Image: Batteries Dismantled in Residential Area, Pesarean

Preliminary Engineering Design

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May 20, 2016 (Final Submission May 27, 2016)
Project: “Clean-Up of Metal Smelting Waste, Tegal Regency, Central Java, Indonesia”
Activity Number: 14321-4, File 2015-5179

Table of Contents

LIST OF APPENDICES

LIST OF FIGURES

LIST OF ABBREVIATIONS

µg/dL micrograms per deciliter

BLL Blood lead level

CDC United States Government Centers for Disease Control

cm centimeters

CV Curriculum Vitae

DANIDA Danish International Development Agency

HEPA High Efficiency Particulate Air filter

m^2 square meters

m^3 cubic meters

mg/kg milligrams per kilogram

MOEF Ministry of Environment and Forestry, Government of Indonesia

PIK Perkampungan Industri Kecil, Kebasen - industrial facility for small scale industries

ppm parts per million

QC Quality Control

TCLP Toxicity Characteristic Leaching Procedure - analysis to simulate landfill leaching

ULAB used lead acid batteries

XRF portable X-Ray Fluorescence analyzer

Project Summary

1 On February 26, 2016, Pure Earth was contracted by The Ministry of Foreign Affairs of Denmark to support the joint efforts of Indonesia and Denmark in the Environmental Support Programme, Phase Three. The programme is focused on reconciling economic growth with sustainable development through improved environmental management and climate change mitigation and adaptation. In support of these goals, Pure Earth is providing a feasibility study and preliminary engineering designs for the clean-up of metal smelting waste in Pesarean Village within Tegal Regency of Central Java, Indonesia.

2 As described in the Terms of Reference, this contract encompasses five Key Outputs:

Output 1: Feasibility Study and Recommendations
Output 2: Preliminary Engineering Designs for the chosen remediation option
Output 3: Best Practices Guidelines for Encapsulation (eliminated by DANIDA from required outputs)
Output 4: Project Action Plan for full project implementation
Output 5: Guidance and content for procurement and construction tenders
Output 6: Recommendations for improving operations at the PIK, Kebasen (added by DANIDA to required outputs)

3 The Feasibility Study (Output 1) was delivered on May 13, 2016. This Preliminary Engineering Design document, delivered May 20, 2016, includes Outputs 2, 4 and 5. The enclosed documents are based on the Feasibility Study and Stakeholder Feedback and research completed by a team from Pure Earth led by Mr. John Keith, with key experts, Ibu Warmadewanthi, Environmental Specialist; Bapak Iswanto, Social Specialist; and Bapak Imam Masykur, the Pesarean Community Representative. The team completed the enclosed preliminary engineering designs, implementation plans, and guidance for procurement and construction tenders to inform the formal bidding and award process and the next phase of clean-up and remediation in Pesarean Village, Tegal Regency.

Executive Summary

4 This project focuses on the village of Pesarean in Tegal Regency, Central Java Province. Villagers have doing metal-working in the village for more than 50 years. The related smelting and open-burning in the village has resulted in waste materials dumped throughout the village, particularly in a large waste dump in the center of the village. As a result, contaminated dust and soil have spread throughout the residential areas, in homes, yards, and along streets and pathways. This village is particularly suited for a remediation project because there is local government cooperation, community willingness, and a potential for funding the clean-up and community education work.

5 This report follows a detailed Feasibility Study that was compiled and presented to DANIDA and all stakeholders by the Pure Earth team. That report analyzed all available remediation options and recommended the best alternatives. In response to that information, the decision was made by the stakeholders that soil and contaminated waste in the village should be excavated and sent to a manufacturer of paving stones, bricks, or other products for non-residential uses.

6 This report outlines the requirements for the remediation, including guidance for the tenders to be issued for the next phases of work, the specific activities required, project management and quality control guidelines, the anticipated schedule, and cost estimates. The report also includes detailed implementation instructions for each phase of remediation, health and safety requirements, worker training requirements, and house cleaning protocols. Additionally, the team prepared recommendations for improving operations at the PIK, Kebasen smelters and analyzed the required institutional arrangements for the remediation project.

7 Key recommendations for DANIDA are that 5 separate tenders be prepared and requested on a “time and materials” basis; initial excavation be done at 15 cm for yards and alleys, and according to the depth map of the waste dump site; and that a transfer pad or pads be built.

Background

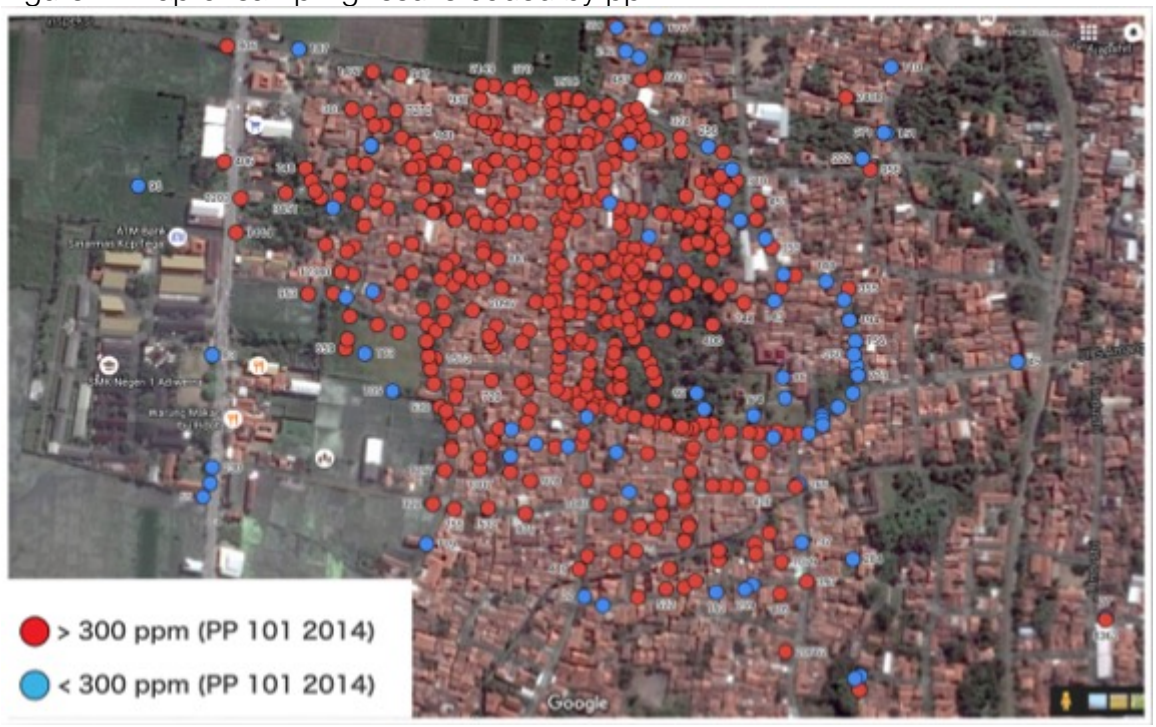
8 The village of Pesarean, Adiwerna District, Tegal Regency, Central Java Province, historically had around 300 households involved in smelting and metal working activities. Villagers have been working with aluminum, copper, lead, zinc, mercury, tin, iron and steel for more than half a century. Raw materials come from scrap metal, including used lead acid batteries (ULAB) from cars, motorcycles and trucks. Smelting activities mostly involve open burning and resulting waste materials are dumped around the village. In 2010, the Government of Tegal Regency started to relocate the smelting activities to the Perkampungan Industri Kecil (PIK) Kebasen, the industrial facility for small and medium scale industries located 1.3 kilometers from Pesarean. A study conducted by Pure Earth in 2015 estimated that about 40 metalworking shops remain in the village including at least 1 remaining lead smelter. In the focus groups conducted as part of the Feasibility Study, the community agreed that all smelting activities will be banned in the village so that remediation and clean-up can be sustainable. All metal smelting is to be relocated to an industrial area outside of the residential zones of the village. Recommendations for improving operations at the PIK, Kebasen are included in Appendix J.

9 Several studies have confirmed contamination of soil and water in Pesarean. Furthermore, blood tests indicated that 9.8% of people in the village have blood lead levels above 30 µg/dL and 22% have blood lead levels above 10 µg/dL. Blood lead level (BLL) testing indicates recent exposure to lead. The United States Government Centers for Disease Control (CDC) states that there is no safe level of exposure to lead, but that exposures resulting in blood lead levels at or above 5 µg/dL are “of concern” and likely to have health effects.

10 In 2015 and 2016, Pure Earth sampled soil at 552 points in Pesarean village using a portable X-Ray Fluorescence (XRF) analyzer using 300 milligrams per kilogram (mg/kg) or parts per million (ppm) of lead as the clean-up standard on the advice of the Directorate of Remediation of Hazardous Waste Contamination and Emergency Response, in the Ministry of Environment and

Forestry (MOEF). The results of the soil sampling are summarized on the map in Figure 1.

Figure 1. Map of sampling results coded by ppm



11 Additionally, Pure Earth had Toxicity Characteristic Leaching Procedure (TCLP) testing done on 2 samples from the waste dump site and 1 from a contaminated yard. The TCLP test is a chemical analysis to simulate potential for leaching through a landfill and is required by the Government of Indonesia. The results, shown in Figure 2 below, unsurprisingly are that the soil can be considered hazardous waste according to Indonesian regulations.

Figure 2. Total Metal Concentrations and TCLP results
(obtained November 2015, using boring and measured using portable XRF)

Depth (cm)	Residential area (#410)					
	TC : Pb (ppm)	PP 101/2014	TC : Zn (ppm)	PP 101/2014	TC : Cu (ppm)	PP 101/2014
0	54,339	300 ppm	13,680	120 ppm	33,301	30 ppm
25	2,540	300 ppm	11,013	120 ppm	943	30 ppm
75	2,349	300 ppm	11,846	120 ppm	923	30 ppm
100						
150						
200						

Depth (cm)	Residential area (#410)					
	TCLP : Pb (mg/L)	PP 101/2014	TCLP : Zn (mg/L)	PP 101/2014	TCLP : Cu (mg/L)	PP 101/2014
0	TBA	0.2 mg/L	TBA	20 mg/L	n/a	4 mg/L
25	TBA	0.2 mg/L	TBA	20 mg/L	n/a	4 mg/L
75	40.00	0.2 mg/L	88.30	20 mg/L	0.90	4 mg/L
100						
150						
200						

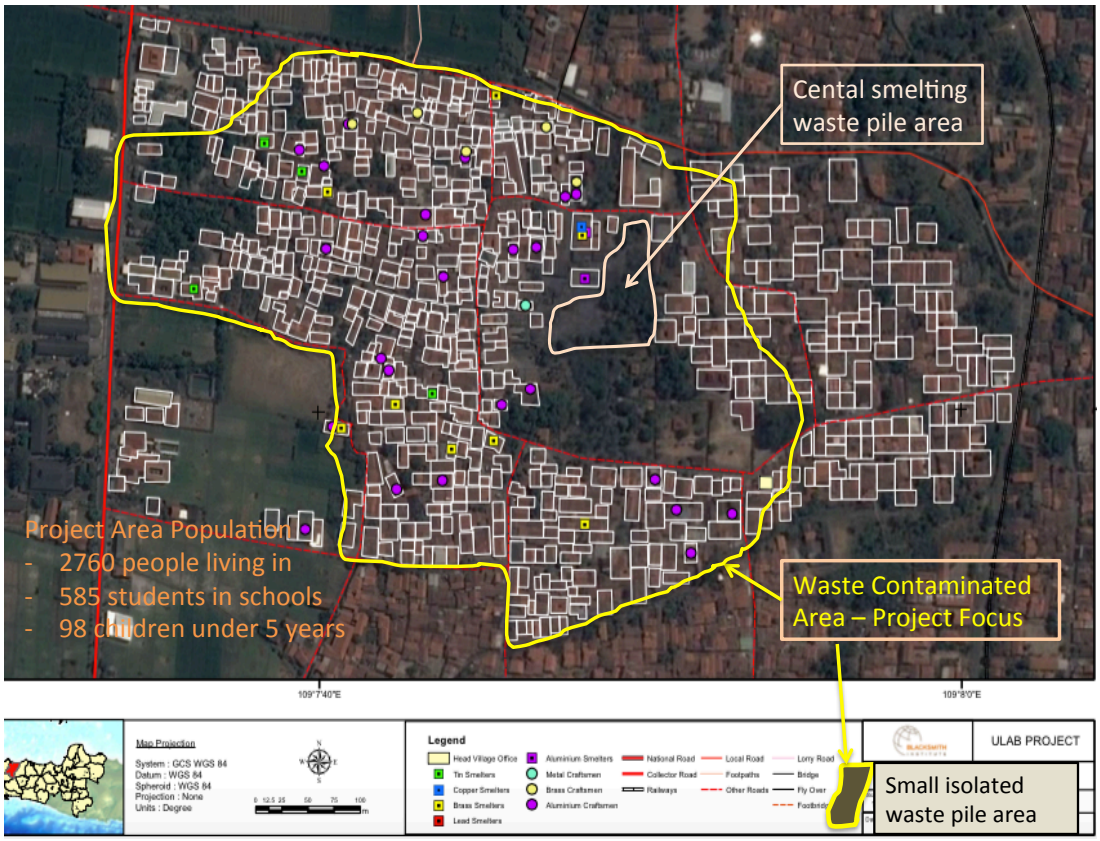
Depth (cm)	Dumpsite (#343)					
	TC : Pb (ppm)	PP 101/2014	TC : Zn (ppm)	PP 101/2014	TC : Cu (ppm)	PP 101/2014
0	24,023	300 ppm	8,928	120 ppm	232,193	30 ppm
25	34,348	300 ppm	10,884	120 ppm	295,781	30 ppm
75	16,161	300 ppm	164,683	120 ppm	7,171	30 ppm
100	16,881	300 ppm	210,190	120 ppm	10,969	30 ppm
150	7,830	300 ppm	5,420	120 ppm	139,991	30 ppm
200	2,900	300 ppm	871	120 ppm	11,277	30 ppm

