TERMS OF REFERENCE

Project 100122
Removal of Technical and Economic Barriers to Initiating the Clean-up Activities for Alpha-HCH, Beta-HCH and Lindane Contaminated Sites at OHIS

TENDER SPECIFICATIONS FOR
REMEDIATION OF THE HCH CONTAMINATED SITE

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Abbreviations

ADR	The European Agreement concerning the International Carriage of Dangerous Goods by Road
BAT	Best Available Technique
BEP	Best Environmental Practice
CHC	Chlorinated hydrocarbons
DE	Destruction Efficiency
DRE	Destruction and Removal Efficiency
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
e.g.	Exempli gratia / for example
ESM	Environmentally Sound Management
EU	European Union
kW	Kilowatt
MoEPP	Ministry of Environment and Physical Planning
µg	Microgram
mg/kg dm	Milligram per kilogram dry matter
Ng	Nanogram (1000 ng = 1 µg)
NIP	National Implementation Plan
PCB	Polychlorinated Biphenyls
PCE	Perchloroethylene
HCH	Hexachlorocyclohexane
HCl	Hydrochloric acid
PCDD	Poly-Chlorinated Dibenzo-p-Dioxins or dioxin
PCDF	Poly-Chlorinated Dibenzo-Furans or furan
PEHD	Polyethylene High-Density
POPs	Persistent Organic Pollutants
ppm	parts per million (mg/kg)
QHSE	Quality, Health, Safety and Environment
SC	Stockholm Convention
TCB	Trichlorobenzene
TCE	Trichloroethylene
ToR	Terms of Reference
UNIDO	United Nations Industrial Development Organisation
UNOPS	United Nations Office for Project Services

Glossary

D'Appolonia	Consultant that has implemented study at OHIS in 2010
ENACON	Consultant that has implemented study at OHIS in 2009
EPTISA	Consultant that has implemented study at OHIS in 2007
Intervention values	The level of contamination above which there is a serious case of soil contamination
OHIS	The Organic Chemical Industry of Skopje AD in the Republic of North Macedonia
Soil treatment plant	Plant for on-site treatment of the soil contaminated with HCH
Target values	Risk based values that ensure no risk for the considered receptors, and consequently the values that need to be achieved during the remediation
Technical assistance	Technical assistance in this document includes, unless specified, (i) off-site technical assistance such as information and guidance provision through telephone, fax, e-mail, and if possible video conference and (ii) onsite technical assistance, upon request at an additional cost (except in Phase 1), such as supervision, guidance, onsite training, technical advice and demonstration by qualified engineer(s) employed by the Contractor.
Waste treatment plant	Plant for off-site treatment of the high concentrated HCH waste

1. General background information and aim of the project

The Republic of North Macedonia, hereinafter called Macedonia, signed the Stockholm Convention on 23rd May 2001 and ratified it on 19th March 2004, thereby undertaking the obligations arising from the same.

The Organic Chemical Industry of Skopje AD (OHIS) was burdened by the historical production of lindane, an organochlorine pesticide. The lindane plant was gradually put into operation since 1964 and manufactured lindane until 1977, when its production ceased due to changing market conditions and environmental burden. Lindane, the gamma isomer of hexachlorocyclohexane (HCH) was produced by the process of photo-chlorination of benzene. The total lindane production according to the data provided by OHIS was around 2,800 tons resulting in a generation of around 25,000-30,000 tons of inactive isomers, i.e. alfa-, beta- and delta-HCH that were improperly dumped, causing secondary contamination of the soil and groundwater, and generation of air emissions as well. However, according to the detailed site investigation performed in 2017-2018, the estimated total quantities of the HCH containing waste and contaminated soil are around 60,088 tons.

Macedonia endorsed its National Implementation Plan (NIP) on Persistent Organic Pollutants (POPs) reduction and elimination on 2nd September 2005. After ten new POPs inclusion in the Stockholm Convention Annexes, the Republic of North Macedonia updated the existing NIP on POPs in 2014 giving a basis for realization of activities linked with priorities and action plans for new POPs. Lindane and its isomers have been added to the Stockholm Convention as POPs in 2009, and this OHIS site is now recognized as POPs contaminated site. One of the priorities in the „old“ and „new“ NIP is solving the problem with HCH-isomers in OHIS Skopje.

The project “Removal of Technical and Economic Barriers to Initiating the Clean-up Activities for Alpha-HCH, Beta-HCH and Lindane Contaminated Sites at OHIS” provides the opportunity for Macedonia to gradually solve the problem ranked as the top priority on the list of contaminated sites, i.e. industrial hotspots in the country.

The rationale and objectives of the project originated from the priorities and key objectives established by the NIP on POPs. The implementation of these priorities will assist the country to comply with its obligations under the Stockholm Convention on POPs and contribute, through this, to improvement of the environmental situation and eventually reduce and eliminate the threats, which HCH pollution at the OHIS site poses for the human health.

The main global environmental benefit from the project is the mitigation and/or elimination of risks associated with the release of HCH into the environment and their subsequent global distribution with resultant ecological and human health impacts from exposure to these chemicals. This will be achieved directly during the project period by activities related to the remediation of HCH waste and contaminated soil. It will also be achieved indirectly though strengthening technical, regulatory and institutional capacities for sound management of the 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.

Through this tender process, the project intents to remediate 6,661 tons of the HCH waste, the HCH contaminated soil and HCH contaminated concrete from the delta HCH dump. Having in mind that the estimated total quantities of the HCH containing waste, contaminated soil and concrete in the both dumps (alpha, beta HCH dump and the delta HCH dump) are around 60,088 tons and in order to sustain the remediation activities beyond the project duration, i.e. after the remediation of the foreseen 6,661 tons, the intention of the project is to strengthen the technical capacities of the country by demonstrating the most cost-effective and efficient option in cleaning of the site.

The clean-up operation will be executed by a Contractor, i.e. a service provider on a turn-key basis.

The Government of the Republic of Macedonia is committed to financially support the implementation of the project. In that direction, the Government of the Republic of Macedonia established a multi-donor fund for mobilization of financial sources for the entire clean-up of the OHIS site and signed a Memorandum of Understanding with UNOPS for administration of the fund. The Contractor will sign a

contract with UNIDO for remediation of 500 tons of the HCH waste and 2,500 tons of the HCH contaminated soil under Lot 1. In case of available funds, satisfactory performance and positive evaluation for Lot 1 by UNOPS, UNOPS may sign a separate contract with the Contractor under the same or similar conditions and the same price per ton as for the contract signed with UNIDO, for the clean-up of a part the remaining quantities of the delta HCH dump, i.e. for the disposal of the HCH waste in amount of 600 tons, and of the HCH contaminated soil in amount of 1,560 tons and of the HCH contaminated concrete in amount of 240 tons under Lot 2. In case of available funds, satisfactory performance and positive evaluation for Lot 2 by UNOPS, UNOPS may sign a separate contract with the Contractor under the same or similar conditions and the same price per ton as for the contract signed with UNIDO for the finalization of the clean-up of the delta HCH dump, i.e. for the disposal of HCH waste in amount of 501 tons, and of the HCH contaminated concrete in amount of 760 tons under Lot 3.

Upon mutual agreement reached between the Contractor and UNOPS and based on the lessons learned during the execution of the work under the Lot 1, the work defined at this stage to be performed under the Lots 2 and 3 might be subject of adjustments in order to achieve higher level of effectiveness.

See Table 1 for an overview of the amounts to be treated under this Lot 1 contract and the possible other contracts for respectively Lot 2 and Lot 3.

Table 1: Amount in Lot 1, 2 and 3 from the delta HCH dump

Lot	HCH waste	HCH contaminated soil	HCH contaminated concrete
1	500 tons	2,500 tons	
2	600 tons	1,560 tons	240 tons
3	501 tons		760 tons
Total	**1,601 tons**	**4,060 tons**	**1,000 tons**

In view of the above, the scope of services under these Terms of Reference has been divided in three (3) Lots. The United Nations Development Organization, in the framework of this Request for Proposals, is responsible of Lot 1, should a Contract be awarded.

Note that upon clean-up of the delta HCH dump, additional investigation is to be performed in order to identify and quantify the possible contamination of the soil underneath the dump. Only the perimeter of the dump was subject of investigation (see details in Appendix D of Polyeco report), while the soil underneath was not investigated, and it is expected the contaminants had penetrated through the concrete bottom and contaminated the soil underneath. If it turned out that there is contamination of the soil underneath, the identified quantities may be subsequently included for treatment by the Contractor under the contract that is to be signed with UNOPS.

All handling, storage and process activities shall be according to the actual EU-legislation concerning POPs and the corresponding technical guidelines provided by the Basel Convention.

