USAID ENERGY POLICY PROGRAM

ENVIRONMENTAL MITIGATION AND MONITORING PLAN

REPAIR AND REHABILITATION WORK AT TARBELA HYDROELECTRIC POWER STATION

November 2011

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1. Introduction

The Government of United States of America (USG) through United States Agency for International Development (USAID) is funding the repair and rehabilitation of three thermal power plants–Guddu, Muzaffargarh, and Jamshoro (GENCO I, II & III) and one hydropower plant (Tarbela). For the implementation of the projects, USAID has tasked Advanced Engineering Associates International (AEAI) to carry out monitoring and support for the implementation of the projects, part of which is to ensure that all repair and rehabilitation works are environmentally compliant in accordance with the applicable USG and Government of Pakistan policies and regulations.

AEAI acquired the services of Hagler Bailly Pakistan (HBP) to develop Environmental Mitigation and Monitoring Plans (EMMPs) for the four projects. This document presents the EMMP of Tarbela Hydroelectric Power Station (THPS).

1.1 Terms of Reference

The terms of reference of the assignment are included as **Appendix A**. Briefly it includes review of the existing initial environmental examination (IEE) of the proposed activities and other relevant documents, visit to the plant site, development of the EMMP, drafting of terms for contract, and addressing the comments of USAID mission officers on the draft EMMP. The assignment focused on the scope of activities under the USAID funded repair and rehabilitation program.

1.2 Legislative and Regulatory Framework;

The United States laws require that all activities financed by USAID shall comply with the requirement of the US law 22 CFR 216. The IEE for the proposed activities (see **Appendix B**) were prepared by USAID in compliance with this requirement. The environmental mitigation and monitoring plan is a key tool to implement the recommendations of the IEE.

The Pakistan Environmental Protection Act 1997 requires that initial environmental examination or environmental impact assessment shall be carried out for every 'project'. The types of project for which the requirement is applicable are listed in *Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment (EIA) Procedures 2000*. The definition of the project under the law includes both construction of a new project and modification to the existing project. There is no definition in the law on the level of modification which defines the threshold after which the IEE or EIA requirement is applicable on a modification project. However, the practice that is followed is that if the modification results in substantial change in the emission, effluent, waste generation, production, or use of natural resources, the IEE or the EIA, as appropriate shall be carried out. Based on this no IEE or EIA shall be required for the proposed activities under the national law since the proposed activities are designed to restore, to the extent possible, the power plant to its original conditions in terms of production.

1.3 Diary of Activities

The following is the brief description of the work plan followed for the assignment:

Document review: At the start of the assignment, HBP requested the concerned organizations for all relevant documents. The available documents were reviewed by the HBP team. From the review, potential environmental, social, and occupational safety issues at each plant were identified.

Site visit: A visit to the THPS was undertaken in July 2011. The activities undertaken during this visit included:

- Meeting with the plant management, in particular with the following staff who helped to provide valuable information:
  - Mr Ahmad Waheed, Chief Engineer (Power)
  - Mr Bashir, Resident Engineer THPS
  - Mr Javed Akhtar, RE Mechanical
  - Mr Asif Shah, Deputy Resident Engineer
- Walk through the plant to inspect all the equipments and sites where rehabilitation work will be carried out
- General review of the existing site conditions and OHS practices
- Review of the detailed plans for the proposed repair and rehabilitation activities

Waste Management Plan: The existing practices of environmentally sound waste management and safe disposal of old equipments and spares is a particular focus of the study. During the site visit and subsequently, an inventory of the waste generated during the rehabilitation and repair activities was generated.

Preparation of EMMP: Following the visit, HBP team prepared the EMMP as presented in this report.

1.4 Study Team

The study team includes the following:

1. Hidayat Hasan, Environmental Specialist and team leader
2. Farrukh Ahmad, Environmental Scientist
3. Syed Hassan Ahmed, Environmental Engineer
4. Manzar Qureshi, Technical Advisor

2. Description of Proposed Activity

The Tarbela Dam is a large dam on the Indus River in Pakistan that rises 485 ft (148 m) above the river bed. It is located in Haripur District within the Hazara Division of the Khyber Pakhtunkhwa Province (KPK) about 120 km (by road) northwest of Islamabad. The reservoir size of some 95 sq. mi (250 km^2) makes it the largest earth-filled dam in the world. The dam was completed in 1974 and was designed to store water from the Indus River for irrigation and flood control, and for the generation of hydroelectric power.

The Tarbela Hydroelectric Power Station (THPS) has a nominal capacity of 3,478 MW and is operated by the Pakistan Water and Power Development Authority (WAPDA). It has 14 generating units installed on three power/irrigation tunnels. The power plant has been operating up to 3,700 MW in high head during the high flow months of summer. However the plant sometime fails to operate at its maximum capacity due to following factors: (a) damaged lower insulation class (Class B) generator windings of units 1, 3, and 4; (b) unavailability of essential spare parts to carry out preventive maintenance; and (c) lack of training of plant staff to establish operations and maintenance (O&M) as per prudent utility.

Under an agreement, the Fixed Amount Reimbursement Agreement (FARA), between the USG and the Government of Pakistan, USAID will be financing the planned repair and maintenance of USD 16.5 million at THPS. This repair and maintenance will be completed in 18-24 months from the time the equipment is ordered. In addition USAID also anticipates supporting staff training for improved operations. The proposed program will produce additional energy of 192 GWh per annum and an additional peaking capacity of 80 MW in summer months when there is an acute shortage of power.

The activities that have been identified for USAID funding under the THPS rehabilitation project mainly includes replacement of damaged or worn-out parts and equipment. In most cases, the replaced parts and equipment will be identical or similar, in terms of specifications, to those that are currently installed. In few cases, new equipment will be installed. A detailed description of proposed activities is presented in **Exhibit 2.1**.

Exhibit 2.1: Proposed Activities of the THPS Rehabilitation Project

Item No.	*List*	*Description*	*Activity*	*Type of Service/work*
1	Replacement of damaged generator stator windings (class F) in unit 1,3 and 4	Replacing of damaged stator windings at generators of unit 1, 3 and 4	Replacement of damaged stator windings of the generator. The rotor will be lifted by crane and stator old parts including wiring etc. will be replaced and new copper buds will be installed by welding and fabrication	Replacement
2	Combine in Item # 1			
3	Combine in Item # 1			
4	Up-grading of SCADA system	Upgrading the entire SCADA system at Unit 1-14	Replacement of the old SCADA system along with hardware and sofwarr with upgraded SCADA system	Replacement
5	Spares seats and guides for relief and bypass valves on turbines side	Replacement of worn out seals for relief valves at unit 1-10	The damaged spare seats and guides in turbine will be dismantlled and new will be installed	Replacement
6	Replacement of electromechanical governors by digitals ones	Replacement of the obsolete electromechanical governors by quick response time digital governors at unit 1-10	The electromechanical spares will be replaced by the digital spares parts. The pumps and other equipment will not be replaced	Replacement
7	Replacement of worn out station drainage and dewatering pumps	The drainage and dewatering pumps which collects water from all equipment and turbines has been damaged and will be replaced	The activity will involve dismantling of old pumps and installation of new pumps	Replacement
8	Training	Engineer(s) of the Tarbela HPS will be sent broad for training	The engineer(s) will be selected and will be sent for training	Training

3. Waste Management Plan

The existing practices of environmentally sound waste management and safe disposal of old equipments and spares were a particular focus of the study.