Depth (cm)	Dumpsite (#343)					
	TCLP : Pb (mg/L)	PP 101/2014	TCLP : Zn (mg/L)	PP 101/2014	TCLP : Cu (mg/L)	PP 101/2014
0	n/a	0.2 mg/L	n/a	20 mg/L		4 mg/L
25	7.00	0.2 mg/L	519.00	20 mg/L	3.15	4 mg/L
75	108.00	0.2 mg/L	246.00	20 mg/L	5.25	4 mg/L
100	n/a	0.2 mg/L	n/a	20 mg/L	n/a	4 mg/L
150	n/a	0.2 mg/L	n/a	20 mg/L	n/a	4 mg/L
200	n/a	0.2 mg/L	n/a	20 mg/L	n/a	4 mg/L

Project Area

12 As part of the Feasibility Study conducted between February and April 2016, a project area was defined and accepted by stakeholders. This project area definition is a result of combining and evaluating soil contamination data from yards and paths, identification of waste piles, groundwater depth testing, and waste dump contamination analysis. The area shown in Figure 3 is where the majority of waste piles and soil contamination over levels of concern were found and also where residents are being exposed to the most dangerous levels of contamination.

Figure 3. Project Area



13 A survey conducted by the Pure Earth team determined that the volume of waste and contaminated soil in the dumpsite, high school yard, and public cemetery, as well as in unpaved open spaces, yards, alleys and along roadsides is about 20,015.92 cubic meters (m^3).

The estimates for yards, unpaved roads and the schoolyard are based on an average depth of contamination of 15 centimeters (cm). Pure Earth's experience at other similar contaminated areas has shown that lead and other metals generally do not migrate downward if deposited by spills and dust, and are generally found in the top layer of soil. Therefore, Pure Earth uses 15 cm as the excavation depth when estimating volumes. The exact depth will be confirmed by XRF during remediation to be sure that all contamination is removed. Figure 4 shows the area and volume of contaminated material to be cleaned up.

Figure 4. Volume Estimates

LOCATION	AREA (m2)	VOLUME of contaminated material (m3)	COMMENT
Dumpsite	13,000	18,000.00	per depth sampling
Yards	11,427	1,714.12	if excavated to 15 cm
Unpaved roads/alleys	1,352	202.80	if excavated to 15 cm
High School yard	660	99.00	if excavated to 15 cm
Public Cemetery	12,000		Not included in this estimate
Totals	13,439	20,015.92	Yards, Alleys, and School

Overview of Remediation Strategy

14 This project's key objective is to reduce health risks in a sustainable manner and within a budget available from the Danish International Development Agency (DANIDA) and the Government of Indonesia. The Risk Analysis completed as part of the Conceptual Site Model (source – pathway – receptor chain), indicated that the greatest focus should be on sources that present the greatest risk to the people (particularly children) of Pesarean. Consideration must also be given to cost effectiveness in terms of risk reduction achieved per cost. Figure 5 shows the alternatives evaluated for remediating the various contaminated areas in Pesarean.

Figure 5. Evaluation of Remediation Methods for Pesarean

Remediation Method	Applicability
I. Excavation of contaminated soil from yards and alleys	Contaminated yards and alleys. Excavated material must be disposed of using one of the methods described below
II. Encapsulation structure at waste dump site for all contaminated material	Waste dumpsite. Contaminated material could be brought from other sites or another disposal method could be used
III. Encapsulate waste dump site on top/sides only	Waste dumpsite. Contaminated material could be brought from other sites or another disposal method could be used
IVa. Off-site encapsulation structure at football field	Waste and contaminated soil from the waste dumpsite and all other areas could be brought to the structure
IVb. Off-site encapsulation structure at a site ~ 30 km away from Pesarean	Waste and contaminated soil from the waste dumpsite and all other areas could be brought to the structure. The site selected (by the Tegal government) also must be approvable by MOEF
IVc. Off-site encapsulation structure at football field, with stabilization of waste and soils	Waste and contaminated soil from the waste dumpsite and all other areas could be brought to the structure. Prior to placing the material into the encapsulation structure, the material would be stabilized or solidified such that it would pass a TCLP test
V. Stabilize or solidify contaminated material then use treated material in road construction	Waste and contaminated soil from the dumpsite and all other areas could be disposed of. Prior to placing material under roads, it would be stabilized or solidified to pass a TCLP test
VI. Solidification of contaminated materials into blocks or pavers	Waste and contaminated soil from the waste dumpsite and all other areas could be disposed of
VII. Two encapsulation facilities	Waste and contaminated soil from the waste dumpsite and all other areas could be disposed of
VII. Pave contaminated areas	Unpaved yards, alleys, and paths of the waste dumpsite and cemetery
VIII. Cover contaminated areas with gravel	Unpaved yards, alleys, and paths of the waste dumpsite and cemetery
IX. Cover contaminated areas with clean soil	Yards, alleys, schoolyard, cemetery (likely without barrier cloth). Also possibly done at waste dumpsite as a temporary measure

15 Furthermore, for each of the remediation methods, an evaluation analysis ranked each alternative on a zero-to-five scale (five being best) considering:

- Risk reduction effectiveness
- Sustainability
- Risks during the work
- Community acceptance
- Construction/project time
- Logistical feasibility (space, getting materials/equipment to the site, geology, etc.)
- Regulatory compliance
- Conformance with internationally accepted practices
- Advantages or disadvantages to the community (losing or gaining use of land)
- Cost

The results are shown in Figure 6 below.

Figure 6. Pesarean Remediation Matrix Analysis

Alter-native	Alternative	Overall Ranking	Risk Reduction Effective-ness	Sustaina-bility	Risks During Work	Commun-ity Acceptance	Construc-tion Time	Logistical Feasibility	Regulatory Compli-ance	Int'l Practice Compli-ance	Cost	Community Advan./ Disadvan-tage
I	Send Waste to Hazardous Waste Landfill	4.0 But above funding ability	5	5	2 long distance transport	5	4 5-8 months	4	5	5	0 127 Bil. Rp	5
Ivb	Encapsulation structure at a location away from Pesarean	4.0 if approv-able site available	4	5	2 Transport of waste	5	3 7-12 months	4	4 May need variance, eng. controls	5	3 20 - 25 B Rph	5
V	Solidification /stabilization, then use in road constr.	3.5 If road project available	5	5	2 Stabilization area	3 Need road proj. support	1 8 - 12 months	3	3	4	3 25 - 30 Bil Rp Depends on location	5
Via	Solidification of waste into blocks or pavers at PIK	3.5 But above funding ability	4 Some concern about product use	4	4	4	2 8 - 12 months	2 - Need temporary storage	4	4	1 45 - 50 Bil. Rp	5
Vib	Solidification of waste into blocks/ paver at East Java factory	3.7	4 Some concern about product use	4	2 long distance transport	3 Temp. use of football field	4 5-7 months.	2 Staging pad, transport	5	5	3 20 - 25 Bill. Rp	5
X	Phased Project	3.1 but delays waste removal	4	2	5	3	5 5 - 6 months for Phase I	5 Though need lots of soil	1 May be OK as temp. measure only	1	5 10 - 12 Bil. For Phase I only	2 Dump site remains but yards clean

5 - Very Good 4 - Good 3 - Moderate 2 - Poor 1 Very Poor 0 - Unacceptable

16 The evaluation showed that the most effective remediation strategy, in terms of risk reduction, sustainability, and cost is to construct an encapsulation facility outside of Pesarean that can meet governmental requirements or be engineered to meet the requirements such that it can be approved by the Ministry of Environment and Forestry (MOEF).

17 A potential encapsulation site was identified in Jatilaba, 30 kilometers away from Pesarean. However, this option has risks related to purchasing the site, gaining approval for waste disposal, and obtaining necessary permits and variances for a Class I landfill, that could delay the project beyond the time in which funding is available, or make it impossible due to lack of approvals. Additionally, the Tegal Regency government expressed concern in the stakeholder meeting, indicating that it would not be comfortable assuming responsibility for purchasing the land, getting proper approvals, or overseeing closure and maintenance after the remediation is complete. Therefore, this option was rejected due to the limited timeframe and the approval or site acquisition risks.

18 The second highest ranking option is to send the waste and contaminated soil to a large paving block and/or brick manufacturer for solidification. Such a factory must have hazardous waste processing permits and processing costs within an affordable range. A potential facility for this was identified in Jetis village near Mojokerto. This manufacturer, PRIA, has two local transfer stations for storage/transfer if required and can produce 1500 blocks per hour. **This option was chosen as the most likely to be implemented in the timeframe and within the available budget and thus this report assumes that the government will move forward with this alternative. Cost estimates for each remediation method are in Appendix K.**

Tender Information

19 A key output of this document is to provide guidance on the tenders to be issued for implementing the remediation phase of this project. The purpose of this section therefore, is to

provide recommendations to the project manager obtaining tenders for project work, based on the experience of the Pure Earth team in conducting similar projects in similar villages.

Number of Tenders

20 This remediation project involves several distinct types of work and expertise that lends itself to obtaining different tenders to complete the work, as opposed to a single tender for all functions. It is recommended that the following separate tenders be considered:

Tender 1 - Worker training, waste and contaminated soil removal, transport to transfer pad, operations of transfer pad, and house cleaning. This work involves management of labor and experience with excavation and transport of contaminated soil, including use of heavy equipment, and use of manifest tracking systems. Requirements related to worker training are detailed on pages 19-20, those related to waste and contaminated soil removal are on pages 21-35, those related to transfer pad are on pages 35-37 and 45-48, and those related to house cleaning are on pages 52-57.

Tender 2 - Construction of a concrete transfer pad and related runoff-control measures. This work is basic concrete construction work suitable for a construction contractor. Requirements related to the Transfer Pad construction are detailed on pages 45-48.

Tender 3 - Transport of waste and contaminated soil to a paver or brick manufacturer, and solidification of the waste and soil into bricks blocks and pavers. This tender should be offered to qualified manufacturers of pavers, blocks or bricks with necessary permits for transport and processing of hazardous waste. Requirements related to transport to the final disposal site are detailed on pages 48-52.

Tender 4 - Community outreach and education. This work requires knowledge of the community and effective methods for accomplishing behavioral change education. It also requires excellent community education experience, and ability to work with local leaders and

stakeholders of various literacy and education levels. Requirements related to to community education and outreach are detailed on pages 40-45.

Tender 5 - Technical oversight and assistance, notably a Quality Control Team with an X-Ray Fluorescence (XRF) instrument and skills in project effectiveness assessment. This work requires technical expertise in metals testing including use of an XRF, mapping, and remediation project evaluation. It is important to keep this function separate from the remediation and shipment contracts to avoid conflicts of interest, notably the interest of the remediation contractor to maximize work and minimize costs versus ensuring the work is done to the required standards. Additionally, as part of the project effectiveness assessment, blood testing of children and adults must be done under the auspices of and in conjunction with local health authorities, and requires medical personnel and full understanding of related ethical issues. Requirements related to Quality Control are detailed on pages 62-65.

In addition to the above roles, there must be an overall project manager for all of the work to provide direction and oversight and ensure coordination and quality. Requirements related to project management are detailed on pages 57-66.

21 It may be possible to combine several of the tenders if firms have expertise and capacity in several areas. For example, it is possible that a paver manufacturer also may have the capacity for construction and operation of the transfer pad, or the project manager may have the expertise and capacity to do the technical assistance, XRF mapping and assessment work. Or, it may occur that the paver manufacturer can handle all transport functions, including moving waste out of Pesarean to the transfer pad as well as moving waste from the transfer pad to the paver manufacturing factory.