The project will especially refer to the directives 2008/98/EC, Directive 2004/35/EC, Regulation (EC) 850/2004, Regulation (EC) 1013/2006 and the corresponding amendments as binding guidelines.

2. Site characterisation

2.1 Lindane production plant

The industrial chemical plant OHIS AD is located at the south-eastern edge of the city of Skopje near the Vardar River (see Photo 1: Satellite map of OHIS site and Annex 1: Site layout map and Annex 11: Building inventory). The lindane complex in OHIS AD – Skopje operated an HCH, lindane and trichlorobenzene (TCB) plant, where HCH, lindane, TCB and HCl were produced, respectively. The lindane complex was gradually put into function since 1964 and was functioning until 1977, when it was abandoned and stopped for ecological reasons and change of the market conditions.

In the HCH Plant, technical hexachlorocyclohexane with gamma isomer of 12-14% was produced with photosynthesis of chlorine and benzene. This technical HCH was further treated to obtain pure gamma isomer 99.9%, i. e. lindane, while the non-active isomers such as alpha, and delta which were extracted in the Lindane Plant were used as raw material to produce TCB and HCl in the TCB Plant.

Gamma isomer was extracted from technical HCH with methanol in a closed-loop process. The process of obtaining TCB and HCl from the non-active isomers was performed with thermal degradation in presence of active coal as a catalyst, but the efforts to utilize them to produce TCB and HCl failed, and consequently the inactive isomers (alpha, beta and delta-isomers) were dumped on the very site. Alpha and beta isomers are dumped on one dump and delta isomer on separate dump consisting of 5 concrete basins. The improper dumping of the waste HCH isomers resulted in secondary contamination of the soil and groundwater, and emissions to air as well. In accordance with the detailed site investigation performed in 2017-2018, the estimated total quantities of the HCH containing waste and contaminated soil in both dumps are around 60,088 tons.

The other production plants at the OHIS site are presented in Annex 1: Site layout map, then in Annex 2: Other activities and the Building inventory in Annex 11.

A detailed site investigation was performed in the period 2017-2018 and the summary of the same is presented in Annex 5, while the details can be found in Annex 6 “Available studies” under the “Final results of the site investigation- Polyeco (2017-2018). A Risk Assessment Analysis was prepared in January 2019 and the summary of the analysis is presented in Annex 3.

The summary of the site characteristics, in terms of geology, wind direction, stormwater, and the seismic situation is presented in Annex 4.

All available studies (feasibility studies, conceptual site model, risk assessment analyses, site investigations) related to the OHIS site can be found in Annex 6.

2.2 HCH dumps

2.2.1 Alpha-HCH and Beta-HCH dump

Analyses of samples of waste disposed in the α-HCH and β-HCH dump found almost pure α-HCH. The waste was disposed in this dump onto the natural ground without any protection (see Photo 2: Alpha and beta HCH dump). Thickness of waste (of white colour and loose, powdery consistency) varies from 3.2 to 4.6 m. Waste isomers are overlain by a layer of humus loam and sandy clay of the thickness of 0,5 up to 3 m (1,1 m in average).

Newest data in accordance with the site investigation performed in 2017-2018 showed a maximum content of sum-HCH found in the perimeter soil of 5,906 mg/kg dm (at the depth of 0.6 meters) and for the overlying soil of the α-HCH and β-HCH dump of 2,762.2 mg/kg dm. Moreover, the sum of 3 tetrachlorobenzenes in one sample at the perimeter exceeds the intervention value, while at 3 samples of the overlying soil of the α-HCH and β-HCH dump the sum of 3 tetrachlorobenzenes and the sum of 6 isomers of DDT exceeds the Dutch soil intervention values.

For the latest calculation of waste and overlying soil volume in the α-HCH and β-HCH dump by Polyeco, a 3D model was developed based on data from the boring logs of the ENACON (2009) report and the boring campaign carried out in the context of the project. Borehole profiles and the developed 3D models with the different contamination levels and waste types are presented in Appendices M and L respectively of Polyeco’s investigation report of 2018 (see for further details in Annex 6: Available studies). The detailed site investigation of the α-HCH and β-HCH dump estimated a mass of around 41,628 tons of HCH waste, and 11,799 tons of HCH contaminated soil and concrete. The outputs of the investigation are summarized in Table 2.

Table 2: Basic Parameters of the α and β-HCH dump

Parameter	Value	Mass (tons)
Planar area	5,140 m^2	
Surface area	5,270 m^2	

Parameter	Value	Mass (tons)
Character of the waste	75% of α-HCH; 6.7% of β-HCH; 6.1% of γ-HCH; 10.5% of δ-HCH and 1.7% of ε-HCH	
Soil (top)	5,813 m^3	10,463
Soil aside*	608 m^3	1,094
HCH waste	22,261 m^3	41,628
Concrete**	110 m^3	242
Total:	**28,792 m^3**	**53,427**

*** Soil of the perimeter of the dump contaminated above target concentrations estimated based on the Polyeco's site investigation report. Soil underneath the dump is to be investigated upon clean-up of the dump.**

**** The volume of the concrete estimated by Enacon report "Evaluation of the available disposal, remediation technologies for the HCH-contaminated site and development of technology selection screening matrix" in 2014. The concrete was not subject of investigation.**

2.2.2 Delta-HCH dump

The δ -HCH dump consists of 5 concrete basins of the total area of approximately 940 m^2 (see Photo 1: Satellite map of OHIS site and Photo 3: Delta HCH dump). The bottom of the basins is situated approximately 1.7 meters below ground level (m bgl). The waste was dumped also beyond the perimeter of the basins (total planar area of the dump is 1,240 m^2). The average thickness of the δ-HCH waste is 1,3 m. Based on analysis of the δ-HCH waste, it contains in average 28.5% of α-HCH, 1% of β-HCH, 46% of γ-HCH and 22% of δ-HCH and 2.5% of ε-HCH.

The δ-HCH waste is overlain by sandy and clayey layers with various content of individual HCH isomers. The uppermost layer comprises humus loam 1.2 to 3.2 m thick (2 m in average). Concentration of HCH is in order of tens of thousands of mg/kg. Based on the surveying a 3D model was developed, and planar and surface areas and volume of waste were calculated. It should be noted that in several locations high concentrations of HCH, also high concentrations of tetrachlorobenzenes, pentachlorobenzene and hexachlorobenzenes are measured (see details in Appendix D of Polyeco report). The outputs of the investigation are summarized in Table 3 and the range of HCH concentrations in the various layers in the dump can be seen in
Table 4.

The detailed site investigation of the delta HCH dump estimated a mass of around 1,601 tons of HCH waste, 4,060 tons of HCH contaminated soil (3,542 tons to the overlying soil and underlying sand and clay and 518 tons to the soil aside of the dump) and 1,000 tons of the HCH contaminated concrete. It should be noted that the soil underneath the dump was not investigated and it is expected the contaminants had penetrated through the concrete bottom and contaminated the soil underneath. The newest data showed a maximum content of sum-HCH found in the perimeter soil of the delta-HCH dump of 994.8 mg/kg dm (at the depth of 3 meters) and the average of 83 mg/kg, where the concentrations of the different parameters in some of the boreholes exceed the soil treatment levels (see Table 6) at different depths.

Borehole profiles and the developed 3D models with the different contamination levels and waste types are presented in Appendices M and L respectively of Polyeco's investigation report of 2018 (see for further details under the Report TERMS OF REFERENCE ANNEXES, Annex 6: Available studies) and the findings summarized in Table 3.