3.1 Inventory of Waste

As part of the EMMP, an inventory of the waste generated during the rehabilitation and repair activities has been generated. This is presented in **Exhibit 3.1**. In the table, the nature and estimated quantity of waste generated from each proposed activity is presented. The estimated quantity is based on observations at the site and provided only to indicate the relative magnitude of the generated waste. The actual quantity of waste generated from each activity is may be significantly different.

3.2 Handling and Storage of Waste

Exhibit 3.2 shows the aggregated inventory of various types of waste that is likely to be generated during the rehabilitation project. The category, source and quantity of the waste are identified. The hazard or issues associated with each category during disposal and handling is discussed and the recommended procedures for handling and storage are provided.

3.3 Re-use and Recycling of Waste

As most of the waste generated during the rehabilitation activity consists of worn-out equipment and material, there is very little re-use opportunity. Some re-use opportunities may exist in electronic equipment and components and in packaging material.

It is recommended (see **Section 4**) that a comprehensive waste management plan shall be instituted at THPS during which re-use opportunities for waste generated from the plant during routine operation and maintenance shall be actively investigated.

As a standard practiced all metal (mainly iron and copper) parts generated as waste during the rehabilitation project will be recycled. Similarly, wood will also be recycled. Part of the recycling may be done internally, within THPS or other companies owned by Pakistan Electric Power Company.

3.4 Disposal of Waste

This section discusses the ultimate disposal of various wastes that will be generated during the rehabilitation project. The preferred disposal options are presented in **Exhibit 3.3**.

Exhibit 3.1: Estimated Generated Waste from Each Activity

Item #	*List*	*Activity*	*Estimated Generated Waste**								
			Solid							*Liquid*	*Gases*
			Iron (kg)	*Copper (kg)*	*Other Metals (kg)*	*Oil (l)*	*Plastic (kg)*	*Wood, Cloth and Packaging (kg)*	*Electonics (kg)*	*Oil (l)*	*Air Emissions*
1	Replacement of damaged generator stator windings (class F) in unit 1, 3, and 4	Replacement of damaged stator windings of the generator. The rotor will be lifted by crane and stator old parts including wring etc. will be replaced and new copper buds will be installed by welding and fabrication	1,000	30,300	2	10	100	200		5	E
2	Combine in Item # 1										
3	Combine in Item # 1										
4	Up-grading of SCADA system	Replacement of the old SCADA system with upgraded one	100	100	2		500	500	100		E
5	Spares seats and guides for relief and bypass valves on turbines side	The damaged spare seats and guides in turbine will be dismantled and new will be installed	500					100			E

Item #	*List*	*Activity*	*Estimated Generated Waste**								
			Solid							*Liquid*	*Gases*
			Iron (kg)	*Copper (kg)*	*Other Metals (kg)*	*Oil (l)*	*Plastic (kg)*	*Wood, Cloth and Packaging (kg)*	*Electonics (kg)*	*Oil (l)*	*Air Emissions*
6	Replacement of electromechanical governors by digitals ones	The electromechanical spares will be replaced by the digital spares parts. The pumps and other equipment will not be replaced	100	100				100			E
7	Replacement of worn out station drainage and dewatering pumps	The activity will involve dismantling of old pumps and installation of new	5,300	500				500		5	
8	Training										
Overall			**7,000**	**31,000**	**4**	**10**	**600**	**1,400**	**100**	**10**	**E**

Exhibit 3.2: Handling and Storage of Waste

No.	*Waste Category*	*Sources and Forms*	*Estimated Quantity*	*Associated Hazard*	*Recommended Handling and Disposal*
1	Iron	▶ Tubes form from stator ▶ In bulk form from motors and pumps. ▶ Blades from relief and bypass valves. ▶ Cuttings from dismantling, erection and fabrication of replaced equipment etc.	7,000 kg	▶ Sharp edged metal from cuttings can cause cuts and bruises at any stage of handling or disposal ▶ All the waste generated from the power plant if left unattended or in the passage ways of the may pose threat to the safety of the staff and hamper the movement of the workers	▶ While handling sharp edged metals protective leather gloves shall be used ▶ After dismantling, all parts and machines shall be dispatched from site to storage yard as soon as possible, preferably on the same day ▶ In the store yard all waste shall be properly marked and segregated. A clear passage way marked by lines on the ground shall be left for walking of staff. No waste shall be stored within the passage way. ▶ Sharp edged metal shall not be left unattended at any time. It shall be moved to storage yard immediately after removal. In the storage yard, the storage area for such metal shall be cordoned off using clearly visible tapes.
2	Copper	▶ In wire form from stator windings, SCADA Systems	31,000 kg	▶ All the waste generated from the power plant if left unattended or in the passage ways of the may pose threat to the safety of the staff and hamper the movement of the workers	▶ While handling sharp edged metals protective leather gloves shall be used ▶ All parts and machines after dismantling shall be dispatched from site to store yard as soon as possible, preferably on the same day ▶ In the store yard all waste shall be properly marked and segregated. A clear passage way marked by lines on the ground shall be left for walking of staff. No waste shall be stored within the passage way. ▶ Sharp edged metal shall not be left unattended at any time. It shall be moved to storage yard immediately after removal. In the storage yard, the storage area for such metal shall be cordoned off using clearly visible tapes.

