UNDP-GEF Full-size Project: "*Elimination of obsolete pesticide stockpiles and addressing POPs contaminated sites within a Sound Chemicals Management Framework in Armenia*"

Consulting Assignment: Detailed Design, Technical Definition of Works and Supporting Assessments/Studies required for the Removal of POPs Pesticides and Recovery of Associated Contaminated Soil along with Site Cleanup, Stabilization, Containment, and Monitoring applied to the Nubarashen POPs Burial Site (Yerevan, Armenia).

RFP Section 3: Terms of Reference (TOR) - Nubarashen Clean-up Design Assignment

A. General Background and Overall Assignment Context

This consulting assignment is intended to provide the key technical, operational planning, and environmental management definition required to undertake the cleanup and restoration of a Soviet era obsolete pesticide burial site in Armenia. It is envisioned to be undertaken by an experienced technical consulting services firm with international environmental expertise in partnership or through sub-contracting with national civil engineering, and environmental impact assessment firms and/or individual experts.

The Project that this assignment is a part of is entitled "Elimination of obsolete pesticide stockpiles and addressing POPs contaminated sites within a sound chemicals management framework in Armenia". It is a Global Environment Facility (GEF) project with UNDP as the GEF Implementing Agency that was first approved for preparation in February 2012 and received approval for grant funding of US$4.7 million with a co-financing commitment of US$19.3 million in December 2014. The project as approved by the GEF and formally agreed between UNDP and the Government of Armenia (GoA) is documented in a Project Document (PD)[1].

The project consists of three operational Components plus the standard Monitoring/Evaluation and Project Management provisions. The overall structure of the project in terms of Components, Outcomes and Outputs as approved in the PD is provided in Attachment 1. The project's primary focus, as covered in Component's 1 and 2 and the various Outcomes under each, is the elimination of a large Soviet era POPs and other obsolete pesticide (OP) stockpile/burial site at Nubarashen located on the outskirts of Yerevan (Component 1), and the development of related hazardous waste management capability as part of this, the export disposal of high concentration POPs stockpiles, and treatment of high and lower level contaminated soils (Component 2). The principle Outcomes for each of these Components is summarized below.

- *Component 1, Outcome 1.1* involves work on and around the Nubarashen site and is what this assignment specifically relates to in terms of technical support. In terms of physical scope it covers i) the removal and packaging of this POPs and OPs stockpile and associated highly contaminated soil (Category 1); ii) the secure containment of treated (Category 2) and lesser contaminated (Category 3) soil on site; iii) the restoration/stabilization of the site and its surroundings to prevent future instability; and iii) the establishment of appropriate long term land monitoring and land-use control applicable to the site.
- *Component 1, Outcome 1.2* covers the development of the proposed Kotayk national hazardous chemical waste (HCW) management site that would serve as secure interim storage for material

[1] http://www.am.undp.org/content/dam/armenia/docs/4095_Armenia_UNDP%20PD%20as%20cleared-Signed%20May%2026,%202015.pdf

removed from Nubarashen and other sites prior to export for environmentally sound disposal as well as providing basic infrastructure to allow introduction of hazardous chemical waste storage, treatment and soil remediation technologies constructed and operated for handling of POPs pesticides and associated contaminated materials. The design work associated with the development of this facility will be covered in a separately tendered Request for Proposal (RFP).

- *Component 1, Outcome 1.3* involves the securing remnant stocks and residual contamination at old agro-chemicals storehouses all over the country using non-GEF funds for packaging/removal and site cleanup. This will be undertaken by others and is not related to this assignment or GEF funding.
- *Component 2, Outcome 2.1* covers the anticipated export of the packaged high concentration POPs waste/pesticides material from Nubarashen plus an allowance for obsolete pesticides delivered by others to Nubarashen (estimated to be 900t + 150t in total) for environmentally sound destruction according to international standards (Basel Convention[2] and GEF STAP[3]) at qualified facilities in the EU or elsewhere. The linkage to the current assignment is the updating of current quantity and concentration distribution estimates.
- *Component 2, Outcome 2.2* covers the on-site/in-country treatment of an estimated 7,100 heavily contaminated soil (Category 2) from the Nubarashen site and an allowance of such material delivered by others from obsolete pesticides (OP) storage sites or alternatively exported (the option being market determined by a qualification and international tendering process). The linkage to the current assignment is the updating of current quantity and concentration distribution estimates.
- *Component 3.* Additionally the project provides limited Technical Assistance (TA) for various capacity building activities that remain under discussion with the national Executing agencies. This has partial direct linkage to the current assignment, to the degree that it might be informed by the international practices and standards being utilized during this assignment, as well as some training/demonstration activities.

The project's designated lead Executing Agency is the Ministry of Nature Protection (MNP) based on its role as GEF Focal point. In terms of implementation, the Ministry of Emergency Situations (MES) acts as the primary counterpart and functional Executing agency for Components 1 and 2 with MNP acting in its statutory regulatory capacity. Overall, institutional supervision of the project is provided by a Project Management Board (PMB) co-chaired by MNP and MES. A broader stakeholder advisory committee including representation of civil society is also anticipated to be involved.

Operationally and administratively, the project is being managed by a Project Management Unit (PMU) under the UNDP Armenia CO, with UNDP being the contracting agency and being responsible for commercial administration of this consulting assignment. The principle counterpart executing agency for this particular assignment will be the Ministry of Emergency Situations on technical matters, based on their mandate for the maintenance and custody of the Nubarashen site as well as ownership and operational responsibility for the proposed Kotayk hazardous chemical waste management national facility. Additionally, the assignment will involve interaction with the City of Yerevan (landowner of the Nubarashen site) in relation to offsite infrastructure, access issues and supporting works around the Nubarashen site, and with the MNP in relation to environmental approvals (EIA).
The PMU will utilize additional technical oversight to be provided by UNDP's regional and HQ staff, including technical expertise of project's International Adviser.

[2] http://www.basel.int/Portals/4/Basel%20Convention/docs/pub/techguid/tg-POPs.pdf
[3] http://www.mcdowall.ac.nz/Site/UNEP-Publications files/GEF%20STAP%20March0911-BC%20edit-final.pdf

Site Technical Information

The Nubarashen burial site dates from the late 1970's when a number of pesticides such as DDT and subsequent HCH now controlled as POPs were being banned globally including in the Soviet Union. This resulted in an all-union program involving the storage of banned and obsolete pesticides (OPs) in the supply chain and the establishment of nominally engineered containment facilities in each of the Republics. In Armenia, such a facility was established at Nubarashen on the outskirts of Yerevan. Over the years, the site was subject to various levels of monitoring as well some misuse, the major one being unauthorized access and excavation of the buried pesticides presumably for illegal sale and use. Likewise, it was realized that the location of the site had not been properly selected and it became evident that it was located within a natural drainage path and in an area of general geotechnical instability. Beginning in approximately 2004, in substantial part through the involvement of civil society groups and particularly the Armenian Women for Health and a Healthy Environment (AWHHE) NGO, public attention was drawn to the site and the risks it represented. This resulted in a number of survey level studies by national and international NGOs as well as action by the Ministry of Emergency Situations in 2004 respecting access and ultimately in 2010 undertaking a major interim containment and stabilization program. This was also the stimulus for the Government to seek international support which came in the form of initiating this GEF project in 2010. In parallel involvement of the International HCH and Pesticide Association (IHPA) occurred which in turn resulted in the initiation of a comprehensive site assessment and engineering design study undertaken by an international firm commissioned by OSCE. Additional site assessment was undertaken during the current project's preparation (PPG) phase using GEF and additional bilateral funding. The culmination of this work was the conceptual design technical and costing basis for the current project as defined in the above referenced PD.

Attachment 2 provides a composite extraction of the available background and details of the conceptual design as elaborated in the PD. The following provides a list of available resource documents from the technical work to date which is included in this tender package according to the following list:

1. International POPs Elimination Network "Report on "Environmental security for residents of settlements near to obsolete pesticides burial in Ararat region", AWHHE, 2004
2. "Toxic Hot Spots in Armenia, Monitoring and Sampling Reports", ARNIKA and AWHHE, Prague and Yerevan, 2011
3. R. Yadoyan, "Recommendations on Priority Measures for Security Insuring of the Burial Ground", AWWHHE, 2005 (English extract)
4. "Assessing a Discharge of Contaminants from the Nubarashen Toxic Chemicals Repository Site" National Academy of Science. The Center for Ecological and Noosphere Studies of NAS RA/OSCE, Yerevan, 2010.
5. Strengthening National Capacities on Comprehensive Chemicals (Persistent Organic Pollutants) Contaminated Site Assessment in Armenia, Analytical Report on Sampling on Nubarashen Site, 2013, GEOtest, Brno, Czech Republic
6. John Vijgen "Emergency Action Plan for the Nubarashen Obsolete and POPs pesticides burial site". IHPA/OSCE, 2010.
7. OSCE, "Nubarashen Burial Site in Armenia, Emergency Case - Presentation to the EU Parliament", 2010
8. Tauw, Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 1 and 2 investigation report; Draft, 28 June 2013
9. Tauw, "Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 1 and 2 investigation report", September 2013
10. Tauw, "Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 3: Selection & pre-design of long term technical solutions", December 2013

Assignment Objective

The overall objective of this assignment is to provide a detailed technical and costing definition of the required works to: i) complete the environmentally sound removal of highly contaminated POPs pesticides and OPs from the Nubarashen burial site for off-site management; ii) design solutions for secure excavation, packaging, containment of residual contamination and treated soils; and iii) restore the site in a form suitable for an agreed future land use inclusive of its stabilization to prevent future risks from geotechnical instability. This includes provision of appropriate environmental assessment and impact mitigation associated with the proposed actions, supporting operational procedures and plans, training of implementation forces immediately in advance of the works execution, and technical supervision of the works execution. In addition, a supplementary objective undertaken in parallel with this work is to provide a skill-building training related to contaminated site sampling and associated analytical practices to the national sampling and laboratory staff for stakeholder groups.