Table 3: Basic Parameters of the δ-HCH dump

Parameter	Value	Volune/Bulk density	Mass
Planar area	1,240 m^2		

Parameter	Value	Volune/Bulk density	Mass
Surface area	1,250 m^2		
Character of the waste	16% of α-HCH, 1% of β-HCH, 44% of γ-HCH and 39% of δ-HCH		
Waste properties of the δ-dump			
Dark Brown Paste	Volume [m³]	223	
	Bulk density [kg/m³]	988	
	Mass [tn]		**220.3**
Light Brown Paste	Volume [m³	562	
	Bulk density [kg/m³]	1,034	
	Mass [tn]		**581,1**
White powder	Volume [m³]	427.4	
	Bulk density [kg/m³]	1,870	
	Mass [tn]		**799,3**
Total Waste	*Mass [tn]*		***1,600.7***
Soil properties of the δ-dump			
Overlying soil	Volume [m³]	1,490	
	Bulk density [kg/m³]	1,480	
	Mass [tn]		**2,205.2**
Underlying sand and clay	Volume [m³]	>742.6	
	Bulk density [kg/m³]	1,800	
	Mass [tn]		**>1,336.7**
Soil aside*	Volume [m³]	288 m^3	
	Bulk density [kg/m³]	1,800	
	Mass [tn]		**518.4**
Total Soil	*Mass [tn]*		***4,060.3***
Concrete**	Volume [m³]	455	
	Bulk density [kg/m³]	2,200	
Total Concrete	Mass [tn]		***1,000***
Total Soil & Concrete	*Mass [tn]*		***5,060.3***

*** Soil of the perimeter of the dump contaminated above target concentrations estimated based on the Polyeco's site investigation report. Soil underneath the dump is to be investigated upon clean-up of the dump.**

**** The volume of the concrete estimated by Enacon report "Evaluation of the available disposal, remediation technologies for the HCH-contaminated site and development of technology selection screening matrix" in 2014. The concrete was not subject of investigation.**

In all samples the concentration of HCH isomers are mostly exceeding the soil target levels with the exception of the sample SK-S-L-2-5-3 (sand with light chemical odor – depth 4,3m). The maximum sum HCH concentration determined is 26.96% in the sample SK-S-L-1-1-2 (light brown paste with chemical odor – depth 2,9m) and the minimum is 0.0002% in the sample SK-S-L-2-5-3.
The composition of the waste types with the corresponding HCH concentrations are presented in Appendix D of Polyeco's investigation report of 2018 and the summary is presented in Table 4.

Table 4: Sum HCH range at different stratigraphy δ-dump

Description	Sum HCH (mg/kg) - individual samples				Sum HCH (mg/kg) - composite samples	Comments
	Min	Max	Average	Median		
Overlying Soil	71.3	30,871	2,531.3	508.3	1,508.9	
Liquid-oil sludge	8,904	131,144	44,729.3	19,434.5	-	
White powder	22,284	25,222	23,753	23,753	18,012	
Dark brown paste	18,013	179,470	96,148.8	105,145.5	256,230	
Light brown paste	36,849	269,648	102,047.5	65,789	970,330	

Description	Sum HCH (mg/kg) - individual samples				Sum HCH (mg/kg) - composite samples	Comments
Clay	8.8	3,342	1,113.4	522.1	32,653	with tar
					2,070.8	with chemical odour
					2.4	Composite
Sand	2.2	222.3	132.3	128.25	998.6	

Further cross-sections of δ-HCH dump can be found in chapter 9 and Appendix K of the Polyeco report.

3. The scope of the proposed services

3.1 Introduction

Complete rehabilitation of the area is extremely technically, economically and timely demanding. Therefore, the work intended to be provided by the Contractor is to remediate the δ-HCH waste dump by disposal of the δ-HCH waste and treatment of the HCH-contaminated soil at the top, inside and aside of the δ-HCH dump. The soil is contaminated with HCH and other related components and here after referred as HCH contaminated soil.

Having in mind that there is no single technology that would be able to economically and practically address all HCH wastes fractions (low, high concentrations and pure HCH substance), two or more of different technologies could be used together for more effective treatment. Remediation can employ one method, or a combination of the available physical, chemical and biological methods. They can either be integrated processes or a series of treatments combined in sequence to provide the necessary overall degree of treatment. The treatment combinations might be used to render a medium more easily treated by one of the technologies, to reduce the amount of waste requiring treatment by a more expensive technology, to prevent the emissions of volatile contaminants and/or to minimize the overall cost of treatment.

Once removal of the δ-HCH dump and the treatment of related HCH-contaminated soil will be completed, it is planned to proceed with gradual remediation of the α, β-HCH dump beyond the project lifetime supported by the financial mechanism adopted by the Government.

3.2 Scope of services

The full scope of services for the remediation of the δ-HCH waste dump is as follows:

A. Preparation of site remediation plan. Hereafter referred as **Site remediation plan**

B. Excavation, separation, packing, temporary storage and shipment of 1,601 tons of the HCH waste from the δ-HCH waste dump and the by-products generated during the treatment. Hereafter referred as **Packing and transportation of 1,601 tons HCH waste**

C. Disposal of 1,601 tons of the HCH waste from the δ-HCH waste dump and the by-products generated during the treatment at a licensed facility abroad. Hereafter referred as **Disposal of 1,601 tons HCH waste**

D. Installation of the on-site (in- and/or ex-situ) remediation technology for the remediation of the 4,060 tons of the HCH contaminated soil from the top, inside and aside of the δ-HCH dump and 1,000 tons contaminated concrete or exportation of the HCH contaminated soil/concrete for off-site treatment abroad. Note that regardless of the type of technology proposed by the Bidder (remediation on-site or exportation), the scope of this tender does not include the purchase of any equipment/machinery. Hereafter referred as **Remediation of 4,060 tons of HCH contaminated soil and 1,000 of contaminated concrete**

The above scope of services will be split into three (3) Lots, as further indicated in Chapter 4, ii "Planned Lots and payments under Lot 1".

Note that for the HCH contaminated soil the Bidder is free to propose whether to employ the on-site (in- and/or ex-situ) and/or the off-site (excavation, separation, packing, shipment abroad) treatment of the HCH contaminated soil.

It should be noted that under no circumstances may dust odour emissions occur outside the premises of the Contractor's site responsible OHIS area. This means that contaminated air e.g. generated within environmental enclosures (at delta dump excavations, soil treatment plant, temporary storages of contaminated soils, and other storage of contaminated materials), needs to be treated by the respective air treatment systems.

It is not allowed that any contaminated water leaves the Contractor's site responsible OHIS area. The water stemming from washing of contaminated equipment, packages, washing and sweeping of roads or water from the soil treatment plant, condense water from environmental enclosures, needs to be treated or otherwise disposed in environmentally sound manner. Other rainfall within the Contractor's site area, needs to be led to a temporary storage and settling basin. If after analysing the water is fulfilling the permitted discharge concentrations, the water can be led into the atmospheric sewer that leads to the Vardar river. If not, treatment of the water must take place. If below the remediation criteria applied, otherwise treatment in the soil treatment plant must take place.

Contaminated soils and concrete treated at the on-site soil treatment plant must be used as fill material on site. No treated soils and concrete can leave the OHIS area.

The work to be provided by the Contractor can be divided into the 5 stages as provided in Table 5.

Table 5: Summary scope of work

Stage	Stage description	Work to be provided
A	Site remediation plan	Preparation of a site remediation plan indicating the schedule for the treatment, the needed logistical equipment to be provided by the Contractor (excavator, bulldozer, forklift, etc.), defining the necessary activities and measures needed to be undertaken to ensure environmentally sound remediation of the HCH- contaminated site and groundwater protection from further contamination. Moreover, site remediation goals should be set, and all risk reduction procedures and plans (health and safety plans and operational risk analysis) are to be designed to achieve an acceptable level of risk for the current or proposed site's land use. The site remediation plan will include also the monitoring plan for verification the successfulness of the treatment, status of the environmental media for possible pollution during the remediation process and the post remediation monitoring.
B	Packing and transportation of 1,601 tons HCH waste	Accomplish the excavation, separation and packing of the 1,601 tons HCH waste (and its related degradation products) from the δ-HCH dump and the by-products generated during the treatment, into UN approved packaging, labelling and weighing of the packages using appropriate health and safety equipment, preparation of the sites for the packing and temporary storage activities.
		Arrange for, either directly or through a specifically described sub-contractor, the enforcement of all Macedonian and international regulations including customs, EC Directive No. 1013/2006 of the European Council concerning the shipments of waste, ADR/RID/IMDG regulations, the Basel and Stockholm Convention documentations for transboundary movement of around 1,601 tons of the HCH waste and plus the treatment by-products from Macedonia to the destination country including all handling, transportation and disposal according to BAT/BEP standards and including any provisions for insurances and financial guarantees and including preparation all transport documents, which will be required by the export and import countries.

Stage	Stage description	Work to be provided
C	Disposal of 1,601 tons of HCH waste	Receive and destroy, through a longstanding proven and licensed HCH waste disposal technology, around 1,601 tons of the HCH waste and the treatment by-products.
		Provide certification documentation (certificates of disposal) that the HCH wastes and the treatment by-products have been destroyed in compliance with internationally recognized and mandated emissions standards.
D	Remediation of 4,060* tons of HCH contaminated soil	Installation of the on-site (in- and/or ex-situ) HCH contaminated soil treatment technology at OHIS site and provision of all necessary operating permits or exportation of the HCH contaminated soil for off-site treatment abroad.
		Execution of the clean-up of around 4,060 tons of the HCH contaminated soil from the δ-dump by respecting all preventive and protection measures to avoid and prevent any incidents that might endanger the human health and the environment or cause significant nuisances to near-by residents.
E	Remediation of 1,000 tons of HCH contaminated concrete	Cleaning of surface of the 5 concrete basins contaminated with HCH. Demolishing the 5 concrete basins. Installation of ex-situ on-site treatment technology at OHIS site and provision of all necessary operating permits or exportation of the HCH contaminated concrete for off-site treatment abroad.
		Execution of the clean-up of around 1,000 tons of the HCH contaminated concrete from the 5 concrete basins by respecting all preventive and protection measures to avoid and prevent any incidents that might endanger the human health and the environment or cause significant nuisances to near-by residents.