22 **It is recommended that separate tenders be prepared for the five categories above to assure that the most competent firms have a chance to submit proposals and the**

best prices are obtained. It is also recommended that the number of tenders not be increased beyond the above categories to avoid unnecessarily complex coordination between contractors.

Types of Tenders

23 **It is recommended that proposals be requested based on a "time and material" basis, as opposed to a "lump sum" or "fixed total price" basis.** The work does not lend itself to a "lump sum" or "fixed total price" approach. As with any complex remediation project, there are variables and potential obstacles that make it unreasonable to develop a definitive scope of work suitable for a "fixed total price" proposal. Pure Earth's experience is that if a "fixed total price" is requested in tenders, then firms making proposals will include very high estimates for the work to account for inevitable unknown issues that arise. This can result in higher overall costs than a "time and material" approach, or can lead to costly extras for work outside of the defined scope.

24 It is noted that with a "time and material" basis, excellent records and documentation must be kept by the contractors, and the project manager must exercise tight control of costs and ensure payments are made only for satisfactory work completed and items with proof of purchase.

25 It is also noted that for the waste transport to the paver manufacturer and for the solidification into pavers, blocks or bricks, proposals should be based on a "per kilo" of waste or contaminated soil transported or processed basis. Requirements related to transport to the final disposal site are detailed on pages 45-52.

26 Additionally, the scope of work for construction of the transfer pad depends on the location selected and its size and characteristics. It is suggested that construction firms be asked to give an estimated price per square meter of pad plus the price of the runoff control system,

along with a total estimate for a 1,200 square meter, 20-centimeter-thick pad built on a level, dry, easily accessed site. Requirements related to the the transfer pad construction are detailed on pages 45-46.

Information to be Provided to Firms to Develop Proposals

27 Firms from which proposals are being solicited should be provided with a relevant scope of work and other information as outlined in this document and refined by a detailed design engineering firm, including:

- Work methods, as presented in this document
- Anticipated project schedules
- Estimated labor, equipment, material and supplies

  (although it should be made clear that the proposing firms must develop their own estimates and that the estimates are samples only and do not set contract amounts)
- Technical support documents, including testing results, maps, stabilization recipes, etc.
- Proposed payment terms, including down payment, anticipated payment frequency (e.g. monthly), percent hold back for final completion and any other financial terms
- Documentation expectations for financial and project oversight
- An example contract document so proposing firms can see legal terms and conditions with which they would be expected to comply
- Expertise required for the work
- Permits and government approvals necessary for the work.
- Names and contact information for key stakeholders, notably in the MOEF, Tegal Regency government and Pesarean village authority

28 Pure Earth suggests that contracts be kept as short and straight-forward as possible, in plain language, as opposed to lengthy, highly technical contracts. Complex contracts rarely add value, can intimidate otherwise qualified firms, and suggest a lack of trust that is not helpful in remediation projects. Finally, Pure Earth suggests that firms be required to visit Pesarean to gain first-hand knowledge of the site and work conditions before developing proposals.

Information to Request in Tenders

29 The information to be requested in tenders includes:

- Expertise and qualifications of the firm for type of work being tendered, including examples of relevant similar work.
- Names of key individuals to be involved, such as the project manager and technical experts, including a Curriculum Vitae (CV) or summary of the qualifications of each
- Unit prices for key labor, materials, tools, instruments and supplies, as described in this document and listed in Appendix G. Proposals should indicate either the unit price to be charged to the project, or should indicate that prices will be based on actual cost plus a defined mark-up. A mixture of these two methods is typical, such as a unit per diem price for labor, supervision, and heavy equipment, but a "cost plus" approach to supplies, small tools, and equipment.
- A description of the firm's approach to the work to be done
- An assessment by the firm of labor, equipment, supplies and material needs
- A schedule for the proposed work, prepared by the firm, and specifically whether they can comply with the projected overall work schedule as shown in Appendix I
- The firm's proposed payment terms

Worker Training

30 Training of all workers involved in the Pesarean remediation project is essential both to protect the workers and community from adverse health effects and to successfully complete the project. Inadequately trained workers can put themselves and others at risk, cause environmental damage, or create conditions that would increase remediation needs and resulting costs. Training is also essential so that the project is executed in a coordinated, efficient manner, and adheres to schedules. Key items for worker education include:

- The purpose of the project – why it is important, what is being achieved
- The project scope, project area and schedule
- Work methods to conduct the remediation
- Health hazards of lead and other metal contaminants, including how these pollutants enter the body and their short and long term health effects

- Health, safety, environmental protections and security measures, outlined in Appendix A
- Project organization and lines of authority, specifically the role of key decision makers such as supervisors, the health and safety officer, security officers, the Quality Control team, technical advisers, and the project manager
- Specific work teams and the specific tasks and expectations
- Interactions with the community, as described in this document specifically for community engagement, outreach and education

31 All workers must attend a training session about the project and work methods before starting work. They must also attend a session on health, safety, security and environmental protection, likely given by a health and safety officer. It is anticipated that each of these sessions will require at least 2 hours. This requirement also applies to supervisors, managers, and workers with a supporting role in the project such as guards, truck drivers and laundry workers; however, training content for these workers may be altered as appropriate by role.

32 Teaching methods and aids may include lectures, films, slide presentations (e.g. PowerPoint), pamphlets and live demonstrations. Questions must be encouraged during the training sessions. Workers should be given written materials summarizing the training content, as well as outlining key responsibilities and communication methods, so that they can refer to these materials. Methods for conducting the training are to be decided by the contractor, who may enlist technical advisers and other participants to deliver the training and education programs.

33 There must be measures to assure workers have learned the material. This could include written tests, oral examination, or requests of workers to physically demonstrate methods and procedures. A simple statement by workers that they understand the material is not sufficient.

34 Records must be kept of the worker training, including:

- Worker sign in sheets
- Education and training session content, format and duration
- The methods used to evaluate and assure effective learning
- Records of measures demonstrating workers successfully completed the training.

35 There must be measures to ensure that untrained workers are not used in the work. This can be challenging as the project ramps up to its full activity level and as personnel change, so a formal system of tracking who is working and whether they have been trained must be established. It is expected that multiple training sessions will be needed during the project, especially during start up, so that all initial workers are trained and new workers joining in the middle of the project are also trained.

Waste and Contaminated Soil Removal and Remediation

36 This section describes work to remediate contaminated areas within the project area as shown in Figure 3 and the detailed remediation maps and data in Appendices B, C, E, and H.

Waste Dump Site

37 This section outlines the steps to be followed in preparing for and remediating the dump site in the center of the project area.

Preparation for Work

38 In preparation for the remediation, the following steps should be taken:

- Workers will be trained in work methods as well as health, safety, security and general work practices as outlined in Appendix A
- A secure storage room will be established to stockpile supplies and tools safely
- Measures will be established for worker protection, personal protective equipment (PPE), uniforms, clothes-changing requirements, washing, eating and provision of water supply
- Security perimeters will be installed around the dump site, and guards employed
- Equipment will be mobilized to the area. Equipment that may be required is listed below. Note that no equipment should be mobilized until there is a secure storage area and guard.
- Clean soil will be brought to Pesarean and a stockpile established for use as needed during

the excavation work. The location of the stockpile should be near the dump site, but preferably in a clean or paved area, or on a tarpaulin separating clean soil from underlying contamination. Note that any clean soil used in the remediation project must be from this clean soil stockpile. This soil cannot be taken from the Pesarean area, given that almost all of the land in this area has been contaminated by hazardous waste. The observations and results obtained from interviews with local community reveal that a number of nearby regions could be the source of clean soil. These regions are Pangkah, Kedung Banteng and Margasari. The clean soil source location must be approved by the project manager, and tested by the Quality Control team to document that it is not contaminated.

- Concrete pavers will be brought to a stockpile area for use in pathway paving once remediation work is done
- Vegetation in the dump area will be removed, using axes, scythes, hoes, saws or heavy equipment (front end loaders, excavators) as appropriate. These materials will be cut off at ground level (not below ground). Cut vegetation (trees, bushes weeds) will be placed in trucks manually or using heavy equipment, then removed for disposal as non-hazardous vegetative waste. Proper, legal disposal methods shall be practiced.

Excavation of Waste

39 In excavating the waste, the Dump Site Waste Depth Profile Map (Appendix B) will be reviewed by the project manager and contractor (with heavy equipment operators and team leaders) to plan the excavation approach. Generally, excavation will start at one side of the site and proceed gradually to the other side. In excavation planning, consideration must be given to how trucks will move through the area and be loaded without contaminating previously excavated areas. Excavation will be done in sections, with each section being a reasonably sized contiguous area as defined by the project manager.

40 After removal of vegetation, waste and contaminated soil will be excavated using an excavator, a front-end loader or Bobcat, at the contractor's discretion. Whenever possible, the waste will be loaded directly into trucks for transport to the transfer pad. Creation of temporary storage piles is discouraged.

41 Loaded waste will be taken directly by trucks (generally 5 cubic meter capacity) to the transfer pad following the pre-approved truck routes shown in Appendix D. Care must be taken to ensure that waste or contaminated soil is not spilled during loading of trucks or transport to the landfill. Trucks should be loaded full but not to a level that could result in spills during transport. Dust control measures will be practiced as described on pages 48-50.

42 Excavation will continue until the approximate depth of contamination (i.e. above 300 mg/kg of lead) is reached as indicated on the depth profile map (Appendix B). Visual observation of the material being excavated may also help define how deep to dig – i.e. when it appears underlying soil is reached. However, XRF measurements will be used to confirm when the appropriate level is reached. Care must be taken not to dig too deeply in order to prevent excavation of clean soil and avoid unnecessary disposal cost. After removal of visible waste and/or reaching the depths suggested by the Appendix B map, the Quality Control team must be called.

43 The Quality Control team will conduct several XRF soil readings in the excavation area and determine if clean soil has been reached (below 300 mg/kg lead) or if further excavation is needed. If further excavation is needed, this will be done using the excavator, front- end loader or manually with shovels, as decided by the construction manager. Excavation should proceed in increments of 15 to 25 centimeters, to avoid excessive excavation.

44 It is important that spillage is prevented and excavated contaminated materials are not spread around the area, particularly because of adjacent schools. Wheelbarrows should not be filled

to the top, but kept partially empty to allow easier maneuvering and less risk of spillage. Wheelbarrows must be covered when leaving the excavation area. Transfer from wheelbarrows to dump trucks should be done carefully, using ramps or other methods to allow dumping directly into trucks without spillage. Paths used to bring the contaminated soil out of the dumpsite and to the trucks (or transfer pad) must be tested frequently by the Quality Control team using the XRF to verify that there has been no spillage or that any spilled material has been thoroughly cleaned up.

45 Once the excavation, as directed by the Quality Control Team is done, the XRF will be used to re-test the excavated area. If clean, excavation will end for the area. If not, excavation of another layer will be done. The Quality Control team will use its professional expertise and discretion to decide when excavation should end, and this direction will be followed by the excavation workers. It is noted that final fine excavation work may be needed using shovels and wheelbarrows. The Quality Control team will keep records of the work done and XRF records of all readings at excavation areas to provide a record that all waste and contaminated soil was removed.

46 When one area is excavated to clean soil, the excavation equipment and workers will move to an adjacent section and repeat the process, using care not to spill waste or contaminated soil in the previously excavated, now clean areas. This process will be continued until the entire waste dump area is clean as verified by the Quality Control Team.

Grading and Clean Soil Application

47 Once excavation of waste and contaminated soil is complete, the area should be smoothed to a reasonably level surface using a front-end loader, other equipment, or hand labor as determined by the contractor. Clean soil will be applied in excavated areas as fill or to allow access to during clean up of the next section. Clean soil must be brought to the area in a separate truck NOT used for transport of waste to avoid contamination of the clean soil.

48 The area, after being leveled and filled, will be graded and compacted by front end loader or by manual labor using rakes and compaction rollers as appropriate and as determined by the contractor. The final surface should be reasonably level, and covered by at least 10 centimeters of clean soil. Once the area is level and covered with soil, grass seed will be applied (of a hardy, local variety), with fertilizer if necessary, to create a pleasing green area. Watering of the area after the security perimeters are removed will be the landowner's responsibility.

49 In areas shown on the map in Appendix E, pavers will be installed on top of the clean soil to create finished paved paths. These paths are in heavily trafficked routes across the area. Professionals with experience in building paved walkways will be used for this work to assure durability of the paved paths. Materials used in paving must be contamination-free as determined by the Quality Control team.

50 The Quality Control team will conduct a final survey of the finished area, taking readings to document that the area is now clean. Records of this testing will be kept by coordinates and shown on an area map.

Yards and Alley Excavation and Remediation (including high school yard)

51 Unlike the larger dumpsite area, the contaminated yards and alleys will be excavated by hand, using shovels, hoes, and wheelbarrows. Typically, this will be done by a crew of 5 or 6 laborers, excavating the top 5 centimeters (cm) of soil by hand, and placing the contaminated soil in wheelbarrows for transport to a truck that will take the soil to the transfer pad.