Scope of Work

This assignment will be undertaken by a Consultant team (the Consultant) with relevant international environmental expertise with **substantive direct experience in the assessment, design, planning and management of similar hazardous waste stockpiles and contaminated sites with experienced national technical expertise in civil engineering works design and environmental assessment.** Consistent with the above assignment objective, the scope of work to be undertaken by the Consultant is described under the following task definitions and documented outputs:

- ***Task 1 - Assignment familiarization and mobilization:*** This is essentially the assignment inception task that will involve the mobilization of the agreed team both at home office and in-country locations, and development of sufficient understanding of the project to initiate the subsequent substantive technical tasks. This will include the review of existing data and planning documentation, making contact and establishing working relationships with counterpart organizations (MNP, MES, Yerevan City Municipality, environmental NGOs, site sampling and analytical service providers, etc.), site familiarization, and mobilization of technical support resources required (e.g. site sampling and analytical capability). The principal Task 1 outputs as to be documented in an Inception Report will be: i) a critical commentary on the existing state of knowledge and operational planning (developed from the Consultant's technical proposal); ii) an updated and detailed work plan for the overall assignment; iii) description/confirmation of mobilization and implementation status; and iv) assurance of relevant equipment and availability to be used as needed.

- ***Task 2 - Undertaking comprehensive site mapping and analytical assessment:*** This task will firstly involve the development and execution of a comprehensive supplementary[4] site sampling, analytical characterization and assessment required for the detailed delineation of areas[5] of site contamination with particular emphasis on the identified burial cells and their immediate surroundings and for mapping/modeling of foreseen excavation, packaging, transportation/storage, destruction, decontamination, etc., works with focus on health/environmental safety and economic feasibility of proposed methodologies/approaches. This needs to be done in sufficient detail to accurately define the quantities of target waste categories and their distribution to be excavated, and to accurately estimate costs of works with the scope undertaken being justified and agreed with UNDP in advance. The analytical work should be undertaken under an agreed protocol (the Offeror is expected to include

[4] *In addition to the available site data and previous studies, based on the reference documents/reports.*

[5] *Intended to meet the criteria of defining the three dimensional distribution of contamination i) material above the "low POPs content" as defined by Stockholm Convention and ii) other contaminated soil above levels defined as requiring management based on risk assessment (Task 4) such that well defined specifications and operational plans can be developed and estimated costs to a high degree of confidence can be generated.*

in the proposal and provide a reference(s) for the proposed protocol) that ideally will combine a field quick screening technique that correlates with POPs pesticides and/or total organic chlorinated pesticides (OCP) laboratory analyses performed by ISO/IEC 17025 or equivalent internationally certified laboratory and/or certified analytical procedures. In developing this practice, the Consultant should also develop justified explanation on the techniques and equipment that should be in place for operational screening determination of contamination types and levels during the excavation to control the extent and manage the effectiveness of such excavation and to identify excavated materials. As a guidance, there is no preference stated for the use of national or international laboratories/methods, as long as they are duly accredited/certified and qualified for a resolution level and reliability suitable for a decision making based on practical site assessment results. Selection and contracting of a qualified sampling and analytical capability is the responsibility of the Consultant. When analytical services are selected, an assurance that a reliable sample transfer/export protocol, providing a rapid turn-around has been established, should be provided.

Since the landfill body (where the hazardous chemical waste has been buried) is part of a bigger landslide area which is governed by uphill slope movement, any further excavation works may have an impact on the overall stability of the site and its surroundings. Therefore, within this task, secondly, additional investigations for geotechnical and hydrogeological site assessment have to be carried out at the burial site and its close vicinity (including uphill and downhill areas which require stabilization works) to recommend on safety measures/works for proper planning of the temporary infrastructure installation, site excavation, waste handling and transportation, as well as for the final site stabilization activities. These geotechnical and geophysical investigations should be aimed also at screening the waste locations, density under the ground, in addition to supplement the data generated by part one physico-chemical analytical investigations and assessment. The principal outputs of the Task 2 will be documented in an updated Site Assessment and Characterization Report.

- ***Task 3. Collection/extraction, packaging and labeling of contaminated soil samples (Category 2) for testing of de-contamination efficiency by soil clean-up technologies:*** In the course of site assessment and sampling exercise under the Task 2, based on sample physico-chemical characterization analytical assessment results, the Consultant will: i) identify and collect (extracting during sampling) relevant Category 2 POPs/OPs contaminated soil validation samples to be exported to up to three pre-identified soil decontamination/treatment technology companies; ii) pack up and label collected samples (the following packaging is recommended - up to 20 samples 3 kg each, up to 10 samples 5 kg each, up to 3 samples 10 kg each) in appropriate containers corresponding to hazardous material international shipment standards; iii) develop respective accompanying documents for the international shipment and for the testing technology respectively; iv) deliver samples to the PMU in a safe conditions ready for shipment, and consult the PMU on shipping procedure and requirements. The data analysis of testing results obtained from soil clean-up technology/company and selection of the most efficient, environmentally sound and economically feasible technology to be used for Category 2 POPs/OPs waste de-contamination on-site in the proximity of Nubarashen burial site (if such scenario is ultimately confirmed), is the responsibility of the PMU, which will coordinate sharing the testing findings with the Consultant for its consideration in design of related activities and corresponding budget estimate. The outputs of the Task 3 will be the respectively collected/extracted, packed and labeled Category 2 soil samples, ready for shipment to soil clean-up technology testing, securely and timely delivered to PMU and the respectively prepared accompanying documentation necessary for international shipment and for delivery to the testing technologies.
- ***Task 4 - Review and update risk assessment and classification criteria:*** As described in Appendix 2, the conceptual approach for the classification criteria of contamination soil is based on a Tier 2 risk assessment applying relatively conservative international criteria for human health and agricultural

impact risks. It is recognized that this approach is only one of a number of possible approaches that could accomplish similar levels of POPs elimination and release reduction through application of various criteria in association with combinations of excavation of more heavily contaminated material, containment of remaining contaminated material, enforced designated land use, and site protection/monitoring measures. With this in mind, the Consultant will review and update potential risk based logic for the design and planning of the approach to managing the Nubarashen site with a view to optimize the cost effectiveness of investments for required works and potentially the overall project investment. The Consultant will also ensure that the criteria options used are acceptable in principle to MNP and other national regulatory bodies. The principal Task 4 outputs as documented in Risk Assessment and Classification Criteria Review Report will be: i) an assessment and ranking of risk reduction options identified; and ii) detailed estimates of quantities of POPs pesticides/OPs and their distribution applicable to potential clean-up options.

- ***Task 5. – Development of site clean-up works design, operational work-plans and associated cost estimates:*** In response to this task the Consultant will develop operational plans for the works at or adjacent to the Nubarashen site for up to three selected options (with respectively aligned elements/components of clean-up works of all phases) in consultation with major stakeholders and the PMU for option(s) recommended in Task 4, inclusive of a working detailed cost estimates for each. The scope of works considered under this task will cover the design, operational work plans and cost estimates, as applicable: i) the establishment of infrastructure for safe access, utilities/supplies and supporting temporary constructions, on-site works and immediate off-site handling; ii) on-site area allocations and their control classifications; iii) excavation works; iv) ongoing/regular on-site screening sample analysis for operational decision making; v) sequencing of operational activities with respect to the active excavation areas; vi) feasible segregation and packaging; vii) disposal off-site, separating in-country and international transportation with a provisional list/contents of required accompanying trans-boundary movement documentations; viii) waste destruction and contaminated soil treatment[6]; ix) temporary and permanent containment and contaminants release mitigation measures; x) operational Environmental, Health and Safety (EHS) procedures and monitoring measures established within a Prevention and Emergency Plan, (based on WB EHS guidelines[7]), and protocols for safety in emergency situations; xi) site stabilization during the excavation works and completion; xii) site closure, stabilization, restoration, and monitoring measures. Cost estimates shall be sufficiently detailed to include itemized estimates of quantities, equipment, labor, consumables, permitting/other external costs, and overheads, all in a form suitable for assessment of proposals from potential contractors executing the work, all appropriately referenced against applicable national norms and national budgeting requirements. The principal Task 5 output will be the Engineering design (including drawings), Operational Plan and Cost Estimate Report that will be utilized, upon completion, by the PMU and UNDP for purposes of a final selection of the operational plan to be pursued using national co-financing, the availability of which will constitute a major factor in that selection. This decision making process will be administered by the PMU with advice and technical support from UNDP and will ultimately be made by the PMB (Project Management Board). The Consultant will be available to support this process as required.

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[6] *To be based on the: soil clean-up testing findings (shared by the Project) under Task 3, finalized selection of the feasible (efficient, cost effective, rational, tested and recognized) soil remediation option under the responsibility of the Project, allowing completion of the contaminated soil treatment within the designed scope and the Project timeframe (till April 2019).*

[7] http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

A complementary output of the Task 5 will be a simple animated film (with Armenian and English explanatory caption) for up to 3 minutes, demonstrating Nubarashen site preparation and clean-up modeled/designed works proposed by the Consultant and agreed ultimately.

- ***Task 6 - Tender specification for selected operational work-plans:*** This task will involve converting of the selected model of works and operational work plans decided upon and designed in the scope of Task 5 into a formal tender specification to be used for selecting a company(ies) in a bidding process and ultimately undertaking the POPs/OPs waste excavation, packaging, handling, removal, destruction of excavated waste and soil decontamination works, either in one package or in separate selection processes depending on the approved scenario of clean-up/remediation works. As such, the specifications shall be compliant with any national requirements and norms applicable to such public tender documents where supplemental country resources are being utilized. It will include specification of all performance requirements of the works and the materials used therein. Additionally it will cover the required internationally recognized EHS standard procedures and practices[8]) and Environmental Management Plan (EMP) to be utilized, all consistent with both national and international standards and as specified in applicable environmental and technical design regulatory submissions and associated approvals (Task 7 and Task 8). The principal Task 6 output will be the final Nubarashen clean-up works Technical Specifications (in one package or splitted respectively).

- ***Task 7 - Develop, submit, and ensure approval of environmental/social impact assessment documentation:*** The Project and specifically the Nubarashen works is covered by both: the national regulatory environmental approvals process (EIA – the RoA Law "On Environmental Impact Assessment and Expertise" 21.06.2014) through MNP and approval at an international level through the environmental and social safeguarding process applied by UNDP (refer to http://www.undp.org/ses for more information). While information included in each will generally be common, these may differ in format and approach, something the Consultant should research and accommodate. In the case of the national environmental expert examination, the required submission is referred to as an EIA Report that would be in compliance with the standards, rules and procedures and based on the selected design as defined in Tasks 5 and 6 above. The UNDP/GEF documentation would involve a standard Social and Environmental Assessment (SES) and EMP. The latter details a check list of measures to be applied and which are monitored against in the inspection safeguarding process as part of the projects monitoring and evaluation procedures. In terms of timing, the national practice requires that the EIA Report and resulting decision on the Environmental Expert Examination (EIA statement or Expert Conclusion) be completed and included in the subsequent submission for technical expertise of civil works design (TECWD) approval (Task 8). The Consultant or its local representative organization (as the "Initiator") submits for EIA approval for this assignment.