No.	*Waste Category*	*Sources and Forms*	*Estimated Quantity*	*Associated Hazard*	*Recommended Handling and Disposal*
3	Other Metals	▶ In minute amount from the SCAD systems and Pumps	4 kg	▶ As the nature of such waste is not clearly established it is possible that the waste may contain heavy metal. Unless otherwise established through tests or known composition of waste, all such waste material shall be treated as hazardous and treated accordingly	▶ The waste shall be segregated from other waste and shall be clearly marked with a proper hazard sign. ▶ Before final disposal, any potentially hazardous substance such as lead or material containing lead shall be identified and disposed off accordingly.
4	Oils	▶ As waste oil from stator ▶ Accidental release of additive oils and paints	10 L	▶ Spills and leaks will contaminate the soil and potentially water resources ▶ Oil on floor poses tripping hazard to the workers	▶ To the extent possible any oil or grease in the equipment to be replaced shall be removed before dismantling of the equipment ▶ All effort shall be made to avoid spilling the oil on the floor ▶ Any spillage shall be removed immediately. For this purpose, spill control kits shall be made available near the work areas. ▶ Waste oil shall be stored in leak proof containers ▶ Oil shall be stored in designated and clearly marked areas. The oil storage area shall be lined with impervious flooring ▶ The area shall be away from direct heat and fire source ▶ The oil storage area shall have dykes constructed around it to control accidental leakages and spills

No.	*Waste Category*	*Sources and Forms*	*Estimated Quantity*	*Associated Hazard*	*Recommended Handling and Disposal*
5	Plastic	▶ In bulk quantity as boards, controller devices and equipment from SCADA systems ▶ As insulator tubes from motors and pumps wire winding etc ▶ From packaging material	600 kg	▶ Nuisance and littering ▶ Open air burning may affect in local air quality	▶ All type of plastic shall be collected and stored in separate bins marked for this purpose ▶ Plastic waste shall not be burned in open air or disposed of by dumping in the areas surrounding the plant site
6	Wood, Clothing and Packaging Material	▶ Wood and packaging material from the packaging of procured equipment for the activity ▶ Clothing as gloves and cleaning cloth	1,400 kg	▶ Wood may contain nails that may injure the staff ▶ Nuisance and littering ▶ Open air burning may affect in local air quality ▶ Oil stained gloves and cleaning clothes may cause contamination of water if they are dumped in water bodies.	▶ Nails shall be removed from the wood ▶ All type of waste shall be collected and stored in separate bins marked for this purpose ▶ Waste shall not be burned in open air or disposed of by dumping in the areas surrounding the plant site
7	Electronic and Circuit boards	▶ In bulk quantity from the SCADA system	100 kg	▶ Some of devices and equipment may contain toxic material. These can be a health hazard if opened in the plant	▶ The equipment shall be opened only under a qualified person. Any potentially hazardous material such as mercury shall be identified prior to dismantling and appropriate safety measures shall be taken.
10	Air Emission	▶ The air emissions will be released due to welding and cutting and grinding	E	▶ Can affect the respiratory systems	▶ Standard protective equipment including eye protective glass, gloves and mask shall be used

Exhibit 3.3: Disposal of Waste

No.	*Waste Category*	*Ultimate Disposal*	*Estimated Quantity*	*Associated Hazard or Issues*	*Recommended Procedure*
1	Iron	▶ Recycling	7,000 kg	▶ Some parts may be contaminated with oil. The parts on melting in furnace may give out fumes that are hazardous or may constitute a nuisance	▶ Separate oil contaminated parts from the rest ▶ Include in the contract agreement with waste disposal contractor condition that the oil contaminated parts will be cleaned before being fed into furnace. Alternatively, the cleaning may be undertaken at THPS.
2	Copper	▶ Recycling	31,000 kg	▶ Copper wires are covered with insulation, which if burned in low temperature can release hazardous materials	▶ Separate wires and other copper waste with insulation material from the rest ▶ Include in the contract agreement with waste disposal contractor condition that such waste will either be incinerated in high temperature incinerators or alternatively, the insulation will be removed mechanically.
3	Other Metals	▶ Recycling	4 kg	▶ Some of the waste may be hazardous which can ultimately affect the human health if not appropriately handled	▶ Before final disposal, any potentially hazardous substance such as lead or material containing lead shall be identified. ▶ The risk associated with the wastes. If any shall be identified, and accepted disposal methods for such waste shall be followed.
4	Oils	▶ Recycling through waste contractors	10 L	▶ Contamination of soil and water bodies	▶ Only recycling contractors with certification from the concerned agencies shall be used for disposal
5	Plastic	▶ Recycling	600 kg	▶ Nuisance and littering ▶ Open air burning may affect in local air quality	▶ Include in the contract agreement with waste disposal contractor condition that any unwanted plastic waste will be disposed at municipal landfill site

No.	*Waste Category*	*Ultimate Disposal*	*Estimated Quantity*	*Associated Hazard or Issues*	*Recommended Procedure*
6	Wood, cotton waste and packaging material	▶ Waste contractor ▶ Municipal landfill	14,00 kg	▶ Open burning and associated nuisance ▶ Improper disposal resulting in littering	▶ Include in the contract agreement with waste disposal contractor condition that such waste will either be disposed at pre-identified municipal landfill site.
7	Electronic equipment and circuit boards	▶ Waste contractor	100 kg	▶ Some of devices and equipment may contain toxic material. These can be a health hazard if improperly handled	▶ Include in the contract agreement with waste disposal contractor condition that the equipment will be opened only by a qualified person.

4. Environmental and Social Concerns, Mitigation and Minnitoring Measures

4.1 Environmental and Social Aspects

The repair and rehabilitation activities can be broadly divided into the procurement, storage, installation and repair, and waste disposal stages. The environmental aspects of these stages are:

1. The equipment will be transported in large flat-bed trucks (trailers). As the material will be transported using existing national highways and roads which already are used for the heavy traffic. The number and frequency of the vehicles due to the rehabilitation works will not affect the existing number and frequency of traffic. Therefore transportation is not expected to produce major issues and no specific mitigation measures are proposed.
2. Occupational health and safety are the main issues during onsite storage and handling of equipment and during repair, rehabilitation, and installation work– whether carried out by THPS staff or by contractors. The issues are discussed in **Exhibit 4.1** where the mitigation measures associated with the issues are identified.
3. Waste disposal issues have been identified in **Section 3**.

4.2 Monitoring

The above mentioned environmental aspects have been assessed and mitigation measures for potential adverse impacts identified during this study. In order to ensure that the proposed mitigation measures are implemented, the monitoring requirements including indicators and specific requirements are listed in **Exhibit 4.1**. The overall responsibility of EMMP's monitoring rests with plant Management. This monitoring arrangement can be carried out either by using the existing staff with requisite expertise or a dedicated HSE officer may be hired in case of time and/or capacity constraints.

4.3 Training Requirements

Trainings will be required in the following areas for implementation of the EMMP:

1. *Occupational Health and Safety:* All concerned staff shall be provided training in use of PPE. Training may also be required in confined space identification and entry procedure. External sources may be needed for providing of these training. At later stage this training can be provided internally.
2. *HSE Audit:* Relevant THPS staff will require training in HSE audit and inspection. External sources may be needed for providing of these training.
3. *Waste Management and Handling:* The relevant staff will require training in waste management and handling. This training can be provided internally.