52 The area to be excavated will be carefully defined by the contractor, using XRF readings made by the Quality Control Technician. Following excavation of the top 5 cm of soil, the Quality Control team will conduct new XRF readings in a tight grid pattern. If contamination above 300 mg/kg is found, excavation of another 5 cm in the problem areas will be done and the area will be re-tested. Pure Earth's experience has shown that lead and other metal contamination

largely remains in the top of the soil. As the soil is quite hard, the manual excavation can be difficult and removal of more than necessary is to be avoided. Note that this excavation process applies to the school yard in the project area as well as contaminated yards and alleys throughout the project area.

Preparation for Work

53 As in the dump site preparation, the following steps should be taken in preparation for remediation of yards and alleys:

- Workers will be trained in work methods as well as health, safety, security and general work practices as outlined in Appendix A.
- A secure storage room will be established to stockpile supplies and tools safely
- Measures will be established for worker protection, personal protective equipment (PPE), uniforms, clothes-changing requirements, washing, eating and provision of water supply
- Security perimeters will be installed to limit access to the work zone
- Equipment and tools will be mobilized to a central area from which they can be accessed by work crews.
- Clean soil will be brought to a stockpile established for use as needed during the excavation work. The location of the stockpile should be near the work site, but preferably in a clean or paved area, or on a tarpaulin separating clean soil from underlying contamination.
- Concrete pavers will also be brought to a stockpile area for use in alley paving once remediation work is done.

54 A plan for the order of yards and alleys to be excavated will be developed by the contractor (utilizing the survey of contaminated yards and alleys, Appendix H). Generally, work should start at one side of the village and proceed in an orderly manner to the other side and in each yard or alley, should start at one side and proceed to the other. In the planning, consideration

must be given to how excavated material will move to trucks, and how to prevent workers or equipment from traversing contaminated soil to access the clean sites. This is essential to prevent recontamination of cleaned areas.

55 Trained workers will be divided into teams, typically with 5 members per team. Supervisors will be appointed for each team, with each supervisor managing 2 or 3 teams. The purpose of the supervisor is to coordinate excavation work, contaminated soil removal to the transfer pad, delivery of clean soil, provision of supplies, etc., as well as to assure quality of work.

56 There will be "Excavation Teams" and "Clean Soil Teams". Excavation Teams remove the waste and contaminated soil from (unpaved) yards and alleys, while the Clean Soil Teams backfill the excavated yards and alleys with clean soil and leave the areas in good condition for future use. Both teams use uniforms, but respiratory protection is not required for the Clean Soil Teams, as they are not working with contaminated material.

Excavation of Waste and Contaminated Soil

57 Before excavation begins, the project manager and contractor decide how to approach the excavation – i.e. in what order will yards and alleys be excavated, using the maps in Appendices C, E and H as a guide. Generally, excavation will involve one entire yard or alley at a time, with one excavation crew for each. Pure Earth's experience at similar projects has been that a crew of 5 workers can generally excavate about 100 m^2 per day, though this depends on the hardness of the soil, complexity of the site and ease of removing excavated soil to a truck.

58 Residents adjacent to the yard or alley will be notified of the planned work and asked to stay out of the area and keep doors and windows closed during the work. Children should leave the house and stay away. As yards and alleys generally can be excavated in one work day or less, this should not present a great burden to residents.

59 Vegetation in yards to be remediated will be removed, using axes, scythes, hoes, saws or small front-end loaders (e.g. Bobcats) as determined by the contractor. Vegetation will be cut off at the ground level (not below ground). Then, cut vegetation will be placed in trucks and removed for disposal as non-hazardous vegetative waste. Proper, legal disposal rules will be followed.

60 Waste and contaminated soil (after removal of vegetation) will be excavated by workers manually using shovels and hoes. Where possible, such as in larger yards where access is possible, small front-end loaders may be used. This will be determined by the contractors on a case by case basis. Dust control measures as detailed on pages 48-50 will be enacted.

61 Waste piles, if they exist, should be removed first, before soil excavation. Soil excavation should proceed to 10 or 15 cm depth as needed, in 5 to 10 cm increments as discussed above, by scraping, digging or hoeing. Excavated soil should be placed in wheelbarrows or carts, covered, and taken to a location where it can be loaded into trucks for transport to the transfer pad. These transport locations should be as close as possible to the work area.

62 When a 5 to 10 cm layer has been excavated, the Quality Control team will be called and will test the excavated area with the XRF. If the soil tests below 300 mg/kg of lead, then excavation work is complete. If the soil readings are still over the target clean up level, the Quality Control team will direct further digging until the readings indicate that the soil has reached target levels. This process of digging and testing will continue until XRF testing shows that all waste has been removed or, in very limited situations, when the Quality Control team, contractor, and project manager determine that further excavation is not reasonable to do.

63 Loading of trucks can be done in several ways, such as dumping wheel barrow contents into a small pile and then using a front-end loader to dump it into the truck, using ramps to access the truck, or shoveling wheelbarrow contents into trucks. The contractor will decide what method works in specific areas, but in all cases attention is paid to minimize dust and spillage.

Generally, for efficient loading of trucks, use of transfer piles is most efficient. This recommendation is for yards and alleys, not for the waste dump site where it is NOT recommended to use transfer piles.

64 Loaded waste will be taken directly to the transfer pad following pre-approved truck routes (see Appendix D) to the extent possible, although routes may vary to allow close access to the yards and alleys being excavated. Once work using a particular truck loading area is complete, the area used for transfer piles must be thoroughly cleaned using shovels and vacuums if necessary, and tested by the Quality Control team to document that the area is clean.

65 Once a yard or alley area is excavated to clean soil, the excavation team will move to an adjacent or nearby yard or alley to continue work, as directed by the supervisor, and repeat the process. This process will continue until all yards and alleys in the project area are remediated. The Quality Control team will keep detailed records of the work done and the XRF readings to provide documentation that all waste and contaminated soil was removed. Area residents can return once the contaminated soil is all excavated – their return does not have to wait for the clean soil crews to be finished.

Clean Soil Application, Paving and Finishing

66 After all waste and contaminated soil has been removed from a yard or alley, the area will be lower than original ground level, typically by 15 cm or more, and may be uneven. The areas should be reasonably levelled with shovels and rakes or a small front-end loader if possible.

67 Clean soil will be brought from the stockpile area to the yard or alley using trucks, loaders wheelbarrows or carts whatever is most practical. The loaders, wheelbarrows or carts must not be the same ones used for transport of contaminated soil, to avoid recontaminating the area, unless equipment has been washed and tested by the Quality Control team to determine that it is clean. Clean soil will be spread across the yard or alley and levelled by the clean soil

crews using rakes, hoes and shovels. Then it will be compacted using a manually pulled roller compactor. The finished yard or alley should be smooth, reasonably level, and covered by at least 10 cm of clean soil.

68 In areas shown on the map in Appendix E, pavers will be installed on top of the clean soil to create finished paved paths or alleys. Professionals with experience in building paved walkways will be used for this work to assure durability of the paved paths. Materials used in paving must be contamination-free as determined by the Quality Control team.

69 Then, the Quality Control team will conduct a final survey of the finished yards or alleys, taking test readings to document that the area is now clean. Records of this testing will be kept by coordinates and shown on an area map.

Cemetery Area Remediation

70 The public cemetery is adjacent to the waste disposal site. The total area of the cemetery is 12,000 square meters (m^2) or 1.2 hectares. The concentration of pollutants, in particular lead, is reasonably high in this area; however, the risk of exposure to the public is relatively low, because for the most part, people only walk through this area, typically staying on the path. Nevertheless, this area needs to be cleaned because people frequently traverse the site, occasionally spending time at family graves, and come into contact with contaminated dust or soil. Additionally, this area floods and if not covered, existing contaminated soil or waste on the ground surface could be washed to nearby yards and roadways after they have been cleaned.

Preparation for Work

71 As in the preparation for the yard and dumpsite work, the following steps should be taken in preparation for the remediation of the cemetery:

- Workers will be trained in work methods as well as health, safety, security and general work practices as outlined in Appendix A.

- A secure storage room will be established to stockpile supplies and tools safely
- Measures will be established for worker protection, personal protective equipment (PPE), uniforms, clothes-changing requirements, washing, eating and provision of water supply
- Security perimeters will be installed around the cemetery, and guards employed
- Equipment and tools will be mobilized to a central area from which they can be accessed by work crews. See below for equipment that may be required.
- Clean soil will be brought to a stockpile. The location of the stockpile should be near the work site, but preferably in a clean or paved area, or on a tarpaulin separating clean soil from underlying contamination
- Concrete pavers will also be brought to a stockpile area for use in paving the paths once remediation work is done.

72 A plan for the order of the work in the cemetery will be developed by the contractor (taking into account the current drainage issues in the area, and working with a community representative to confirm which trees and plantings will be preserved). Generally, work should start at one side of the cemetery and proceed in an orderly manner to the other side.

Clearing Vegetation, Clean Soil Application, Paving, and Finishing

73 In order to clean the public cemetery, the project will not excavate the area, but only repair its environmental conditions. This will be done by clearing the surrounding vegetation, particularly the bushes and other wild plants on the site (not the ornamental plantings and trees on the gravesites). The cleaning process will employ manual labor and may use heavy equipment. A front-end loader could be used to clear and level the ground away from graves and to bring in the clean soil from a stockpile area, while manual labor likely will be needed at the graves. Wheelbarrows will be used to transport vegetation out of the areas and bring clean soil in as necessary, and shovels, picks, hoes and rakes will be used to spread the soil as appropriate.

74 In remediating the cemetery, nonessential vegetation (as approved by a community representative) will be removed, using axes, scythes, hoes, saws or small front-end loaders (e.g. Bobcats) as determined by the contractor. These materials will be cut off at the ground level (not below ground). Then, cut vegetation (trees, bushes, weeds) will be placed in trucks and removed for disposal as non-hazardous vegetative waste. Proper, legal disposal methods shall be followed. Dust control measures detailed on pages 48-50 will be enacted.

75 After all vegetation (that is not required to be maintained) has been removed, the graves will be covered with clean soil. In order to maintain each gravesite and its markers, care will be taken to work one grave at a time, or one team per grave site. The recommendation is to photograph each grave, remove each stone carefully chalking a number on the bottom of each in order to reconstruct any small walls outlining the grave, and noting the position of the marker stone (front and back). Extra care must be taken not to damage or break the stones in the removal process. It is best to place a thin piece of wood against each stone during digging to prevent nicks from tools, to work from the back of the marker stone, and to dig by hand with small tools around the base of the stone, until it is freed. Once the grave marker and any related grave outlining stones are numbered, removed, and safely stored, the grave will be covered with 30 cm of clean soil in general, although variations in the cemetery level may result in more or less cover to resolve flooding or puddling issues. A minimum of 15 cm of soil will be applied. It is important that the clean soil applied around ornamental trees and plants not be higher than 15 cm. Pure Earth's experience has shown that piling soil higher than 15 cm will kill the trees and plants soon after the remediation process.

76 The soil that is added to the gravesite should be clean soil that does not contain heavy metals and should be a suitable soil for grave cover and able to grow the ornamental plants in the area. Based on 30 cm of cover and a total area of 12000 m^2, the total volume of clean soil required is estimated to be approximately 3600 m^3.

77 The wheelbarrows or carts used to bring in clean soil must not be the same ones used for transport of contaminated soil, to avoid recontaminating the area, unless equipment has been washed and tested by the Quality Control team to determine that it is clean. Clean soil will be spread across the graves and levelled by the clean soil crews using rakes, hoes and shovels. Then the graves will be reconstructed according to the chalked numbers and photographs of the original grave.

78 The existing public path through the cemetery will be paved with pavers installed on top of the clean soil to prevent exposure from underlying contamination and protect the applied clean soil from erosion by pedestrians, motorcycles or bicycles that pass through the area. Prior to laying paving stones on the path, geotextile sheets will be applied below the area to be paved. Paving will be done in a manner similar to the paving of alleys discussed above. The pathway will provide access to and through the cemetery and will have a width of approximately 1 m. The estimated length of the paved pathway is 400 m, including the pathway through the cemetery and the pathway along the northern edge of the cemetery. Professionals with experience in building paved walkways will be used for this work to assure durability of the paving and suitable drainage design to prevent puddling. Materials used in paving must be contamination-free as determined by the Quality Control team.

79 Then, the Quality Control team will conduct a final survey of the cemetery, taking test readings to document that the area is now clean. Records of this testing will be kept by coordinates and shown on an area map.