  The UNDP/GEF safeguards documentation is less time constrained and would be required before any decision on release of investment funding under UNDP's procedures. The national Environmental Expert Examination process is anticipated to take up to 9 weeks after EIA final report submission. For the UNDP/GEF safeguards approval process it would be anticipated to take around 6 weeks. The principal Task 7 outputs in each case are the respective expert assessment and approved documents. It should be noted that all fees and charges (the currently established EIA fee is 500,000 Armenian drams) associated with the national Environmental Expert Examination (EIA) approval process need to be paid in accordance with the national regulations requirements.

8 http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/publications_policy_ehs-general

- ***Task 8 - Develop, submit and ensure approval for the design technical expertise approvals in accordance with national regulations and requirements:*** Based on the familiarization, establishment of counterpart relationships, and information gathering undertaken in Task 1, the Consultant in its legal capacity as the Author of the works design will prepare the necessary submission material for the required technical approvals for the designed works at and adjacent to the Nubarashen site under the national approvals process that apply. The substance of this material should be generated in Tasks 5, 6 and 7 above. The design for site works is required to pass engineering/civil works expertise by the respective organization in compliance with the state regulations and shall include with results of the national EIA covered in Task 7 above. The Consultant as the "Initiator" authorized by the Developer (Yerevan Municipality for this project) will submit the technical design package (the approved/positive EIA will be incorporated into the technical design package) for technical expertise and based on the recommendations of technical expertise will consider the design approval. Other regulatory/procedural/approval requirements and the response initiatives will be determined as needed.

  Subsequent field works will be subject to technical inspection and author's inspection as part of the Task 11 below. The principal Task 8 output will be the positive engineering/civil works technical expertise assessment and approval. It should be noted that all the fees and charges associated with this process (the currently established fee is 25,000 Armenian drams, and the payment for the design expertise is negotiable within 2-3% of the designed operational works estimated budget) need to be paid in accordance with the requirements of national regulations.

- ***Task 9 - Training for site supervision and labor staff:*** Under this task, the Consultant will develop a training program and deliver courses specifically designed for operational/labor personnel and site supervisory staff involved directly in the cleanup of the Nubarashen site and associated activities. The detailed scope of the training programs, its various components and the levels of instruction required, will be determined in consultation with the relevant stakeholders. However the program design should utilize accepted international standard guidance materials (see footnote 6, also consider Basel Convention/UNEP Guidelines and Training Materials related to hazardous waste management) as successfully applied on other like projects and would include but not necessarily be limited to the following subject matter: i) overall scope and purpose of the Nubarashen site cleanup; ii) site access and movement rules, iii) use of PPE (personal protective equipment); iv) procedures on key operational activities such as excavation (manual and mechanized), packaging/loading/transport on and off the site; iv) environmental practices to minimize contaminant spread (Prevention/Mitigation Plan); v) emergency response procedures (Emergency Plan); vi) health monitoring requirements; vii) record keeping; viii) EHS communication and feedback mechanisms; ix) violation reporting; and x) public communication/liaison. Course delivery will be in the Armenian language (or with interpretation) and should be a combination of classroom and practical demonstration formats. The number of primary trainees who are anticipated to be drawn from stakeholder emergency services operational staff and from personnel from perspective national works execution entities, will be determined by stakeholder in consultation with the Consultant based on operational staffing requirements defined in the selected operational plan (Task 5). The program will be supported by a training manual which along with the program presentation materials will be the Task's main outputs. It is anticipated that the training for operational personnel will be delivered immediately in advance of initiating Nubarashen site works. Recognizing that this may occur in phases with preliminary activities occurring as early as late 2017 and main site work in mid-2018, at least two training course periods can be anticipated along with periodic short refresher and update provisions made during the work as required. Optimization of delivery through use of a phased "training of trainers" (TOT) approach may be considered, noting that leaving a cadre of qualified trainers within stakeholder is desirable. It should be noted that the Consultant's scope

is confined to provision of the training program design and delivery, instructional materials and the core copies of training manual and presentations, and a TOT for selected staff.

- ***Task 10 – Supplementary training for designated national sampling and laboratory staff:*** Under this task, the Consultant will develop and deliver a training program (based on Task 2 methodology and procedures), specifically designed for a group of (up to 12 persons) national sampling and laboratory staff through developing skills and knowledge on procedures. This training will cover soil sampling exercise (combined with Task 2 sampling) and relevant laboratory methods, as well as QA/QC procedures. Course delivery will be in Armenian (or with interpretation) and should be a combination of classroom and practical demonstration formats. It is anticipated that delivery of this task will be completed before the end of 2017.

- ***Task 11 – Ad-hoc consultation in selection of a company executing the designed works and performance of author's supervision in the course of designed works implementation:*** In the course of tendering/selection of a company for the designed works implementation, the Consultant may be requested (if needed) to provide ad-hoc technical advice/explanations to the Project in relation to the designed works. The final task of the assignment is the provision of on-site author's supervision and quality assurance for the implementation of the clean-up works inclusive of coordinating the orderly accumulation of documentation, data and as-built records for transfer to the Project and sharing with the national stakeholder executive agencies. This is anticipated to be provided by the Consultant's qualified national technical staff, involved in the primary design tasks supported (as required) by the Consultant's international expert(s).

Consultant's Responsibilities and Schedule of Deliverables

The primary responsibility of the Consultant is to efficiently deliver the following tasks and deliverables at a high level of quality and competence within the agreed schedule by ensuring the required resources and expertise is applied when and where required to do so. Basic to fulfilling such responsibilities will be provision of appropriate logistical support, materials and communication capability in Armenia and elsewhere to meet these responsibilities. This will include provision of technical support services such as site sampling and associated analytical work, and supply of required equipment and PPE for field staff. The following summarizes client's expectations with respect to deliverables and an indicative schedule.

Task		Deliverable	Indicative duration (weeks)	Indicative Delivery Date*
Task 1	Assignment familiarization and mobilization	Inception report	4 weeks	5th week
Task 2	Undertaking comprehensive site mapping and analytical assessment	Updated site description and assessment report	15 weeks	17th week
Task 3	Collection and handling of contaminated soil samples (Category 2) for testing of de-contamination efficiency of soil clean-up technologies	Respectively collected and packed Category 2 soil samples, developed respective accompanying documents, safely and timely delivered to the PMU	4 weeks	7th week
Task 4	Review and update risk assessment and classification criteria	Risk assessment and classification criteria review report	7 weeks	14th week
Task 5	Development of site clean-up works design, operational work-plans and associated cost estimates	Operational plan and cost estimate report	19 weeks (inclusive of 2 week decision making by UNDP/ PMU)	36th Week
Task 6	Tender specification for selected operational work- plans	Nubarashen works technical specification	10 weeks	38rd week
Task 7	Develop, submit, and ensure approval of environmental/social impact assessment documentation	EIA report for Environmental Expertise submission; EA, SA and EMP for UNDP safeguards review	30 weeks (inclusive of up to 1 week for publishing the decision, up to 9 weeks for expert examination, 10	30th week

Task		Deliverable	Indicative duration (weeks)	Indicative Delivery Date*
			weeks for EIA development).	
Task 8	Develop, submit and ensure approval for design technical expertise (TECWD) approvals in accordance with national regulations and requirements	Technical expertise submission documentation	2 weeks plus 4 weeks approval period (TBD)	34th week for submission of materials (subject to Task 6 approval)
Task 9	Training for site supervision and labor staff	Training Manual, Presentation materials; Delivery of training modules /delivery of TOT, main training course immediately before field works start/	7 weeks	30th week (main training course TBD)
Task 10	Supplementary training for designated national sampling and laboratory staff	Presentation materials Delivery of training modules/course (included classroom sessions)	10 weeks	Aligned with Task 2 (completed by the end of November)
Task 11	Ad-hoc consultation in selection of a company executing the designed works and performance of author's supervision in the course of designed works implementation	Ad-hoc technical advice to the Project; Inspection reports, Assembled data, As-built records /under author's supervision/	TBD	2018-19/TBD

* Weeks from date of contract signing. Certain activities may have overlap timing.

Reporting Arrangements

The contracting arrangements for this assignment will be made through the UNDP Armenia Country Office with administrative supervision provided by the PMU. The day-to-day operational counterpart will be specified by the PMU. Technical peer review of outputs in addition will be provided by the UNDP's regional and HQ staff including the International Adviser. For purposes of scheduling deliverable review, the Consultant should assume at least one week response time for review and comments from counterparts as administered and coordinated through the PMU. Where the work involves significant decision points requiring such action in the form of major scoping decisions from UNDP and the PMU on project options and direction, a period of two weeks shall be assumed.

Consultant Qualifications

The following outlines the basic qualification requirements applicable to i) the proposing Consulting firm (inclusive of its partners and sub-contractors) as will be provided in the formal corporate qualification submission; and ii) the key expertise as evidenced in the CVs supplied and the allocation of resources as defined in this RFP (Section 2).

a) Consulting Firm/Partner/Sub-Contractor Qualifications

The lead Consultant firm (the Consultant) will be a recognized engineering/general environmental technical services provider firm with international environmental expertise providing a broad range of interdisciplinary capability with specific emphasis on the management of hazardous waste and contaminated sites, inclusive of the key supporting disciplines that this entails. Specific technical capability and experience exhibited by the Consultant (in combination with partners and sub-contractors proposed for this assignment) that should be presented for purposes of assessing qualification and capability will include but not necessarily be limited to:

1. Demonstration that the lead Consulting firm is a well-established consultancy in the above general areas in at least the region, and preferably global in scope, undertaking like environmental management assignments over a period of at least during the past five (5) years.