An indicative environmental training program is provided in **Exhibit 4.2**, which will be finalized before the commencement of the project.

4.4 Occupational Safety Measures

Lack of appropriate occupation health and safety measures practice is a key area of concern identified. Recommendations have been provided in the **Section 3** and **4** of this report. It is recommended that an appropriate HSE management system shall be developed at the THPS. It should include:

- HSE Policy
- Occupational health and safety management measures
- Use of personal protection equipment
- Trainings requirement and management
- Documented procedures
- Monitoring and audit, and
- Reporting.

Although the development of such a system is beyond the scope of the present project, some standard procedures relevant to the present project are provided in **Appendix C** for reference.

4.5 Staffing

For the environmental performance during the project execution, the primary responsibilities will be assumed by the highest ranking officer of the plant. He will be assisted by the Head of maintenance on all environment and safety-related matters. On behalf of the contractors, the main responsibility for all matters pertaining to environment will be that of the Head of the company or the Chief Engineer.

The plant management will appoint or designate a dedicated HSE Officer, who will be responsible for ensuring compliance with the EMMP and waste management during the project activities. He will also be responsible for the training of the project related personnel in all aspects of the EMMP.

The total staff associated with the implementation of EMMP may be between three to five people including one HSE Officer, one or two HSE Inspectors and one or two sanitary workers. The number of inspectors and sanitary workers may vary depending on workload of the project related acuities undertaken at a time.

4.6 Responsibilities

The following are the key responsibilities of THPS, management and staff, in the context of this EMMP:

1. Ensure that the repair and rehabilitation work is carried out in accordance with this EMMP and the corresponding IEE

2. Ensure that all resources are made available to implement the provisions of the EMMP
3. Maintain appropriate records (checklist, receipts, inspection reports, audit reports, monitoring data) to demonstrate that the EMMP is implemented
4. Prepare a brief monitoring report and submit to the USAID once every three months. The report shall summarize the following:
    a. Activities carried out
    b. Waste generated and handled
    c. Inspections carried out
    d. Status of implementation
    e. Occupational safety and health and environmental issues that were raised and resolved
    f. Pending issue
    g. Occupational safety and health and environmental related incidents
5. In case of any accident involving occupational safety issue or environmental issue (accidental release of pollutant) report the incident to USAID within 48 hours of the incident.
6. In case of any change in implementation plans, reevaluate the occupational safety, health and relevant environmental issues and modify the EMMP accordingly. The EMMP shall be submitted to USAID for approval.
    a. A proposed format for the inspection and monitoring of the project activities has been presented in **Appendix D**.

4.7 Budgetary Estimates

The budgetary requirements for implementation of the EMMP cannot be fully monetized. Whereas, THPS has some internal systems, the actual budget would depend on whether the new systems are developed to cater for the project only or are implemented plant-wise. However an indicative budget has been developed and shown in **Exhibit4.3**. The total financial impact for the implementation of this EMMP is estimated to be PKR 1762,000. The major components of the budget include salaries for the HSE personnel, capacity building, and purchasing of HSE related equipments.

Exhibit 4.1: Environmental Management and Monitoring Plan

Activity	*Mitigation Measure(s)*	*Monitoring Indicator(s)*	*Monitoring*	*Party(ies) Responsible*
Transportation of equipment from Karachi to THPS	▶ Vehicles used for the transportation are NEQS compliant for the emissions and noise	▶ Results of the noise and emissions	▶ Vehicles used for the transportation shall be monitored for the emissions and noise.	Contractor
Onsite handling and storage of new equipment	▶ The new equipment shall be stored in properly demarcated and identified areas ▶ Separate storage of each item should be adopted and each area should be marked either on floor or cordoned off by tapes ▶ Lifting equipment (cranes) used for the equipment shall follow the prescribed safety specification. ▶ Material Safety Data Sheet (MSDS) for chemicals, if any, shall accompany the consignment. A copy of the MSDS shall be available near the storage area at all times.	▶ Availability of certification of lifting equipment ▶ Availability of MSDS	▶ A checklist-based monitoring shall be undertaken at the following stages: ▶ Inspection of designated storage areas prior to arrival of the supplies ▶ During unloading of equipment ▶ One a month, while the equipment is stored ▶ After final removal of all equipment and rehabilitation of the site, if required ▶ Incidental, in case of an accident or reporting of noncompliance	Resident Engineer (RE) of the concerned unit
Repair, rehabilitation and installation activities–General	▶ Appropriate PPE shall be provided to the workers and it shall be ensured that the PPE are used ▶ The staff shall be provided with training in use of PPE. ▶ Proper scaffolding platforms shall be provided for all work areas located more than 1 m above floor level. ▶ First Aid facilities and fire protection devices should be placed in areas where activates will be performed ▶ Ear protection devise shall be used if the noise level is above 85 dB(A)	▶ Installation of specified scaffolding ▶ Availability and use of PPE ▶ Availability of first aid facilities	▶ A checklist-based monitoring shall be undertaken at the following stages: ▶ Inspection of work areas prior to start of activities ▶ Once a week during repair, rehabilitation or installation work ▶ Incidental, in case of an accident or reporting of noncompliance ▶ Noise level monitoring once at the start and once at the peak of activities	Contractor, RE

Activity	*Mitigation Measure(s)*	*Monitoring Indicator(s)*	*Monitoring*	*Party(ies) Responsible*
Repair, rehabilitation and installation activities–Working in confined Spaces	▶ All confined spaces1 should be identified ▶ The temperature of the confined space should be in the human tolerance range ▶ Artificial and intrinsically safe lighting shall be provided in the confined spaces ▶ If there is a risk of gases or fumes in the confined space the provisions for ventilation shall be made	▶ Visual Inspection of the confined space prior to activity ▶ Temperature measurement before commencement of activities	▶ A checklist-based monitoring shall be undertaken prior to entry into confined space, covering: ▶ Inspection of entrance ▶ Measurement of temperature ▶ Risk of fumes or gases ▶ Availability of equipment	Contractor RE of each unit
Waste management	▶ Waste management plan is presented separately in Section 3.	▶ Quantity of waste generated, their classification and disposal mechanism ▶ Waste disposals contracts for inclusion of appropriate clauses	▶ Inventory of all waste shall be prepared. For each type of waste the quantity and disposal mechanism shall be identified ▶ Where necessary, audit of the waste contractor	Store Supervisor

[1] Confined space" means a space that:
(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and
(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
(3) Is not designed for continuous employee occupancy.

