5	DIN EN ISO 10301			< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5
1,1,2,2-Tetrachloro ethane	µg/l	0.5	DIN EN ISO 10301			< 0,5	< 0,5	4.5	< 0,5	< 0,5	< 0,5	4.8	< 0,5
Hexachloro ethane	µg/l	0.2	DIN EN ISO 10301			< 0,2	< 0,2	23	< 0,2	7	2.8	< 0,2	< 0,2
Pentachloro ethane	µg/l	1	DIN EN ISO 10301			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

	Result > Intervention value
	Result > Target value (Inervention value does not exist)
	Target value < Result < Intervention value

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Output 2.2: Survey of ground water for drinking and irrigation purposes conducted including installation of boreholes where needed

Sample no.						171149899	171149900	171150201	171150202	171150203	171150204	171150205	171164969	171164970	171212800
Sample label						MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16	SK-DW-LIS	SK-DW-BOR	SK-DW-3
Parameter	Unit	Standard LOQ	Method	Intervention (µg/l)	Target (µg/l)	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Mercury	µg/l	0.1	DIN EN 1483	0.3	0.05	< 0,1	5.8	< 0,1	< 0,1	2.3	0.7	0.1	< 0,1	< 0,1	< 0,1
Selected chloro organic parameters:															
alpha-HCH	µg/l	0.01	DIN 38407-2	1	0.05	9.2	0.08	0.27	0.14	0.98	1.4	2.6	0.06	0.09	0.02
beta - HCH	µg/l	0.01	DIN 38407-2			4.7	2.1	0.76	0.34	2.2	2.7	2.9	0.39	0.02	< 0,01
gamma-HCH	µg/l	0.01	DIN 38407-2			0.26	0.16	0.35	0.23	0.51	0.45	0.68	0.05	0.02	0.01
delta - HCH	µg/l	0.01	DIN 38407-2			0.74	0.12	0.47	0.4	0.56	0.04	0.83	0.07	0.03	0.02
Aldrin	µg/l	0.01	DIN 38407-2		0.000009	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Dieldrin	µg/l	0.01	DIN 38407-2		0.0001	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Endrin	µg/l	0.01	DIN 38407-2		0.00004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Heptachlor	µg/l	0.01	DIN 38407-2	0.3	0.000005	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
cis-Heptachloro epoxide	µg/l	0.01	DIN 38407-2	3	0.000005	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
trans-Heptachloro epoxide	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
alpha Endosulfan	µg/l	0.01	DIN 38407-2	5	0.0002	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
beta Endosulfan	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDE	µg/l	0.01	DIN 38407-2	0.01	0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
p, p´ - DDE	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDD	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
p, p´ - DDD	µg/l	0.01	DIN 38407-2		0.000004	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
o, p´ - DDT	µg/l	0.05	DIN 38407-2		0.000004	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
p, p´ - DDT	µg/l	0.05	DIN 38407-2		0.000004	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
Methoxychlor	µg/l	0.05	DIN 38407-2			< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
Chloro benzenes:															
Chloro benzene	µg/l	1	DIN 38407-9-1	180	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichloro benzene	µg/l	0.05	DIN 38407-2	50	3	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05
1,3-Dichloro benzene	µg/l	0.05	DIN 38407-2			< 0,05	< 0,05	< 0,05	< 0,05	2	2	3	< 0,05	< 0,05	< 0,05
1,4-Dichloro benzene	µg/l	0.05	DIN 38407-2			< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	< 0,05	1	< 0,05	< 0,05	< 0,05
1,2,3-Trichloro benzene	µg/l	0.01	DIN 38407-2	10	0.01	< 0,01	0.2	0.1	0.07	0.67	0.78	11	< 0,01	< 0,01	< 0,01
1,2,4-Trichloro benzene	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	< 0,01	0.07	3.8	4	18	< 0,01	< 0,01	< 0,01
1,3,5-Trichloro benzene	µg/l	0.01	DIN 38407-2			< 0,01	0.31	0.25	0.03	2	1.9	5.2	< 0,01	< 0,01	< 0,01
1,2,4,5-Tetrachloro benzene	µg/l	0.01	DIN 38407-2	2.5	0.01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
1,2,3,4-Tetrachloro benzene	µg/l	0.01	DIN 38407-2			< 0,01	< 0,01	0.22	0.06	0.45	0.57	1.5	< 0,01	< 0,01	< 0,01
Pentachloro benzene	µg/l	0.01	DIN 38407-2	1	0.003	< 0,01	0.45	0.57	0.01	0.22	0.21	0.33	< 0,01	< 0,01	< 0,01
Hexachloro benzene	µg/l	0.01	DIN 38407-2	0.5	0.00009	< 0,01	0.26	0.13	0.01	0.11	0.08	0.07	< 0,01	< 0,01	< 0,01
Chloro ethenes and ethanes:															
Chloro ethene (Vinyl chloride)	µg/l	1	DIN EN ISO 10301	5	0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloro ethene	µg/l	1	DIN EN ISO 10301	20	0.01	< 1	< 1	1	< 1	2	3	4	< 1	< 1	< 1
trans-1,2-Dichloro ethene	µg/l	1	DIN EN ISO 10301			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloro ethane	µg/l	0.2	DIN EN ISO 10301	300	0.01	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2	< 0,2
Trichloro ethene	µg/l	0.1	DIN EN ISO 10301	500	24	0.2	16	1.5	< 0,1	120	220	270	1	0.1	0.3
Tetrachloro ethene	µg/l	0.1	DIN EN ISO 10301	40	0.01	0.4	3.4	0.5	< 0,1	32	36	40	1.2	0.2	0.4
Trichloro methane	µg/l	0.5	DIN EN ISO 10301	400	6	< 0,5	< 0,5	< 0,5	< 0,5	1.9	2.2	1.1	< 0,5	< 0,5	< 0,5
1,1,2-Trichloro ethane	µg/l	0.2	DIN EN ISO 10301	130	0.01	< 0,2	< 0,2	< 0,2	< 0,2	0.4	1.6	1.6	< 0,2	< 0,2	< 0,2
1,1-Dichloro ethane	µg/l	1	DIN EN ISO 10301	900	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichloro ethane	µg/l	1	DIN EN ISO 10301	400	7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-Dichloro ethene	µg/l	1	DIN EN ISO 10301	10	0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1,2-Tetrachloro ethane	µg/l	0.5	DIN EN ISO 10301			< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5	< 0,5
1,1,2,2-Tetrachloro ethane	µg/l	0.5	DIN EN ISO 10301			< 0,5	< 0,5	< 0,5	< 0,5	2.3	1.1	8.9	< 0,5	< 0,5	< 0,5
Hexachloro ethane	µg/l	0.2	DIN EN ISO 10301			< 0,2	< 0,2	< 0,2	< 0,2	3.4	3.1	2.5	< 0,2	< 0,2	< 0,2
Pentachloro ethane	µg/l	1	DIN EN ISO 10301			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

	Result > Intervention value
	Result > Target value (Inervention value does not exist)
	Target value < Result < Intervention value

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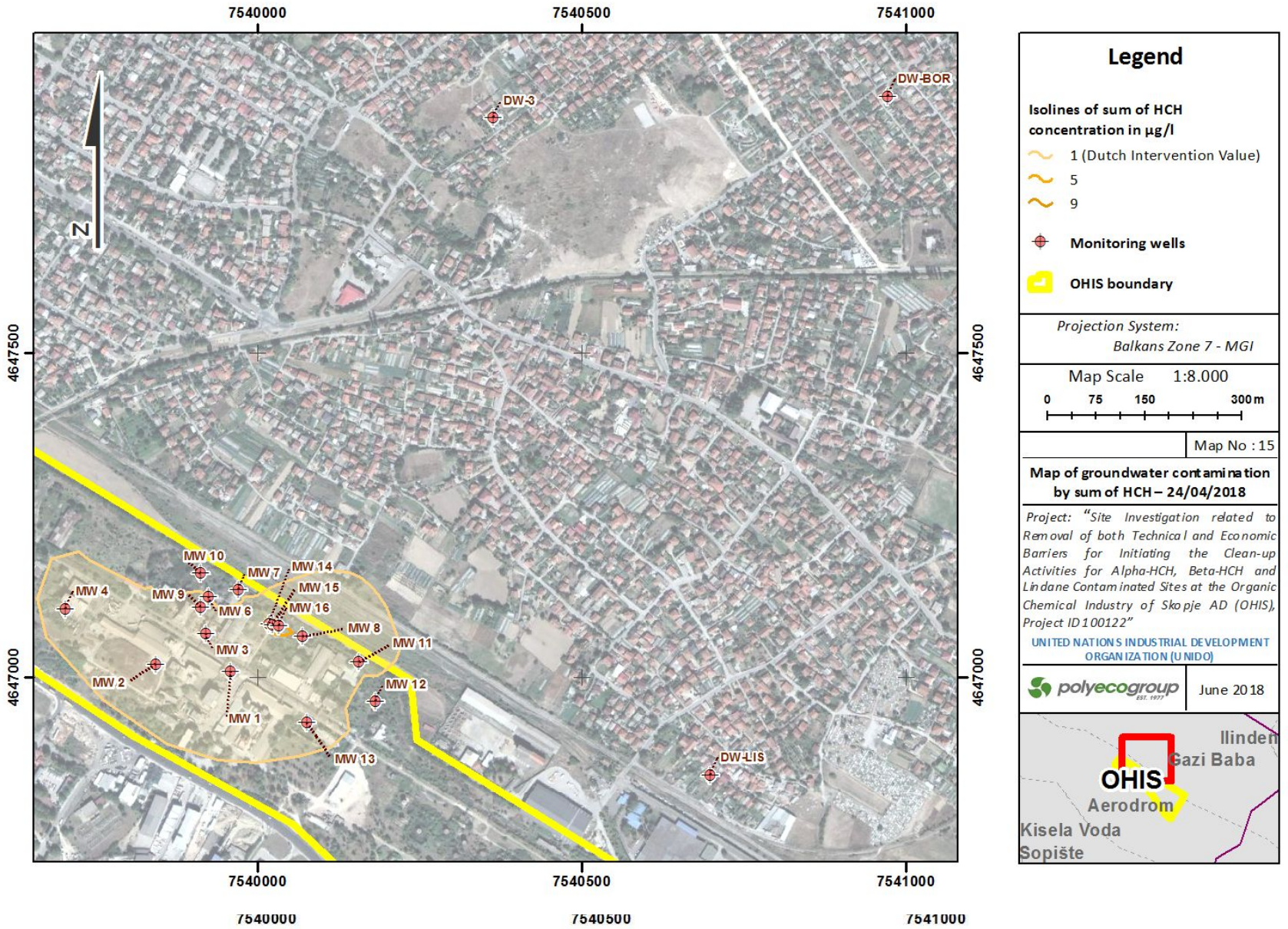
Output 2.2: Survey of ground water for drinking and irrigation purposes conducted including installation of boreholes where needed