2. Direct experience with the management of hazardous waste and contaminated sites (preferably in combination) involving POPs, POPs pesticides and OPs with at least three (3) such projects being successfully undertaken that directly relate to country or regional initiatives associated with Stockholm Convention compliance (supported by client references and statements of satisfactory performance for at least three (3) such projects).
3. Direct experience with like assignments and counterparts in the region and/or comparable countries including successful operation at a local level in cooperation with national counterparts and service providers (supported by at least (3) relevant counterpart references on multiple assignments).
4. Capability to undertake relevant risk assessment, site sampling and supporting analytical programs on like sites (supported by relevant project references).
5. Experience and operating capability with current technology site mapping, and digital imaging and graphical modeling tools for assessment of site contamination distribution and its quantification (supported by relevant project references).
6. Civil-engineering design, cost estimating, tender specification development and site technical supervision experience for similar works inclusive of contaminated site cleanup projects internationally, and comparable civil works nationally in Armenia.
7. Familiarity with national environmental and technical regulatory approvals processes in the region (ideally in Armenia) as demonstrated by specific reference to approvals work undertaken on like projects.
8. Familiarity with the nature, operation and constraints involved in undertaking like assignments, involving GEF or other international funding administered through international Implementing Agencies and in combination with national funding processes.
9. High quality document writing, formatting and presentation skills.

b) Key Assignment Staffing Qualifications

The following lists the key areas of expertise with associated qualifications that should be covered in the Consultant's individual staffing and supported by appropriate CVs (as presented in the Consultant's Technical Proposal per Section 2 of the RFP) that are anticipated to be required and should be proposed for individuals, noting that one or more individuals may cover a specific position or more than one position or expertise area at the Consultant's option when organizing the proposed Consultant team, such overlaps in expertise and position to be specifically defined in the Technical Proposal.

i) Assignment Project Manager

- At least five (5) years international project management experience at a senior level, involving planning and implementation of substantial environmental management projects of a similar nature globally, with such experience in the region and undertaken through GEF implementing agencies being an asset.
- At least ten (10) years international experience in a technical and project management capacity in the implementation of hazardous waste management/contaminated site remediation projects, with such experience in the region and undertaken through GEF implementing agencies being an asset.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical/environmental engineering, and/or chemistry.
- Demonstrated English language skills with knowledge of Russian and/or Armenian being an asset.

ii) Resident Project Coordinator

- At least five (5) years of direct technical experience involved with planning, design and implementation of comparable civil engineering works and/or environmental management projects

in the region including such experience in Armenia and through international or bilateral implementing agencies.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical engineering, or environmental engineering/science.
- Demonstrated English, Armenian and/or Russian language skills.

iii) Site Assessment Expert

- At least five (5) years international experience in a technical capacity in the implementation of hazardous waste management/contaminated site remediation projects specifically in relation to designing and implementation of site assessment programs including sampling and analysis and on-site coaching/training activities, site mapping/modeling and quality/distribution assessment, tender specification developments, with such experience in the region an asset.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical/environmental engineering/science, or agro-chemistry.
- Demonstrated English language skills with knowledge of Russian and/or Armenian being an asset.

iv) Contaminated Site Clean-up/Remediation Design Engineer (with experience in site clean-up/waste destruction and operations for soil de-contamination respectively: optionally two experts may be proposed, evaluation will count cumulative scores)

- At least five (5) years international experience in a technical capacity in the implementation of hazardous waste management/contaminated site remediation projects specifically in relation to designing and implementation of such projects including planning, civil works design, EHS management, cost estimating, and tender specification developments, with such experience in the region being an asset.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical engineering, environmental engineering/science.
- Demonstrated English language skills with knowledge of Russian and/or Armenian being an asset.

v) Civil Works Design and Cost Estimating Engineer

- At least five (5) years of direct technical experience involved with planning, design and cost estimating of comparable civil engineering works projects in Armenia including familiarity with national norms and technical approvals.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical engineering or related disciplines.
- Demonstrated English, Armenian and/or Russian language skills.

vi) Environmental and Social Impact Assessment Expert

- At least five (5) years of direct technical experience undertaking the development of EIA and social impact aspects of EIA documentation in support of national environmental expertise and approvals for comparable projects, with the development of environmental safeguards documentation for international organizations to international standards in the region being a major asset.
- A relevant advanced degree or equivalent practical experience in environmental science or related disciplines.
- Demonstrated English, Armenian and/or Russian language skills.

vii) Hazardous Waste/Contaminated Site Clean-up Training

- At least five (5) years international experience in a technical capacity in the implementation of hazardous waste management/contaminated site remediation projects specifically in relation to implementation of EHS practices and procedures and in training operational staff, with such experience in the region an asset.

- A relevant advanced degree or equivalent practical experience in civil/geotechnical engineering, environmental engineering/science, or chemistry.
- Demonstrated English language skills with knowledge of Russian and/or Armenian being an asset.

viii) Site Sampling and Analytical Practice Training

- At least five (5) years international experience in undertaking implementation and associated training of field and national sampling/laboratory staff in sampling, analytical screening and confirmatory laboratory analysis on relevant contaminated sites and hazardous waste stockpiles, with such experience in the region an asset.
- A relevant advanced degree or equivalent practical experience in civil/geotechnical engineering, environmental engineering/science, or chemistry.
- Demonstrated English language skills with knowledge of Russian and/or Armenian being an asset.

ix) Site Works Implementation Author's Supervision

- It is assumed that the staffing for this activity will be drawn from one or more of the individuals providing the above expertise and will cover the requirements and responsibilities related to all aspects of QA/QC, EHS management due diligence, quality of civil works and the associated record keeping and documentation of as completed works. In addition, ad-hoc consultation will be provided by the Consultant's international expert during the selection of a company for execution of the designed clean-up works onsite.

Attachment 1

Elaborated project design framework by Outcome, Output and Activity

Outcome	Outputs	Activity Description
Component 1: Capture and Containment of Obsolete Pesticide Stockpiles and Wastes		
Outcome 1.1 Removal of priority POPs pesticide waste from the Nubarashen burial site, secure containment of residual contamination on-site, site stabilization and restoration, with the site secured under appropriate institutional arrangements providing effective access limitations, monitoring and future land use control, all endorsed by an informed public.	1.1.1 Design documentation, tender specification, implementation procedures to undertake the required works. 1.1.2 EHS procedures documented and promulgated in support of the works required. 1.1.3 EIA and Environmental Expertise approval to proceed with the works 1.1.4 Removal to secure storage of 900 t of pure pesticides and high concentration POPs wastes from the Nubarashen burial site 1.1.5 Removal to temporary secure storage for treatment of 7,000 t of POPs pesticide waste in the form of highly contaminated soil from the Nubarashen burial site completed 1.1.6 Onsite secure containment of 12,000 t of low and moderately contaminated soil in an engineered landfill within the Nubarashen site in place. 1.1.7 Restoration and access control provisions for the Nubarashen burial site are in place and civil works to stabilize the surrounding land and drainage are completed. 1.1.8 Training delivered to 20 national technical and regulatory staff in support of Nubarashen operations. 1.1.9 5 public consultation events held and 10 public documents/web/media products delivered.	1.1.1 Detailed site assessment, clean-up design, geotechnical/hydrological stabilization design, EIA, permitting and tender document preparation for excavation/packaging/containment and site works supervision including on-site screening analysis capability for segregation of POPs pesticide waste categories. 1.1.2 Installation of site access and safeguarding infrastructure for recovery and restoration activities 1.1.3 Excavation, packaging and removal of OP burial cells and other associated priority POPs pesticide wastes involving estimated 900 t Category 1 POPs pesticide wastes (pure pesticides and POPs pesticide wastes >30% pure pesticides) 1.1.4 Redistribution, segregation and initial containment of Category 2 and 3 soils 1.1.5 Excavation, packaging and removal of 7,100 t Category 2 POPs wastes (high concentration soils using health risk criteria of > 1,500 ppm), packaging and removal 1.1.6 On-Site final Containment of 12,700 t Category 3 POPs waste (< 1,500 ppm health risk criteria, >0.7 ppm agricultural risk criteria) 1.1.7 Site restoration, undertaking area site geotechnical/hydrological stabilization, and drainage improvements. installation of monitoring and establishment of long term land use control arrangements 1.1.8 Operational and safeguards training for hazardous waste and contaminated site management including site excavation, packaging and restoration operations – Estimated 20 national technical staff trained for work on site. 1.1.9 Supporting public consultation for design, permitting, operational and restoration/monitoring phases of Nubarashen site work. Estimated 5 formal events held and 10 public documents/web/media products produced.
Outcome 1.2: Development of the Kotayk national hazardous waste management site at equipped with secure storage and basic infrastructure to allow introduction of HW treatment soil remediation technologies constructed and operated for the secure storage of POPs pesticide waste and OP stockpiles, and the treatment of POPs pesticide contaminated soil.	1.2.1 Design documentation, tender specification, implementation procedures to undertake the Kotayk HW facility site development. 1.2.2 Applicable EHS procedures documented and promulgated in support of the works required. 1.2.3 EIA and Environmental Expertise approval to proceed with the Kotayk HW facility site development 1.2.4 Kotayk national HW management site developed to and operated to international standards. 1.2.5 Operation of the facility for the storage of 1050 t of POPs pesticide waste and OP stockpiles pending export for environmentally sound destruction. 1.2.6 Operation of the facility to host remediation technology treating 7.100 t of	1.2.1 Detailed design, EIA, permitting and tender development and construction supervision for the Kotayk HW facility site development 1.2.2 Storage Facility upgrading and construction works for indoor secure storage capacity for 1,100 t of Category 1 POPs pesticides and OPs from Nubarashen and OP storehouses, and covered external secure on-site storage of up to 7,100 t of highly contaminated soil (Category 2) from Nubarashen and OP storehouse clean ups 1.2.3 Receiving storage and custody operations for Category 1 and Category 2 material received from Nubarashen and OP stockpiles from storehouses 1.2.4 Technical and safeguards training for hazardous waste facility operation. Estimated 20 operational staff from MES or contracted service providers involved 1.2.5 Supporting public consultation for design, permitting, and operational phases of Kotayk