Exhibit 4.2: Proposed Training Program

Training Type	*Staff*	*Contents*	*Schedule*	*Duration*	*Responsibility*
Occupational Health and Safety	Plant Management and HSE Officer	Requirements of EMMP, PPE, Identification of confined spaces and entry procedures.	Before the start of the project	Full day; session	External sources
	Project Staff	General safety, Use of PPE, confined space, Health and Hygiene	Before the start of project and during the project	Two days; session	HSE Officer
HSE Audit	Personnel involved in audits and inspection related activities	HSE audit and inspection requirements and reporting	At the start of the project	Full day session	External sources
Waste Management and Handling	The relevant staff	Waste management and handling as per EMMP	At the start of the project	Full day session	External sources

Exhibit 4.3: Indicative Budget for Monitoring and Management Plan

Core Activity	*Budgeted Activity*	*Budget Rationale*	*Indicative Budget*
Transportation of equipment from Karachi to THPS	▶ Monitoring of vehicles for emissions and noise	▶ Monitoring of 15[2] vehicles at PKR 5,000 each	PKR 75,000
Onsite handling and storage of new equipment	▶ Storage of new equipment	▶ No additional cost	–
	▶ Implementation of safety specifications for lifting equipment (cranes)	▶ No additional cost	–
	▶ All types of materials shall be purchased along with respective Material Safety Data Sheet (MSDS)	▶ No additional cost	–
Repair, rehabilitation and installation activities– General	▶ Purchase of required PPEs'	▶ 30 Sets of PPEs' at PKR 15,000 for each	PKR 450,000
	▶ Proper scaffolding platforms for all work areas located more than 1 m above floor level.	▶ Should be included in the repair and maintenance contract	–
	▶ First Aid facilities and fire protection devices	▶ Cost of five first aid boxes at PKR 4,000	PKR 20,000
	▶ Monitoring of noise levels	▶ Purchase of noise meter	PKR 200,000
Staff Hiring	▶ Recruitment of one HSE Officer	▶ Salary of HSE Officer for 3 months at the cost of 60,000/month	PKR 180,000
	▶ Recruitment of HSE Inspectors	▶ Salary of an HSE Inspector is estimated at 30,000 per month. The project requires maximum of two HSE Inspectors for three months	PKR. 180,000
	▶ Recruitment of Sanitary Workers	▶ Salary of a sanitary worker is estimated at 10000/month. The project may require two sanitary workers at maximum for three months	PKR 60,000

[2] The number of vehicles has been estimated based on the size and quantity of the equipment to be transported for project activity.

Core Activity	*Budgeted Activity*	*Budget Rationale*	*Indicative Budget*
Repair, rehabilitation and installation activities– Working in confined Spaces	▶ Identification of confined spaces	▶ This cost is included in staffing of HSE officer	–
	▶ Managing temperature, lighting and risk of gases or fumes in confined spaces	▶ This cost is included in staffing of HSE officer	–
	▶ Monitoring and inspection	▶ Cost of HSE officer for inspection and monitoring at PKR 4,000 per day for three days	PKR 12,000
Waste management	▶ Onsite collection, segregation and storage of wastes	▶ Cost of waste bins	PKR 5,000
Trainings	▶ Occupational Health and Safety	▶ HSE Trainer fee for two days at PKR 40,000 per day; travel and boarding at PKR 60,000 per visit	PKR 140,000
	▶ HSE Audit	▶ HSE Trainer fee for one day at PKR 40,000 per day; travel and boarding at PKR 40,000 per visit	PKR 80,000
	▶ Waste Management and Handling	▶ HSE Trainer fee for one day at PKR 40,000 per day; travel and boarding at PKR 40,000 per visit	PKR 80,000
HSE Audit	▶ Conducting and reporting of HSE audit	▶ HSE Auditor fee for four days for two audits at PKR 40,000 per day; travel and boarding at PKR 60,000 per visit	PKR 280,000

Appendix A: Terms of Reference

Term of Reference: Technical Assistance for the Development of Environmental Mitigation and Monitoring Plans (EMMPs) for the thermal and hydropower plants

Background:

The U.S. Government's Quick Impact Energy Program, was announced by Secretary of State Hillary Clinton in October 2009 to address Pakistan's severe electricity shortages that have created an energy crisis threatening the country's political and economic stability. As part of Phase-I Signature Energy Program, USG acting through USAID is funding the repair and rehabilitation of three thermal power plants (GENCO I, II & III) and one hydropower plant (Tarbela).

For the implementation of the projects, USAID has tasked Advanced Engineering Associates International (AEAI) to carry out monitoring and support for the implementation of the projects, part of which is to ensure that all repair and rehabilitation works are environmentally compliant in accordance with the applicable USG and Government of Pakistan policies and regulations.

In this regard, AEAI is seeking technical assistance from a local engineering/environmental firm to develop Environmental Mitigation and Monitoring Plans (EMMPs) for the three thermals and one hydropower plant. The duration of the assignment is 1-1.5 months. Details of the task are mentioned as under:

Tasks:

1. Review the existing environmental reports including the Initial Environmental Examinations (IEEs) for Guddu TPS (GENCO-II), Muzaffargarh TPS (GENCO-III), Jamshoro TPS (GENCO-I) and Tarbela hydro power station, and prepare a baseline summary for each plant of the environmental issues, positive and negative impacts and proposed mitigation and monitoring measures for the scope of activities under the repair and rehabilitation program.

2. Visit the plants onsite to physically examine the existing conditions and measures adopted to mitigate the environmental impacts for activities under the repair and rehabilitation program and as recommended in the IEEs.

3. Develop Environmental Mitigation and Monitoring Plans (EMMPs) separately for each power plant to ensure that all measures required under the Pakistani and USG environmental regulations are addressed. The EMMPs will include a mitigation plan, environmental monitoring plan, documentation and reporting protocols and capacity building needs. It should also include an indicative budget associated with the proposed mitigation and monitoring measures during the implementation of EMMPs. The EMMPs in particular should elaborate environmentally safe and sound waste management and disposal of the old equipment/spares and wastes, Occupational Health and Safety (OHS) procedures, as well as industry best practices for carrying out the proposed works. This task requires working closely with USAID Environmental Officers, WAPDA, GENCOs, federal and provincial EPAs and/or other entities.

4. Draft conditions/language to be included into a Contract(s) for translating EMMP thus making implementation of the EMMP binding for the project owners, in this case WAPDA and GENCOs.

5. Review and address comments of Mission's Environmental Officers for final approval of EMMPs.

Appendix B: Initial Environmental Examination of the Proposed Activity

See following pages.