*** Note that upon clean-up of the dump additional investigation is to be performed in order to identify and quantify the possible contamination of the soil underneath the dump. Only the perimeter of the dump was subject of investigation (see details in Appendix D of Polyeco report), while the soil underneath was not investigated, and it is expected the contaminants had penetrated through the concrete bottom and contaminated the soil underneath. If it turned out that there is contamination of the soil underneath, the identified quantities may be subsequently included for treatment.**

A. Preparation of site remediation plan

i. The Contractor shall develop a site remediation action plan which should:

a) Set remediation or management goals that ensure the site and any relevant additional land contaminated by site activities will be suitable for its current or proposed site's land use; and will pose no unacceptable risk to human health and/or the environment, either on-site or off-site or significant nuisances to near-by residents;

b) Document in detail all risk-reducing procedures and plans to be implemented to achieve an acceptable level of risk for the current or proposed site's land use;

c) Health and safety plan and operational risk analyses, which will put in place procedures for the safe operation and with the aim to identify, and mitigate for, all hazards and risks posed by the planned operations on the health and the environment; emergency plans in case of accidents; control measures to minimize fugitive air emissions, surface water control, worker health and safety;

d) Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner. The site remediation plan should include also the monitoring plan for verification the successfulness of the treatment, status of the environmental media for eventual pollution during the remediation process and the post 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

- For monitoring emission/immision levels for water, air , see also Annex 11, 12 and 13. For soil monitoring see remediation criteria under I Technical data and specifications required.
- Post remediation monitoring, i.e. after the site has been remediated, there will be verification that it meets the regulatory requirements

ii. After the Contracrt is signed, the site remediation plan shall be prepared within 2 (two) months.

B. Packing and transportation of 1,601 tons HCH waste

i. The Contractor shall arrange for appropriate excavation, separation and packing of 1,601 tons of the HCH waste (and its related degradation products) from the δ-HCH waste dump and the by-products generated during the treatment by using UN certified packaging, labelling and weighing of the packages ensuring that all necessary safety precautions are taken, in order to prevent any possible contamination at the sites, as well as possible workers and near-by resident exposure, see also under ii. The Contractor shall ensure that the excavation/packaging operation is carried out by a duly certified company and duly trained employees. The Contractor shall arrange the needed handling and packing equipment (for analytical results of investigations see Annex 6, Polyeco, 2018 and other former investigations). For the selection of the UN certified packaging, 1. **big bags are not allowed**, as no emissions of vapours from HCH-isomers and/or its degradation products such as chlorobenzenes evaporation through the packaging are allowed at any time. Further, 2. **odour emissions are not allowed**. This applies for all activities during packaging, temporary storage, transport and final disposal.

ii. The Contractor shall take all necessary measures (being part of the Contractor’s monitoring plan), during the excavation and packaging **to avoid fugitive odour, vapour and dust emissions** from works areas within environmental enclosures maintained with sufficient negative air pressure, with air ventilation through scrubbers and with installation of sluice systems to prevent fugitive emissions during haul truck (and other mechanical equipment) ingress and egress. The Contractor has to test and prove the functionality of the environmental enclosures first, if sufficient negative air pressure can be permanently obtained before excavation, secondly after the start of the first excavation of the contaminated soil layer, to verify that the dust and odour emissions have been dealt with and documented as required, thirdly when starting the packaging/excavation of HCH-waste to make sure that with high exposure, the same requirements, the odour and dust emissions have been met and documented accordingly. The contractor has to ensure that the position of the environmental enclosures is based on the investigations available, that excavation of the contaminated soils and concrete, after the removal of the HCH waste (and its related degradation products), can always take place under natural embankment inside the environmental enclosures.

Seismic requirements for the environmental enclosure

Please note the seismic situation around Skopje: According to the building code all buildings must be constructed to resist an earthquake rank 9 on the Mercali Ranks. The seismic risk can be evaluated as moderate to high. This is important for any kind of structures to be

erected/maintained during the project (e.g. environmental enclosures structures for excavation works). See also Annex 4 and in Annex 6 the FEASIBILITY STUDY OHIS PLANT-EPTISA

iii. In the event the Contractor would envisage temporary storage at the site after completion of packaging and until the time of transportation, the Contractor shall bear full responsibility for the packed HCH waste during such storage. All packed materials must be cleaned of the dust before leaving the OHIS area.

iv. In the event the packing operation would be planned with intermissions, during such intermissions the Contractor shall bear full responsibility for safety on site, the Contractor's owned working equipment, as well as HCH waste envisaged for packing and/or packed.

v. The Contractor shall be responsible for obtaining any permits/documentation necessary to carry out the transportation and environmentally sound disposal operation, as required under EU and other international regulations and within jurisdiction of the Republic of N. Macedonia and the regulations of the country of disposal.

vi. Upon obtaining of the import, transit and export permits, the Contractor shall submit approved copies to UNIDO and/or UNOPS, as per applicable Lot. The Contractor shall provide the financial guarantee requested for the Transboundary Movement of Waste notification procedure in accordance with Basel Convention and EC Directive No. 1013/2006 of the European Council concerning the shipments of waste.

vii. The Contractor shall arrange for, either directly or through a specifically described and licensed sub-contractor, the adherence to all Macedonian and international regulations including Customs, EC Directive No. 1013/2006 of the European Council concerning the shipments of waste, ADR/RID/IMDG regulations, the Basel and Stockholm Convention norms for transboundary movement of the HCH waste from Macedonia to the destination country including all handling, transportation and disposal according to BAT/BEP standards and including provisions for insurance, i.e. financial guarantees, as well as coverage of fees for export, transit and/or import permits; possible rental costs for sea containers; possible hazardous waste storage charges, bank guarantees etc.

viii. The Contractor shall provide either directly or through a specifically described and licensed sub-contractor enough cargo means of sufficient capacity ratings for international carriage of shipping containers, packing materials, tools and equipment to avoid interruptions in the work performance due to the lack of vehicles and other media. Ensure the necessary cargo insurance during transportation, which shall include environmental liabilities for the transport of HCH and any emergency situations resulting from inappropriate handling of cargo, inclusive of force major.

ix. The Contractor is to provide either directly or through a specifically described and licensed sub-contractor all transport documents required according the customs legislation of all involved countries. Arrange customs clearance and payment of all duties and taxies, related with export/transit/import to the country of destination of the HCH waste.

x. Upon withdrawal of the HCH waste for transportation to the disposal site, the Contractor shall submit to UNIDO and/or UNOPS, as per applicable Lot, a verification of the withdrawal of the HCH waste, carried out in compliance with legislative requirements and pursuant to conditions stated in respective permits.

xi. Upon delivery of the wastes at the disposal site, the Contactor shall submit to UNIDO and/or UNOPS, as per applicable Lot, verification from the disposal site on acceptance of the cargo/shipment of HCH waste, carried out in compliance with legislative requirements and pursuant to conditions stated in respective permits.

xii. Transport of the HCH waste from the OHIS site to the destruction facility shall comply fully with applicable EU regulations such as actual ADR, RID and IMDG regulations, or similar regulation if the receiving country lies outside of Europe.

xiii. After the Contract is signed, the packing and transportation of the HCH waste within the Lot no. 1 shall be completed within 18 (eighteen) months and performed at intervals set by Contractor

based on the economically justifiable quantities, having in mind that the HCH waste waiting for transportation and subsequent disposal shall not be temporarily stored more than 3 months.