Outcome	Outputs	Activity Description
	soil highly contaminated with POPs pesticide in an environmentally sound manner. 1.2.7 20 HW facility operational staff trained and equipped with respect HW management, safeguards and EHS practices. 1.2.8 5 public consultation events held and 10 public documents/web/media products delivered.	facility development. Estimated 5 formal events held and 10 public documents/web/media products produced.
Outcome 1.3: Remaining significant historical OP storehouses have OP stocks packaged and removed for destruction and residual site contamination cleaned up.	1.3.1 Screening assessments completed/documented on 24 identified historical OP stockpile sites and 150 t of OP stockpiles and clean up residuals packaged and removed to the Kotayk HW facility. 1.3.2 Detailed contaminated site and risk assessments and remediation/clean up designs on 6 identified priority sites completed/documented 1.3.3 Excavation/removal, remediation and/or containment on 6 identified priority sites completed 1.3.4 6 public consultation events held at 6 priority sites and 10 public documents/web/media products delivered.	1.3.1 OP Storehouse screening assessments, stockpile packaging and surficial (surface) clean up and removal to the Kotayk storage facility (150 t of OP and clean-up residuals from 24 sites) and export of 150 t for destruction 1.3.2 Follow up detailed site assessment, clean up design, and supervision permitting on 6 priority sites identified during PPG but subject to results of Activity 1.3.1 above. 1.3 3 Excavation/Removal, containment and/or remediation up to 200 t Category 2 and 3 contaminated soil of the 6 priority sites 1.3.4 Supporting public consultation for design, permitting, and operational phases of clean ups under 1.3.2-1.3.3 on 6 priority sites. Estimated 6 formal events held and 10 public documents/web/media products produced
Component 2: Obsolete Pesticide Stockpile and Waste Elimination		
Outcome 2.1: Removal from Armenia of all substantially all high priority POPs pesticides, associate very high concentration wastes and OP stockpiles.	2.1.1 Export of 900 t of Category 1 POPs pesticides, priority POPs pesticide wastes, and OPs from the Kotayk facility for destruction in a qualified international facility	2.1.1 Export of 900 t of Category 1 POPs pesticides, priority POPs pesticide wastes, and OPs from the Kotayk facility for destruction in a qualified international facility
Outcome 2.2: Environmentally sound remediation of heavily POPs pesticide contaminated soil inclusive of destruction of extracted POPs pesticides demonstrated.	2.2.1 7,100 t of heavily contaminated POPs contaminated soil (POPs pesticide waste) remediated to levels below the low POPs content returned and contained on the Nubarashen site 2.2.2 Commercially viability of in-country remediation of POPs contaminated soil demonstrated 2.2.3 Operational training of 20 national technical personal on a modern contaminated soil technology	2.2.1 Environmentally sound remediation of 7,100 t of Category 2 POPs pesticide contaminated soil (7,100 t from Nubarashen and 100 t from 6 OP storage sites), involving the removal and destruction of residual POPs pesticide contaminants (to <50 ppm) at market selected soil remediation facilities either operated at the Kotayk site or a qualified facilities in another country.
Component 3: Institutional and Regulatory Capacity Strengthening for Sound Chemicals Management and Contaminated Sites		
Outcome 3.1: Legal/regulatory and technical guidance tools for management of chemical wastes, including POPs, and, contaminated sites management within a national sound chemicals management framework strengthened	3.1.1: Policies, legislation and regulatory measures respecting hazardous chemical wastes and contaminated sites management reviewed, updated and appropriate revisions implemented	3.1.1 Rationalization, updating and revision of polices, legislation and guidelines covering hazardous chemicals waste and contaminated sites management
	3.1.2. Adopted technical guidelines on operational safety procedures for hazardous chemicals waste handling, transport, storage and disposal, developed in accordance with international practice and 50 relevant national personal trained	3.1.2 Preparation and adoption of technical guidelines on operational safety procedures for hazardous chemicals waste handling, transport, storage and disposal, developed in accordance with international practice, including national training.
	3.1.3 Guidance documentation on environmental and health risk assessment methodologies and practices applicable to hazardous waste stockpiles and contaminated sites developed in	3.1.3 Introduction of environmental and health risk assessment methodologies and practices applicable to hazardous waste stockpiles and contaminated sites developed in accordance with international practice inclusive of training programs. . Estimated

Outcome	Outputs	Activity Description
	accordance with international practice introduced and adopted, and 50 professional trained.	18 institutional, academic, industrial, private service provider and NGO professionals trained
Outcome 3.2: Technical/environmental performance evaluation and upgrading requirements for existing national destruction capability	3.2.1 Qualification test burns undertaken based in international standards on the *EcoProtect* incineration facility to determine appropriate HW streams for its application. 3.2.2 Technical assessment produced defining upgrading and investment requirements for expanded application	3.2.1 Undertaking technical and environment performance assessment of the *Eco Protect* incineration facility inclusive of an international standard test burn on characteristic waste streams and a design assessment to define required upgrading requirements
Outcome 3.3: Basic national capacity for effective hazardous chemicals sampling and analysis for multi-environmental media and contaminated sites in place, operational and certified to international standards	3.3.1 Adopted national strategy for rationalization and upgrading national laboratory capability to serve a sound chemicals management framework including hazardous waste and contaminated sites management. 3.3.2 3 national laboratories, including one each in the regulatory, academic and private sector upgraded with suitable capability for hazardous chemical waste and contaminated site sampling and analysis 3.3.3 30 laboratory and associated personnel training upgraded 3.3.4 3 laboratories with international certification and international methods and practice in place	3.3.1 Development of a national laboratory rationalization and optimization strategy
		3.3.2 Laboratory infrastructure and equipment upgrading as required to optimize national capacity
		3.3.3 3 Training of laboratory personal on site and multi-environmental media sampling, laboratory analysis and QA/OC procedures. Estimated 30 professional staff will be trained
		3.3.4 International laboratory certification support for selected labs in accordance with the strategy. 3 designated national laboratories to be certified.
4.0 Project Monitoring and Evaluation		
Project Management		

Background, Summary of Previous Work and Project Design Strategy for Addressing the Nubarashen Site (Based on the UNDP Project Document)

Nubarashen Site History

In the late 1970s and early 1980s, a USSR all-Union program was initiated to collect the accumulated banned and expired pesticides that had accumulated within the pesticide distribution system for consolidation and disposal. The disposal option of choice was development of engineered landfills or burial sites within each of the Soviet Republics. One such site referred herein as the Nubarashen burial site is known to have been developed in Armenia in 1982. It is located on the SW edge of Yerevan in the Nubarashen district of the city on a relatively remote elevated slope used as a communal grazing area within a natural drainage course. This is adjacent to what was subsequently established as the Erebuni State Reserve protecting an internationally significant area preserving agro-biodiversity in the form of a number of ancient grain types. This Reserve is administered by the Bioresourses Management Agency of MNP and was established in 1981. Its goal is to protect the wild species of wheat and other cereals growing in their natural (original) environment. The flora and fauna of the State Reserve is very rich and varied. It includes about 300 species of higher flowering plants, which is more than 9 % of the Armenian flora. The nearest settlement is a summer residence/country garden community approximate 1 km down slope from the site on the same drainage, that originates in and above the valley where the burial site is located. Two other permanent settlements are located approximately 3-4 km distant and the overall location is within sight of the developed outskirts of Yerevan. Figure 1 below provides a general view of the site and surroundings.

Figure 1: Location of the Nubarashen burial site relative to its surroundings

(Courtesy of Tauw/OSCE)

Original records indicate that the burial structure consisted of four rectangular, clay lined and capped cells approximately 5 m deep at the base in an overall site approximately 120 m by 20 m. 33 different organic and inorganic pesticides (total of 512 t) were recorded as being disposed of in the site (Table 1) with the largest quantities being DDT (193 t) and HCH (48 t). Until 1989, the site was regularly monitored and maintained, but this was then discontinued. In the period 2003-2004, the site became generally recognized as presenting a major potential environmental risk due to its location on an unstable slope and drainage course which resulted in sliding of the burial structure down slope, water in-flow, and release of buried material due the vandalism and illegal excavation. Awareness of this situation was substantively the result of an initiative by the NGO Armenian Women for Health and a Healthy

Environment (AWHHE) who, as part of USAID and IPEN[9] programs in 2004-2005 implemented initial public awareness surveys, physical site assessment, geophysical, and geological assessment as well as sampling of water and soil which formed the basis of subsequent investigations. This included commissioning a report on site stability issues and on addressing them[10]. In 2004, a government decision officially designated the situation as a priority issue, and mandated and funded the Ministry of Emergency Situations (MES) to take action.

Table 1: Inventory of obsolete pesticides recorded as being deposited in the Nubarashen burial site (data provided by AWHHE)

Chemical	Quantity (t)	Chemical	Quantity (t)
DDT	192.5	Chlorophos	1.7
Entobacterin	33.1	Sevin	1.8
Fenthiuran	6.8	Cosan	1.5
Dalapon	17.0	Cyneb	16.4
Hexachlorocyclohexane	48.4	Colloid sulphur	18.0
Simazine	18.1	Metaldehyde	0.1
Cosan	2.7	Calcium Arsenate	42.6
Granosan	8.4	Tobacco packs	5,494 packs
TUR	1.3	BIP	5.2
Thorvit	1.8	Tetramethylthiuramdisulphide	7.2
Cynox	0.1	Paris Green	0.2
Liquid soap	0.3	Vitriol	7.3
Hexachlorobenze	1.3	Dendrobacilim	9.8
Dichol	0.2	Rezetopth	17.1
Phentachlorphenol	8.7	DNOC (Dinitrocresol)	0.9
Lissapol	1.9	Sodium trichloroacetate	5.0
Diamine Phosphate	5.0	Misc. pesticides containing As, S, phosphorus, cyanides, Hg)	30.0

As a consequence, a number of national and international initiatives have been undertaken in relation to the Nubarashen burial site. In 2004, MES undertook an emergency rehabilitation of the site including repairs to the original surface drainage, restoration of cover and installation of security fencing. However, illegal access continued with destruction of fencing and containment due to illegal excavation including a major incident in early 2010. In addition, slow sliding of land mass including the burial site itself continued with the consequence of possible breaches in the original cell containment occurring. In the summer of 2010, the government through MNP and MES made a more substantial investment in stabilization of site. This involved installation of an expanded surface cap over the original burial area and estimated area where sub-surface sliding had occurred (130 m by 30 m). This consisted of a soil and synthetic cap and attempts to establish stabilizing vegetation. In addition, a concrete surface runoff drainage system upstream and along the sides of the burial berm was installed as was robust fencing, signage and a locked access gate. Permanent manned security by MES officers was also provided for.

The Nubarashen site has also gained international attention in recent years, having been identified by various EU based NGOs such as the International HCH and Pesticides Association (IHPA) and the International POPs Elimination Network (IPEN) as a significant example of potential risk from historical obsolete pesticide management practices in the Former Soviet Union. This interest extended to formal expressions of concern by the European Parliament and in the Government making a formal approach to the international community for assistance in addressing the issue. In turn, this has resulted in a number

[9]International POPs Elimination Network "Report on"Environmental security for residents of settlements near to obsolete pesticides burial in Ararat region", AWHHE, 2004

[10]R. Yadoyan, "Recommendations on Priority Measures for Security Insuring of the Burial Ground", AWWHHE, 2005

of initiatives directed primarily toward developing additional data in and around the site including the following:

- Soil sampling around the burial site as well as down slope from it and into surrounding settlements and sampling of agriculture production was undertaken through cooperation between a local and international NGO using EU funding. DDT was detected in soil and drainage channels immediately adjacent to the site with levels decreasing more remotely[11].
- An initiative by OSCE to support awareness of the issue and a number of locally based studies with MES and the National Academy of Science which undertook a water sampling program that detected DDT water and sediment contamination downstream of the burial site[12]. OSCE has also undertaken the solicitation of funding support in the EU and bilateral agencies (USAID) to support a more substantial technical "feasibility" study involving local and international experts results of which are described in more detail below as part of the PPG work undertaken within the framework of the this program.