Transport of waste and contaminated soil to trans-shipment pad

80 The transport equipment – trucks - that are used to carry the hazardous waste in this project must have approval from the MOEF and permission from the Ministry of Transportation, consistent with PP no.101/2014. The areas that are contaminated by hazardous waste in Pesarean are scattered across several locations, principally the waste disposal site, yards and

alleys, the schoolyard and the cemetery. The total volume of waste that needs to be excavated is estimated to be about 20,000 m^3 or 26,000 tons. Additionally, all trash and waste generated by the project must be collected and disposed of properly, especially for contaminated material. The waste should be sent to the transfer pad for collection and disposal. The contractor will make arrangements for proper disposal of contaminated waste (such as bags) that cannot be sent to the manufacturer of the paver. Several methods may be used to transport contaminated material from the various contaminated areas to the temporary collection site, called the transfer pad. These alternative methods are as follows:

1. Waste Dump Site

   A total area of 13,000 m^2 with a total volume of 18,000 m3 will be excavated at the dump site. The excavation will be undertaken gradually by the excavator machine, which can enter the site via Pesarean village. Road access for the excavator is noted in Appendix D. The excavated soil will be deposited onto trucks with a capacity of 5 m^3. The trucks used to transport the contaminated soil must be covered and have a licence to carry hazardous waste.

   The route for the trucks from the dumpsite to the transfer pad is noted in Attachment D. The trucks will transport the contaminated soil to a transfer site equipped with a concrete pad for temporary waste collection. Subsequently, the contaminated soil will be transferred to larger trucks with a capacity of 20 tons and transported to the final location, where the waste will be utilized for production of pavers, bricks or other concrete items.

2. Yards and Alleys

   The location of the contaminated yards and alleys to be excavated is shown in Appendix C. The total volume to be excavated and transported is estimated to be about 2,000 m^3. The process will involve manual loading of trucks using wheelbarrows, shovels, or small front-end loaders, at locations as near as possible to the area to be excavated. Excavated

soil will be transported by the indicated road, which typically will be about 4 m wide, to the transfer pad, using trucks with a capacity of 5 m^3. Subsequently, the contaminated soil will be transferred to larger trucks with a capacity of 20 tons and transported to the final disposal location, where the waste will be utilized for production of pavers, bricks or other concrete items.

3. School Yards

The transport method from the contaminated schoolyards is similar to the disposal site. The front-end loader will excavate the schoolyards. The area to be excavated is 660 m^2 with a depth of 15 cm, while the total volume is approximately 99 m^3 of soil. Once excavated, the contaminated soil will be directly transported by trucks with a capacity of 5 m^3 to the transfer pad. Subsequently, the contaminated soil will be transferred to larger trucks with a capacity of 20 tons and transported to the final location, where the waste will be utilized for production of pavers, bricks or other concrete items.

Transfer Pad Operations

81 The transfer pad area is used for moving excavated materials delivered by small, 5 m^3 trucks (transporting from work sites to the transfer pad) to large, 20 m^3 trucks which will be used to take the materials from the transfer pad to the paver manufacturer (final disposal site). This is necessary because of narrow roads or paths and limited access from contaminated areas to the transfer pad area, which makes use of hand carts and small trucks necessary, combined with the need to transport the material in larger trucks to the disposal site in order to minimize the number of trucks on the road and to reduce transport costs.

1. Operation and security

The transfer pad will be kept orderly and secure at all times. The area will be fenced with temporary fencing, if not already fenced or walled. There must be a clear entrance and exit for trucks, with a separate entrance for personnel for safety. Efficient routes for trucks

through the pad must be established, preferably with trucks entering at one point, dumping or picking up material, and exiting by another point. The actual route will be determined by the contractor depending on the pad site and layout.

Material that is received from Pesarean will be dumped into piles on the transfer pad, and when there is sufficient volume, a large front-end loader will pick up the material and dump it into large trucks for shipment to the final disposal site. Piles of materials to be transferred must be kept orderly, and well away from the perimeter of the transfer pad. To prevent the possibility of runoff, the contaminated soil should be covered with plastic sheets to minimize the amount of water reaching the waste piles.

To the extent possible, the timing and amounts of material received from Pesarean will be coordinated with the timing and amounts shipped to the final disposal site, such that there is little accumulation, piles are kept as small as possible at the end of each workday, and all material is shipped out within 3 days of being received at the transfer pad. Dust control must be done and covers applied to all inactive piles at the end of each day as described in Appendix A. Health and safety procedures as described in Appendix A must also be followed, notably regarding the use of respiratory protection. A guard should be assigned for security, to assure that unauthorized persons do not enter the site.

2. Receipt and shipment documentation

The documentation of materials at the transfer pad is divided into two activities, the incoming and the outgoing. Excavated materials coming into the transfer pad must be organized, with each load documented regarding the date, time, and volume of excavated material received and location from which it was taken. Additionally, any regulations by the government regarding hazardous waste hauling requirements and documentation will be followed.

Materials leaving the transfer pad must also be documented to record date, time, and how much volume has been moved to the final disposal site. This is critically important for financial documentation purposes. Additionally, any regulations by the government regarding hazardous waste hauling documentation and requirements will be followed.

The transfer pad requires a transfer pad coordinator who is responsible for recording all the materials that enter and exit the area, and then reconciling these receipts and deliveries on a daily basis. Records of these volumes and the reconciliation must be kept along with all other documentation required by the government.

3. Inspection and testing of spill control tank

   Rainfall could cause contaminated materials to runoff the site and contaminate surrounding areas. To prevent this, the transfer pad will have curbs and gutters to direct any runoff to a collection "spill control" tank, as shown in Appendix F. The purpose of the tank is to capture runoff and any soil or waste particles washed into the drainage system. This tank must be inspected at least weekly in dry weather, and after every significant rain event. The contractor shall clear task a transfer pad supervisor with this responsibility. Records of each inspection must be kept. The inspection must record the level of the water in the tank and note any need for pumping out, as well as noting the presence of or significant accumulations of soil or waste.

   When the tank is nearly full, and rain events have ended, the water in the tank must be tested for metals. Parameters for testing include lead, copper, and zinc in addition to the pH condition. If the concentrations of pollutants exceed the MOEF quality standards threshold, then treatment is required by adding precipitating agents or adsorbent materials to bind and precipitate heavy metals in the settling tank. When acceptable water quality is reached, the water will be pumped out to the nearest available drainage channel.

Sediments in the spill collection tank must be treated as contaminated waste, removed, and combined with other materials for shipment to the ultimate disposer. This will be done as often a necessary to keep the spill collection tank operational as determined by the contractor, and will be done at the end of the project as well.

Equipment, Tool, Material, and Labor Requirements

82 Based on experience with other similar projects, the amounts of equipment, tools, materials and labor anticipated to conduct the remediation work at the central waste dump area, yards and alleys, and the cemetery area are shown in Appendix G. This is based on a tentative project schedule (from start of work) as shown on the Gantt chart in Appendix I. Appendix G also includes equipment, tools materials and labor needed for the house cleaning work and the transfer pad operation. However, Appendix G does not include estimates for the transfer pad construction (covered separately), project management, assessment and community outreach and education. Also, Appendix G does not include transport of waste from the transfer pad to the final disposal site, which is anticipated to be the responsibility of the final disposal contractor (who has a hazardous waste transport license) and so will be in that cost proposal.

83 Note that actual quantities of equipment, labor, tools and materials needed may vary depending on conditions found once excavation is underway. Also, the efficiency of organization and labor and the ability to use mechanical equipment rather than manual labor can significantly impact the quantity estimates. The contractor should develop her/his own estimate of requirements after review of the project area and the requirement in the Tender documents.

84 Below are special notes regarding equipment, materials and supplies to be used, not covered in the information in Appendix G:

1) The excavator should be large enough for efficient operation, with a long reach to minimize small back and forth adjustments and facilitate loading of trucks directly by the excavator. A 6 m3 bucket would be desirable, but a minimum of 4 m3 is recommended.

2) Similarly, the front-end loaders to be used in the waste dump area and at the transfer pad should be large enough to allow efficient loading of materials, while also considering the space and road access limitations in the village.

3) The excavator, front-end loader and Bobcats (small loaders) must be staffed by high quality operators. The contractor must demonstrate a process of confirming skill and experience for operators to prevent damage to village structures reduce accident risk.

4) Provision must be made for fuelling the vehicles, preferably by bringing fuel to the excavator and front-end loader so they do not need to leave the waste dump area during the work. Costs for fuel should be included in the per diem cost for the equipment operation.

5) Clean soil should be obtained from a site as near as possible to keep transport costs low. This soil must be tested and approved by the Quality Control team, with records kept, prior to use to assure that it is not contaminated and is suitable for use in locations regularly used by children. Notes on potential clean soil locations are included on page 21-22.

6) The pavers to be used for paths and alleys should be of good quality, and similar to what is currently used for this purpose in Pesarean. Paving with hexagonal concrete pavers is anticipated.

7) Purchase of good quality tools is strongly recommended, as the use is strenuous. This applies to shovels, picks, rakes, hoes, buckets, and especially wheelbarrows and the

HEPA vacuums. Pure Earth's experience at other project sites has shown that poor-quality items break or simply are not usable in the conditions of this type of work.

8) Toilet and shower facilities must be arranged for all workers for use during and at the end of each day. The number and location depends on the arrangements made. Use of existing facilities is desirable as opposed to constructing temporary facilities. Existing facilities use might be arranged with owners of government buildings, schools, private homes, etc. At a minimum, facilities will near the waste dump area and at the transfer pad, and in other locations for the yard and alley remediation workers.

Health and Safety

85 This project must be managed in a way that protects the health and safety of both workers on the project and community. Protection of workers is a critical consideration for the project design and execution, as is protection of the community during the work, and after the clean up in order to prevent recontamination. Worker hygiene, safety, dust control, eating arrangements, laundry, and security requirements among other health and safety considerations are addressed in detail in Appendix A.

Community Engagement, Outreach, and Education

86 The goal of remediation is to restore and improve the quality of the environment to be cleaner, healthier, and safer by reducing exposure pathways of people in the village (particularly children) to toxics. The work cannot be done without cooperation, engagement, and support of the local community. Therefore, the community must be involved in the planning, implementation, monitoring, evaluation and follow-up to the project.

87 Building community engagement in this remediation project will be done in several ways:

1) Involvement in Decision-making.

It will be made clear to the residents of the village that this project will be done for the benefit of the community, with their approval, and to their standards. It is important that the community leadership is involved in key meetings regarding the project and that they communicate their support of the work to the community.

Pure Earth has involved a community representative, Bapak H. Imam Masykur in addition to The Village Head, Chairman of the Cooperative at PIK Kebasen, and Head of the local Environmental Agency in the stakeholder meetings for this project. Additionally, community members have been involved in two Focus Group Discussions to describe the project, discuss alternatives for remediation, and receive comments and feedback from residents. The contractor(s) responsible for project management and for community outreach and education must continue to involve key decision-makers in communications regarding the project in order to maintain the positive relationship and momentum of the remediation project in Pesarean.

2) Involvement in Education and Trainings

Several community members will be chosen to be Trainers, both for worker training and for behaviour change trainings for residents. These key educational champions should be representative of the groups to be trained, i.e. a worker, a youth, a woman, and a respected community educator - from a school, health office, or religious institution. These community trainers will be trained first by the contractor responsible for training and then they will assist and lead different portions of the community and worker education sessions. A key benefit of this process will be that the detailed training knowledge will remain in the community for future trainings, translation/cultural sensitivity will be ensured, and the effectiveness of the training can be tested before being presented to the community as a whole.

3) Involvement in clean up and remediation work

There will be a lot of labor needs in the project - digging, hauling soil in carts and wheelbarrows, guarding equipment and stockpiles, levelling and backfilling, paving, cleaning, etc. The contractor should hire local people whenever possible to fill roles that they are qualified to perform. While this decision will be made by the contractor, it is important to note that the creation of local jobs will ease the community acceptance of the project and hiring locally reduces costs in most cases because there is no need for additional transport or lodging.

Advisory Committee

88 In order to have consistent and coordinated communication between the project manager and the community, it is recommended that the following people be invited to join an Advisory Committee for the Remediation of Pesarean:

- Representative from BLH of Tegal Regency
- Representative from Health Department of Tegal Regency
- Head of Adiwerna Sub-district
- Public Health Center (Puskesmas) of Adiwerna
- Head of Pesarean Village
- Community Representative (H. Imam Masykur has already been involved in this role)
- Schools Representative
- Smelters Representative

89 The responsibilities of this Advisory Committee will be to:

- Guide, nurture, direct and assist the project manager so that the remediation efforts can be implemented smoothly, safely and effectively
- Act as liaison and ambassador between residents and the remediation project

management, ensuring trainings, communications, and activities are presented in a culturally appropriate and respectful way

- Help the contractors gain required permissions from local landowners or local government
- Support conflict prevention and resolution as needed
- Participate in local training sessions either directly in training or attending the session to show support and validation of the messages
- Support the activities of remediation and support the enforcement of temporary rules needed for the project (road closures, access restrictions, etc.)