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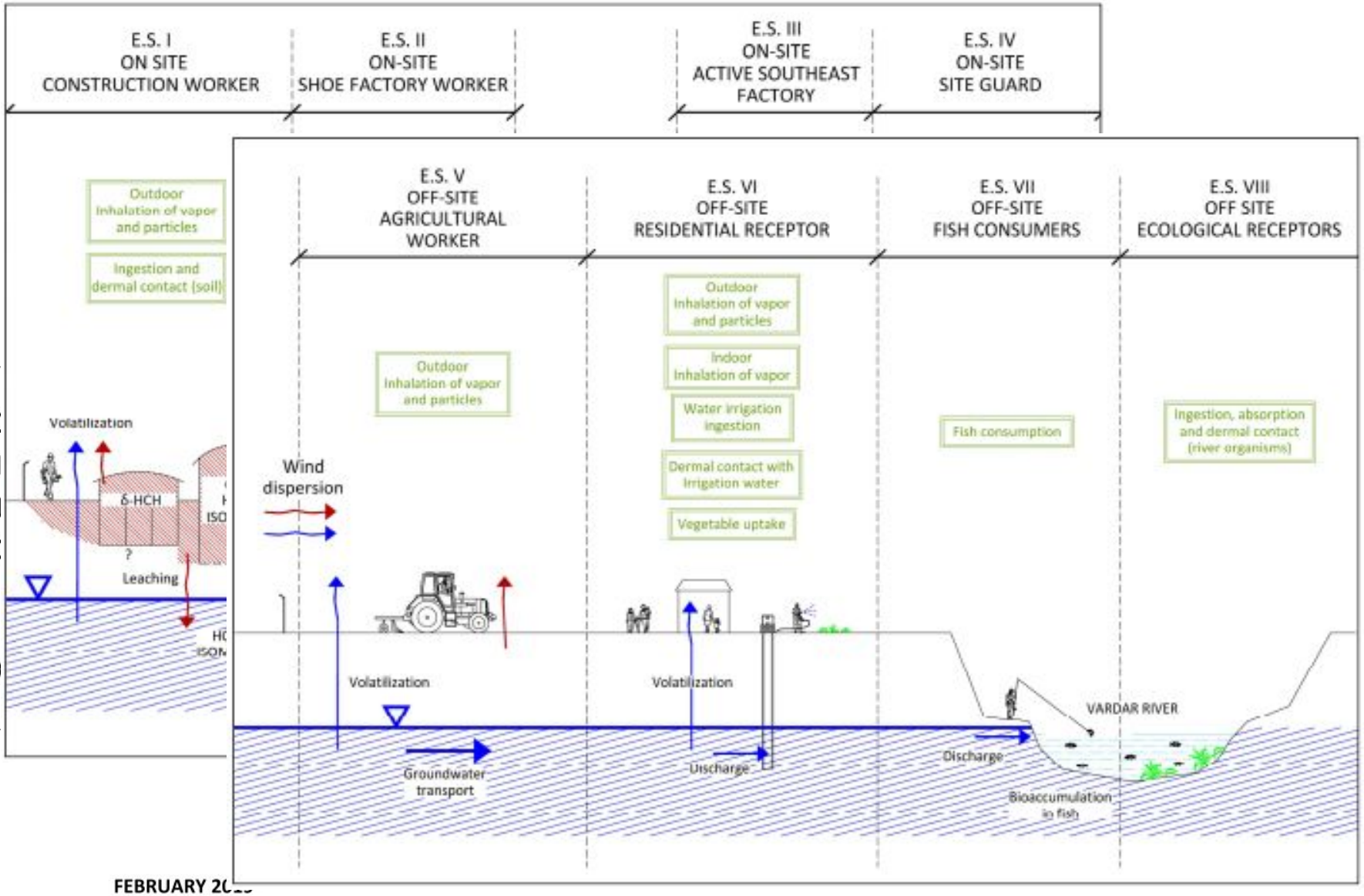
Output 2.3: Current risk assessment analyses updated and the risk management options defined



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FEBRUARY 20

Output 2.3: Current risk assessment analyses updated and the risk management options defined

The risk assessment analysis updated, based on the findings from the detailed site investigation (identifying the sources of contamination, the exposure pathways, the receptors, the contaminant migration, the risk characterization identifying unacceptable risks for certain receptors) and the defining corresponding risk management options towards reduction/elimination of the risks.

ES	Risk	Ingestion/dermal contact affected soil	Outdoor inhalation particles/vapor	Indoor inhalation vapor*	Cumulative risk
I: Construction/ remediation worker	**Yes**	**HQ=6.8E+2 ILCR=8.1E-3**	**HQ=4.4E+2 ILCR=7.0E-4**	NA	**HQ=1.1E+3 ILCR=8.8E-3**
II: Shoe factory worker	**Yes**	NA	**HQ=2.7E+1 ILCR=1.1E-3**	**HQ=1.5E+0 ILCR=8.8E-5**	**HQ=2.8E+1 ILCR=1.2E-3**
III: Southeast facility worker	(Yes)	NA	NA	HQ=3.1E-1 ILCR=7.1E-7	HQ=3.1E-1 ILCR=7.1E-7
IV: Site guard	**Yes**	**HQ=1.3E+1 ILCR=4.0E-3**	**HQ=1.9E+2 ILCR=7.7E-3**	NA	**HQ=2.0E+2 ILCR=1.2E-2**

HQ: Hazard quotient (values less than 1 are indicative of acceptable risk)
ILCR: Incremental lifetime cancer risk (values less than 1.0E-5 are indicative of acceptable carcinogenic risk)
NA: Not applicable
**: Indoor exposure only evaluates enclosed space accumulation of vapors from soil and groundwater*
(Yes): There could be a risk by outdoor inhalation (evaluated under scenarios II and IV) and/or by the entrance of outdoor air in the building by a forced ventilation system or gaps in the walls, windows or doors

ES	Risk	Outdoor inhalation particles /vapor	Indoor inhalation vapor	Ingestion /absorption surface water (river)	Ingestion/ dermal contact with irrigation water	Fish ingestion	Vegetable uptake	Cumulative risk
V. Agricultural worker	**Yes**	**HQ=5.5E+1 ILCR=2.2E-3**	NA	NA	NA	NA	NA	**HQ=5.5E+1 ILCR 2.2E-3**
VI. Residents	**Yes**	**HQ=4.7E+0 ILCR=2.3E-4**	HQ=7.0E-1 ILCR=3.9E-6	NA	**HQ=1.5E+0 ILCR=5.7E-5**	NA	**HQ=7.3E+0[1] ILCR=3.0E-4[2]**	**HQ=1.4E+1 ILCR=5.9E-4**
VII. Fish consumers	No	NA	NA	NA	NA	HQ=5.3E-5 ILCR=1.2E-8	NA	HQ=5.3E-5 ILCR=1.2E-8
VIII: Ecological receptors	No	NA	NA	HQ=4.5E-1	NA	NA	NA	HQ=4.5E-1

HQ: Hazard quotient (values less than 1 are indicative of acceptable risk)
ILCR: Incremental lifetime cancer risk (values less than 1,0E-5 are indicative of acceptable carcinogenic risk)
NA: Not applicable
[1]: Due to β-HCH (no cumulative risk assessed)
[2]: Due to α-HCH (no cumulative risk assessed)

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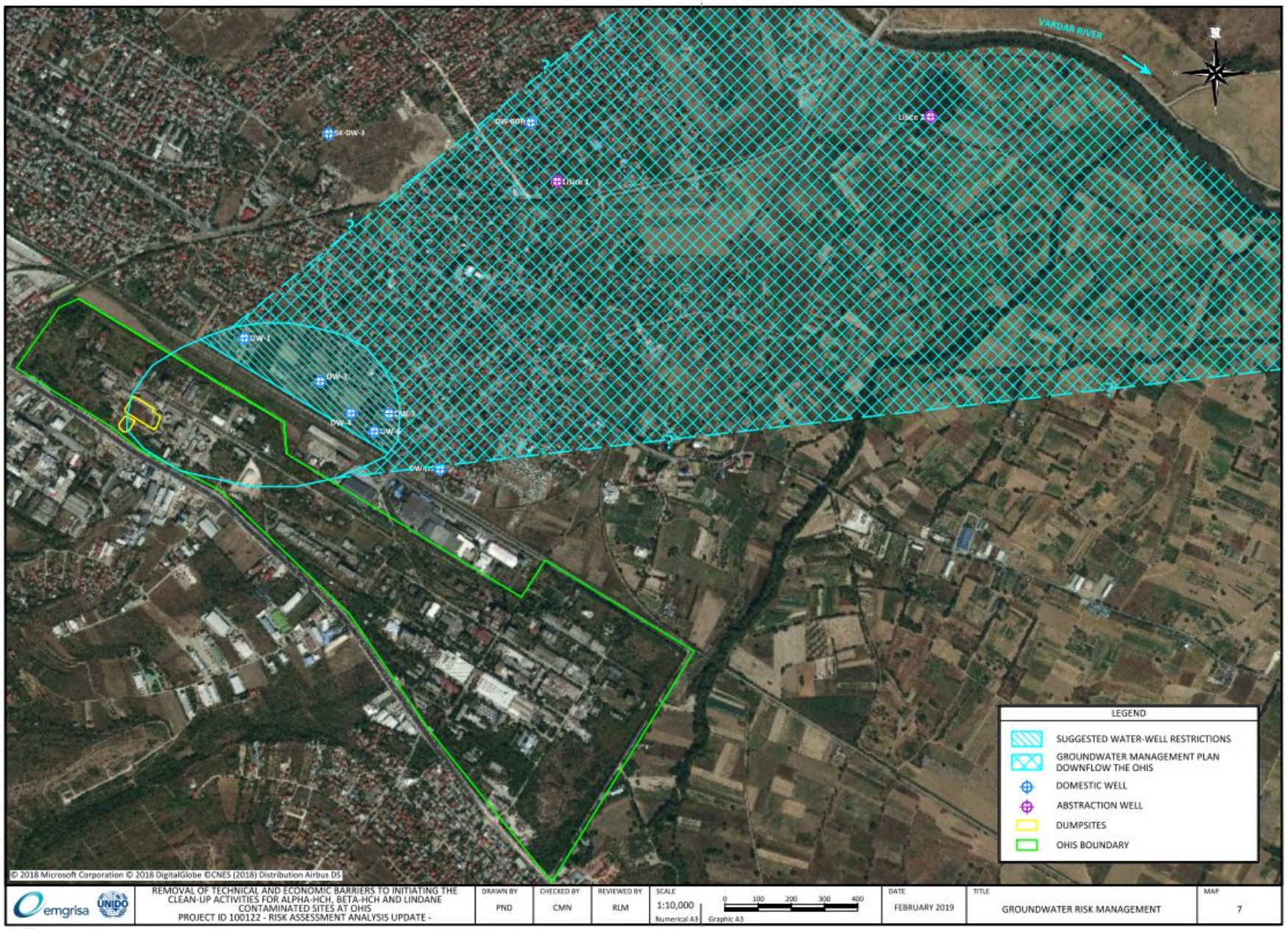
Output 2.3: Current risk assessment analyses updated and the risk management options defined



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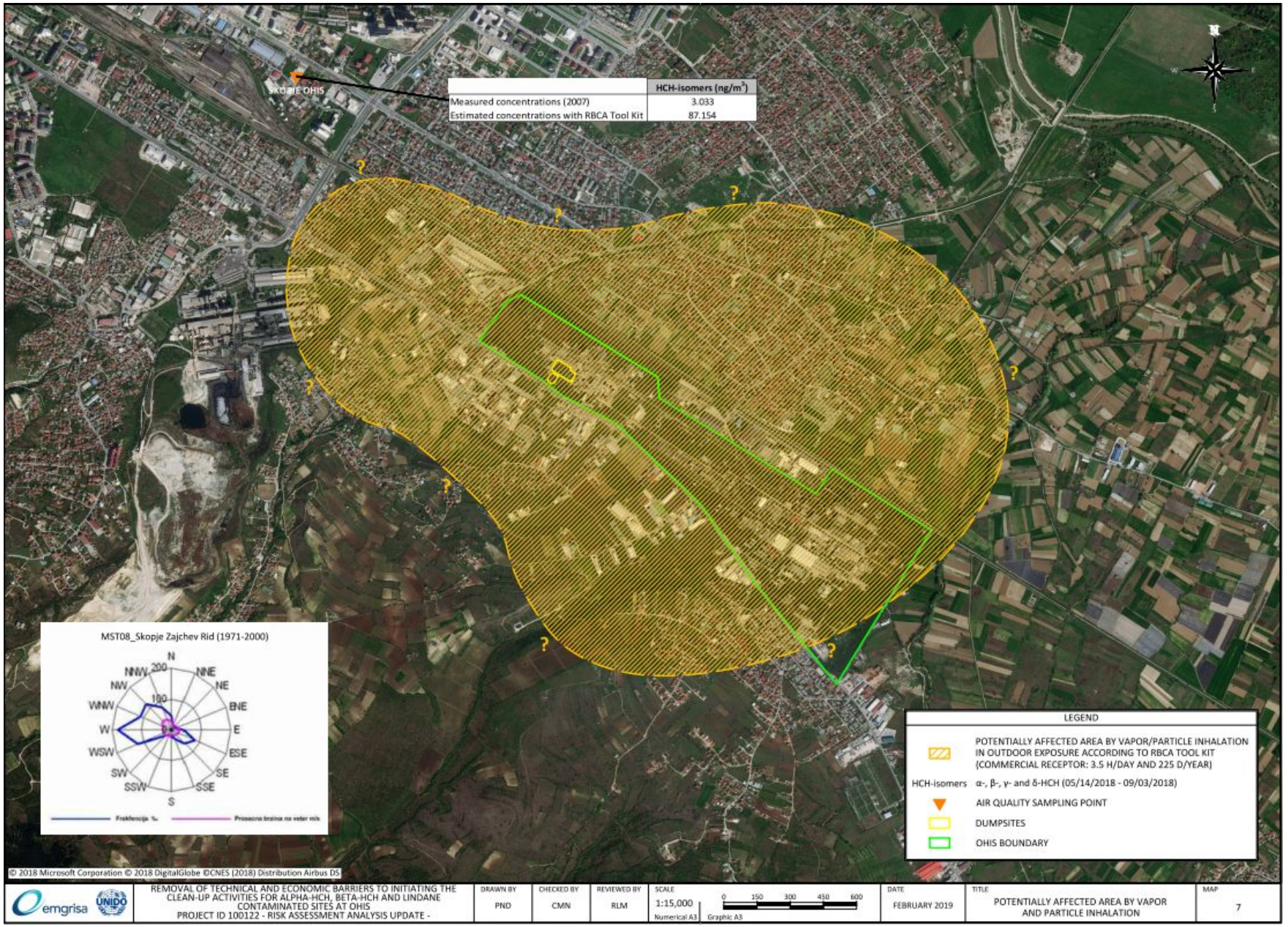
Output 2.3: Current risk assessment analyses updated and the risk management options defined