In 2011, these somewhat fragmented efforts came together through the Government requesting UNDP to develop a full scale project that would specifically address the Nubarashen site along with other obsolete pesticide issues, all within a framework of improved technical capacity for chemicals management in this area. This resulted in the preparation, submission and approval of a PIF and PPG by the GEF in 2012.

Current situation respecting the Nubarashen Site based on GEF Project Preparation and Related Work

The following provides a summary of work undertaken directly using PPG resources and that made available through two bilateral programs that coordinated their work with the UNDP PPG work. First and foremost among these was the site investigation and feasibility study work on the Nubarashen burial site which was undertaken under the auspices of OSCE by an international consultant and local partners (referred herein as the OSCE program) in consultation with UNDP. The other initiative was a program of supplemental site assessment undertaken by an international consultant as part of a technical capacity strengthening program related to contaminated sites funded by the Czech Republic and blended with UNDP funds. The PPG itself funded other studies that were undertaken by national consultants including conceptual engineering design work related to the civil works at the Nubarashen site. Collectively this forms the basis for the project design subsequently elaborated in this document and summarized in the next section below.

As noted previously the principle investigation work undertaken in relation to the Nubarashen site was done though the OSCE program. This undertook a more in depth physical site assessment than had been previously done, including evaluation of the site's geotechnical stability, characterization of the hydrology associated with the site as well as its direct physical characterization and a program of soil and water sampling[13,14,15]. The latter was supplemented by a follow-on analytical program under the Czech/UNDP financed work[16]. Using refined analytical, site assessment and digital terrain modeling techniques (DTM) this allowed a more detailed quantification of locations of buried obsolete pesticides and definition of the distribution and extent of the associated contamination beyond the actual burial

[11] "Toxic Hot Spots in Armenia, Monitoring and Sampling Reports ", ARNIKA and AWHHE, Prague and Yerevan, 2011

[12] "Addressing a Discharge of Chemicals from the Nubarashen Toxic Chemicals Repository" National Academy of Science. Center for Ecological and Noosphere Studies/OSCE, Yerevan, 2010.

[13] Tauw, "Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 1 and 2 investigation report", Draft June 2013.

[14] Tauw, "Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 1 and 2 investigation report", September 2013.

[15] Tauw, "Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia - Phase 3 Selection & pre-design of long term technical solutions", December 2013

[16] GeoTest, "Strengthening National Capacities on Comprehensive Chemicals (Persistent Organic Pollutants) - Contaminated Site Assessment in Armenia, Report on Sampling on Nubarashen Site, 2013

cells themselves. From this, first order estimated quantification of amounts of contaminated soil in various ranges of POPs contamination was developed. A Tier 1 and 2 risk assessment was also undertaken which when applied with a knowledge of the POPs contamination levels provides direction on the strategy and various technical options appropriate in designing actions that would be recommended. The overall results then allowed an assessment of various intervention scenarios and followed by development of a more detailed technical definition and conceptual cost estimate of the two scenarios considered to best match the timing of the current project. The following summarizes the key findings from the OSCE and supplementary Czech/UNDP site assessment reports referenced below, interpreted for purposes of application in the project design elaborated below:

- Site Configuration: The overall landfill site occupies approximately 0.8 ha of fenced area within which the primary landfill body itself is defined by a hillock which is enclosed on three sides by concrete runoff drains and two run off trenches located 10 m on the down slope side. The landfill body as generally defined by the hillock has a surface area of approximately 0.2 hectares with a height of 1 to 1.5 m above the surrounding land and is covered with a 40-70 cm top clay cover on top of a 2 mm synthetic liner.

- Landfill Body Configuration: The landfill body consists of five cells (rather than the originally assumed four) as illustrated in Figure 3. Cells 1, 2 and 3 are completely covered by the hillock. Cell 4 is partly covered by the hillock and Cell 5 is found outside the hillock. This suggests that Cell 5 may have been created latter as an ad hoc measure. Cell 1 holds wet pesticides, appears water tight, and is contained by structure of stone/concrete. Cells 2, 3, 4 and 5 cells contain dry solid pesticides and are essentially excavated pits in the native clay/loam soil without purpose built containment. This is generally the type of design used in other places in the Soviet Union for such sites. Cells 2 and 3 appear to have been opened likely by illegal waste mining and now contain a mixture of pure pesticides and the surrounding soil. Cell depth below the surface is generally 100-200 cm except for Cell 5 and part of Cell 4 where pure pesticides are encountered at less than 0.05 m below the surface (areas outside the hillock). The bottom of the cells is between 4 and 6 m below the surface.

Figure 2. Overview of the Nubarashen burial site

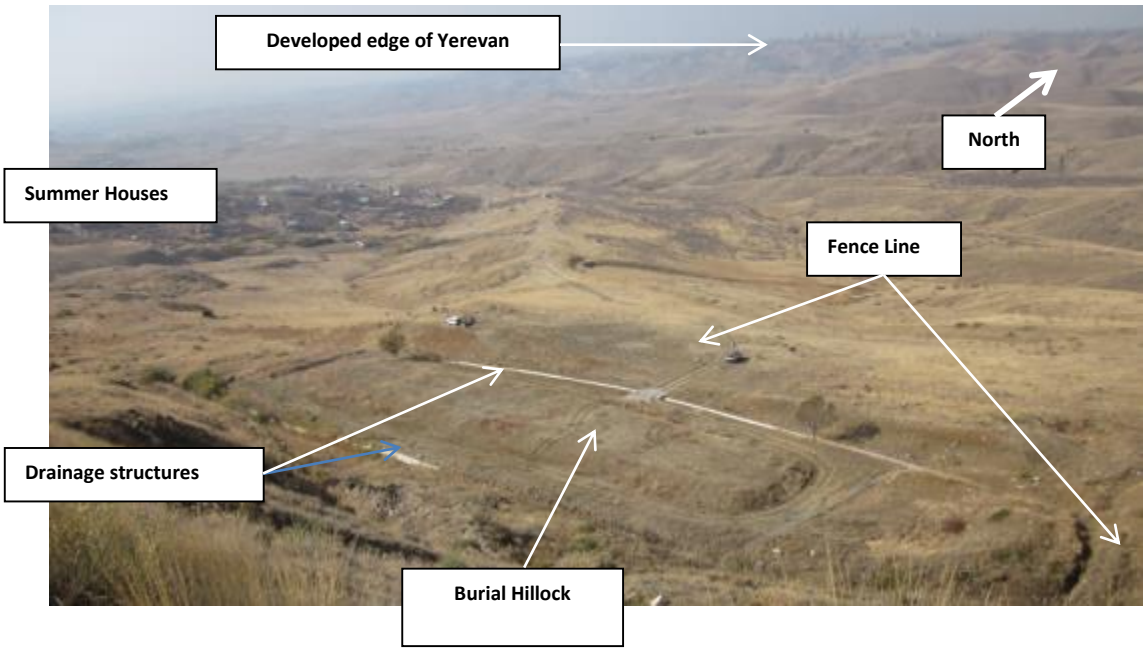
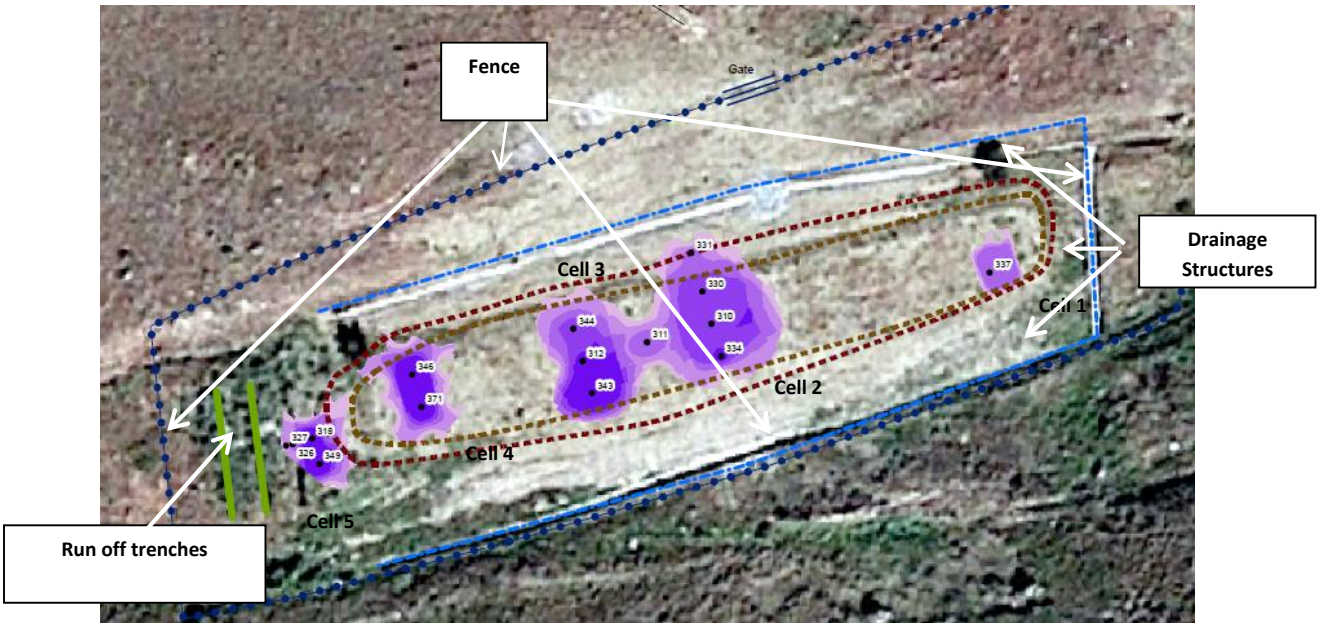


Figure 3. Location of the five cells and the landfill body features



(Courtesy of Tauw/OSCE)

- Potential POPs Waste Volumes: Soil sampling and application of DTM techniques resulted in estimated 634 m^3 of pure pesticide (including POPs pesticides) and immediately surrounding clay present in the five cells. There is detectable surface and subsurface POPs and other OCP contamination to varying degrees distributed across most of the fenced area of overall site with this varying in concentration and continuity generally moving away from the cells and being higher on the surface around and to the north of Cells 2 and 3 where illegal waste mining is thought to have occurred. It was estimated that 1,127 m^3 of heavily contaminated soil with traces of pure pesticides, 2,386 m^3 of contaminated soil without traces of pure pesticides and 890 m^3 of lightly contaminated surface material are present in the hillock area itself. Over the remaining 0.6 ha within the fence significant contaminated locations exist to a depth of 0.5 m, giving an estimated potential contaminated top soil of approximately 3,000 m^3. Outside the fenced area, 4,000 m^3 of surficial material having locations of relatively low surficial contamination is estimated. These areas are listed and categorized in Table 2 both in volume and estimated weight, along with estimates of excavated volumes with normal ex-situ growth factors applied and in descending order of likely contaminant concentration.