C. Disposal 1,601 tons of HCH waste

i. The Bidder shall provide type and full description of a final disposal method, including:

a) Technology;

b) Evaluation of residual POPs content in solid and liquid residuals and discharges resulted of the disposal operation;

c) Emission and residue control equipment;

d) Compliance with emission/releases standards in a country of disposal;

e) Annual capacity for general hazardous waste, and separately for chlorinated HCH/wastes;

f) Description of the quality systems (and quality control) and emission monitoring practices applied during disposal operations.

ii. The Contractor is to receive and destroy, through a longstanding proven and licensed HCH waste disposal technology, an amount of 1,601 tons of the HCH waste and the by-products generated during the treatment. The plant should also be certified and have implemented an "Environmental Management System" that complies with the international standard ISO 14001 (proof to be submitted). In case that the disposal capacities are not sufficient at the proposed plant, and subcontracting is planned at another disposal plant, the same requirements must be fulfilled and the same proofs have to be submitted and to be approved.

iii. The Contractor shall issue a certificate of disposal confirming disposal of the HCH waste in compliance with internationally recognized and mandated (for instance, EU serving as a benchmark) emissions standards and pursuant to the requirements of the Council regulation (EEC) No. 259/93 and 94/67/EC, the European Commission IPPC BREF for BAT applicable to waste incineration (European Commission, 2006 and any later updates) or other similar legislation if equally stringent. The Certificate shall be issued within latest one (1) month after disposal of all the waste, however latest six (6) months after arrival of the waste in the destruction facility.

iv. The HCH waste will be destroyed by the technology provided by the supplier, to a level that destroys 99.99% of Destruction Efficiency (DE) and respectively 99.9999% of Destruction and Removal Efficiency (DRE) of the original HCH content of processed waste. Emissions must be within the limits set by international bodies for destruction of POPs chemicals (as listed under iii and Basel Convention), or the country hosting the destruction facility, whichever is more stringent. The permit of the plant with the details of limits shall be provided in English in the proposal.

v. The Contractor shall warrant that the generated residuals and by-products are disposed in environmentally sound manner. Permits of such disposal and the proof of their disposal should be provided within latest one (1) month after disposal.

vi. After the Contract is signed, the disposal of the HCH waste within the Lot no. 1 shall be completed within 24 (twenty-four) months and performed at intervals set by Contractor.

D. Remediation of 4,060 tons of HCH contaminated soil

i. The Contractor (in case of on-site treatment) shall perform a trial, performance test for 100 tons in order to confirm the environmental performance criteria for max concentrations of HCH of 5,000 mg/kg, i.e. the efficiency of the treatment technology and the fulfilment of related emissions criteria.

ii. The Contractor (in case of off-site treatment abroad) shall arrange the excavation, separation, packing, temporary storage and transportation of the HCH contaminated soil as per item B of this chapter.

iii. The Contractor shall be responsible for obtaining the needed permits for the on-site treatment, such as: an Environmental Impact Assessment (EIA), Intergrated Pollution Prevention and Control (IPPC), Permit for storage and treatment of hazardous waste for the installation and operation of the treatment technology of the HCH contaminated soil. The Contractor shall install at the OHIS site a treatment technology (in situ/ex-situ) for the treatment of the HCH contaminated soil. The Contractor shall arrange the needed logistical equipment (excavator, bulldozer, forklift, etc.).

iv. The Contractor shall be responsible for execution of the remediation of around 4,060 tons of the HCH contaminated soil by the installed on-site or by the off-site technology abroad. The Contractor shall achieve the target remediation values for the on-site treated soil as presented in the Table 6, while for the off-site treatment the values set by the authorities of the country of import. Note that upon clean-up of the dump additional investigation is to be performed in order to identify and quantify the possible contamination of the soil underneath the dump. Only the perimeter of the dump was subject of investigation (see details in Appendix D of Polyeco report), while the soil underneath was not investigated, and it is expected the contaminants have penetrated through the concrete bottom (cracks and seams) and contaminated the soil underneath. If it turned out that there is contamination of the soil underneath, the identified quantities may be subsequently included for treatment.

v. The Contractor shall be responsible for the safe operation of the remediation process and shall be responsible to take all necessary precautionary measures to avoid any accident that can endanger human health and environment. In the case of an accident during the remediation process, the Contractor shall be responsible and should be insured to cover all the costs related to the remediation of the negative effects.

vi. The Contractor shall take all necessary measures, during the on-site (in- and/or ex-situ remediation) or exportation for the off-site treatment of the 4,060 tons of the HCH contaminated soil, to reduce fugitive odour, vapour and dust emissions from the whole project areas. In case of ex-situ and/or off-site remediation by performing the soil extraction/excavation activity and materials processing/blending/separation/treatment activities within enclosed and contained environment maintained with negative air pressure, with air ventilation through scrubbers and with installation of sluice systems to prevent fugitive emissions during haul truck ingress and egress. The contractor has to ensure that the position of the enclosed environmental, is as such that excavation of the contaminated soils and removal of contaminated concrete can always take place under natural embankment inside the environmental enclosures. This should all be documented in detail in the Contractors monitoring plan. The information to design the enclosed environment must be based on the investigations available.

vii. The contractor makes before any ground works in inventory of the above and below ground infrastructure (See also Annex 7, 8 and 9).

viii. The onsite activities may in principle not damage any onsite infrastructure. If any cable, flowline, piping, pavement, streetlight and or gutter etc. must be removed or protected the contractor makes before appointments with the site owner about the protection or removal and the restoration.

ix. Vegetation that must be removed is free from soil and the soil is treated as if it is contaminated soil. The vegetation itself is to a dedicated land fill for organic waste.

x. The Contractor shall be responsible for the treatment of the residues, by-products and other wastes arising from the operational on-site remediation process. Those residues, by-products and other wastes arising from the operational process that could not be decontaminated will be disposed in an environmentally sound manner by the Contractor. Residues and by-products to be disposed of within Macedonia must fulfil the Macedonian as well as the EU directives for land filling. The Contractor shall process all necessary activities (packing and labelling of the waste, requesting permit for transport and export, organizing transportation, selecting the disposal facility and disposal) related to the final disposal of the by-products/residues that could not be land-filled in Macedonia.

xi. The Contractor shall be responsible to revitalize the site for future industrial use by backfilling the treated soil in the pit originated from the excavation of HCH contaminated soil and HCH waste in case on-site remediation or by backfilling the pit with clean, i.e. soil with contamination levels as per Table 6 in case of off-site treatment. The backfilling will be at least to the surface level of the surrounding area and compacted to the same degree as the surrounding soil without damaging any subsurface infrastructure.

xii. The Contractor shall be responsible for developing and establishing a monitoring plan for:

a) Monitoring of the successfulness of the treatment by sampling and analyses of treated soil and water samples;

b) Monitoring of the environmental media for the possible pollution during the remediation process i.e. controlling of the air emissions, liquid discharges, i.e. effluents, groundwater, etc.

c) Periodical (minimal quarterly) medical check up including a baseline of the workers;

d) Post remediation monitoring, i.e. after the site has been remediated, there will be verification that it meets the regulatory requirements and technical requirements from these tender specifications;

e) Monitoring emissions at temporary storage before treatment.

The Contractor shall prepare site validation report confirming statistically that the remediated site complies with the clean-up criteria set for the site in the remedial action plan. For obtaining of the monitoring verification results, the Contractor shall engage accredited laboratory.

All monitoring costs and cost related to the sampling, sample transportation and laboratory analyses and sample disposal shall be covered by the Contractor.

xiii. After the contract is signed the remediation of the HCH contaminated soil within the Lot no. 1 shall be completed within 18 (eighteen) months.

xiv. The Certificate of Acceptance will be signed by the Contractor and UNIDO and/or UNOPS, as per applicable Lot, at the end of the successful completion of the remediation.

The Table 6 indicates the cleaning levels of the soil for the depths of up to and more than 1 meter below the ground level.

Table 6: Soil treatment levels

Contaminant	Soil (mg/kg) – different depths below ground level	
	0-1 m	**>1 m**
alpha-HCH		3.7
beta-HCH		15
gamma-HCH		45
delta-HCH		40
Sum HCH	0.5	-
Hexachlorobenzene		9.7
1,4-Dichlorobenzene		31
Sum chlorobenzenes	0.5	-

E. Remediation of 1,000 tons of HCH contaminated concrete

i. The Contractor shall take representative core samples of the floor (min from each basin 1 sample) and sides (min from each basing 1 samples) to establish the quality of the concrete per layer of max 5 cm by visual observations and chemical analyses. Before the sampling the surface of the floors and the sides are cleaned from all waste and soil. The bottom part of the core samples is cleaned from waste and soil before transported to the lab

ii. Each core sample is described per minimum 5 cm and each core sample is photographed

iii. The core samples are sealed, packed and labelled individual. All core samples are transported to the lab under a cold chain.

iv. The lab analyses the first 2 layers of minimum 5 cm. if the sample from 5 to 10 cm is contaminated with HCH and its by product the next two layers are analysed

v. The Contractor shall based on the description of the core, the photographs and the analytical results establish the parts of the concrete to be treated as HCH contaminated concrete.

xv. When contaminants have penetrated in vertical direction more than 75% of the concrete floor sample the whole floor is contaminated

xvi. When contaminants have penetrated in horizontal direction more than 75% of the concrete side sample the whole side is contaminated

xvii. The Contractor shall describe the technique used to separate the contaminated parts form the clean parts

xviii. The Contractor shall separate the contaminated parts from the clean parts of the concrete floor of the 5 concrete basins under the same conditions as the contaminated soil is removed.

xix. The Contractor shall be responsible for the safe operation of the concrete remediation process and shall be responsible to take all necessary precautionary measures to avoid any accident that can endanger human health and environment. In the case of an accident during the concrete remediation process, the Contractor shall be responsible and should be insured to cover all the costs related to the concrete remediation of the negative effects.

xx. The Contractor shall take all necessary measures, during removal of the contaminated concrete, to reduce fugitive odour, vapour and dust emissions from the whole project areas.

xxi. The Contractor shall be responsible for the proper treatment and or disposal of the contaminated concrete

xxii. The Contractor shall be responsible for the disposal to a controlled landfill of the concrete that is not impacted by the HCH.

xxiii. The Contractor shall be responsible for developing and establishing a monitoring plan for:

a) Monitoring of the successfulness of the treatment by sampling and analyses of treated concrete

b) Monitoring of the environmental media for the possible pollution during the remediation process i.e. controlling of the air emissions, liquid discharges, i.e. effluents, groundwater, etc.