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Project components/Work Plan

Outcomes/Outputs/Activities	2015										2016												2017											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Outcome 1: Legal framework and institutional capacities to support, justify and evaluate the clean-up of the OHIS site contaminated with alpha-HCH, beta-HCH and lindane established, enhanced and enforced																																		
Output 1.1: Legal acts and institutional and technical tools prepared to ensure the completion of the OHIS site clean up operations and building capacities towards contaminated sites management in general																																		
Output 1.2: Technical tools (guidelines, procedures, instructions) for contaminated site management prepared and approved																																		
Output 1.3: Environmental officers, contaminated site owners and the potential contaminated site clean up operators trained on practical usage of the prepared guidelines, procedures and instructions																																		
Output 1.4: Laboratory personnel trained for sampling and analyses standards and protocols for POPs/HCH																																		
Outcome 2: Characterization of the HCH contaminated site completed, risk assessed and risk management options defined																																		
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses based on the sampling plan developed during PPG																																		
Output 2.2: Survey of groundwater for drinking and irrigation purposes conducted																																		
Output 2.3: Current risk assessment analyses updated and the risk management options defined																																		
Outcome 3: Contaminated site clean up plan and strategies established and key stakeholders including local communities ready to cooperate																																		
Output 3.1: Contaminated site clean up operation/remediation plan and groundwater management plan prepared for prevention of further contamination and adverse human health impact																																		
Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site																																		
Output 3.3: City development plan and zoning of OHIS site reviewed and revised																																		
Outcome 4: Clean up operation initiated and the execution mechanism in place to sustain the clean up operations beyond the project period																																		
Output 4.1: ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared																																		
Output 4.2: Technology/service providers selected																																		
Output 4.3: Parties (private sectors, state owned companies or PPP contractual agreement form) interested as potential operators identified and investors as potential clean up operators consulted																																		
Output 4.4: Operating entity selected and established																																		
Output 4.5: Clean up operation/remediation and business plan prepared by the selected operating entity in consultation with the technical providers and all stakeholders and approved by the PSC																																		
Output 4.6: Needed permits for the technology treatment installation (EIA, IPPC) obtained																																		
Output 4.7: A monitoring program, system established in the location																																		
Output 4.8: Clean up operation executed																																		
Outcome 5: Project management structure established, and monitoring and evaluation conducted																																		
Output 5.1: Project results monitored and reported																																		
Output 5.2: Project evaluated meeting the GEF's evaluation criteria																																		

CONTAMINATED SITE CLEAN UP PLAN AND STRATEGIES ESTABLISHED AND KEY STAKEHOLDERS INCLUDING LOCAL COMMUNITIES READY TO COOPERATE

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Component 3: Contaminated site clean-up plan and strategies established and key stakeholders including local communities ready to cooperate

- **Output 3.1: Clean up operation/remediation plan prepared by the company selected for the remediation of the delta dump;**
- **Output 3.2: Awareness raising campaign conducted to gain and mobilize the public opinion towards successful realization of the foreseen contaminated site clean-up activities at OHIS;**
- **Output 3.2: Cost-benefit analysis prepared with the main objective to quantify the expected costs and the social, public health benefits from the intervention.**

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GEF

ME:PP-POPs Unit

Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site

Awareness raising campaign conducted to gain and mobilize the public opinion towards successful realization of the foreseen contaminated site clean-up activities at OHIS, within which following activities have been realized:

i) questionnaires formulated and general survey about the current level of knowledge of the local population of the particular problem and planned actions for clean-up activities for HCH contaminated sites at OHIS conducted;

ii) two awareness raising workshops on health and environmental hazards posed by POPs/HCH, socio-economic impacts of POPs/HCH, regulatory requirements, and on the establishment of sustainable operation for the OHIS contaminated site among different target groups (government institutions, local community, the print and electronic media, NGOs, women associations and the general public as well, especially the vulnerable population) organized with the participation of 71 persons;

iii) Awareness raising materials prepared, printed and disseminated;

iv) Awareness raising activities at five schools on the harmful impact of the Lindane on human health and the environment organized;

v) Visibility event to inform the public and other interested parties in initiation of the cleaning activities organized;

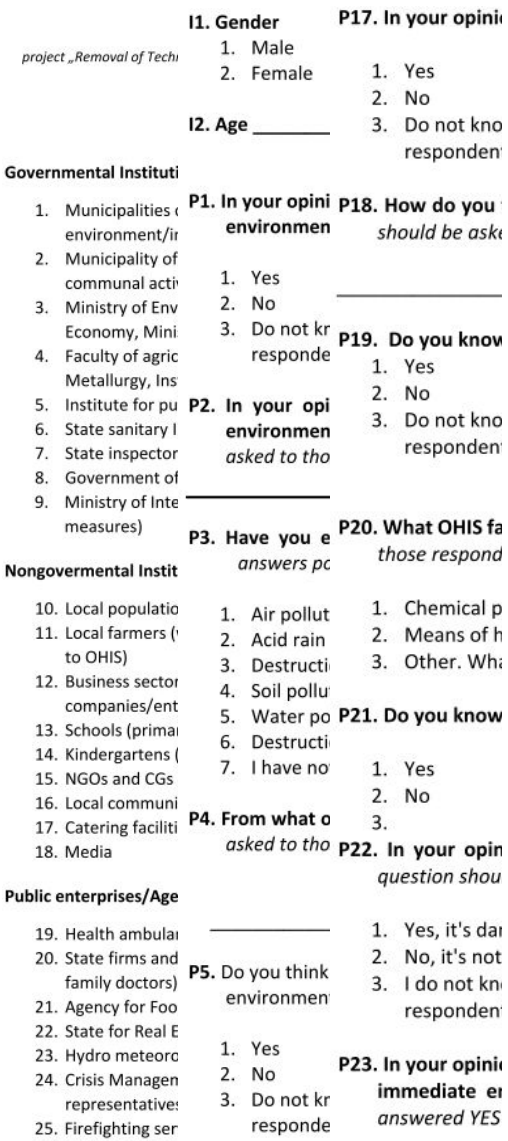
vi) Clean-up activities regularly promoted in printed and electronic media;

vii) Media event organized at OHIS site for demonstration of the progress of the remediation activities (12 media presented at the site, statements on the progress of the remediation works given and the explanation on the technical aspects of the clean-up provided to journalists inside the tent;

viii) Three panel discussions organized with POLYECO and the other stakeholders (NGOs, local residents, local communities) on the progress of the clean-up, the difficulties in the process and the corrective measures undertaken;

ix) Video material on the site clean-up activities to contribute to the overall support of the local population and stakeholders of the entire three-month process of clean-up activities prepared and promoted.

Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site



project „Removal of Techi

I1. Gender
1. Male
2. Female

I2. Age _____

Governmental Instituti

1. Municipalities environment/ir
2. Municipality of communal acti
3. Ministry of Env Economy, Mini
4. Faculty of agric Metallurgy, Ins
5. Institute for pu
6. State sanitary I
7. State inspector
8. Government of
9. Ministry of Inte measures)

Nongovermental Instit

10. Local populatio
11. Local farmers (to OHIS)
12. Business sector companies/ent
13. Schools (prima
14. Kindergartens (
15. NGOs and CGs
16. Local communi
17. Catering faciliti
18. Media

Public enterprises/Age

19. Health ambula
20. State firms and family doctors)
21. Agency for Foo
22. State for Real E
23. Hydro meteorc
24. Crisis Managen representatives
25. Firefighting ser

P1. In your opini environmen
1. Yes
2. No
3. Do not kr respond

P2. In your opi environmen *asked to tho*

P3. Have you e *answers pc*
1. Air pollut
2. Acid rain
3. Destructi
4. Soil pollu
5. Water po
6. Destructi
7. I have no

P4. From what o *asked to tho*

P5. Do you think environmen
1. Yes
2. No
3. Do not kr respond

P17. In your opini
1. Yes
2. No
3. Do not kno respondent

P18. How do you *should be aske*

P19. Do you know
1. Yes
2. No
3. Do not kno respondent

P20. What OHIS fa *those respond*
1. Chemical p
2. Means of h
3. Other. Wha

P21. Do you know
1. Yes
2. No
3.

P22. In your opin *question shou*
1. Yes, it's dar
2. No, it's not
3. I do not kn respondent

P23. In your opini immediate er *answered YES*

The analysis of the results from the conducted survey was done in January 2019 (Annex IV). General conclusions of the analysis of the results are the following:

- Industrial facilities are recognized as serious polluters with hazardous and harmful waste;
- 99% of respondents stated that they need to be informed about the presence of potential hazardous and harmful substances in their immediate surroundings;
- Television media are convincingly the most desirable ways of informing citizens about the presence of potential hazardous and harmful substances in their immediate surroundings;
- More than half of the respondents claim that at this point they are very little or not at all informed about the risks to the environment;
- More than 2/3 of the respondents assess the situation of environmental pollution in their immediate surroundings as very bad;
- Almost half of the respondents fully agree that OHIS already pollutes their immediate surroundings by inadequate waste disposal;
- About 1/3 of the respondents know what is lindane. Almost all of these respondents stated that lindane is a threat to their health and that it is a polluting threat to their immediate surroundings;
- Respondents who have declared that they have wells and cultivate various vegetative crops are not fully aware of the danger of consuming contaminated water and fruit / vegetables / cereals. Also, almost half of the respondents consider that the soil is contaminated in their immediate surroundings;
- 48.6% of the respondents claim to have heard about the initiative for the removal of lindane or the initiative of the removal in general;
- 72.4% of the respondents stated that the initiative for the removal of lindane will positively affect their health and their immediate surroundings; and
- Almost all respondents stated that they want to be informed about the process of cleaning the lindane from their environment.