90 The contractor responsible for community education and outreach will establish the Advisory Committee prior to the start of remediation activities and will appoint a committee chair to call regular meetings (at least monthly) to ensure the community remains involved in the project. The committee roles and schedule for meetings will be agreed upon at the first meeting.

91 In order to both share information, gather feedback, and gain trust and cooperation from the community, it is important that key project information be shared with the community in many forums and with ample time for questions and responses from residents. The project manager, contractor responsible for community outreach, and members of the Advisory Committee should present at regular village meetings - religious meetings, women's groups, cooperative meetings, savings circles, etc. Additionally, meetings should be held at the local schools (with teachers and with students). Visual aids will be important tools in these meetings - printouts of maps, pictures, and photos of the work being done in similar projects. Relevant maps and detailed lists of project areas to be remediated, truck routes, and other important project sites should be posted in visible, highly trafficked public areas. Finally, and key to the project, there will be a series of public education trainings - on keeping safe from contamination, on house-cleaning, and on the project as a whole and the expectations of community members.

Community Education Topics

92 It is important to note that the Community Education will be addressed to all elements of society from children to the elderly who live in the project area including school students around Pesarean. Key topics to be addressed in the Community Education Workshops are:

1) Background and purpose of the clean up and remediation project
2) Specific locations that will be involved in the project - sites to be cleaned, sites to be paved storage areas, transfer pad, etc.
3) Clean up and remediation methods that will be executed in various areas
4) Routes for transport of waste and contaminated soil
5) Expectations of the community before, during and after the clean up and remediation;
6) Available job opportunities in the remediation work and how to apply
7) Safety during remediation activities (Including information from Appendix A)
8) Members of the Advisory Committee and their roles
9) Sources of hazardous waste in Pesarean
10) Migration and Exposure routes of hazardous waste from the source to humans
11) Efforts to prevent hazardous waste exposure to family members and people.
12) Specific house-cleaning protocols

93 These topics should be compiled into easily understandable materials. For example, for children, a story book or comic could be developed or stickers could be printed. In school particularly, these topics could be incorporated into the curriculum so that each the schools teach the material again annually and extra-curricular activities could be developed to sample water or soil or to visit a paver facility and learn about hazardous waste and recycling. Before developing any materials, the contractor should refer to the notes from the Focus Group Discussions held in 2016 for specific notes on community preferences regarding educational presentations.

94 Signs should note all restricted access areas and the restrictions must be enforced by security guards. Key restrictions to communicate to the public include perimeters of contaminated areas being remediated; storage areas for the use of select managers only, stockpiles of clean pavers and soil that must be kept uncontaminated; clean versus contaminated equipment areas; showers, lavatories and changing areas for workers; and any other restricted access points. These areas will be clearly marked by lines, placards, hazard tape and/or signs; or enclosed by physical barriers, such as fences or ropes. All personnel will wear the level of protection required by the Worker Safety Training (covered in Appendix A and in the Worker Training prior to beginning work). Some restricted access will be short-term - a few hours or 1 day, for example an alley may be closed for excavation for one day or a road may be closed for 1 hour as a large convoy of trucks travels to the transfer pad. Signs or barricades will be set up and residents will be informed that they cannot access the area until the signs are removed and the team has completed the work. If feasible, separate entrances and exits will be established to separate personnel and equipment moving into and out of the restricted areas and to prevent any recontamination of clean areas. Proposing firms must provide an outline of the security and signage protocols proposed for the remediation areas in general.

95 This project is expected to run smoothly and safely for both workers and the community. The hope is that there will be minimal problems and no accidents. But if such events happen, it is necessary to handle the issue properly. Therefore, clear communication channels will be established to submit complaints to the project manager through the Advisory Committee.

Transfer Pad Construction

96 A transfer pad is needed to allow transfer of waste and contaminated soil, brought out of Pesarean in 5 m^3 trucks, into larger, 20 m^3 trucks for efficient long distance transport to the ultimate disposal location. The location of the transfer pad has not been determined, but there

are a number of promising possibilities along the major road just outside of Pesarean. It is expected that the transfer pad location will be leased for the duration of the project, and that that construction of a suitable concrete pad will then proceed. After the project and thorough cleaning of the pad, the site would be returned to the owner, who could use the pad for other purposes.

Government Approvals

97 The construction of the transfer location, which is equipped with a concrete pad, should be situated near Pesarean village. The constructed pad should be sufficient to bear the weight of heavy trucks and equipment, and would include curbs, drainage control and storm runoff collection, in addition to settling tanks to prevent the release of contamination due to storm runoff. The location and design structure of the concrete pad must obtain approval from the MOEF, as well as support from the Government of Tegal District. This concrete pad will allow transfer of hazardous waste and contaminated soil from small trucks to larger trucks. It is expected that waste and soil will NOT be stored on site but will move in and out efficiently, such that it is not held for more than three days.

Concrete Pad Requirements

98 A concrete pad approximately 1200 m^2 (30 x 40 m) will be needed for this operation, at a location near to Pesarean. Other dimensions of a similar size may be suitable and actual dimensions will depend on the site chosen, but the 30 x 40 m size is used herein for design purposes. One potential location – the football field at the edge of Pesarean is now considered unsuitable due to the narrow roads which connect the football field to the main road (too small and with difficult turns for a 20-ton truck to navigate) and because of community opposition. Based on the results of field observations, along the main road in Adiwerna, there are a number of potential sites available. These sites are currently not in use, are of adequate size, offer easy access and are in industrial areas. It is expected that a short term lease of one of the sites will

be possible, with the owner acquiring, in addition to whatever rental fee is negotiated, an improved site with a firm concrete base for future operations.

99 The concrete pad must be designed such that it is able to receive trucks weighing 20 tons or more. The concrete K-350 that can hold the compressive strength of 31,2 MPa can be used with a concentre thickness of 20 cm. The suggested design of the concrete can be seen in Appendix F, based on 30 x 40 m dimensions.

Water Management and Spill Control

100 The area around the concrete pad should be fitted with curbs, drainage control and storm runoff collection as shown in Appendix F. The drainage system should be available around the concrete pad and flow into the settling tank. The settling tank or area must have a low point where a pump can be placed to remove accumulated water. It is crucial to conduct periodic inspections to check the collected water in the settling tank and test and if necessary treat collected water before discharge – see the section on operation of the transfer pad.

Cleaning and Decommissioning

101 After all the contaminated soil is transported to the final location, it will be necessary to clean up the concrete pad, so it can be utilized by local residents. Moreover, as the concrete pad is a strong structure that can hold loads of more than 20 tons, it can be used by local industries for a variety of purposes, such as a truck yard or a workshop. The cleaning process shall be completed by washing the surface of the concrete pad thoroughly with water. Wash water will be collected in the settling tank, allowed to settle and then treated as necessary to meet MOEF quality standards before discharge, such as by adding an adsorbent to absorb heavy metals or a precipitating agent to precipitate heavy metals suspended in the waste water. If this concrete pad will not be used in the future, after the cleaning process, it may be demolished and the condition of the surrounding environment restored as agreed with the lessor

Records, Health and Safety

102 Records must be kept of the design of the transfer pad and given to the lessor at the end of the pad use. Health and safety procedures must be followed during construction, as described in Appendix A.

Shipment and Use of Waste and Soil in Concrete Products

Transportation Requirements

103 A recommendation from the MOEF should be obtained regarding the modes of transportation for the waste and contaminated soil from the transfer pad to the final disposal site. Transportation licenses must also be obtained from the Ministry of Transportation. Trucks with a capacity of 5 m^3 will be used to transport the waste from the various sources in Pesarean to the transfer pad, while larger trucks, which weigh 20 tons or more, will be utilized to transport the waste from the concrete pad to the final disposal site. The entire transportation system should be managed through a proper manifest system, in order to be track the quantity of waste transferred to the manufacturer and to ensure that all the waste from the various sources is transported to the transfer pad and then to the manufacturer (cradle to grave control). Transportation planning must be be done because of the enormous amount of waste to be transported, which will reach approximately 26,000 tons. For example, if the capacity of the larger truck is 20 tons, an estimated 1,300 trucks will carry the waste from the transfer pad along highways to the final disposal site during the project. Plans must be made for the exact route for trucks to follow from the transfer pad to the disposal site, where breaks for the truck drivers may be taken, and procedures and contingency protocols for breakdowns or spills.

104 The act of contaminated soil excavation and transportation by a number of trucks to the final location will obviously effect both the environment in Pesarean village and its surroundings, principally because of dust. Contamination will be prevented at excavation sites, along transportation routes, and during transport through daily watering, washing, covering, and spill

checking/clean-up as detailed below:

1) Watering: Hoses and portable sprayers will be provided to support watering activities.
    - Excavation sites, such as yards, the waste dump site and others, will require watering to reduce the dust, as the area is excavated.
    - Moreover, in order to reduce dust along the route that the trucks will take out of Pesarean, the roads used should be watered every day prior to beginning of the waste transportation activities.
2) Washing:
    - parts of vehicles such as tires and buckets that come in contact with lead contamination must be washed down with water inside the project area (for vehicles transporting material to the transfer pad) or at the transfer pad (for vehicles transporting waste to the final disposal site.) before leaving
3) Covering:
    - to minimise dust from the trucks during the transportation process, the trucks will use covers, in accordance with regulation PP 101/2014, Article 47
    - Moreover, arrangements will be made to temporarily close roads that the waste transportation trucks will drive along, with the aim of reducing road users to any dust.
    - In order to control the dust from wheelbarrows, carts and front-end loaders, equipment will be covered, particularly if the material is being moved over some distance. These measures are included in Appendix A.

4) Spill Checking/Clean-Up:

- In view of the amount of waste to be transported and the number of trucks involved, there is a reasonable possibility of waste spills occurring during transportation activities.
- To minimise the impact of spills, at the end of transportation activities each day, spill checks will be conducted along the entire truck routes from Pesarean to the transfer pad.
- Any spills should be cleaned as soon as possible in accordance with a standard operating procedures
- Similarly, in case of spills or other problems taking place during the transportation of the waste to the final disposal location, an emergency response system and standard procedure are required to prevent wider contamination.
- If an incident occurs, it should be clear in the procedures who takes responsibility, who should be called in the first instance, and what action should be implemented immediately.
- Any problems that arise during the transportation process should be recorded as a part of the monitoring process; moreover, the problem solving in this case is the responsibility of the transporter.

Manufacturer Requirements

105 The basic disposal plan for waste and contaminated soil from this project is to have it solidified into bricks, concrete pavers or other concrete objects. Because of the large amount of material to solidify, estimated at 26,000 tons in total, and the limited time frame to complete the work, the brick or paver manufacturer to receive the material must have significant capacity. In this project, all the waste is desired to be transported within a period of less than four months, and

definitely no longer than six months. Capacity to meet this schedule is a key factor in the selection of the company to receive the materials. In addition, the company that will process the hazardous waste must also have a temporary storage area with a storage capacity suitable to store volumes of the waste that they are not able to immediately process.

106 The company selected must meet the regulatory requirements of Kepdal no.1/1995 and PP 101/2014; wherein each temporary storage area for this project must have a permit to receive and provide temporary storage for hazardous waste, and also follow MOEF requirements to prevent contamination to the environment and accidents. Several of these requirements include: constructing the temporary storage area as a Category 1 Facility able to receive hazardous waste; have equipped infrastructure to contain any spilled waste, including wastewater treatment, adequate ventilation, a drainage system separate from the sewerage, safety showers and eye wash, an alarm system, and a fire fighting system.

Finished Product Requirements

107 Hazardous waste utilization as a raw material in the manufacture of pavers, concrete blocks or bricks is an approved disposal method listed in PP 101 in 2014. Before the waste is used for these products, a radioactivity test is required on the waste, in accordance with article 54 of PP 101/2014. Each product made of waste should have a certificate and should be tested in relation to its quality. Furthermore, products made of waste should pass the TCLP test, in keeping with the standards attached in Annex IV of PP 101/2014. In addition, the pavers concrete blocks or bricks made from the waste must pass a compression test. Based on the head of BAPEDAL's decree no 3/1995, the compression test for hazardous waste product stabilization/solidification is 10 tons/m^2. However, the compressive strength required for the products actually depends on the use of the paver, concrete blocks or bricks.

108 After the waste is processed into new products, then this solidification / stabilization product can be employed as building materials in construction projects. However, one factor that must

be considered is the ultimate use of the products. While safe for general use if they pass a TCLP test and meet other regulatory requirements, as an extra precaution the products manufactured should not be used in residential locations. This is due to the possibility of damage or erosion over time, creating a minor risk of future exposure to dust or particles. The pavers, bricks or concrete blocks made from this hazardous waste should preferably be used in industrial, commercial, utility, large roadways and others non-residential areas.