Asia 10-96 Pakistan IEE - ETD Tarbela Dam repair

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INITIAL ENVIRONMENTAL EXAMINATION

PROGRAM/ACTIVITY DATA:

Country: Pakistan

Objective: To enhance the existing power generation capacity through up-gradation and repair of Tarbela Dam's generating units

Activity Name: Tarbela Dam repair and maintenance program

Funding Begins: FY 2009 Funding Ends: FY 2011 LOP Amount: $ 16.5 million

IEE Prepared By: Latif Ur Rahman Date: January 05, 2009

IEE Amendment (Y/N): No If "yes", File name & date of original

ENVIRONMENTAL ACTION RECOMMENDED: (Place X where applicable)

Categorical Exclusion	[X]	Deferral	[ ]
Positive Determination	[ ]	Negative Determination	[X]
With Conditions	[X]	Exemption	[ ]

1.0 BACKGROUND AND PROGRAM DESCRIPTION

1.1 Purpose and Scope of IEE

The purpose of this initial environmental examination (IEE), in accordance with 22 CFR 216, is to provide the first review of the reasonably foreseeable effects on the environment as well as recommend Threshold Decisions for the replacement/up-gradation of spares for dam generating units and also the staff training for improved operations under Tarbela Dam repair and maintenance project, as a part of Pakistan Signature Energy Program. This IEE provides a brief statement of the factual basis for a Threshold Decision as to whether an Environmental Assessment or an Environmental Impact Statement is required for the Project Support Program.

1.2 Background

The Tarbela Dam is a large dam on the Indus River in Pakistan that rises 485 ft (148 m) above the river bed. It is located in Haripur District within the Hazara Division of the North West Frontier Province (NWFP) about 120 km (by road) northwest of Islamabad. The reservoir size of some 95 sq mi (250 km2) makes it the largest earth-filled dam in the world. The dam was completed in 1974 and was designed to store water from the Indus River for irrigation and flood control, and for the generation of hydroelectric power.

The Tarbela Hydroelectric Power Station (HPS) has a nominal capacity of 3,478 MW, and is operated by the Pakistan Water and Power Development Authority (WAPDA). It has 14 generating units installed on three power/irrigation tunnels. The power plant has been operating up to 3,700 MW in high head during the high flow months of summer. However, the plant sometimes fails to operate at its maximum capacity due to following factors: (a) damaged lower insulation class (Class B) generator windings of units 1, 3, and 4 [1] (b) unavailability of essential spare parts to carry out preventive maintenance; and (c) lack of training of plant staff to establish operations and maintenance (O&M) as per prudent utility.

USAID and the Government of Pakistan (GOP) propose to address the immediate needs of the Tarbela Dam through the replacement of the generator stator windings in unit 1, 3 and 4 and other electro mechanical equipment. The existing units 1 and 3 have a total capacity of 175 MW each though both can be overloaded up to 195 MW. If the class B stator winding is replaced with class F windings, this would provide an additional capacity of 20 MW per unit. The existing unit 4 has a total capacity of 175 MW and can be operated at 195 MW under overload conditions. However, due to damage to the generator windings, the unit is currently operated at 135 MW. With replacement of the class B windings by class F windings, the unit can be operated at 195 MW, hence recovering not only the lost capacity of 40 MW but also another additional 20 MW. The proposed program will produce additional energy of 192 GWh per annum and an additional peaking capacity of 80 MW in summer months when there is an acute shortage of power.

In the spirit of increased partnership between the United States Government and the GOP, and as an inaugural project in this partnership that will ultimately invest $125 million in Pakistan's energy sector, USAID will conduct the planned repair and maintenance (R&M) of $16.5 million at Tarbela Dam. This R&M will be completed in 18-24 months from the time the equipment is ordered. The timing of the shipment and installation is critical for installing the windings in time for the non-peak months of October 2009 through January 2010. The benefits of this work will be experienced in the summer of 2011. In addition, USAID also anticipates supporting staff training for improved operations.

USAID will fund this purchase through a Fixed Amount Reimbursement Agreement (FARA) with WAPDA. WAPDA has already completed the procurement process for the purchase of the

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[1] The two main parts of a generator are (a) Rotor - the rotating part of a generator and (b) Stator – the stationary part of a generator. The rotor is a series of large = electromagnets that spins inside a tightly-wound coil of copper wire called the stator. Electricity is produced as the rotors spin past the stationary wining of stator The windings are separated by insulation. Class F insulation that protects the windings from burning out at higher temperature

initial equipment while the same procurement process will be followed for the remaining replacement/up-gradation spares. Once the installation works are completed, USAID/or a third party will inspect and verify the installation of equipments/spares and then USAID will release the payment to WAPDA.

1.3 Description of Activities

The following activities have been identified for USAID funding under the Tarbela Dam repair and maintenance program:

A. Replacement/up-gradation of spares

(i) Replacement of damaged generator stator windings (class F) in unit 1, 3 & 4
(ii) Up-grading of SCADA system
(iii) Spares seats and guides for relief and bypass valves on turbine side
(iv) Replacement of electromechanical governors by digitals ones

B. Training of staff for improved operation and maintenance

The above activities were already prioritized by WAPDA as a part of their maintenance program to improve reliability and productivity of the existing Tarbela Hydroelectric Power Station.

2.0 COUNTRY AND ENVIRONMENTAL INFORMATION (BASELINE INFORMATION)

Studies conducted by the Government and donor agencies in Pakistan have highlighted a number of environmental issues. Broadly, the areas of concern identified include water, energy, pollution and waste management, irrigated agriculture, and biodiversity. Overall, these studies reveal deterioration in all these areas. The increasing pollution of water, air, and land continues to have an enormous impact on people's health, especially that of vulnerable groups such as children. The quality and quantity of renewable natural resources such as water, forests and other vegetation, and key biological habitats have declined. The Government, private sector and civil society have not responded adequately to meet these challenges, although there have been some exceptions, such as the switchover to cleaner fuels in the transport subsector.

3.0 NATIONAL ENVIRONMENTAL LEGISLATION

3.1 Pakistan Environmental Protection Act 1997

The Pakistan Environmental Protection Act, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. This Act broadly applie to air, water, soil and noise pollution, as well as the handling of hazardous waste. Penalties have been prescribed for those who contravene the Act's provisions. The powers of the Federal and Provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have the power to conduct inquiries into possible breaches of environmental laws either of their own accord, or upon the registration of a complaint.

Under this Act, no project involving construction activities or any change in the physical environment can be commence unless the fulfillment of prerequisite to conduct an IEE or EIA and submit a report to the Federal or Provincial EPA.

3.2 Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2000

The PEPA review of the 2000 IEE and EIA regulations (the 'regulations') provides the necessary details on the preparation, submission and review of the IEE and the EIA reports. The regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule-I lists projects that may not have significant environmental impacts and therefore require an IEE. Schedule-II lists projects of potentially significant environmental impacts requiring preparation of an EIA. However, it may be noted that this regulation does not have any other category for equipment procurement projects.