Surv
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January 2019

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Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site

МКД

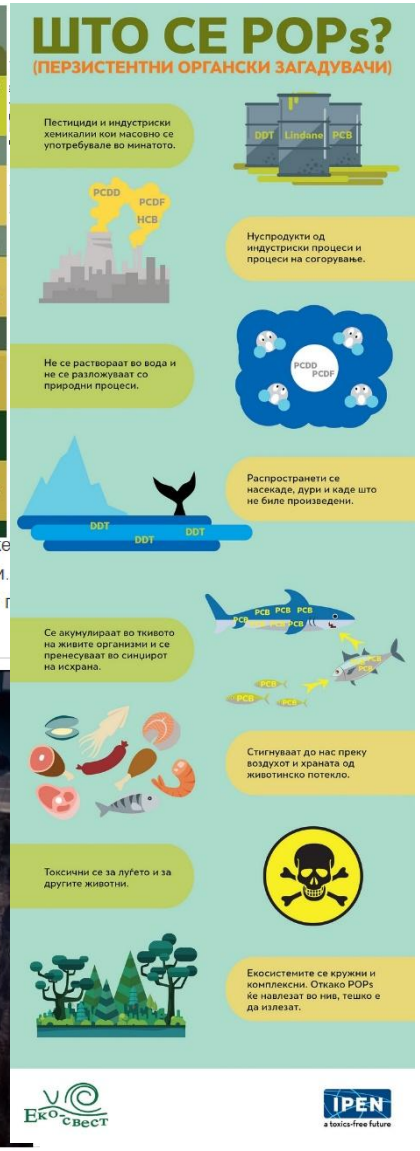
МАКЕДОНИЈА СПОРТ

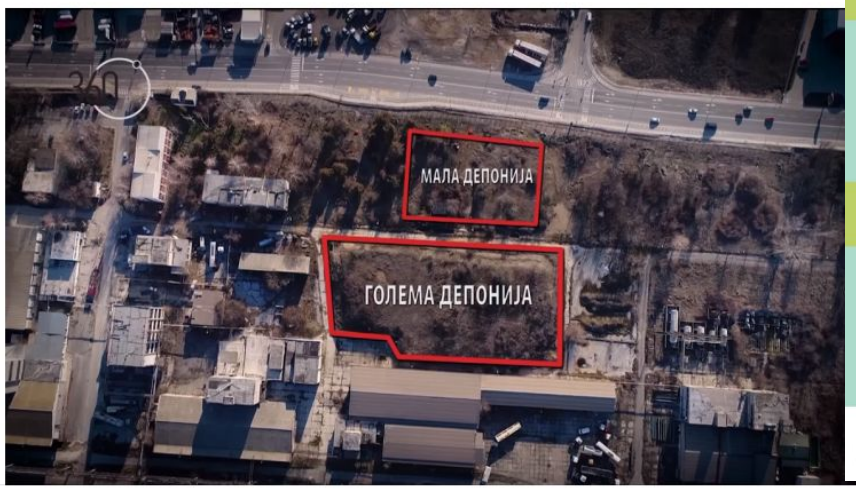
Црна хроника Колумни Автомоб

ПРОЕКТ НА ГЕФ, УНИДО И МЕД

Скопје се подготвува да го отстр линданот од ОХИС

Во ноември почнаа активностите на Канцеларијата за неразгра Министерството за животна средина и просторно планирање чи ќе биде отстранување на депонираниот линдан од една од двет фабриката ОХИС.





Вчера Вл
депониите со концероген линдан во кругот на затворената фаорика ОХИС. Проценката е дека ке
бидат потребни од 40 до 260 милиони евра и се очекува дека тој процес да трае од 3 до 5 години.
Дотогаш 30.000 тони екстремно опасен отпад со канцерогениот пестицид линдан продолжува да
загадува воздухот, водата, почвата...

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Ministry of Environment and Physical Planning

GEF

MEPP-POPs Unit

Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site

COST-BENEFIT ANALYSIS FOR REMEDIATION OF THE OHIS INDUSTRIAL SITE

FINAL REPORT

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

PROJECT: REMOVAL OF TECHNICAL AND ECONOMIC BARRIERS TO INITIATING THE CLEAN-UP ACTIVITIES FOR ALPHA-HCH, BETA-HCH AND LINDANE CONTAMINATED SITES AT OHIS

COST-BENEFIT ANALYSIS FOR REMEDIATION OF THE OHIS INDUSTRIAL SITE

Prepared by:
PointPro Consulting
www.pointpro.com.mk

in association with:
Prof. Trajce Stafilov, PhD
Prof. Elisaveta Stikova, PhD

Skopje, January – May 2019

Cost-benefit analysis prepared with the main objective to quantify the expected costs and the social, public health benefits from the intervention demonstrating how this project will be beneficial to the society and therefore justifying the clean-up activities.

CONTENTS

Project components/Work Plan

Outcomes/Outputs/Activities	2015										2016												2017											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Outcome 1: Legal framework and institutional capacities to support, justify and evaluate the clean-up of the OHIS site contaminated with alpha-HCH, beta-HCH and lindane established, enhanced and enforced																																		
Output 1.1: Legal acts and institutional and technical tools prepared to ensure the completion of the OHIS site clean up operations and building capacities towards contaminated sites management in general																																		
Output 1.2: Technical tools (guidelines, procedures, instructions) for contaminated site management prepared and approved																																		
Output 1.3: Environmental officers, contaminated site owners and the potential contaminated site clean up operators trained on practical usage of the prepared guidelines, procedures and instructions																																		
Output 1.4: Laboratory personnel trained for sampling and analyses standards and protocols for POPs/HCH																																		
Outcome 2: Characterization of the HCH contaminated site completed, risk assessed and risk management options defined																																		
Output 2.1: Site characterization, i.e. detailed site investigation completed by sampling and analyses based on the sampling plan developed during PPG																																		
Output 2.2: Survey of groundwater for drinking and irrigation purposes conducted																																		
Output 2.3: Current risk assessment analyses updated and the risk management options defined																																		
Outcome 3: Contaminated site clean up plan and strategies established and key stakeholders including local communities ready to cooperate																																		
Output 3.1: Contaminated site clean up operation/remediation plan and groundwater management plan prepared for prevention of further contamination and adverse human health impact																																		
Output 3.2: Consensus among the general public and major stakeholders built for the establishment/improvement of OHIS contaminated site																																		
Output 3.3: City development plan and zoning of OHIS site reviewed and revised																																		
Outcome 4: Clean up operation initiated and the execution mechanism in place to sustain the clean up operations beyond the project period																																		
Output 4.1: ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared																																		
Output 4.2: Technology/service providers selected																																		
Output 4.3: Parties (private sectors, state owned companies or PPP contractual agreement form) interested as potential operators identified and investors as potential clean up operators consulted																																		
Output 4.4: Operating entity selected and established																																		
Output 4.5: Clean up operation/remediation and business plan prepared by the selected operating entity in consultation with the technical providers and all stakeholders and approved by the PSC																																		
Output 4.6: Needed permits for the technology treatment installation (EIA, IPPC) obtained																																		
Output 4.7: A monitoring program, system established in the location																																		
Output 4.8: Clean up operation executed																																		
Outcome 5: Project management structure established, and monitoring and evaluation conducted																																		
Output 5.1: Project results monitored and reported																																		
Output 5.2: Project evaluated meeting the GEF's evaluation criteria																																		

CLEAN UP OPERATION INITIATED AND THE EXECUTION MECHANISM IN PLACE TO SUSTAIN THE CLEAN UP OPERATIONS BEYOND THE PROJECT PERIOD

Component 4: Clean-up operation initiated and the execution mechanism in place to sustain the clean-up operations beyond the project period

- **Output 4.1: ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared;**
- **Output 4.2: Technology/service provider selected;**
- **Output 4.5 and 4.6: Clean up operation/remediation plan prepared by POLYECO and approved by the working group established within the MoEPP upon consultations with all relevant institutions to secure safe and environmentally sound remediation;**
- **Output 4.7: Environmental monitoring system/programme established;**
- **Output 4.8: Clean up operation executed.**

Output 4.1: ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared

ToR for the selection of the technology/service providers for the HCH contaminated site remediation prepared. The ToR prescribed the scope of the services; the safety requirements to avoid fugitive odour, vapour and dust emissions during the remedial operations; the provisions related to the excavation, packing, transportation and disposal of the HCH waste/contaminated soil, as well as the monitoring aspect of the remediation. Upon the finalization of the Bidders' technical and commercial proposals, the company POLYECO was selected to perform the remediation of the delta dump.

TERMS OF

Project G
Removal of Technical and Economic Ba
for Alpha-HCH, Beta-HCH and L

TENDER SPEC
REMEDIATION OF THE H

	Stage	Expenditures	Scenario 1		Scenario 2	
			Total (USD)	USD/kg	Total (USD)	USD/kg
A	Capping of the alpha and beta HCH dump	**Capping of the alpha and beta HCH dump costs**				
		HCH remediation technology costs:				
B	Delivery and installation of the remediation technology for the HCH contaminated soil at OHIS site and treatment of the foreseen quantities	Technology plant capital costs				
		Logistics and infrastructural costs				
		Technology transportation and installation costs				
		Training of Operating Entity personnel costs				
		On-site/off-site support costs				
		Operating and maintenance costs:				
		Pre-treatment costs				
		Utilities costs				
C	Packing, temporary storage and shipment of the HCH waste	Consumable materials costs				
		Spare parts costs				
		Labour Costs				
		Post-treatment costs				
		Intellectual property costs				
		Revitalization plant costs (backfilling the treated soil and off-site disposal of the surplus of treated soil/concrete)				
		Monitoring costs				
		Final disposal costs:				
		Packing costs				
		Transportation costs				
D	Disposal of the HCH waste	Disposal costs				
		Management and administration costs				
		Other costs				
		Total:				

Output 4.5: Clean up operation/remediation and business plan prepared by the selected operating entity in consultation with the technical providers and all stakeholders and its approval by the operating entity

Clean up operation/remediation plan prepared by POLYECO and approved by the working group established within the MoEPP upon consultations with all relevant institutions to secure safe and environmentally sound remediation.

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SITE REMEDIATION PLAN

(Part I - Site Take Over Report)

PROJECT: Removal of Technical and Economic Barriers to Initiating the Clean-up Activities for Alpha-HCH, Beta-HCH and Lindane Contaminated Sites at OHIS
Project No: 100122

EMPLOYER: United Nations Industrial Development Organization
Procurement Services Division/CMO/OSS/PRO
Att: A. Bravin
Wargramer Strasse 5, Room D-2010
PO Box: 300, A-1400, Vienna, Austria

BIDDER: POLYECO S.A. 16th km National Road Athens-Corinth
GR 19300, Aspropyrgos, Greece
Kostas Tsirikos, Head of Project and Tender Management
Tel: +30 210 4060000, Fax: +30 210 4617423
Email: k.tsirikos@polyecogroup.com

DATE: November 2020

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SITE REMEDIATION PLAN

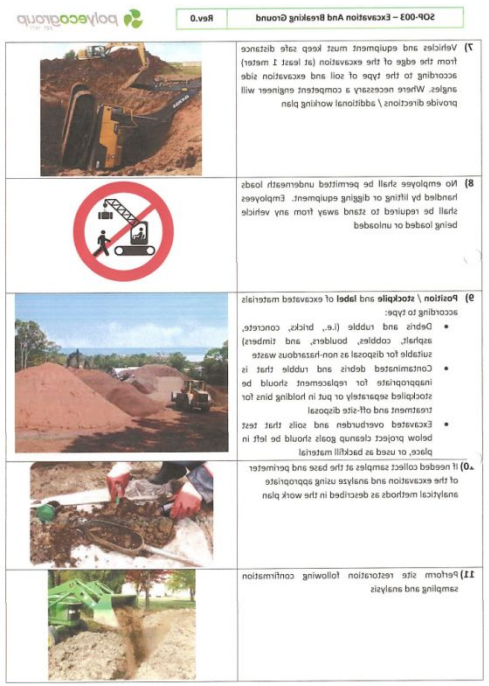
(Part II - Health and Safety Plan (HASP))

PROJECT: Removal of Technical and Economic Barriers to Initiating the Clean-up Activities for Alpha-HCH, Beta-HCH and Lindane Contaminated Sites at OHIS
Project No: 100122

EMPLOYER: United Nations Industrial Development Organization (UNIDO)
Procurement Services Division/CMO/OSS/PRO
Wargramer Strasse 5, Room D-2010
PO Box: 300, A-1400, Vienna, Austria

CONTRACTOR: POLYECO S.A. 16th km National Road Athens-Corinth
GR 19300, Aspropyrgos, Greece
Kostas Tsirikos, Head of Project and Tender Management
Tel: +30 210 4060000, Fax: +30 210 4617423
Email: k.tsirikos@polyecogroup.com

DATE: November 2020



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Output 4.5: Clean up operation/remediation and business plan prepared by the selected operating entity in consultation with the technical providers and all stakeholders and its approval by the operating entity

TAUW

Note

Contact	Guido van de Coterlet and Boudewijn Fokke
Date	27 November 2020
Reference	N001-1275609GMC-V01

Review of POLYECO Work Plan

1 General

This note contains, in addition to the *Evaluation of the Site Remediation Plan* written by Aleksandar, TAUWs technical comments on the Site Remediation Plan - Part I – Site Take Over Report as submitted by POLYECO on November 11th 2020 as part of the *Removal of Technical and Economic Barriers to Initiating the Clean-up Activities for Alpha-HCH, Beta-HCH and Lindane Contaminated Sites at OHIS Project No: 100122.*

In general, it is a clear report with a good level of detail. Some information is missing that is needed for a full assessment of the proposed operations. This information concerns:

- Cross-section and/or dimension of the hall/tent/containment to be installed over the δ (delta)-dump with heights and exact dimensions
- Complete layout of the whole working area including the location of temporary storage, the water storage etc.
- Entry, exits to the working area / the project site
- Operational area (should be wider)
- Acceptance criteria (environmental quality of the soil and the wastes) from ATM and TREDI

2 Specific remarks

Below the most important remarks are given, for each remark reference to the Section and pages is given (**the heading**). In the pdf version of the Site Remediation Plan - Part I (*OHIS Remediation Plan_Site take over report_with comments TAUW*) these and other more remarks / comments are presented as notes

Section 3.4.5, page 22
Precautions are named for Hot Weather work. No reference is made to cold weather work in this section. As a minimum, in indoor areas where work takes place using air purifier respirators, temperatures should be kept above freezing to avoid:

- Slippery conditions due to freezing and thawing re-freezing of damp coming from the tents
- Frost bites in masks due to continues blowing of cold air

In case sub-zero temperatures are expected, heathers should be installed to raise temperatures inside the tent.