Health, Safety, and Environmental Precautions (for Manufacturing Facility)

109 The manufacturing facility receiving the hazardous receiving the waste and contaminated soil must have good measures in place to protect their workers from health and safety risks and to protect the environment. These measures include worker education about the hazards of the materials; safe working areas with clear working areas and protection against falls; use of appropriate personal protection equipment such as gloves, boots, uniforms and googles, and use of respiratory protection for dust. There should be infrastructure to prevent and control dust and air pollution emissions, to capture and contain spills, and to prevent discharge of contaminated process water or storm water. Any residual waste created by or remaining from the manufacturing process must be properly disposed. There should also be emergency response procedures, equipment, supplies and training.

House Cleaning

110 After completion of yard and alley remediation work, all houses in the project area shall be thoroughly cleaned. The purpose of this cleaning is to remove contamination from inside houses. Testing and evaluation has shown that when wastes and contaminated soils are present in the yards, streets and alleys outside of houses, there is generally significant migration of this contamination into houses as a result of dust brought in on clothing, shoes, feet, etc. This indoor contamination presents significant risks to occupants, especially children, because

of the significant time spent indoors.

Permissions, Education, Participation

111 The consent of homeowners must be obtained prior to any work inside the homes. A specific person – usually a community outreach officer - should be designated to obtain consents and keep track of exactly for which homes consents have been obtained. A suitable consent form should be developed. The community outreach officer must visit each house, explain the purpose of the cleaning and why it is important, explain the process to be used, and obtain an adult homeowner signature showing consent for the work. Homeowners should be encouraged to participate in the work. These signed consent forms will be kept in the project records.

Labor and Equipment Requirements

112 In Pure Earth's experience, a team of 3 cleaners can typically clean 3 houses per day using the protocol described below. Based on 720 houses in the project area and a house-cleaning schedule of 8 weeks (40 days), this would result in a need for 6 cleaning crews with 3 persons each. A supervisor or two should be assigned to coordinate the cleaning crew work and assure good quality.

113 Equipment needs, assuming six cleaning crews, are:

- 6 HEPA vacuums of sturdy design (as they will be heavily used)
- 18 HEPA filters – 3 for each HEPA vacuum, to be changed as needed
- 6 sets of cleaning tools, usually 3 buckets, 3 sponges, and 3 brushes
- Various rags for each team
- Uniforms, gloves and boots for each member of cleaning crews, as discussed in the Health and Safety Appendix A. Respirators are not required for this work.

Additionally, a location to access clean water supplies and to dispose of dirty wash water must be arranged.

Cleaning Protocol

114 Houses are to be cleaned using a six-phased approach:

1) Removal of Bulk Dust and Soils: Accessible dusts and soils will be cleared from common areas, rooms and storage locations by an initial sweeping and vacuuming.
2) Remove Furniture and Personal Items from each room.
3) Clean Individual Rooms using the specific three step protocols detailed below.
4) Clean Hallways and Common Areas following the same three-step process.
5) Clean furniture and personal items: Hard furniture, upholstered furniture, cushions, pillows and fabrics, blankets, and curtains will be washed following the procedures detailed below.
6) Return cleaned furniture and personal items into the house.

115 General rules that apply to all procedures:

1. Always clean from top to bottom, and from one side of the room to the other.
2. Always remove all visible dirt and dust.
3. All dry vacuuming should be done with a HEPA filter vacuum if possible. (HEPA: High Efficiency Particulate Air filter). HEPA filters can remove fine dust particulates with 99.97% efficiency.
4. New mop heads, rags, sponges, and gloves should be used at each house.
5. Use ample water during washing.
6. Do a final HEPA vacuuming and wiping with rags after all surfaces have dried.

Note that this cleaning also applies to store or shop fronts when part of houses. However, cleaning of metal shops or other workshops is not included.

SPECIFIC PROCEDURES:

A. Cleaning of Rooms and Common Areas:

1. Vacuuming: After all personal items have been removed from a room, vacuum the entire room with a high quality vacuum, preferably a HEPA vacuum. Begin at the top and work down (start with the ceiling, then move down the walls). Pay extra attention to windowsills and corners. Start at the end farthest from the main doorway and move towards the door. Vacuum slowly so the vacuum can pick up all lead dust.

2. Wet Wash and Rinse Walls and Ceilings: After vacuuming, the entire room is wet-washed with detergent and water using a three-bucket system. One bucket contains clean water and detergent, the second bucket contains clean rinse water, and the third starts empty. Apply the detergent wash water to the surface with a rag, sponge or, preferably, a garden sprayer, using water from the first bucket. Scrub surfaces with a brush. Start with the ceiling, and then move down the walls. Pay extra attention to windowsills and corners. Wring the dirty water from mops, rags, and brushes into the empty third bucket. Rinse the brushes, rags, sponges and mops in the second bucket. Apply additional wash water to brushes and cleaning surface from the first bucket.

   When washing is done, empty the buckets and refill the first and second buckets with clean water. Rinse the ceiling and walls with clean water from the first bucket containing clean water, using clean rags or a garden sprayer. Wring the brushes, mops and rags in the third bucket and rinse the brushes and rags in the second water bucket.

3. Wet Wash and Rinse Floors: After everything else in the room has been cleaned, wash the floors. Start at the end away from the main doorway and move towards the door. Use a three-bucket system, where one bucket contains clean water and detergent, a second contains cleans rinse water, and the third is empty. Dip a brush in the detergent

wash in the first bucket. Scrub a small section of the floor. Dip a mop in bucket and mop the same area that was scrubbed. Wring out the mop in an empty bucket and rinse the mop and brush in the second bucket. Repeat this process across the entire floor. A wet-dry vacuum may be used to remove all water on the floor following the mopping, or the area may be wiped with rags. Be sure to brush and mop in several directions in all areas, rather than brushing and mopping in the same direction all the time.

After the entire floor surface has been scrubbed and cleaned with detergent, a final rinse with clean water will be done. A bucket with clean water will be used with a new mop to rinse the floor. Wring the mop into an empty bucket after mopping each section, and rinse the mop in the clean bucket and wring again into the empty bucket before moving on to the next section. Dry the floor with clean rags or, if available, a wet-dry vacuum, following closely behind the mopping. Particular attention should be given to remove rinse water from cracks, holes and other irregular surfaces. The rags should show no dirt.

B. Cleaning procedures for furniture and other personal items:

1. Hard Furniture: All hard furniture (wood, plastic, glass, metal, etc.) should be vacuumed then washed similarly to walls.

2. Soft Furniture: Vacuum all soft surface furniture (couches, chairs, etc.) in one direction (horizontally) and then the opposite (vertically) at 5 seconds for a one-foot pass. Use a high quality vacuum, preferable a HEPA vacuum. Cushions should be cleaned on both sides (i.e., all outside edges). Pillows should be cleaned in the same manner as furniture. Mattresses and springs should be dry vacuumed on all outer surfaces.

3. Fabrics: Removable covers on cushions or pillows should be taken off and washed similarly to clothing. Curtains and any quilts or blankets that normally lay on the furniture

should also be washed similarly to clothing. Use ample water during washing and rinse the washed fabrics at least twice with clean water.

4. Appliances: Appliances such as TVs, refrigerators, stoves, lamps, etc. should be moved in order to vacuum and wet clean underneath. Appliances should be vacuumed and wet washed if possible on all sides and underneath similarly to walls. All appliances should be unplugged prior to any cleaning!

C. Disposal of cleaning supplies:

Dirty wash water will be collected and disposed of in a selected site. Used mop heads and rags shall be taken to a designated disposal site with the rest of the household waste from this project.

Project Management, Oversight, and Assessment

116 Throughout the project implementation, good oversight is required and appropriate assessment is necessary to assure that the desired benefits are achieved, to minimize risk and incidents during the project, and to assure compliance with the national and/or international standards. This section is made based on Pure Earth/Blacksmith Institute experience in conducting similar projects and in compliance with DANIDA/ESP3's rules and norms. There are several institutional arrangements required in order to implement the multi-step, multi-stakeholder project.

Institutional Arrangements Required By Activity

STEERING COMMITTEE

- Ministry of Environment and Forestry to oversee all planning, implementation, evaluation and monitoring as well as assist in issuance of necessary permits.
- DANIDA/ESP3 to oversee all work according to approved cost and timeline as well as provide funding and contracting for contractors.

BEFORE REMEDIATION

- Support in identifying and then negotiating a lease for a transfer pad location near the village but on an accessible road, away from residential areas must be provided by the Agency of Tegal Regency in coordination with the Environmental Agency of Tegal Agency and the Authority of Pesarean Village.
- Confirmation/Permitting required by MOEF for use of the transfer pad for temporary hazardous waste storage (contractor hired will already have such permit)
- Road access to/from hazardous waste and contaminated soil to transfer pad must be prepared by the Agency of Tegal Regency in coordination with the Environmental Agency of Tegal Agency and the Authority of Pesarean Village.

BEFORE AND DURING REMEDIATION

- Tender 3: Community outreach and education conducted by consultant in coordination with the Environmental Agency and the Health Agency of Tegal Regency.

REMEDIATION

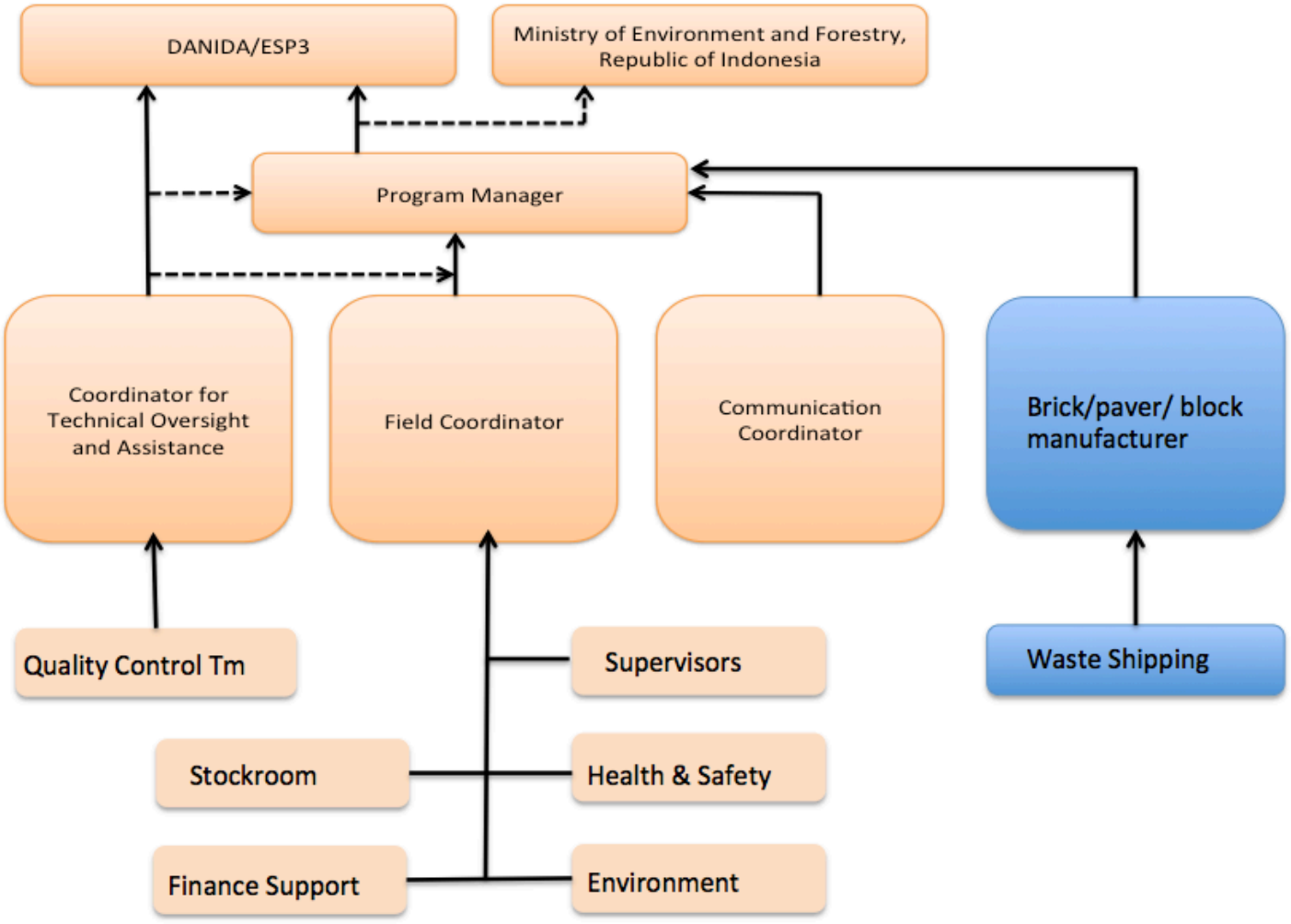
- Tender 5: Technical oversight and assistance will be carried out by independent consultant in coordination with MOEF and DANIDA.
- During the remediation, MOEF shall schedule frequent field verification that remediation is carried out as per approved plan in accordance with the Indonesian regulations.
- Tender 1: Worker training by consultant in coordination with the Agency of Man Power of Tegal Regency.
- Tender 1: Waste and contaminated soil removal by consultant with permit from MOEF.
- Tender 1: Transport to transfer pad by consultant with permit from MOEF.
- Tender 1: Operations for transfer pad by consultant with permit from MOEF.
- Tender 1: House cleaning coordinated by consultant in collaboration with the Environmental Health of Tegal Regency and the Authority of Pesarean Village.
- Tender 2: Construction of transfer pad and related runoff-control measures done by consultant with permit from MOEF.
- Tender 3: Transport of waste and contaminated soil to a paver or brick manufacturer done by consultant with permit from MOEF.
- Tender 3: Solidification of the waste and soil into bricks/blocks/pavers done by manufacturer(s) with permit from MOEF.
- As waste and contaminated soil are removed, the area will be backfilled with clean soil and in certain areas, covered by garden as provided by the Government of Central Java.