3.3 National Environmental Quality Standards (NEQS) 2000

First promulgated in 1993, the NEQS were last amended in 2000. These constitute the basic guidelines with which municipal and industrial origin liquid effluent and gaseous emissions must comply. These standards present the maximum allowable concentration for liquid effluent before its discharge into sea, inland water and sewage (total 32 parameters with which to comply) and gaseous emissions in the ambient air from industrial sources (total 16 parameters with which to comply).

4.0 EVALUATION OF PROJECT ISSUES WITH RESPECT TO ENVIRONMENTAL IMPACT POTENTIAL

As mentioned, Tarbela dam was completed in 1974 and all of the activities under Section 1.3-A have been identified as a part of the on-going maintenance program to improve reliability and productivity of the existing Tarbela Hydroelectric Power Station. The only issue is the disposal of the old equipments/spares (copper windings, metals and rubber seals, computer parts etc) in an environmentally safe manner by a certified company in accordance with Pakistani laws, and in their absence, in accordance with international best practice acceptable to USAID. The exiting practice is that the old equipments/spares are auctioned to the recycling companies, who will follow Pakistani environmental laws for safe disposal. Hence, the same practice shall be adopted. WAPDA with the assistance of USAID energy team will prepare Environmental Mitigation and Monitoring Plan (EMMP) to ensure that the old equipment/spares including any wastes have been safely disposed under the prevailing environmental laws. Implementation of EMMP will be reviewed and approved by the Mission Environmental Officer (MEO).

The training of staff for improved operation (Section 1.3-B) will not have any adverse impact on the natural or physical environment and comes under technical assistance or training program.

5.0 RECOMMENDED THRESHOLD DECISIONS & MITIGATION ACTIONS (INCLUDING MONITORING AND EVALUATION)

5.1 The following table presents the summary of activities, environmental impacts and recommended threshold decisions.

5.1 Summary of recommended threshold decisions.

Activities	Environmental Impact	Recommended Determination
Staff training on hydroelectric power station operations.	None	Categorical Exclusion per 22 CFR 216.2 (c)(1)(i) and (c)(2)(i)
Repair and maintenance of hydroelectric power station through replacement/up-gradation of essential spares.	Minor to moderate adverse impact on the natural and physical environment.	Negative Determination with Conditions per 22 CFR 216.3 (a) (2) (iii), the Conditions being use of environmentally sound materials, monitoring and evaluation (M&E), and good international industry practices acceptable to USAID. An EMMP shall be prepared which will elaborate environmentally safe and sound waste management and disposal as well as ensure compliance with all OHS requirements acceptable to USAID. EMMP will be approved by MEO.

5.2 In accordance with 22 CFR 216.3(a) (9), if new information becomes available which indicates that activities to be funded by the Program might be "major" and the Program's effect "significant," the Negative Determination with Conditions will be reviewed and revised by the originator of the project and submitted through the MEO to the BEO/Asia for approval and, if appropriate, an environmental assessment will be prepared.

Sample Environmental Mitigation & Monitoring Plan (EMMP)

- An EMMP should either be included in or developed for (1) all IEEs that have at least one "Negative Determination with Conditions" (or for activities for which an environmental review has been completed pursuant to an IEE requirement) and (2) all Environmental Assessments (EAs).
- If the EMMP is not developed as part of the IEE, the implementing partner should usually lead development of the EMMP, subject to review and oversight by the MEO and COTR/ACTR.
- In all cases, the tasks identified in the EMMP are incorporated into the implementing partner's Work Plan, budget, and reporting.
- The following EMMP format is recommended. It can be adapted, as necessary.

Environmental Mitigation and Monitoring Plan

Activity Title:

Implementing Partner:

Activity	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Party(ies) Responsible	Indicative Budget
List all activities in IEE that received a "negative determination with conditions." *Do not list any other activities in separate rows*	If mitigation measures are well-specified in the IEE, quote directly from IEE If they are not well-specified in the IEE, define more specifically here.	Specify indicators to (1) determine if mitigation is in place and (2) successful. For example, visual inspections for seepage around pit latrine; sedimentation at stream crossings, etc.)	For example: "monitor weekly, and report in quarterly reports. If XXX occurs, immediately inform USAID activity manager."	If appropriate, *separately* specify the parties responsible for mitigation, for monitoring and for reporting.	

Appendix C: Typical Occupational Health and Safety Procedures

Confined Space Entry

Buildings and Floors

Equipment Guarding, Safeguard and Safety Devices

Ladders, Stairs, Walkways and Working Platforms

Lifting Devices

Fall Protection

Confined Space Entry

1.0 PURPOSE AND SCOPE

1.1 The worker who enters a confined space may be exposed to multiple hazards including poor lighting, slippery work surfaces, excessive noise levels, heat, toxic and flammable gases, and oxygen deficient atmospheres. Such hazards, encountered when entering or working in confined spaces, are capable of causing bodily injury, illness or even death to the worker. Accidents often occur among workers because of failure to recognize that a confined space represents serious potential hazards.

1.2 The purpose of this procedure is to specify the appropriate precautions that shall be taken to ensure that safe conditions are provided and maintained for all employees entering or working in confined spaces.

2.0 DEFINITIONS

2.1 *Confined Space* means a space that meets all the below listed criteria:

2.1.1 Is large enough and so configured that an employee can bodily enter and perform assigned work; and

2.1.2 Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); and

2.1.3 Is not designed for continuous employee occupancy.

2.2 *Permit Required Confined Space* means a confined space that has one or more of the following characteristics:

2.2.1 contains, or has a potential to contain, a hazardous atmosphere;

2.2.2 contains a material that has the potential for engulfing an entrant;

2.2.3 has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or floors that slope downward and taper to a smaller cross-section; and

2.2.4 contains any other recognized serious safety or health hazard.

2.3 *Non-Permit Confined Space* means a confined space that does not contain, or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

2.4 *Authorized Entrant* means a trained employee who is authorized to enter a confined space during the term of a permit. Authorized Entrants may rotate duties with Safety Attendants. Any properly trained person with the authority to authorize entry may enter the space during the term of the permit provided the Attendant is informed of the entry.

2.5 *Safety Attendant* means a trained individual stationed outside the confined space who monitors the authorized entrants of that space. The Safety Attendant must remain in contact with the entrants at all times (visually or verbally) and is the first responder in the event of an emergency, though he does not enter the confined space for rescue. The Safety Attendant shall not be assigned to any other duties while monitoring a confined space.