All monitoring costs and cost related to the sampling, sample transportation and laboratory analyses and sample disposal shall be covered by the Contractor.

<u>Available infrastructure for the clean-up process</u>

The scheme of the water supply installations is provided in Annex 7, then the scheme of the electrical installations is provided in Annex 8 and the conditions for the usage of the available infrastructure at OHIS site set by the owner of the same in Annex 9.

4. Acceptance of Works and payments

4.1 Certifications

All certification listed below shall be submitted to UNIDO and/or UNOPS, as per applicable Lot, after completion of the works.

a. **Certificate of satisfactory performance of the work** shall be issued by the Contractor confirming the successful execution of the remediation of soil and achieving the target remediation values, signed

by the Contractor, and the UNIDO and/or UNOPS, as per applicable Lot, authorized representative.

b. **Certificate/approval on withdrawal of the HCH waste from the OHIS site,** signed by the Contractor and the UNIDO and/or UNOPS, as per applicable Lot, authorized representative.

c. **Certificate of delivery/acceptance and the disposal of the HCH waste** shall be issued by the entity responsible for disposal facility identifying the quantity (number of packaging) and weight of the HCH waste accepted. This certificate shall be submitted to the UNIDO and/or UNOPS, as per applicable Lot, and shall serve as confirmation for completion of tasks under part B of Section 3.2 "Scope of services" and confirming safe disposal of the HCH waste according to international standards and the regulations of the import country. The Certificate must verify that the HCH waste was destroyed to the required level of destruction, and that emissions during the destruction process did not exceed the levels set by international bodies or the host country, whichever is more stringent. This certificate shall be submitted to the UNIDO and/or UNOPS, as per applicable Lot, and shall serve as confirmation for completion of tasks under part C of Section 3.2 "Scope of services".

4.2 Planned Lots and payments

Payments shall be executed by UNIDO and/or UNOPS, as per applicable Lot, upon satisfactory completion and acceptance of works according to respective Lots described in this Terms of Reference, and upon receipt of respective invoice by the Contractor along with the requested documents.

As planned, the realization of the activities requested in this ToR will be performed in three phases, i.e. Lots, where UNIDO will be responsible for the Lot no. 1 and UNOPS for the Lot no. 2 and the Lot no. 3.

The scope of services to be performed by the Contractor within the Lot no. 1, for which UNIDO is responsible, should a Contract be awarded, are as follows:

- Preparation of the site remediation plan;
- Packing and transportation of 500 tons of HCH waste;
- Disposal of 500 tons of HCH waste;
- Remediation of 2,500 tons of HCH contaminated soil (for on-site remediation obtaining the needed permits, installation of the technology on-site, trial, performance test and remediation of the HCH contaminated soil, while for the off-site treatment packing and transportation of the HCH contaminated soil and treatment of the same);
- Execution of the monitoring plan.

The Contractor is requested to guarantee the same or similar conditions (including price per ton) as for the contract signed with UNIDO (Lot 1), for the work which might be contracted by UNOPS (Lot 2 and Lot 3) related to the finalization of the clean-up of the delta dump, subject to satisfactory performance and positive evaluation as well as other considerations by UNOPS.
The bidder's offer shall include a clear statement regarding the above.

The scope of services to be performed by the Contractor within the Lot no.2 are as follows:

- Packing and transportation of 600 tons of HCH waste;
- Disposal of 600 tons of HCH waste;
- Remediation of 1,560 tons of HCH contaminated soil and 240 tons of HCH contaminated concrete;
- Execution of the monitoring plan.

The scope of services to be performed by the Contractor within the Lot no.3 are as follows:

- Packing and transportation of 501 tons of HCH waste;
- Disposal of 501 tons of HCH waste;
- Remediation of 760 tons of HCH contaminated concrete;
- Execution of the monitoring plan;
- Revitalization/restauration of the plant site.

The Contractor is requested to provide a:

- **Technical Offer for all services indicated under these Terms of Reference for all three lots with a clear distinction between each lot and, bearing in mind the guarantee of the same or similar conditions for Lot 1, 2 and 3;**

- **Financial Offer for the services under Lot 1 only, and, the guarantee that the same price per ton of waste, soil and concrete are applicable for Lot 2 and 3.**

Payments will be effected to the Contractor within thirty (30) calendar days after receipt of the respective reports, subject to the acceptance by UNIDO of the Services/Works. UNIDO reserves the right to modify the proposed payment schedules when contracting.

Note that the order of the payments might vary as it depends on time of the finalization of the requested deliverables.

Table 7: The Payment Schedule for Lot 1

No.	Payment
1	Upon Contractor's submission and UNIDO's approval of the site remediation plan and the site take over report
2	Upon Contractor's submission and UNIDO's approval of the obtained the environmental permits
3	Upon Contractor's submission and UNIDO's approval of the Contractor's Report No. 1 evidencing packing of 500 tons of the HCH waste
4	Upon Contractor's submission and UNIDO's approval of the Contractor's Report No. 3 evidencing disposal of 500 tons of the HCH waste
5	Upon Contractor's submission and UNIDO's approval of the Contractor's Report No. 5 evidencing remediation of 2,500 tons HCH contaminated soil
6	Upon Contractor's submission and UNIDO's approval of the Contractor's Final report on fulfilled activities

5 Technology requirements

A. Packing of 1,601 tons of the HCH waste

The technology for the packing, temporary storage, shipment of the HCH waste and the treatment by-products must meet the following key criteria:

1. The Contractor must be certified providing that the packaging operation is carried out by a duly certified company and duly trained employees.
2. The Contractor will apply operational zoning of the site work areas. In general, the three zones (noting that boundaries between them must be clearly demarcated) to be applied are defined as follows:
    a. Clean zone: This applies to those parts of the site where there is no risk of contact with or exposure to HCH wastes, HCH impacted wastes, or other contaminated materials;
    b. Intermediate zone: This applies to the areas of the site, which have been cleaned of HCH wastes and HCH impacted wastes. 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 is to be used to enter the contaminated zone, for final handling, labelling, staging, storage and removal of repacked HCH wastes, HCH impacted wastes, decontamination of staff and clean materials when leaving the contaminated zone and going to the clean zone;
    c. Contaminated zone: The contaminated zone applies to all those parts of the site where HCH wastes and HCH impacted waste are still freely present. Risk of contact with the contaminants in this zone is high and stringent health and safety precautions are in place and enforced.
3. The packaging should be UN Certified packaging[1], internationally accepted for use in these

[1] The net cost and weight of packaging selected (estimated costs to be itemized in the Commercial Proposal) will impact the overall unit cost/ton for the management of HCH waste and HCH impacted waste thereby being a potentially significant factor in the selection of the successful contractor

applications and specifically compliant with the ADR and IMDG standards as approved for use in Macedonia and international transport in compliance with the relevant international agreements for the transport of dangerous goods, taking into consideration that no emissions by vapours from HCH-isomers and/or its degradation products such as chlorobenzenes evaporation through the packaging are permitted at any time, Also, any odour emissions are not permitted. This applies for all activities during packaging, temporary storage and transport and final disposal. Therefore, the use of big bags is not allowed. For the air emission limit values see Annex 12: Air emission limit values on the remediation site to be observed by the contractor and Annex 13: Monitoring system criteria by authorities.