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closed mode for off-site transport (inside closed containers or closed canvas trucks). These Zone 1 areas are to be clearly demarcated with tape and appropriate signage.

Zone 2: *Intermediate zone or* ***YELLOW Zone:*** This applies to the areas of the site, which have been cleaned of stockpiled HCH wastes, prior to the start of the works and where visually no POPs waste residues are present. In the intermediate zone, risk of contact with contaminated materials is limited. However, low concentrations of HCH impacted particulate might still be present. The zone will be used for final loading, unloading, storage and removal of repacked HCH wastes and clean materials. Outdoor areas are demarcated with tape and appropriate signage.

gmc 19.12.2020, 16:19:59
This zone is too small

Zone 3: *Contaminated zone or* ***RED Zone:*** The contaminated zone applies to all those areas where HCH wastes are still freely present. Risk of contact with POPs contamination in this zone is high and stringent health and safety precaut

Entry and exit points to the environmental enclosur
brush.

gmc 19.12.2020, 16:19:09
Space available in the Yellow zone?

Each one of the machineries will operate in a spe
will operate only in the RED Zone. A second forklift
cranes will operate only in the GREEN Zone. However, if a machinery will cross to a
Zone it has to be decontaminated at the "wheel washing station"

POLYECO's responsibility for this activity includes the following actions, works and materials:

- Installation of demarcation lines and appropriate signage.
- Provision of packaging filling equipment at suitable operational locations.
- Placement of zoning signs (20cm x 30 cm) with zoning requirements at all entry and exit points to zoning areas.
- Installation and maintenance of required dry boot brushes.
- Wheel wash basins for vehicles moving be
- For all working areas a clearly visible s
PPE in the local language and with interna
- A communication system will be in place

gmc 19.12.2020, 16:20:04
Where is this located?

gmc 19.12.2020, 16:19:29
Temporary storage areas are

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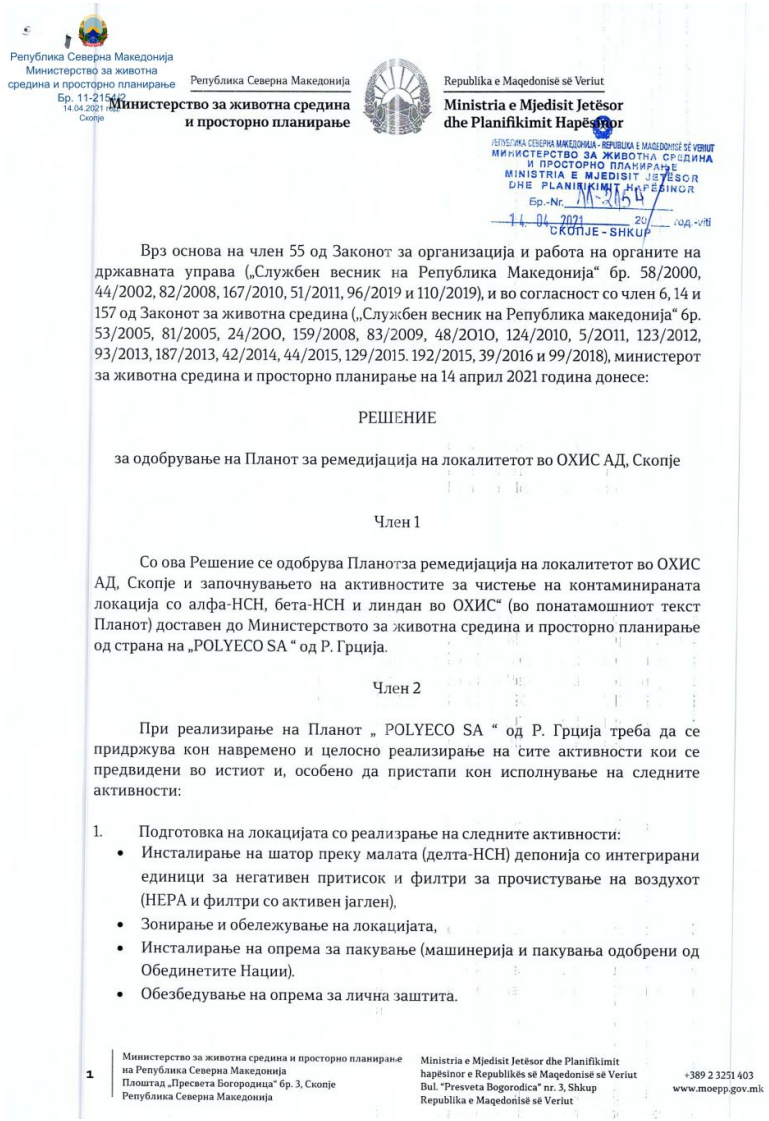
Output 4.6: Needed permits for the technology treatment installation (EIA, IPPC) obtained



Република Северна Македонија
Министерство за животна средина и просторно планирање
Бр. 11-2154/2
14.04.2021 година
Скопје

Република Северна Македонија
Министерство за животна средина и просторно планирање

Republika e Maqedonisë së Veriut
Ministria e Mjedisit Jetësor dhe Planifikimit Hapësinor

РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА - REPUBLIKA E MAQEDONISË SË VERIUT
МИНИСТЕРСТВО ЗА ЖИВОТНА СРЕДИНА И ПРОСТОРНО ПЛАНИРАЊЕ
MINISTRIA E MJEDISIT JETËSOR DHE PLANIFIKIMIT HAPËSINOR
Бр.-Nr. 11-2154
14.04.2021 20__ год.-vti
СКОПЈЕ - SHKUP

Врз основа на член 55 од Законот за организација и работа на органите на државната управа („Службен весник на Република Македонија“ бр. 58/2000, 44/2002, 82/2008, 167/2010, 51/2011, 96/2019 и 110/2019), и во согласност со член 6, 14 и 157 од Законот за животна средина („Службен весник на Република македонија“ бр. 53/2005, 81/2005, 24/2OO, 159/2008, 83/2009, 48/2O1O, 124/2010, 5/2011, 123/2012, 93/2013, 187/2013, 42/2014, 44/2015, 129/2015. 192/2015, 39/2016 и 99/2018), министерот за животна средина и просторно планирање на 14 април 2021 година донесе:

РЕШЕНИЕ

за одобрување на Планот за ремедијација на локалитетот во ОХИС АД, Скопје

Член 1

Со ова Решение се одобрува Планотза ремедијација на локалитетот во ОХИС АД, Скопје и започнувањето на активностите за чистење на контаминираната локација со алфа-HCH, бета-HCH и линдан во ОХИС“ (во понатамошниот текст Планот) доставен до Министерството за животна средина и просторно планирање од страна на „POLYECO SA “ од Р. Грција.

Член 2

При реализирање на Планот „ POLYECO SA “ од Р. Грција треба да се придржува кон навремено и целосно реализирање на сите активности кои се предвидени во истиот и, особено да пристапи кон исполнување на следните активности:

1. Подготовка на локацијата со реализрање на следните активности:
   - Инсталирање на шатор преку малата (делта-HCH) депонија со интегрирани единици за негативен притисок и филтри за прочистување на воздухот (HEPA и филтри со активен јаглен),
   - Зонирање и обележување на локацијата,
   - Инсталирање на опрема за пакување (машинерија и пакувања одобрени од Обединетите Нации).
   - Обезбедување на опрема за лична заштита.

Министерство за животна средина и просторно планирање
на Република Северна Македонија
Плоштад „Пресвета Богородица“ бр. 3, Скопје
Република Северна Македонија

Ministria e Mjedisit Jetësor dhe Planifikimit
hapësinor e Republikës së Maqedonisë së Veriut
Bul. "Presveta Bogorodica" nr. 3, Shkup
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Министерство за животна средина и просторно планирање

Republika e Maqedonisë së Veriut
Ministria e Mjedisit Jetësor dhe Planifikimit Hapësinor

година, за разгледување на Планот. Работната група го разгледа Планот и му даде предлог на министерот за негово одобрување со прилог на активности кои треба да бидат превземени согласно позитивното законско право.

Министерството за животна средина и просторно планирање согласно предвидените активности во рамките на проектот „Отстранување на техничките и економските бариери за започнување на ремедијацијата на локациите контаминирани со α- HCH, β- HCH и линдан во ОХИС“ редовно ќе ја информира јавноста за секоја фаза од активностите предвидени во Планот.

Согласно горенаведеното се донесе Решение како во дизпозитивот

МИНИСТЕР / MINISTËR
Naser Nuredini

Министерство за животна средина и просторно планирање
на Република Северна Македонија
Плоштад „Пресвета Богородица“ бр. 3, Скопје
Република Северна Македонија

Ministria e Mjedisit Jetësor dhe Planifikimit
hapësinor e Republikës së Maqedonisë së Veriut
Bul. "Presveta Bogorodica" nr. 3, Shkup
Republika e Maqedonisë së Veriut

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www.moepp.gov.mk

Output 4.7: A monitoring program,system established in the location

The environmental and human bio-monitoring programme established prior to and during the site clean-up activities (2 air sampling points at the residential area in the vicinity of OHIS site; 3 air sampling points in the remediation area in OHIS; 1 air sampling point inside the environmental enclosure; 2 soil sampling points at the residential area in the vicinity of OHIS; workers' blood and rain water collected from working area).