Table 2: In-situ and excavated estimates of POPs waste and contaminated soil by Category (Courtesy Tauw/OSCE)

Component of general landfill site and landfill body	Estimated Quantities m^3 or t		
	In situ	Excavated	Weight
Category 1: Pure pesticides or associated material > 30% pure pesticides			
Pesticides in cell 1, 2, 3, 4, 5 and between cell 3 and 4	605	605	605
Contaminated clay at the bottom of four excavated pits (cell 2, 3, 4 and 5) and between cell 3 and 4	69	83	117
Total	674	688	722
Category 2: Overall volumes with significant potential for heavily contaminated soil above the human health risk threshold for direct exposure (>1,500 ppm DDT) or visual presence of pure pesticides in it			
Contaminated top soil with traces of pure pesticides in landfill body	1,127	1,352	1,916

Component of general landfill site and landfill body	Estimated Quantities m^3 or t		
	In situ	Excavated	Weight
Contaminated top soil with traces of pure pesticides in fenced area land	3,000	3,600	5,100
Total	4,127	4,852	7,016
Category 3: Overall volumes with potential for levels of soil contamination less than determined as human health risk threshold but above the agricultural (grazing) risk threshold (0.7 ppm-1,500 ppm DDT)			
Contaminated top soil without pure traces of pesticides in landfill body	2,387	2,864	4,058
Slightly contaminated top cover landfill body	890	1,068	1,513
Low contaminated soil outside the landfill site	4,000	4,800	6,800
Nominally clean white/purple coarse sandy liner support / drainage layer	100	120	170
Total	4,377	8,852	12,541
Category 4: Building materials with surface contamination (Suitable for mechanical cleaning techniques)			
Synthetic cover (2mm)	4	20	5
Contaminated bricks/concrete/rubble (cell 1)	16	19	36
Total	20	39	41

*Quantities are calculated by using the Digital Terrain Modeling

** Volume of excavated soil is set as 120 % of in-situ soil

- Interpretive analysis of potential volumes and supplemental analytical results: It should be noted that apart from Category 1, the above volumes represent what should be a conservative estimate, recognizing that within any given location or category the highly heterogeneous nature of the contaminant distribution will result in amounts within these estimates having much lower concentrations than implied by the risk assessment determined thresholds quoted. The more extensive sampling and analysis undertaken as part of the Czech/UNDP program showed that in areas outside the hillock both inside (which largely defines the Category 2 material) and immediately outside the fence above (Category 3 material), much of the area had low levels of total POPs pesticide (< 10 ppm) but several specific areas consistently had levels in the range of 200 to 400 ppm, particularly adjacent to Cell 2 on the south side between the fence and hillock and the length of the north side between the hillock and the fence. This suggests that in reality it is likely that substantially more soil currently classed as Category 2 would fall into Category 3 but it is also probable that where selective segregation of distributed pure pesticides from Category 2 material was feasible, the volume of Category 1 material would increase somewhat, depending on how feasible such discrimination upon on excavation was. The one caution created by the supplemental Czech analysis results is that in some places the higher concentrations appear to extend to a greater depth than originally estimated and presented in Table 4.

- Offsite Impacts: Notwithstanding the issues related to overall site stability and site drainage, soil, ground and surface water analytical results indicate that the integrity of the landfill body's containment has generally been maintained. No impacts were noted in the ground water within and downstream of the landfill body and similarly downstream water quality is not impacted. The only downstream impact highlighted was detectable contamination of sediment in pond in the downstream summer house (dacha) community (Figure 1 Pond 8-9) suggesting some cumulative impact over time. Similarly it is apparent that contamination has not generally spread significantly around the original cells at depth suggesting the natural clay has provided an effective hydrogeological barrier for contamination spread at least until now. These results indicate that the main cause of spreading of contamination was the illegal access that has occurred historically, rather than substantial subsurface failure of the original cell containment.

- Overall Site Stability: Assessment of the geotechnical and hydrogeological stability of the general area of the site confirmed that it is generally unstable and progressive land sliding has and continues

to naturally occur over time down the valley and water course in which the landfill body is located (Figure 1). This process is being substantially aggravated by the presence of a run off pond (Figure 1 Pond 1), leaking water line, and blockages to drainage upstream at the top of the valley, the presence of a perched shallow water table above the site in the valley and blockages due to poor maintenance in the drainage immediate around the landfill body. The result is general slope instability due to underlying water flow and within the landfill body itself. Additional mass land movement below the landfill site have created further blockages to naturally efficient drainage. While not yet resulting in significant offsite spread of contamination, these mechanisms will ultimately result in this occurring on an accelerated basis over time. As such, addressing these stability issues is required as part of any remediation and containment works to be undertaken.

- Risk Assessment: The environmental assessment and associated Tier 2 risk assessment indicates that sustained direct exposure to concentrations of POPs (DDT) in soil greater than 1,500 ppm represent the threshold conditions for human health risk. On this basis it was concluded that there is minimal current offsite risk from the landfill body and its surroundings to either human health or the environment in the surrounding area, although the development of such risks over time, particularly with increased instability cannot be ignored. The direct potential risk to human health associated with the site is limited to those spending sustained periods on the site without appropriate personal protection equipment (PPE), principally those that might be involved in assessment and civil works undertaken on the site. A lesser risk might be associated with casual access to the site. The risk assessment also indicates that nominal risk may also be associated with grazing on the site area when applying a strict international agricultural soil quality standards noting this is mainly precautionary recognizing the only intermittent grazing use and access limitations to the actual landfill site. Nevertheless, a buffer zone of 100 m beyond the currently fenced area is recommended for exclusion of public and gazing access.

- Strategy for Elimination, Remediation and Containment: The overall strategy proposed for addressing the Nubarashen site proposed in the OSCE work is based on the premise that the highest concentration materials should be prioritized for excavation and elimination. Based on the simplifying assumption that Category 1 material contains essentially 100% of the targeted contaminants, the Category 2 material has an average concentration of 5,000 ppm and the Category 3 material has an average concentration of 30 ppm, 94% of the contamination is eliminated by removing and destroying the Category 1 material, 5 % is eliminated with the Category 2 material and less than 1% is eliminated with the Category 3 material. This in turn has guided the selection of approaches that, depending on assumption made in respect to funding availability and timing, cover various combinations and applications of i) containment on site; ii) removal and secure storage of priority material (Category 1); and iii) removal and destruction or remediation of Category 1 and as much Category 2 POPs waste as practical. In addition to removing and isolating the sources of the current risk the other element of the strategy recommended is stabilization of the overall site to minimize the risk of continued land movement and ensure adequate drainage on a sustainable basis, this minimizing the risk of long term distribution of the remaining contaminants.

- Developed scenarios for addressing the Nubarashen site: The OSCE work developed two scenarios in some detail. Both essentially have the same scope based on excavation and removal of Category 1 and 2 materials to storage, either on-site or off-site with export of this material for destruction or soil treatment. Category 3 material would be contained on the site in a hydro-geologically secure engineered structure, and the site would be re-vegetated, monitored, and subject to restricted access and future land use. Stabilization measures respecting the elimination of upstream ponding and resulting perched water table to enhance overall slope stability and ensuring surface and sub-surface drainage around rather than through the retained containment structure would be taken. Additionally the site would be equipped for passive remediation techniques (phytoremediation with surface vegetation and reed beds in downstream ponds). Both scenarios have a total estimated present value cost of approximately US$9 million, approximately 80% of which are for off-site management, treatment and/or destruction of Category 1 and 2 materials. The differences in the two scenarios are essentially related to the timing of the key activities as dictated by the availability of

funding. One where funding might be available in two lots, one immediately as might be the case through the GEF Project assuming committed co-financing levels and the other in the future. The latter involves undertaking the extraction and disposal of the Category 1 materials immediately along with the site stabilization measures with all remaining material being contained, and then latter removing and exporting the Category 2 material for destruction/treatment with the final stabilization and restoration of the site being undertaken.

- Long Term Land Use and Monitoring: Notwithstanding the approach of substantially removing the primary source of the contamination and containing what remains, the site inclusive of an appropriate buffer should remain restricted with respect to future land use and public access, and should be subject to a program involving monitoring as well as maintenance of the drainage and other stabilization measures. To this end institutional arrangements involving extending the Erebuni State Reserve to cover the site and associated buffer were also recommended.

Strategy and Proposed Action for Addressing the Nubarashen Site

On the basis of the above study and conceptual design work, the overall strategy adopted for the project for purposes of the PD and GEF funding approval is based on the approach of ensuring the capture, securing to prevent continuing release, and the elimination of the substantive POPs pesticides stockpiles and wastes. This would be done on a prioritized basis that allocates resources in accordance with the actual concentration of POPs involved, hence maximizing the amount of actual POPs dealt with and the level of protection for human health and environment calibrated to the availability of financial resources.

For purposes of prioritization of POPs pesticides and wastes, the project design utilizes the system of categorization developed jointly with the OSCE international consultant during the PPG (Table 2). For the overall volumes to be used in the project design, Table 3 illustrates this prioritization by category of material being managed to show the inverse relationship between physical volumes and actual POPs or OPs captured, contained and/or eliminated from the primary stockpile and waste source (Nubarashen burial site). For project design purposes quantities are increased in some cases from those estimated during the PPG to account for anticipated growth and as yet accurately defined aspects. It also accommodates disposal of the relatively minor OP stockpiles and potential amounts that may come from storehouse site clean ups being assumed to be undertaken by others in parallel.