4. The use of uncontaminated, second-hand packaging and pallets as applicable is permitted but is subject to inspection and approval by UNIDO and/or UNOPS, as applicable, authorized representative.
5. Packaging should only be undertaken within contained and enclosed environment, as described in chapter 3.2 as well chapter 3.2 under B. Packing of 1,601 tons δ-HCH waste, at filling point(s) suited to the type of UN approved primary packaging that the Contractor selects for final removal of the HCH waste from the site.
6. Weighing of HCH and HCH impacted waste will be done on-site in the final primary packaging prior to transfer of the materials into the vehicle for off-site transport. Agreed baseline weights of the empty packaging and other consumables associated with the weighted material will be established in advance to allow calculation of net waste shipped and delivered to destruction facilities.
7. Weighing will be done with a calibrated scale that has a minimum accuracy of 1.0 kg and a minimum precision of ± 1 %. Calibration papers will be provided to the UNIDO PMU representative prior to the start of using the scale and be available for inspection on request throughout the work.
8. Mixing of HCH waste with other materials is prohibited. HCH impacted wastes will be separately collected, handled and packaged for off-site disposal, treatment, and/or destruction separately on physical appearance, and/or expected/proven HCH concentrations. Mixing of HCH impacted wastes with other materials will be minimized and avoided where possible.
9. The primary packaging container labels will be in compliance with the guidelines of the ADR and IMDG Code.
10. The shipping containers (where applicable) will be labelled in accordance with ADR, RID and IMDG Codes.
11. Packaged HCH wastes should be fixed with adequate dunnage consisting of wooden structures and/or straps on or within cargo transport units before transport and should be secured in accordance with standard EN 12195-1:2010 per the ADR standard as a minimum. If further transport via rail or sea takes place, the provisions of the RID and/or IMDG for stowage should be considered.
12. All site personnel under the Contractor’s direction are to be properly trained and all tools and materials are in good working order and suitable for the intended application;
13. The vehicle, its driver and staff involved in the loading of the vehicle shall comply with all applicable national and international regulatory provisions including vehicle licensing/training, emergency response equipment, communication, and placarding equipment provisions, particularly in the case of the driver licensing and training provision have the appropriate legal certificates according to Macedonian regulatory provisions applicable to transport of materials involving hazardous waste, all of which shall be subject to examination and inspection by the UNIDO authorized representative.
14. The Contractor will ensure the provision of the required emergency response capability in terms of spill containment and clean up capability.
15. The locations where wastes are handled shall have a solid foundation to ensure stability of the hoisting equipment, stored materials and vehicles.

16. Entry of vehicles with technical malfunctions or without fire-extinguishing capability and an electrostatic elimination device into the site or their repair on the site shall be prohibited.
17. All storage and staging prior to release of truck loads should take place within the confines of the site.
18. On-site storage of HCH waste is recommended to be organized within one of the available buildings and can only take place in packaged form within final sealed mode of off-site transport (for instance shipping container) according to ADR and UN standard. Air and dust monitoring of the building must be organized, when HCH-waste is temporary stored.
19. Any outdoor storage of POPs wastes and POPs impacted wastes is prohibited.
20. Packaging of stored or staged materials cannot come into contact with the site soil or site floors.

B Disposal of 1,601 tons δ-HCH waste

The technology for the final disposal (destruction) of the HCH waste and the generated by-products must meet the following key criteria:

1. The technology for the HCH waste treatment/disposal must be certified by the respecting authority in the country of operation.
2. The process shall warrant achieved levels of the Destruction Efficiency (DE) should be at minimum 99.99%, combined with the Destruction and Removal Efficiency (DRE) of 99.9999%.
3. If combustion technologies are considered as final disposal option, their use should be consistent with the guidance on best available techniques (BAT) and best environmental practice (BEP) for provided by the Convention (Stockholm Convention, N.D.), Council directive 94/67/EC, and the European Commission IPPC BREF for BAT applicable to waste incineration (European Commission, 2006 and/or possible later updates*)*. Unintended release limits should be at 0.1 ng TEQ/Nm^3, for PCDD/PCDF air emissions.
4. The technology must not produce dioxins or other POPs waste as an intrinsic characteristic and must have the capability of containing and possible reprocessing of all process streams. All the emissions in the environment shall be in accordance with EU and Macedonian regulations. As a reference, the benchmark level in developed countries and the Basel guidelines for PCDD/PCDF is 0.1 ng TEQ/Nm^3 will be used.
5. The technology should be demonstrably and inherently safe. A “demonstrably safe” technology is one that achieves the highest possible level of occupational safety and has a proven and documented history (list to be provided) of safe operation, with no cases of death or injury or incidents that threatened life or injury resulting from the use of the technology. Inherent safety means that the hazardous substances shall be destroyed, and any hazardous by-product that might be generated during the processing shall be kept in the closed system and recycled and/or destroyed.

C. Remediation of HCH contaminated soil

The technology for the on-site (in-situ/ex-situ) remediation of the HCH contaminated soil from the top, beneath and aside of the δ-HCH dump must meet the following key criteria:

1. The Contractor will apply and enforce operational zoning (Clean, Intermediate and Contaminated zone) of the site work areas as described above.
2. The technology proposed must be proven in technically and economically viable conditions, allows implementation at relevant industrial scale and available for technology transfer, i.e. for on-site installation.
3. The foreseen remediation on-site technology (in-situ/ex-situ) shall comply with BAT and BEP requirements according to EU 96/61/CE directive or with equivalent guidelines/regulations coming from an EU member state’s Ministry of Environment and relevant Conventions (Basel Convention, Stockholm Convention). The technology shall be applicable for the treatment of the soil and concrete parts contaminated by HCH and other related components and therefore shall significantly reduce the amount of waste that will eventually still need to be exported for final disposal. These inevitable

hazardous residues can be transported to other countries for incineration if all requirements of the Basel Convention are respected.

4. The processing unit should be able to separate/concentrate or destroy/irreversible transform the HCH from the contaminated soil. It would be considered as advantage if the technology is able to destroy/irreversible transform or to isolate/concentrate broader spectrum of contaminants, i.e. the other contaminants identified at the site (mercury, chlorobenzenes, DDT and other degradation products of HCH).
5. The treatment capacity of the on-site technology should not be less than 2 tons per hour achieving the target remediation values presented in Table 6.
6. The on-site treatment technology should be able to remediate the soil so that all direct human health risks, the direct ecological risks and the risks for off-site migration of the contaminants are eliminated within a period of maximum 2 years. Special note on treatment contaminated concrete parts: It must be noted that for the on-site treatment technology there are additional requirements to be fulfilled:
    a. Further it should be additionally considered the necessity of remediation of contaminated soil below the concrete layer, as this is not yet known and for the on-site treatment can be implemented after the concrete parts have been excavated and removed as part of the contract to be signed with UNOPS. Therefore, in this case the concrete parts are remaining, and it should be clarified before that the following issues have been dealt with:
        i. Investigation, before approval of this alternative, of the actual soil contamination situation below the concrete floors. Based on these results that:
            1. the soil is contaminated below the concrete and that the on-site treatment must be implemented;
            2. the soil is not contaminated, and no further action must take place.
7. The on-site treatment technology involves also the installation of the containment, monitoring and aftercare of remaining risks.
8. The technology should be able to keep the values of the contaminants in the air as in accordance with the Annex 12: Air emission limit values on the remediation site to be observed by the contractor and Annex 13: Monitoring system criteria by authorities.
9. The technology must not produce dioxins or other POPs waste as an intrinsic characteristic and must have the capability of containing and possible reprocessing of all process streams. All the emissions in the environment shall be in accordance with EU and Macedonian regulations. As a reference, the benchmark level in developed countries and the Basel guidelines for PCDD/PCDF is 0.1 ng TEQ/Nm^3 will be used.
10. The technology should be demonstrably and inherently safe. A “demonstrably safe” technology is one that achieves the highest possible level of occupational safety and has a proven and documented history (list to be provided) of safe operation, with no cases of death or injury or incidents that threatened life or injury resulting from the use of the technology. Inherent safety means that the hazardous substances shall be destroyed, and any hazardous by-product that might be generated during the processing shall be kept in the closed system and recycled and/or destroyed.

In case the Contractor employs the off-site treatment for the HCH contaminated soil abroad, then in addition to the relevant requirements set in this item C, the Contractor shall follow the requirements set in the item A (related to the excavation, packing, temporary storage and transportation of the HCH contaminated soil).

In case of on-site treatment of the HCH contaminated soil and having in mind the great environmental and health impact and the social implications that on-site treatment might cause, only the companies with proven evidence of successful demonstration of the on-site HCH contaminated soil remediation globally will be taken into consideration.