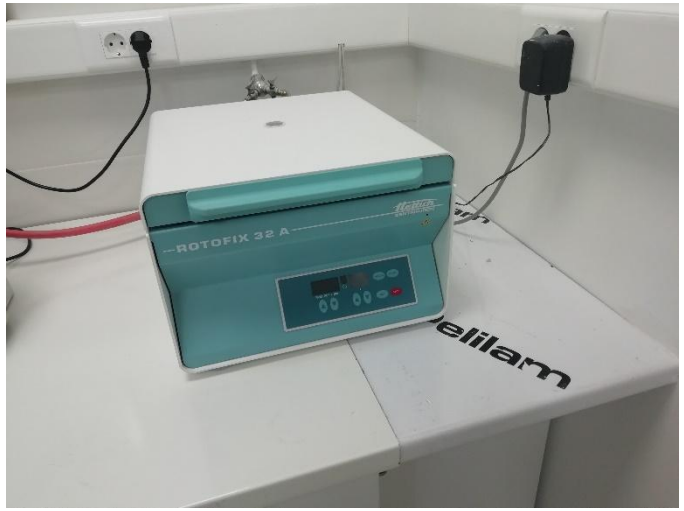
xii. remediation monitoring. The monitoring should take place least at the following locations and fulfill the following conditions

- Inside environmental enclosures including details of proposed continous and/or periodical measuring equipment
- Directly outside the environmental enclosures including details of proposed continous and/or periodical measuring equipment plus the planned emergency actions in case of exceedance of the permitted levels conform Annex 13, "Proposed values for air immisions" on page 4 of Annex 13, "Decision tree air monitoring values" on page 5 and "Explanation about derivation of limit values for the Monitoring plan of the authorities" on page 6 of the same Annex
- At the physical border of the A/B dump, including details of proposed continous and/or periodical measuring equipment plus the planned emergency actions in case of exceedance of the permitted levels
- At the border /fences of the contractor's site
- Any of the listed OHIS facilities in Annex 10, if falling within the areas of the Contractor's site

	max 2 weeks	max 2 weeks	max 2 weeks	
rolling mean[12]	125-150 ng/m³	25-30 ng/m³	220-300 ng/m³	NA
daily (24h)	NA	NA	NA	One result of the sum of HCH >2000 ng/m³ at one position at two consecutive days
weakly average[1]	>300 ng/m³ for more than 2 weeks	>90 ng/m³ for more than 2 weeks	>300 ng/m³ for more than 2 weeks	NA
rolling mean[12]	>150 ng/m³	>30 ng/m³	>300 ng/m³	NA

14th International HCH and Pesticides Forum

Output 4.7: A monitoring program, system established in the location - delivery of laboratory equipment -



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Republic of North Macedonia
Ministry of Environment and Physical Planning

GEF

MEPP-POPs Unit

14th International HCH and Pesticides Forum

Output 4.7: A monitoring program, system established in the location - delivery of laboratory equipment -

Република Северна Македонија
Министерство за животна средина и просторно планирање
Бр.-Nr. 17-3225/1

Република Северна Македонија
Универзитет "СВ. КИРИЛ И МЕТОДИЈ"
ПРИРОДНО МАТЕМАТИЧКИ ФАКУЛТЕТ
Бр. 03-938/1
29.4 2022 год.

ДОГОВОР

за вршење на мониторинг на воздух и почва во околината на ОХИС за време на постапката на отстранување на заостанати изомери на линдан во ОХИС

Склучен на ден 11.04.2022 година, во Скопје помеѓу:

1. **Република Северна Македонија, Министерство за животна средина и просторно планирање**, со седиште на Плоштад Пресвета Богородица бр. 3. Скопје со ЕМБС 5262887, ЕДБ 4030998358508, (во понатамошниот текст: Нарачател на мониторинг), застапуван од министерот Насер Нуредини од една страна и

2. **Универзитет „Св. Кирил и Методиј" во Скопје, Природно-математички факултет – Скопје**, со седиште на ул. „Архимедова" бр. 3 со ЕМБС 6462618 и ЕДБ 4043009100070, застапуван од деканот проф. д-р Александар Скепаровски, (во понатамошниот текст: Извршител на мониторинг) од друга страна.

ПРЕДМЕТ НА ДОГОВОРОТ

Член 1

Предмет на договорот е мониторинг на органохлорни соединенија во воздух и почва во околината на ОХИС за време на постапката на отстранување на заостанати изомери на линдан во ОХИС, преку земање на примероци од почва и воздух.

Член 2

Извршителот на мониторингот се обврзува во период од 12 месеци да врши мониторинг на органохлорни соединенија во воздух и почва во околината на ОХИС за време на постапката на отстранување на заостанати изомери на линдан во ОХИС.

Анализите ќе се вршат во Лабораторијата за хроматографски анализи (во понатамошниот текст: ЛХА) на Институтот за хемија при Природно-математички факултет - Скопје.

Одговорно лице за реализирање на активностите и изготвување на извештаите е проф. д-р Марина Стефова, раководител на ЛХА и редовен професор, и замениците на раководителот: проф. д-р Јасмина Петреска Станоева, вонреден професор и проф. д-р Јане Богданов, редовен професор на Институтот за хемија при Факултетот.

Република Северна Македонија
Министерство за животна средина и просторно планирање
Бр.-Nr. 17-6963/1
22.09.2022 20__ год.-vtë
СКОПЈЕ - SHKUP

03-2254/1
23 09 2

ДОГОВОР

за вршење на мониторинг на присуство на хексахлороциклохексан (НСН) во крвта на работниците и во атмосферска вода за време на постапката на отстранување на заостанати изомери на НСН во ОХИС

Склучен помеѓу:

1. **Република Северна Македонија, Министерство за животна средина и просторно планирање**, со седиште на Плоштад Пресвета Богородица бр. 3. Скопје со ЕМБС 5262887, ЕДБ 4030998358508, (во понатамошниот текст: Нарачател на мониторинг), застапуван од министерот Насер Нуредини од една страна и

2. **Институт за јавно здравје - Скопје**, со седиште на ул. „50 Дивизија" бр. 6 со ЕМБС 4066383 и ЕДБ 4030982108064, застапуван од директор Доц. д-р Шабан Мемети, (во понатамошниот текст: Извршител на мониторинг) од друга страна.

ПРЕДМЕТ НА ДОГОВОРОТ

Член 1

Предмет на договорот е мониторинг на присуството на НСН во крвта на работниците вклучени во ремедијација на контаминираната локација во ОХИС, како и на атмосферската вода (собраната дождовница) за време на постапката на отстранување на заостанати изомери на НСН во ОХИС, преку земање на примероци од крв и атмосферска вода.

Член 2

Извршителот на мониторингот се обврзува да за време на постапката на отстранување на заостанати изомери на НСН во ОХИС во период од 15 месеци да изведе вкупно 83 анализи, од кои 75 анализи за присуство на НСН во крвта на работниците и 8 анализи за присуство на НСН во атмосферска вода.

Анализите ќе се вршат во Оддел за хемиски и радиолошки анализи (во понатамошниот текст: ОХРИ) на Институтот за јавно здравје-Скопје.

Одговорно лице за реализирање на активностите и изготвување на извештаи е проф. Зорица Арсова-Сарафиновска, раководител на оддел за хемиски и радиолошки испитувања (ОХРИ), м–р спец. Анита Најденкоска, раководител на одделение за контаминенти и екотоксикологија и проф. д –р Елисавета Стикова, раководител на одделение за медицина на труд и проценка на здравствени ризици, при оддел за здравствена екологија.

Republic of North Macedonia
Ministry of Environment and Physical Planning

GEF

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14th International HCH and Pesticides Forum

Output 4.7: A monitoring program,system established in the location - working area -

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Output 4.7: A monitoring program, system established in the location - working area -

WEEK 27	V (m3)	9.6		Location - 3		Location - 1		Location - 2	
	07/03/22 - 13/03/22	Baseline Monitoring		Northside of storage warehouse		Westside of the environmental enclosure		Eastside the environmental enclosure	
	Results from testing	Parameters (standard)	Units	PUF (A)	ng/m3	PUF (B)	ng/m3	PUF (C)	ng/m3
	4.1.1	α-HCH	µg/PUF	11.28	1,175.00	10.88	1,133.33	1.41	146.88
	4.1.2	β-HCH	µg/PUF	1.17	121.88	8.04	837.50	0.66	68.75
	4.1.3	γ-HCH	µg/PUF	0.41	42.71	0.49	51.04	0.10	10.42
	4.1.4	δ-HCH	µg/PUF	0.41	42.71	0.33	34.38	0.08	8.33
	4.1.5	ε-HCH*	µg/PUF	0.06	6.25	0.26	27.08	0.03	3.13
	4.1.6	Total HCH	µg/PUF	13.33	1,388.54	20.00	2,083.33	2.29	238.54
	4.1.7	HCB	µg/PUF	-	-	-	-	-	-

WEEK 29	V (m3)	9.6		Location - 3		Location - 1		Location - 2		Location - 4	
	21/03/22 - 27/03/22	Baseline Monitoring		Northside of storage warehouse		Westside of the environmental enclosure		Eastside the environmental enclosure		Inside of the environmental enclosure	
	Results from testing	Parameters (standard)	Units	PUF (A)	ng/m3	PUF (B)	ng/m3	PUF (C)	ng/m3	PUF (D)	ng/m3
Completion of enclosure	4.1.1	α-HCH	µg/PUF	4.57	476.04	5.59	582.29	49.57	5,163.54	39.21	4,084.38
	4.1.2	β-HCH	µg/PUF	1.58	164.58	4.32	450.00	4.27	444.79	1.72	179.17
	4.1.3	γ-HCH	µg/PUF	0.13	13.54	0.28	29.17	1.44	150.00	5.87	611.46
	4.1.4	δ-HCH	µg/PUF	0.10	10.42	0.21	21.88	0.57	59.38	3.21	334.38
	4.1.5	ε-HCH*	µg/PUF	0.00	0.00	0.08	8.33	0.19	19.79	0.00	0.00
	4.1.6	Total HCH	µg/PUF	6.38	664.58	10.48	1,091.67	56.03	5,836.46	50.00	5,208.33
	4.1.7	HCB	µg/PUF	-	-	-	-	0.06	6.25	0.40	41.67

WEEK 30	V (m3)	8.64		Location - 3		Location - 1		Location - 2		Location - 4	
	28/03/22 - 03/04/22	Commencement of excavation activities		Northside of storage warehouse		Westside of the environmental enclosure		Eastside the environmental enclosure		Inside of the environmental enclosure	
	Results from testing	Parameters (standard)	Units	PUF (A)	ng/m3	PUF (B)	ng/m3	PUF (C)	ng/m3	PUF (D)	ng/m3
	4.1.1	α-HCH	µg/PUF	4.10	474.54	2.99	346.06	12.30	1,423.61	33.32	3,856.48
	4.1.2	β-HCH	µg/PUF	0.08	9.26	0.08	9.26	1.42	164.35	1.11	128.47
	4.1.3	γ-HCH	µg/PUF	0.19	21.99	0.35	40.51	0.00	0.00	14.01	1,621.53
	4.1.4	δ-HCH	µg/PUF	0.06	6.94	0.16	18.52	0.29	33.56	6.81	788.19
	4.1.5	ε-HCH*	µg/PUF	0.01	1.16	0.02	2.31	0.00	0.00	0.54	62.50
	4.1.6	Total HCH	µg/PUF	4.45	515.05	3.61	417.82	14.01	1,621.53	55.79	6,457.18
	4.1.7	HCB	µg/PUF	0.01	1.16	0.01	1.16	0.43	49.77	3.05	353.01

WEEK 31	V (m3)	11.52		Location - 3		Location - 1		Location - 2		Location - 4	
	04/04/22 - 10/04/22	Continuation of excavation activities		Northside of storage warehouse		Westside of the environmental enclosure		Eastside the environmental enclosure		Inside of the environmental enclosure	
	Results from testing	Parameters (standard)	Units	PUF (A)	ng/m3	PUF (B)	ng/m3	PUF (C)	ng/m3	PUF (D)	ng/m3
	4.1.1	α-HCH	µg/PUF	9.56	829.86	8.68	753.47	40.27	3,495.66	58.78	5,102.43
	4.1.2	β-HCH	µg/PUF	0.56	48.61	0.25	21.70	1.88	163.19	2.43	210.94
	4.1.3	γ-HCH	µg/PUF	0.38	32.99	0.85	73.78	1.52	131.94	37.01	3,212.67
	4.1.4	δ-HCH	µg/PUF	0.35	30.38	0.60	52.08	0.64	55.56	20.98	1,821.18
	4.1.5	ε-HCH*	µg/PUF	0.04	3.47	0.05	4.34	0.14	12.15	1.37	118.92
	4.1.6	Total HCH	µg/PUF	10.88	944.44	10.43	905.38	44.45	3,858.51	120.57	10,466.15
	4.1.7	HCB	µg/PUF	-	-	-	-	-	-	3.05	264.76

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Output 4.7: A monitoring program,system established in the location - residential area -

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Ministry of Environment and Physical Planning

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14th International HCH and Pesticides Forum

Output 4.7: A monitoring program,system established in the location - residential area -