UPON COMPLETION OF REMEDIATION

- Based on results from field verification, MOEF will issue a Statement of Remediation Completion (Surat Keterangan Penyelesaian Pemulihan Latan Terkontaminasi/SKPLT).
- The Government of Tegal Regency has committed to fix roads as needed, due to heavy traffic of waste transport, upon project completion.

117 A suggested project management structure is outlined in Figure 7.

Figure 7. Suggested Project Management Structure



Details on Project Management Structure

118 A steering committee should be established including:

1. The Ministry of Environment and Forestry and DANIDA/ESP3.

- Law No. 32/2009 clearly states that environmental remediation related to unknown or unaccountable sources falls under the responsibility of the Central Government, which in this case is the Ministry of Environment and Forestry, as per Ministerial Decree No. 33/2009 that provides guideline for remediation of hazardous waste contaminated land. Thus, throughout the project implementation, the ministry is expected to provide clear guidance to the project team in project planning, implementation, evaluation and monitoring as well as overseeing the whole process to ensure that the project is executed in accordance with the Indonesian regulations, including the manufacture of concrete products and their end use (final disposal).
- As the donor, DANIDA/ESP3 should provide oversight to the Project Manager to assure that the project is implemented within the guidelines required by DANIDA/ESP3, especially regarding costs and time schedules.

2. The Project Manager is the person in charge of all activities included in the remediation work, i.e. worker training, waste and contaminated soil removal, construction of the concrete pad and related run-off control measures, shipment of waste and contaminated soil into bricks/blocks/pavers, house cleaning, and community outreach and education.

- The Project Manager reports to DANIDA/ESP3 and coordinates with MOEF
- The Project Manager will be assisted by a supporting team that oversees administration and financial records.
- The Project Manager is responsible for obtaining necessary approvals from MOEF and DANIDA/ESP3.
- The Project Manager must approve all work plans related to the project before they are implemented.

3. The Field Coordinator is responsible for implementing physical work, including worker training, waste and contaminated soil removal, construction of the transfer pad and related run-off control measures, operation of the transfer pad, and house cleaning.
    - The Field Coordinator reports to the Project Manager.
    - The Field Coordinator, in addition to the technical team, may be assisted by a supporting staff who handles administrative and financial records.
4. The Communication coordinator is responsible for implementing community outreach and education.
    - The Coordinator reports to the Project Manager.
    - The Communication Coordinator would ensure, with support from the technical team, that effective community outreach, education and communication is implemented. He/she may be assisted by a supporting staff who do education and outreach, such as the door to door outreach during house cleaning, and who also may handle administrative and record keeping functions.
5. Coordinator for Technical Oversight and Assistance that reports to DANIDA/ESP3 and provides consultation to the Project Manager and Field Coordinator.
    - Main responsibilities are assuring the quality and technical compliance of the works through monitoring. This Coordinator would assure, through the Quality Control team, that the clean-up target approved by MOEF (300 mg/kg for lead) is met in all project areas, and that all hazardous waste is removed. He/she would also oversee mapping, remediation record-keeping and remediation project evaluation. Also, in collaboration with the local health authorities and in accordance with the ethical codes, he/she would coordinate and oversee blood lead level testing to evaluate project effectiveness.
    - The coordinator reports to DANIDA/ESP3 through bi-weekly progress reports with copies to the Project Manager. Report shall accommodate appropriate recommendations shall deficiencies found in the field.

- This coordinator, in addition to the technical team, would be supported by the Quality Control team, and may also be assisted by a supporting staff that handles mapping, record-keeping as well as administrative and financial records.

6. The ultimate receiver of the waste and contaminated soil is the manufacturer of bricks, pavers or blocks.
   - The company is responsible for shipment of waste and contaminated soil from the transfer pad to the bricks/blocks/pavers manufacturer, for storage of the materials at their facility, and for disposal of the material by solidification into bricks, pavers, blocks or other concrete items. The company must take full responsibility and ownership of the material upon loading into trucks at the transfer pad.
   - The company reports to the project manager, who assures coordination of their waste transport and disposal work with the project work in Pesarean and at the transfer pad.

119 Throughout the project implementation, it is critical to maintain community participation as well as communication with the regulators. Thus, the Project Manager must ensure that the communication team works closely with the community Advisory committee to obtain their support and involvement. In parallel, a regular and incidental consultation meeting with MOEF shall be planned to make sure that all steps in the remediation project are implemented in accordance with the Indonesian regulations.

Work Oversight and Support

120 Close and continuous supervision of contaminated material removal, transport, application of clean soil, paving and finishing work is absolutely necessary during the work. The Field Coordinator shall hire and train and adequate number of qualified supervisors for the work. Close supervision is the only means to assure removal of all contaminated material from the areas to be remediated while not removing materials that are not contaminated, keeping work crews moving briskly, and planning the on-the-ground work sequence and coordination.

Supervision is also necessary to monitor in real-time depth of removal of contaminated material, which is critically important to contain costs.

121 A Health and Safety Officer must be employed during the project to continuously monitor the work and the workers to assure that all health and safety requirements are met. This officer should report to either the Field Coordinator or Project Manager. The officer should have the authority to stop work or order corrective actions if necessary due to observation of unsafe conditions or non-compliance with health and safety requirements.

122 There should be clear responsibility for environmental protection measures, such as keeping dusty areas moist, assuring trucks are covered, inspecting roads for spills, etc. This person might be the same as the Health and Safety officer, or may involve a separate Environmental Officer.

123 In addition to the above persons, there would likely be a need for the following support staff:

- a stockroom manager to manage tools and supplies, to assure good accounting and secure storage of these, and to obtain additional tools and supplies when needed
- a record keeper to track worker time sheets, assure that all workers are trained, track material usage such as clean soil and pavers, track use of heavy equipment, etc.
- financial support staff
- a laundry and food supply coordinator

Quality Control Team

124 Quality Control (QC) Teams will be required to monitor excavation and soil removal work, using an XRF instrument to measure metal contamination levels. As discussed in the work description section, this work is essential to assure that all contaminated materials have been excavated or removed, but also to assure that excess, clean material is not removed (to contain costs). The QC Teams must work closely with the excavation teams both at the waste dump area and the various yards and alleys, with coordination by supervisors. At least 2 QC

Teams are required, and perhaps 3 to keep work moving, with each team consisting of 2-3 people: one person as the XRF operator, one person to note GPS coordinates, and 1 person to recording the results of XRF readings and coordinates obtained from the GPS. The teams usually follow the yard excavation crews, making measurements when a layer (typically 5 to 10 cm) is excavated to determine if the target clean-up level (300 mg/kg for lead) has been reached at the depth excavated. At the waste dump area, the QC team works closely with the excavator operator, making XRF measurements when the suspected contamination depth is reached at any specific sub-area.

125 QC Teams must keep records and maps of the final metal levels achieved after removal of all contaminated materials. This is done by subdividing the project area into specific small maps, such as one map for each yard or alley, and recording the bottom-of-excavation measurements on these maps. QC Teams must know the contaminated areas well to identify locations that need special attention such as a flood areas and small yard areas with high contamination.

126 The QC Teams have the experience and authority in the field to make decisions about the adequacy of excavation work done or the need for further excavation in an area. This must be done in real time, to keep the work moving; a key advantage of the XRF instrument is that it gives immediate results about metal levels in soil.

127 The QC teams are responsible for compiling a report which contains the mapping of the areas measured and metal levels found at the bottom of excavation done. The maps of completed work – where all contaminated materials are removed – must be kept as a record of the work.

Project Effectiveness Assessment

128 Following completion of all work, an assessment of the project must be done. The purpose of the assessment is to determine if the project was successful in achieving its objectives:

reducing risks related to contamination, in a sustainable manner and a manner acceptable to the community and in compliance with regulations. Two types of assessment should be done:

1. Post Work Community Assessment

The community outreach and communication coordinator should conduct a survey of Pesarean residents. Items to cover in the survey would include the residents' satisfaction with the work, effectiveness of communications during the work, problems or complaints, willingness to maintain and protect the clean status of the community, their level of awareness of the hazards of the metal contamination, and other relevant matters. Suggestions for improvements in the project and further work needed should be solicited. A sufficient number of people should be surveyed to make the results representative of the community.

In a similar manner, other stakeholders, notably the government of Tegal Regency and the MOEF should be interviewed about their views on the project, with similar questions.

The results of this survey and interview work should be complied into an assessment report, including learning and recommendations for improvement at future similar projects.

2. Blood Lead Level Testing

Blood lead levels should be tested at or near the beginning of the project, and again about 6 months after the end of the project. Blood lead level reduction is the most valid measure to determine if the project was successful in reducing metal exposures in Pesarean and thus achieving the health risk reduction objective of the project. It is preferable to measure the lead levels in children for two reasons: first children are the most sensitive to lead contamination and therefore are the critical receptors – i.e. the part of the population where reductions are most important and desired; and second because lead purges out of the body most quickly in children, so a test 6 months after completion of work is most likely to reliably detect whether blood lead level reductions are in fact happening.

It is preferred that the same children be tested at the beginning and after completion of the work, to assure comparability. In any case, the number of children (or adults, if child testing is decided against) must be great enough to assure statistical validity of the results. The children tested generally should be young, such as ages 3 to 7, and should represent diverse areas within the project area.

Design of the blood lead testing assessment program must be done by competent people with experience in this area, including both medical and statistical competency. Ethical guidelines for testing of human subjects must be followed. Generally, it is best if the testing is done under the supervision and authority of local health officials, as opposed to outsiders. Trained medical personnel, such as nurses or doctors, usually are involved in the actual testing work. Clear planning for communication of results must be developed, including what to do if very high blood lead levels are found.

Reporting and Recordkeeping

129 Reporting and records are critical not only for project evaluation and monitoring purpose, but it will also be a valuable reference for replication of the similar work in other locations. All reports shall be provided in both English and Bahasa Indonesia. Suggested reports and key records to request of contracted firms include:

- Minutes of Meetings
    - Every meeting shall be well documented with minutes that contain:
        - Day/date,
        - Venue,
        - Agenda,
        - List of participants – names and institutions,
        - Result of meetings,
        - Photos (if available)

- Sampling Records

  Records and maps of XRF readings before and after the work, as discussed in the Quality Control team section above. Also, records of sampling done on the clean soil.
- Excavation and Waste or Contaminated Soil Removal Records

  Records must be kept of the amount of waste and contaminated soil removed and shipped. There should be reconciliation between the records of amounts removed from the project area to the transfer pad, and the amount shipped to the final disposal site.
- Maps of areas excavated must be kept
- Worker Records

  Reports on the number and types of workers per day. These reports are backed up by time sheets and training logs. Also records must be kept of worker blood lead sampling results from before and after work, as described in Appendix A. Record must also be kept of any injuries or incidents during the work.
- Progress Reports -
    - Interim Reports
    - Weekly progress reports
    - Monthly progress report
    - Mid-term report
    - Final Report
- At a minimum the progress reports shall contain:
    - Project summary to date,
    - Project resources used,
    - Project components – implementation and results,
    - Work plan for the remaining term, and
    - Necessary appendices.

- Reports will be submitted to DANIDA/ESP3 by the Project Manager with assistance from the Field and Communication Coordinators as well as the Coordinator for Technical Oversight and assistance.
- Time of submission following timeline given by DANIDA/ESP3

This Preliminary Engineering Designs Report was submitted to DANIDA and stakeholders to complete Outputs 2,4,5, and 6 of Pure Earth's contract and complements the Feasibility Study (Output 1) that was previously submitted. Responses of stakeholders have been taken into consideration in this final version of the report which is submitted to DANIDA/ESP3 on May 27, 2016. Further comments or questions should be addressed by email to John Keith (johnkeith726@gmail.com) with copy to Lara Crampe (lara@blacksmithinstitute.org).