D. Remediation of HCH contaminated concrete

The technology dealing with the contaminated concrete parts of the 5 concrete basins must meet the below listed key criteria. The contractor needs therefore also to submit his on-site experiences on treatment of HCH or similar contaminated concrete parts.

1. The penetration depth of the concrete must be established by core sampling of the concrete and visual observations and chemical analyses of maximum layer thickness of 5 cm.
2. Only the contaminated concrete is treated.
3. Before demolishing and treatment of the 5 concrete basins the surface is cleaned from all waste and soil if another technique is chosen then the technique for the contaminated soil

6 Indicative time schedule for Lot 1

The Table 8 below lists the delivery timeframe for the requested activities from the date the contract is signed for Lot 1 (time schedule for Lot 2 and Lot 3 will be agreed upon, in case opted, between UNOPS and the Contractor).

Table 8: **Delivery Timeframe**

Activity	**Delivery timeframe for destruction system and related activities (given in months after contract signing)**
Site Remediation Plan and Site Take over Report (including detailed overview of all infrastructures for Contractors use) from Client to Contractor.	2
Confirmation on receiving of the environmental and operational documents like EIA, IPPC, Permit for storage and treatment of hazardous waste.	6
Confirmation on installation of the remediation technology for the HCH contaminated soil with approval of test runs. Confirmation of tests of functionality of environmental enclosures at the Delta dump during packaging and technology remediation operation proving enough under pressure by confirmation in relation to compliance with required dust emission level and no odour occurrence in contractors monitoring system and authorities monitoring system	6
Two verification reports each on the treatment of 1,250 tons of the HCH contaminated soil Final report of total quantity of soil treated.	18 *Explanation on the course of the treatment process; results of chemical analyses of HCH in all solids, liquids and gaseous streams performed by accredited laboratory; characterization and quantities of generated by-products/residues; any interruptions in the process; utilities consumption; amounts of consumable materials; eventual incidents and measures taken to minimize the impact on human health and environment, etc.*
Two verification reports (each on 250 tons of the HCH waste) on packing, temporary storage at OHIS site and shipment of the HCH waste	18 (at intervals set by Contractor based on the economically justifiable quantities, having in mind that the HCH waste waiting for transportation and subsequent disposal shall not be temporarily stored

Activity	Delivery timeframe for destruction system and related activities (given in months after contract signing)
	more than 3 months
Confirmation on acceptance of the HCH waste at the final destination and disposal of the same (submission of Certificate of destruction)	24 (at intervals set by Contractor)
Final Report (including handing over of site report from Contractor to Client)	24

7 Bidder's experience and capacities

The Bidder shall demonstrate corporate experience as direct contractor to organizations of the United Nations System and/or other, international or government agencies and private sector which is related or relevant to the one required for this Contract. In line with the "Instructions for the Preparation and Submission of Proposals", references with information (such as name of the project/contract, value of the contract, Client, starting/end date, export country, amount and kind of waste, etc) shall be submitting with regard to the following areas/sectors:

7.1.1 Minimum of 5 (five) similar projects related to packaging, international transport and/or destruction of pesticides POPs waste of a minimum total size of 2,000 tons (wastes and soil separately/in combination) within the last 5 years (2014-2018), including at least 2 (two) projects related to HCH wastes within the last 5 years (2014-2018);

7.1.2 Minimum of 2 (two) similar projects related to packaging, international transport and destruction of pesticides and other POPs waste within the last five years (2014-2018).

7.1.3 The above project references shall also demonstrate experience in management, planning and execution of multidisciplinary, complex site clean-up for HCH wastes, including:

- Occupational health and safety measures, environmental monitoring
- Documentation of compliance to set requirements, notably zero-dust and zero-odour emission outside the environmental enclosures. At the border/fence the Contractor's project area Annex 13, "Proposed values for air immersions" on page 4, "Decision tree air monitoring values" on page 5 have to be applied (under Bidder's responsibility)
- Extensive proven experience in stakeholder management in implemented projects (letters of client's responsible project director and/or concerned head of concerned environmental authorities, with description of role of the company in the stakeholder activities implemented should be included).
- Experience in Emergency Prevention, Preparedness and Response

8 Personnel in the field and language requirements

The Bidder shall assign the number of personnel and their qualifications required for performing the requested activities (CVs of key personnel to be included and availability of key personnel during the entire Contract duration). Special attention is required for the key personnel that manages the soil treatment plant in Macedonia, who should be listed separately, but also should be available for the entire Contract duration.

The working language for the bidder's proposed personnel shall be English. Knowledge of Macedonian language is an advantage.

The following key-personnel shall be provided as part of the proposal:

Overall project manager

- More than 15 years of working experience, and specific experience from similar HCH site clean-up management including excavation, packing, transport, in-situ and ex-situ destruction of HCH

wastes and HCH contaminated soil
- University degree in a relevant technical discipline (i.e. chemical engineering, chemistry, environmental sciences)
- Proven experience with project planning, environmental management planning and monitoring plans for similar projects, including working with environmental enclosures for zero-dust and zero-odour
- Experience with multi-stakeholder engagement
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

Deputy Project Manager

- University degree in relevant technical disciplines (i.e. chemistry, environmental sciences, industrial occupational health and safety)
- 5 years of proven experience with project coordination, follow-up and progress reporting from similar projects
- Experience with authority relations and from engagement management of other stakeholders
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

Health & Safety Manager

- University degree in relevant technical disciplines (i.e. chemistry, environmental sciences, industrial occupational health and safety)
- 10 years of proven experience with Health and Safety management planning for similar projects
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

Environmental Manager

- University degree in relevant technical disciplines (i.e. chemistry, environmental sciences, industrial occupational health and safety)
- 10 years of proven experience with Environment management planning for similar projects
- 5 years of proven experience with establishing and executing monitoring plans for similar sites, including sampling, analyses and reporting
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

QHSE compliance manager

- University degree in relevant technical disciplines (i.e. chemistry, environmental sciences, industrial occupational health and safety)
- 10 years of proven experience with,
  - Establishment and maintenance of requirement registers
  - Establishment and maintenance of risk registers
  - Establishment and maintenance of ‘speak-up’ mechanisms (whistle-blower) internally and externally
  - Compliance activities within the project
  - Organising and conducting training within QHSE
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

Soil Treatment Operator

- University degree in relevant technical disciplines (i.e. chemistry, mechanical, industrial

occupational health and safety)

- Min 5 years' proven experience with offered technology
- Min 5 years' proven experience with training programmes and their implantation for commissioning of plant
- Fluent English language (speaking, reading and writing)
- Knowledge of Macedonian language would be advantage

Knowledge of local language should be ensured throughout the contract duration: Bidders may consider replacing the knowledge of local language with interpretation and translation services.

9 Guarantee Requirements

The Bidder should apply the best available HCH remediation techniques and practices in separating/destroying the HCH content.

1. The Bidder should guarantee the quality of all the work specified in the Scope of the proposed contract services as well as the requirements stated in the technical proposal.
2. The Bidder should guarantee to dispose the HCH waste within the terms stated in the General Time Schedule. i.e. to pack, temporarily store, ship and dispose the HCH waste within the requested period of 24 (twenty-four) months, in order to limit eventual prolongation of the period of the temporary storage of the waste at OHIS site, or at a permitted temporary hazardous waste storage on the way between the OHIS site and the final destination or of the disposal of the same at the final destination. Also fulfilling the condition in Table 8 that the HCH waste shall not be temporarily stored more than 3 months at OHIS site.
3. The Bidder shall guarantee to transport and set-up the process unit (installation, set-up, and initial operation and tests).

   The Performance Guarantee for the entire process-unit for the remediation of the contaminated soil starting after signature of the contract and within the first 6 months, the Contractor shall obtain the necessary permits (IPPC and treatment permit). Thereafter, the Contractor shall install the technology on-site, and then the contractor has 12 months to finalize the remediation, i.e. to finalize the soil treatment after 18 months from the signature of the contract. For this period the Contractor must guarantee the performance of the technology, then the mechanical warranty (including the spare parts, maintenance tools), and guarantee for the consumable supply.
4. The Bidder shall guarantee that the remediation work will be performed by respecting the best working practices and performing all precautionary measures in compliance with required dust emission level and no odour occurrence) in order to minimise/mitigate the risk to human health and the environment.
5. The Bidder shall guarantee to perform the remediation of the HCH contaminated soil and the HCH waste within the terms stated in the General Time Schedule.
6. The Bidder shall guarantee that the decontaminated soil meets the requirements stated in Table 6.

Table 9: Summary of the Bidders Guarantees

Summary of guarantees	Bidders Guarantee
Plant capacity (minimum)	*2 tons/hour*
DE	*99.99%*
DRE	*99.9999%*
HCH concentration in treated soil	*see Table 6*