		15.4.2022		6.5.2022		23.5.2022		15.6.2022		27.6.2022	
		MED	S8	MED	S8	MED	S8	MED	S8	MED	S8
HCB	µg/kg										
alpha HCH	µg/kg	84.36	18.05	98.49	2056.4	72.17	61.24	12.56	26.86	36.91	10.86
beta HCH	µg/kg	21.81	30.73	109.27	777.52	104.34	65.05	13.47	36.79	876.44	15.37
gama HCH	µg/kg	2.72	3.15	4.94	19.72	8.54	0.028	2.70	2.50	3.62	3.10
delta HCH	µg/kg	8.58	8.74	25.92	41.81	31.45	29.42	6.60	6.30	19.91	11.07
epsilon HCH	µg/kg			4.28	28.45	4.22	2.77			12.25	
Total HCH	**µg/kg**	**11.30**	**11.89**	**35.14**	**89.98**	**44.21**	**32.22**	**9.30**	**8.80**	**35.78**	**14.17**
PCB 28	µg/kg										
Heptachlor	µg/kg										
PCB 52	µg/kg										
Aldrin	µg/kg										
Heptachlor epoxide trans	µg/kg										
Heptachlor epoxide cis	µg/kg										
o,p'-DDE	µg/kg										
PCB 101	µg/kg										
alfa-endosulfan	µg/kg										
p,p'-DDE	µg/kg										
Dieldrin	µg/kg	0.257	0.842	1.17	1.47	1.38	3.90	0.26	3.89	0.918	24.79
o,p'-DDD	µg/kg	1.13	1.00	0.202	0.084	0.191	0.185	1.02	0.97	0.153	
Endrin	µg/kg	3.21	2.92	0.703	0.529	0.827	0.665	3.25	0.799	3.25	3.50
PCB 118	µg/kg	0.872	0.803	2.45	2.54	2.64	2.50	0.989	0.734	1.53	2.79
p,p'-DDD	µg/kg										
o,p'-DDT	µg/kg	0.401		0.232	0.332	0.281	0.369	0.352	0.414	0.379	5.34
PCB 153	µg/kg	0.478	0.496	0.172	0.36	0.345	0.291	0.39	0.592	0.388	2.62
p,p'-DDT	µg/kg		0.02								2.86
PCB 138	µg/kg										18.96
PCB 180	µg/kg										
dry w		0.8083	0.7961	0.8496	0.8018	0.8456	0.9023	0.8643	0.8217	0.9082	0.8435

LOD	
0.7	HCB
0.3	α-HCH
1.0	β-HCH
0.4	γ-HCH
0.5	δ-HCH
*	ε-HCH
	Total HCH
1.3	Heptachlor
0.7	Aldrin
*	o,p'-DDE
0.7	alfa-endosu
0.6	p,p'-DDE
0.7	Dieldrin
*	o,p'-DDD
5.5	Endrin
1.5	p,p'-DDD
1.8	p,p'-DDT
*	PCB 52
*	PCB 101
*	PCB 118
*	PCB 153
*	PCB 138
*	PCB 180

16-20.5	028-22; 23-30.5	
30+30 min	5x8 h	30+30 min
MED	GD	MED
0.68	0.90	0.38
5.02	5.57	5.19
0.96	0.45	0.45
2.62	1.39	1.29
0.98	1.10	1.21
/	/	/
9.30	**9.41**	**8.07**
2.66	1.97	1.15
<5.5	<5.5	<5.5
2.78		

Republic of North Macedonia
Ministry of Environment and Physical Planning

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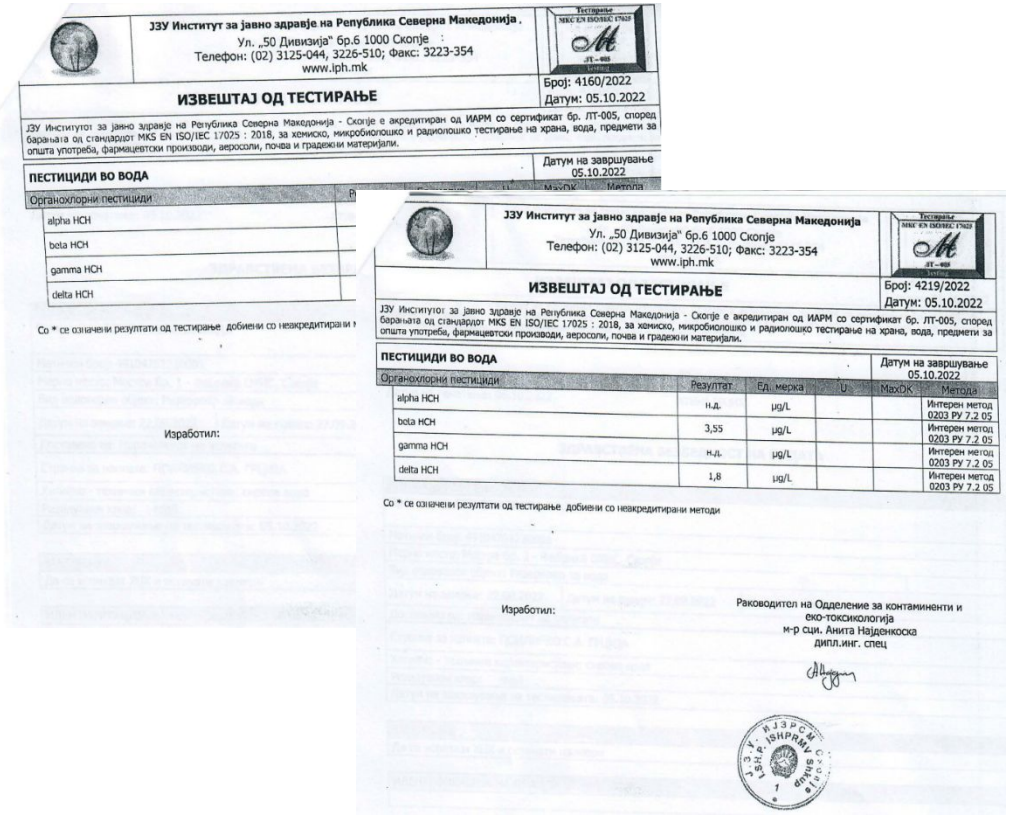
14th International HCH and Pesticides Forum

Output 4.7: A monitoring program, system established in the location - collected rain water -

Parameter	Limits
COD	125 mg/l
BOD	30mg/l
Total Suspended Solids (TSS)	30 mg/l
Total Hydrocarbons	5 mg/l
HCH-isomers	5 ug/l



ЈЗУ Институт за јавно здравје на Република Северна Македонија
Ул. „50 Дивизија" бр.6 1000 Скопје
Телефон: (02) 3125-044, 3226-510; Факс: 3223-354
www.iph.mk

ИЗВЕШТАЈ ОД ТЕСТИРАЊЕ

Број: 4160/2022
Датум: 05.10.2022

ЈЗУ Институтот за јавно здравје на Република Северна Македонија - Скопје е акредитиран од ИАРМ со сертификат бр. ЛТ-005, според барањата од стандардот MKS EN ISO/IEC 17025 : 2018, за хемиско, микробиолошко и радиолошко тестирање на храна, вода, предмети за општа употреба, фармацевтски производи, аеросоли, почва и градежни материјали.

ПЕСТИЦИДИ ВО ВОДА

Датум на завршување 05.10.2022

Органохлорни пестициди	Р	MaxOK	Метода
alpha HCH			
beta HCH			
gamma HCH			
delta HCH			

Со * се означени резултати од тестирање добиени со неакредитирани

Изработил:

ЈЗУ Институт за јавно здравје на Република Северна Македонија
Ул. „50 Дивизија" бр.6 1000 Скопје
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www.iph.mk

ИЗВЕШТАЈ ОД ТЕСТИРАЊЕ

Број: 4219/2022
Датум: 05.10.2022

ЈЗУ Институтот за јавно здравје на Република Северна Македонија - Скопје е акредитиран од ИАРМ со сертификат бр. ЛТ-005, според барањата од стандардот MKS EN ISO/IEC 17025 : 2018, за хемиско, микробиолошко и радиолошко тестирање на храна, вода, предмети за општа употреба, фармацевтски производи, аеросоли, почва и градежни материјали.

ПЕСТИЦИДИ ВО ВОДА

Датум на завршување 05.10.2022

Органохлорни пестициди	Резултат	Ед. мерка	U	MaxOK	Метода
alpha HCH	н.д.	µg/L			Интерен метод 0203 РУ 7.2 05
beta HCH	3,55	µg/L			Интерен метод 0203 РУ 7.2 05
gamma HCH	н.д.	µg/L			Интерен метод 0203 РУ 7.2 05
delta HCH	1,8	µg/L			Интерен метод 0203 РУ 7.2 05

Со * се означени резултати од тестирање добиени со неакредитирани методи

Изработил:

Раководител на Одделение за контаминенти и еко-токсикологија
м-р сци. Анита Најденкоска
дипл.инг. спец

eurofins | athens analysis laboratories

29 Nafpliou St • Metamorphosi 144 52 • Athens • Greece
Tel: +30 210 7470500
email: waternet@ergastiria.gr • website: www.ergastiria.gr

TEST REPORT

Certificate No : **22-0398-076-0324-02**
Date of Issue : **06/12/2022**
Issue No : **1**

Testing Cert. No 102

CUSTOMER DETAILS

Customer : **POLYECO S.A.**
Address : 16th km of Athens-Korinth Ntl Road, 19300, Aspropirgos

SAMPLING DETAILS

Responsible for sampling : CUSTOMER
Sampling Date : 28/11/2022

SAMPLE DETAILS

Sample Code : **324810324**
Sample Description : **WATER SAMPLE AFTER FILTRATION POLYECO- GEORGE TSAIMOS**
Analysis carried out by : EUROFINS Athens Analysis Laboratories
Date of starting the analysis : 28/11/2022
Condition / Quantity of Sample : NORMAL
Date of finishing the analysis : 06/12/2022
Receipt Date : 28/11/2022

Parameter	Method	Unit	Detection Limit	Parametric Value	Result
Total Suspended Solids (103-105°C)	ΕΛΟΤ EN 872:2005	mg/l	0.6	-	Not Detected
Biochemical Oxygen Demand (BOD)	OE-7.0-41	mg/l O2	2	-	Not Detected
Chemical Oxygen Demand (COD)	ISO 15705:2002	mg/l O2	3	-	Not Detected
Dilluted or in emulsion HCs-Mineral Oil (C10-C40)	OE-7.0-83 (GC-FID)	µg/l	8	-	Not Detected
Hexachlorocyclohexane (HCH), alpha-isomer	OE-7.0-79 (GC-MS/MS) *	µg/l	0.006	-	Not Detected
Hexachlorocyclohexane (HCH), beta-isomer	OE-7.0-79 (GC-MS/MS) *	µg/l	0.006	-	0.056
HCH-delta	OE-7.0-79 (GC-MS/MS) *	µg/l	0.006	-	0.047
Lindane (Gamma-isomer of hexachlorocyclohexane (HCH))	OE-7.0-79 (GC-MS/MS) *	µg/l	0.006	-	0.170

(*) Test outside the scope of accreditation.