Table 3: POPs waste volumes by prioritized category used for project design

POPs Waste Categories in Order of Priority by Source	Estimated POPs Waste Bulk Quantity (t)	Estimated OP Quantity (t)	Estimated POPs Pesticide Quantity (t)
Category 1: Pure Pesticides and Associated Material >30% pure pesticides)			
Pure pesticides from 5 Nubarashen burial cells	605	605	284
Contaminated clay adjacent to cells (assume 50% Average pure pesticides)	120	60	28
Segregated pure pesticides removed from soil outside cells	175	175	82
OP stockpiles from storehouses	150	150	-
Category 1 Total	1,050	990	394
Category 2: Soil and other materials with significant potential for heavy contamination above the direct health risk threshold of 1,500 ppm (Assume average 5,000 ppm POPs pesticide) or visual presence of pure pesticides			
Soil from top cover and fenced area with pure pesticides	7,000	83	39
Estimated allowance from priority OP stores remediation/clean-up	100	1	0.5
Category 2 Total	7,100	84	39.5
Category 3: Soil and other materials with contamination levels less than the direct health risk threshold but with potential to be above agricultural risk threshold of 0.7 ppm DDT (assume average 50 ppm POPs pesticides)			
Contaminated soil without traces of pure pesticides from Nubarashen top cover, landfill body, area around site, liner support.	12.550	1.3	0.6

POPs Waste Categories in Order of Priority by Source	Estimated POPs Waste Bulk Quantity (t)	Estimated OP Quantity (t)	Estimated POPs Pesticide Quantity (t)
Mechanically cleaned synthetic cover and cleaned ceramic materials/rubble	50	<0.1	<0.1
Estimated allowance from priority OP stores remediation/clean up	100	<0.1	<0.1
Category 3 Total	12,700	1.3	0.6

The above shows that the priority is the elimination of the Category I material which accounts for 91% of the actual POPs pesticides and OPs but only 5% of the actual physical volumes of POPs waste that will have to be managed.

The above design strategy has been developed under the Project Outcome 1.1 previously introduced and is further elaborated in the following. This outcome covers activities to be undertaken on the Nubarashen site including the final design/assessment/approvals for the works, the sequential removal of priority POPs pesticide waste (Category 1 and 2 materials) from the Nubarashen burial site, the secure containment of residual contamination on-site, and stabilization and restoration of the site. This also covers the supporting infrastructure requirements to undertake the work both on-site and as may be required peripherally in the area, and arrangements made to secure the site in the long term under appropriate institutional arrangements providing for effective access limitations, monitoring and future land use control, all endorsed by an informed public. The conceptual approach proposed is based generally on the conceptual design and works sequence developed during the PPG through the OSCE work (Preliminary Design Scenario 2) and involves a series of steps described below. It is based on undertaking the work in four stages likely over a two to three year period, these stages being: i) detailed design/approvals and initial site preparation works including stabilizing the site; ii) excavation, packaging and removal of the main body of Category 1 material and initial containment of exposed Category 2 and 3 material; iii) excavation, segregation of remaining material into Category 2 and 3, along with excavation, packaging and removal of Category 2 material; iv) final permanent containment of remaining Category 3, recovering and restoration of the site cover and implementation of aftercare measures. This sequencing is selected recognizing a need to phase the storage, subsequent disposal and treatment/remediation activities based at the Kotayk site as addressed in Component 2. It also facilitates flexibility in addressing potential financing constraints and implementation uncertainties risks associated with treatment and disposal options that will be addressed in parallel with final design activities at Nubarashen upon project implementation. The specific activities involved are described below:

- *Activity 1.1.1 – Detailed design and approvals*: This activity involves the updating the preliminary conceptual design concept developed during the PPG as described herein such that detailed clean-up design is documented for purposes of tendering. This will include undertaking additional site sampling and analysis to more accurately delineate areas and depths of contamination. Specific outputs will be design drawings, data sheets and works specifications necessary to produce tender documents and select the works contractors. Additionally, it is anticipated that a formal EIA will be prepared which, together with the design documentation, will be subject to the national environmental expertise process required for approval to proceed with the work as well as needed to meet the international GEF/UNDP safeguarding EA/EMP requirements. It is planned to contract this design and approvals work to an engineering/environmental management consulting firm or joint venture involving both national and international expertise. This GEF funded contract package will include the site assessment sampling and analytical capability preferably including an on-site screening analysis capability that can remain available into the works phase for purposes of defining actual contamination levels and facilitating discrimination between Category 2 and 3 materials. The contract is also expected to also cover on-site supervision of the works through to the completion of the site activities.

- *Activity 1.1.2 – Preparatory site work:* This activity involves the preparation of upgraded access such that the road to the site has reasonable all weather capability for heavy equipment and vehicles, and

the necessary support and safeguarding infrastructure to service the works activities over a two to three year period. This will include i) delineation of working areas including defined clear and contaminated areas and travel/working paths; ii) staff and support facilities (gate house, shower/change house, washing facility, water tank); iii) depot area for interim storage of excavated soil; iv) removal of top cover (clay layer, original synthetic liner and coarse sand layer) to the depot area; and v) construction of a temporary mat to prevent further erosion and cover of exposed pesticides in the burial areas. Additionally, the preliminary geological and hydrogeological stabilization works upstream the burial site would be undertaken involving upgrading of the culvert structure, repair of the leaking water main and works to redirect all surface run-off in this area towards the culvert such that the perched water table would drain and excess run off causing instability in and around the burial site would be reduced. Down-steam drainage improvements would also be affected to stabilize the land movement and through drainage in this area as well.

- *Activity 1.1.3 – Excavation, packaging and removal of Category 1 material:* This activity covers the excavation of the five cells containing pure pesticides along with clay or ceramic material immediately surrounding the cells that are assumed to be highly contaminated. In the case of the brick/concrete associated with Cell 1 this will be dried and mechanically cleaned on site with residues packaged with the Category 1 material and the cleaned material stored for eventual containment on site as Category 3 material. The estimated quantities are shown in Table 3 including an allowance for visually identified and segregated quantities of pure pesticides that might be excavated at this stage from the top cover or other areas as well as what might appear at a later stage of the work. It is assumed that 1 m^3 capacity UN dangerous goods rated "big bags" will be generally used for nominally dry solid material with transfer undertaken with suitable filling equipment. Provision will also be made for wet material as might be encountered in Cell 1 to be packaged in 200 l HDPE barrels. A contractor supplied portable weighting system will be used to weight each big bag or barrel upon loading each of which will have a unique bar coded identifier for tracking and inventory recording purposes.

- *Activity 1.1.4 – Redistribution, segregation and temporary containment of Category 2 and 3 materials:* Following removal of the primary source of POPs contamination through Activity 1.1.3, this activity is directed to stabilizing the site pending further excavation and preparation for final containment. This includes installation of a bottom liner for the final onside containment structure, segregation and relocation of Category 2 and 3 soils to the containment structure, installation of a temporary top cover and drainage layer, and its temporary closure pending availability of capability to manage Category 2 material off site. Allowance in designing the containment structure will exist to return treated Category 2 material.

- *Activity 1.1.5- Excavation, packaging and removal of Category 2 POPs waste:* This activity would be undertaken if and when arrangements are in place for the treatment/remediation of Category 2 highly contaminated soil segregated in the containment structure during Activity 1.1.4. It is currently estimated that 7,100 t of this material would be involved and would be packaged, weighted and identified as described above for Category 1 material using "big bags". It is likely that this work can start when laydown storage capacity for this material is available at the Kotayk storage facility or potentially an alternative arrangement, and could potentially be undertaken immediately after Activity 1.1.3 without the temporary on-site containment stage (Activity 1.1.4). However, this will depend on timing and coordination with technology selection and tender of the treatment/remediation work as well as removal for export from Kotayk of the Category 1 material.

- *Activity 1.1.6 – On-Site Containment of Category 3 POPs waste:* Once the Category 2 contaminated soil is removed or in the event financial constrains prevent its removal, the works required to institute final containment of the remaining Category 3 material (and potentially Category 2 material) will be undertaken. This will include further investigation of lower level contamination outside of the present fenced area and excavation of it as necessary for containment. It will also include re-installation of the top cover and drainage layers as well as temporary stabilization measures if further entry into the containment structure is required as may be the case if treated Category 2 material is to be returned. For purposes of preliminary design the amount at Nubarashen is estimated to be

approximately 12,550 t of material. At this stage, availability of containment capacity is also being provided for an estimated 150 t of contaminated soil from OP storage site clean ups undertaken by others.

- *Activity 1.1.7 - Site restoration and aftercare arrangements:* This final on-site activity involves completing the surface restoration of the site and its surroundings including planning of erosion resistant vegetation, redirection of run-off from to isolate the landfill site, installation of final slope stabilization erosion control measures in catchment area of the landfill, installation of the phytoremediation pond and sediments trap at end of the newly installed site drainage system, removal of all remaining infrastructure, operationalizing the monitoring system, installation of any supporting aftercare support (buffer zone fencing, signage etc.), and transfer of as-built drawings, records and after care procedures from the supervising consultant. It would also involve the formal transfer of the site responsibility and assumption of aftercare and monitoring responsibility under permanent institutional arrangements. These are envisioned to be the inclusion of the site itself, the designated access restricted buffer area and the overall drainage catchment are upstream of the neighboring summer house community into the Erebuni State Natural Reserve under the administration of the Biorecourses Management Agency of MNP.

- *Activity 1.1.8 – Supporting Training:* This activity involves the provision of the necessary operational and safeguards training to the staff that are to be directly involved in the work on the Nubarashen site. It would be provided in advance of starting actual site work and be updated throughout the period of work on the site as required. The scope of the training would cover overall hazardous waste and contaminated site management with specific emphasis on site excavation, packaging and restoration operations. The curriculum for the training will utilize the various international guidance materials available through international organizations. Additionally it would draw on documentation and lessons learned from completed GEF and other relevant projects

- *Activity 1.1.9 – Supporting public awareness and consultation:* This activity covers the required public consultation and awareness work needed to support the Nubarashen works activities above and is essentially a continuation of the work initiated during the PPG. It will be focused primarily on local stakeholders in the immediate area of the site and on the access route into Yerevan. It would also include what broader consultation related to the Nubarashen site in the context of the overall project, particularly in Yerevan and linking to similar public consultation being undertaken for the Kotayk site. It is proposed that this work would be locally contracted independently of the technical design and supervision of the works but would be closely coordinated with that activity throughout the works period and particularly during the front end approval activities.