END OF TEST REPORT

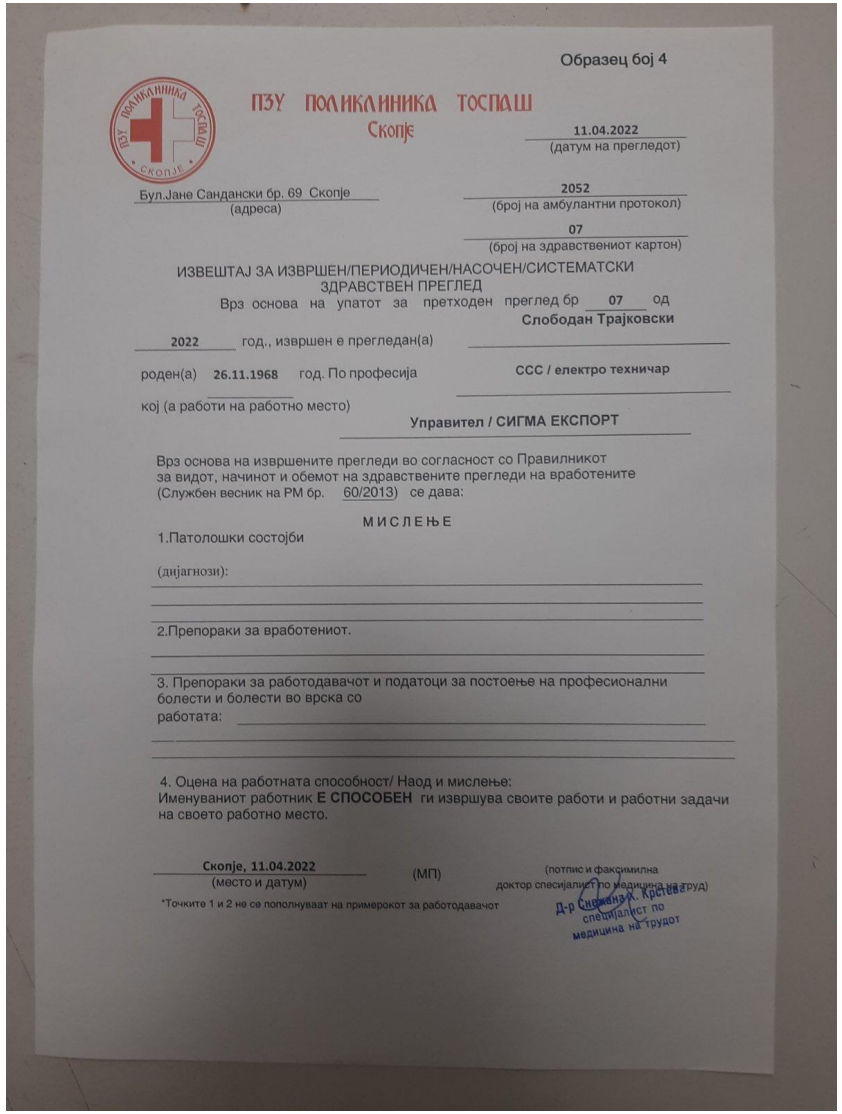
UNIDO

Republic of North Macedonia
Ministry of Environment and Physical Planning

GEF

MEPP-POPs Unit

Output 4.7: A monitoring program, system established in the location - workers blood samples -



Образец бој 4

ПЗУ ПОЛИКЛИНИКА ТОСПАШ
Скопје

11.04.2022
(датум на прегледот)

Бул.Јане Сандански бр. 69 Скопје
(адреса)

2052
(број на амбулантни протокол)

07
(број на здравствениот картон)

ИЗВЕШТАЈ ЗА ИЗВРШЕН/ПЕРИОДИЧЕН/НАСОЧЕН/СИСТЕМАТСКИ ЗДРАВСТВЕН ПРЕГЛЕД

Врз основа на упатот за претходен преглед бр 07 од

Слободан Трајковски

2022 год., извршен е прегледан(а)

роден(а) 26.11.1968 год. По професија ССС / електро техничар

кој (а работи на работно место)

Управител / СИГМА ЕКСПОРТ

Врз основа на извршените прегледи во согласност со Правилникот за видот, начинот и обемот на здравствените прегледи на вработените (Службен весник на РМ бр. 60/2013) се дава:

МИСЛЕЊЕ

1.Патолошки состојби

(дијагнози):

2.Препораки за вработениот.

3. Препораки за работодавачот и податоци за постоење на професионални болести и болести во врска со работата:

4. Оцена на работната способност/ Наод и мислење:
Именуваниот работник **Е СПОСОБЕН** ги извршува своите работи и работни задачи на своето работно место.

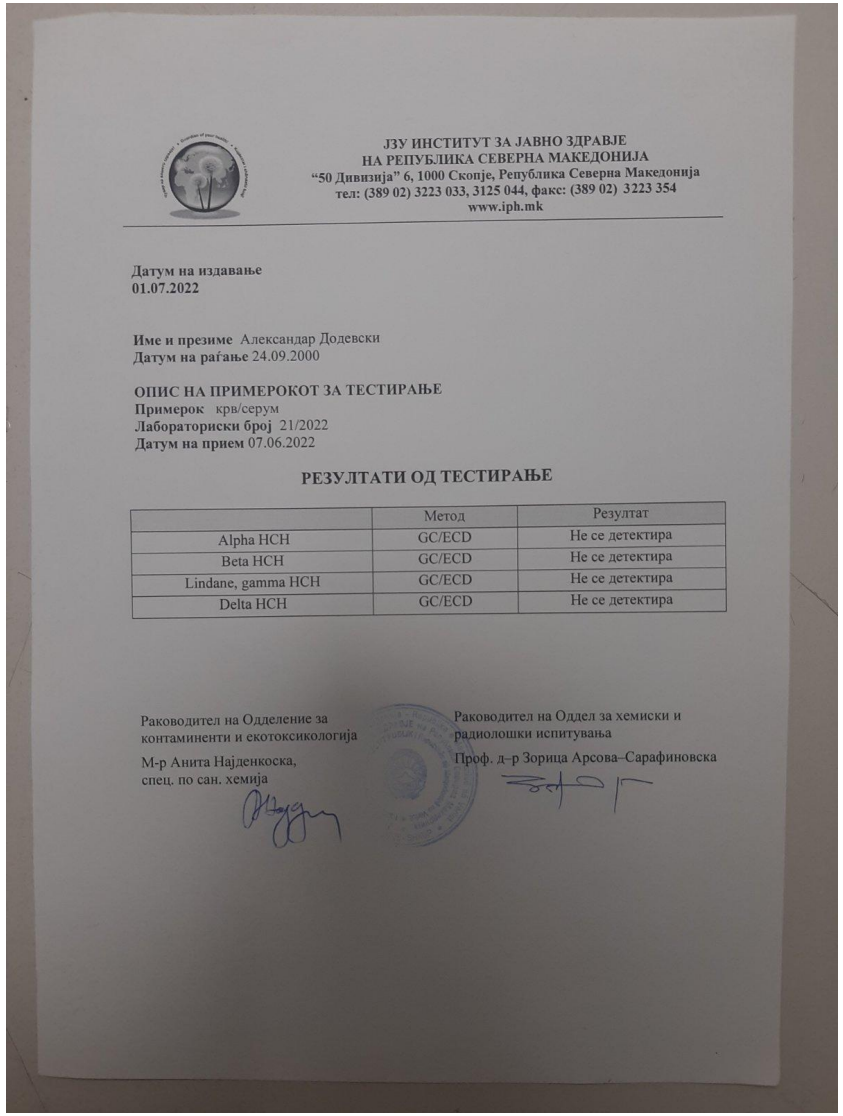
Скопје, 11.04.2022
(место и датум)

(МП)

(потпис и факсимилна
доктор спесијалист по медицина на труд)

Д-р Снежана Х. Крстева
специјалист по
медицина на трудот

*Точките 1 и 2 не се пополнуваат на примерокот за работодавачот



ЈЗУ ИНСТИТУТ ЗА ЈАВНО ЗДРАВЈЕ
НА РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА
"50 Дивизија" 6, 1000 Скопје, Република Северна Македонија
тел: (389 02) 3223 033, 3125 044, факс: (389 02) 3223 354
www.iph.mk

Датум на издавање
01.07.2022

Име и презиме Александар Додевски
Датум на раѓање 24.09.2000

ОПИС НА ПРИМЕРОКОТ ЗА ТЕСТИРАЊЕ
Примерок крв/серум
Лабораториски број 21/2022
Датум на прием 07.06.2022

РЕЗУЛТАТИ ОД ТЕСТИРАЊЕ

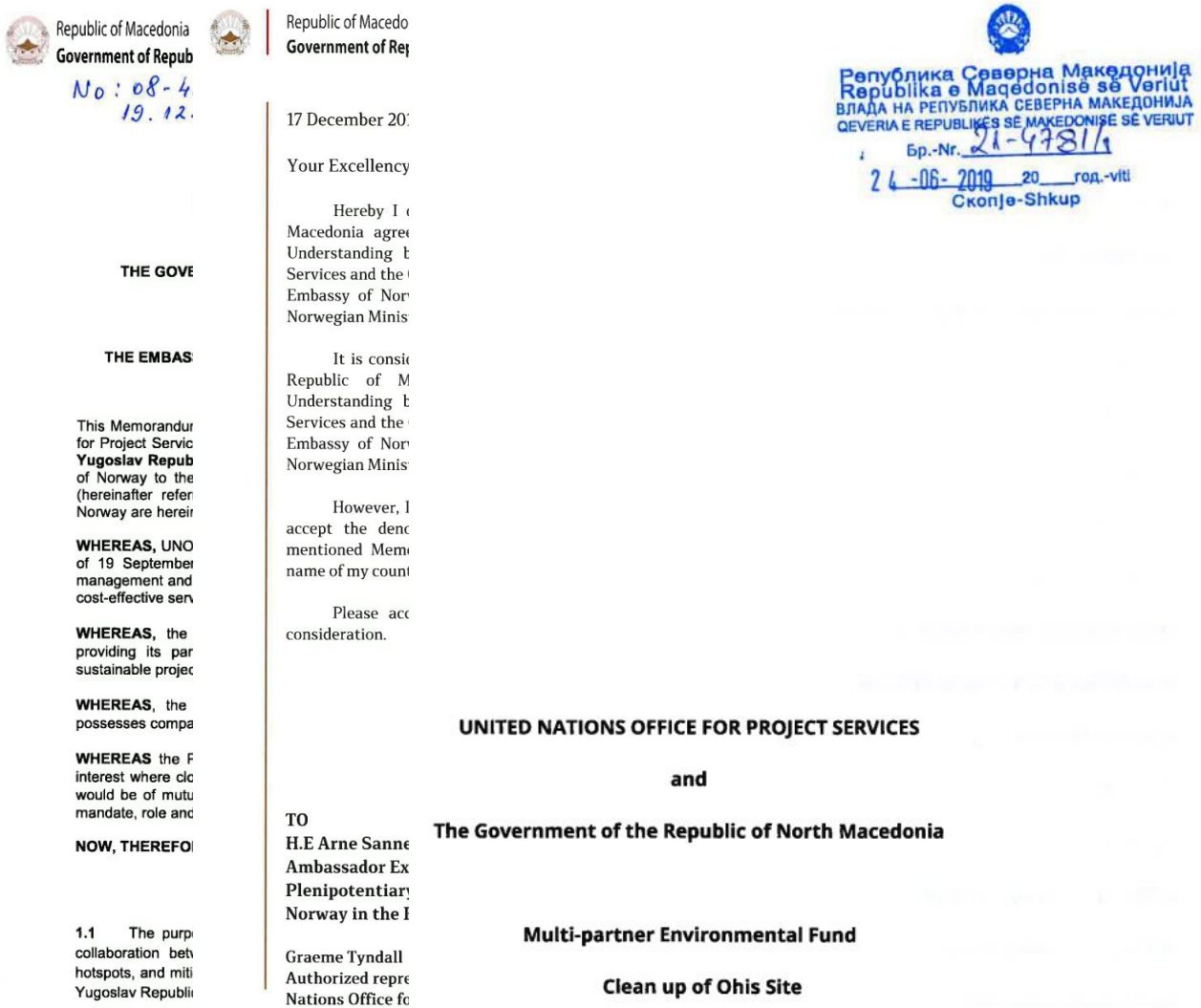
	Метод	Резултат
Alpha HCH	GC/ECD	Не се детектира
Beta HCH	GC/ECD	Не се детектира
Lindane, gamma HCH	GC/ECD	Не се детектира
Delta HCH	GC/ECD	Не се детектира

Раководител на Одделение за контаминенти и екотоксикологија
М-р Анита Најденкоска,
спец. по сан. хемија

Раководител на Оддел за хемиски и радиолошки испитувања
Проф. д–р Зорица Арсова–Сарафиновска

Output 4.8: Clean up operation executed
– financial mechanism for remediation continuation –

In order to secure the sustainability of the clean up activities beyond the project lifetime, the government established a mechanism (Multi-partner Environmental Fund) for continuous provision and generation of funds that are particularly needed after the project phase for ensuring the complete remediation of the contaminated site.



Republic of Macedonia
Government of Repub

No: 08-4
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Government of Rep

17 December 20

Your Excellency

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Ambassador Ex
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Norway in the I

Graeme Tyndall
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Република Северна Македонија
Republika e Maqédonisë së Veriut
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QEVERIA E REPUBLIKËS SË MAKEDONISË SË VERIUT
Бр.-Nr. 21-4781/1
24-06-2019 20 год.-viti
Скопје-Shkup

UNITED NATIONS OFFICE FOR PROJECT SERVICES

and

The Government of the Republic of North Macedonia

Multi-partner Environmental Fund

Clean up of Ohis Site

Thank you for the attention

Ministry of Environment and Physical Planning
POPs Unit

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