2.6 *Confined Space Entry Permit (CSEP)* means a document giving written authorization to enter a confined space which is initiated by the Supervisor responsible for work that is required in that confined space. A sample CSEP is provided as Attachment 10.2 to this procedure. The Confined Space Entry Permit defines:

2.6.1 the conditions under which the permit space may be entered;

2.6.2 reasons for entering;

2.6.3 any anticipated hazards;

2.6.4 precautions which have been taken to protect entrants;

2.6.5 lists eligible Safety Attendants, entrants and those in charge of the entry;

2.6.6 establishes the length of time for which the permit will remain valid.

2.7 *Entry* is the act by which any part of an entrant's body breaks the plane of an opening of a confined space.

2.8 *Hazardous Atmosphere* is an atmosphere that exposes employees to one or more of the following:

2.8.1 a flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

2.8.2 an airborne combustible dust at a concentration that obscures vision at a distance of 1.5 meters or less;

2.8.3 an atmospheric oxygen concentration below 19.5% or above 23.5%;

2.8.4 an atmospheric concentration of any substance exceeding a permissible exposure limit (PEL)

2.8.5 any atmosphere immediately dangerous to life or health.

2.9 *Hot Work* are operations such as riveting, welding, cutting, burning, or heating, including smoking, that could create sufficient heat so as to provide a source of ignition.

2.10 *Hot Work Permit* are document which gives written authorization to perform the above operations. This permit shall be attached to the back of, or incorporated in, the Confined Space Entry Permit anytime hot work is required in a confined space.

2.11 *Lower Flammable Limit (LFL)* of a gas or vapor at ordinary ambient temperature expressed in a percentage of the gas/vapor in air by volume. (If the air monitor reads 10 for LFL, that means the air being tested has a level of flammable gas that is 10% that of the LFL of the gas to which the instrument has been calibrated).

2.12 *Permissible Exposure Limit (PEL)* is the time-weighted average concentration for a normal 8-hour work day, and a 40-hour work week, to which nearly all workers may be exposed without adverse effects. The PEL is measured as parts of the vapor or gas per one million parts of air by volume (ppm) or an approximate milligrams of particulate per cubic meter of air (mg/m3).

2.13 *Emergency* means any occurrence (including any failure of hazard control or monitoring equipment) internal or external to the confined space, that could endanger entrants.

2.14 *Engulfment* means the surrounding and effective capture of a person by a liquid or finely divided solid substance.

2.15 *Blanking and Blinding* means the absolute closure of a pipe, line, or duct, by fastening across its bore a solid plate or "cap" which completely covers the bore, and is capable of withstanding the maximum upstream pressure without leakage.

2.16 *Double Block and Bleed* means the closure of a line, duct, or pipe, by locking and tagging a drain, or vent, which is open to the atmosphere in the line between two locked-closed valves.

2.17 *Immediately Dangerous to Life or Health (IDLH)* refers to a condition which poses an immediate threat of loss of life, irreversible or immediate-severe health effects, or which could impair escape from the permit space.

2.18 *Inerting* means rendering the atmosphere of a permit space non-flammable, non-explosive, or otherwise chemically non-reactive by such means as displacing or diluting, the original atmosphere with steam or a gas that is non-reactive with respect to that space.

2.19 *Isolation* means the separation of a permit space from unwanted forms of energy which could be a serious hazard to permit space entrants.

2.20 *Line Breaking* means the intentional opening of a pipe, line or duct that is, or has been, carrying flammable, corrosive or toxic material, an inert gas, or any fluid at a pressure or temperature capable of causing injury.

2.21 *Rescue Team* means a group of two or more persons designated and trained to perform rescues in permit spaces.

2.22 *Oxygen Deficient Atmosphere* means an atmosphere containing less than 19.5 percent oxygen by volume.

2.23 *Oxygen Enriched Atmosphere* means an atmosphere containing more than 23.5 percent oxygen by volume.

2.24 *Retrieval Line* means a line or rope secured at one end to the worker by a chest-waist or full-body harness, or wristlets, and with its other end secured to either a lifting device, or to an anchor point located outside the entry portal.

2.25 *Permit Authorizing Person* refers to the person assigned the responsibility for, and in charge of, the entry being permitted. This person may be the entrant or attendant.

3.0 RESPONSIBILITY AND AUTHORITY

3.1 The Chief Executive Officer/ Chief Engineer (CEO) shall be ultimately responsible for program implementation and for proper interpretation of these procedures.

3.2 The Maintenance and Operation Managers shall ensure that these procedures are followed when entering and/or working in confined spaces.

3.3 The CEO or designee shall ensure that annual field evaluations of this program are conducted.

3.4 The Training Coordinator shall ensure that appropriate initial training is conducted for employees associated with work in confined spaces. The Training Coordinator shall also ensure that annual refresher training is conducted for employees associated with work in confined spaces.

3.5 Each Supervisor shall be given a copy of the Confined Space Entry Procedure. Supervisors shall be responsible for fully understanding this procedure in its entirety and shall review the procedure with workers prior to any confined space work.

3.6 Each employee shall be obligated to comply with these procedures when entering and/or working in confined spaces. If there is any doubt or question about the safety of a planned confined space entry, the task should not be performed until all parties agree that safe conditions exist.

4.0 IDENTIFYING CONFINED SPACES

4.1 Confined Space Listing

4.1.1 Attachment 10.1 is a list of all confined spaces at the Power Plant. In the event that a new confined space which is not identified on this list is encountered, it shall be brought to the attention of the Safety coordinator and appropriate measures will be taken to incorporate it into this program.

4.1.2 Every item on the list of Attachment 10.1 shall be treated as a confined space and procedural requirements for entry into them shall be followed as outlined in this procedure.

4.2 Labeling

4.2.1 A sign stating "Caution – Confined Space – Entry By Permit Only" or other such labeling defining the area as a confined space, shall be posted in the immediate vicinity of all known confined spaces.

4.2.2 These signs will be at least 6" X 9", so as to make them obvious. Ideally, they should be placed on every possible entrance to a confined space. In certain instances where several entrances to a single space are next to each other, one large sign that clearly identifies that space as a permit regulated area can be used.

4.2.3 Where a confined space is a pit or similar area, a sign located adjacent to the area, which identifies the particular area, shall be posted.

4.3 Confined Space Entry Permit (CSEP)

4.3.1 The confined space entry permit shall be affixed to the sign or to the entrance of that confined space after the space has been approved for safe entry. This will allow Authorized Entrants, Safety Attendants, and those authorizing entry easy access to permit condition information such as the expiration date, or make them more aware of a change from original permit conditions.

4.3.2 The Confined Space Permit shall remain valid until conditions in or around that space change or the job has been completed.

4.3.3 A sample CSEP is provided as Attachment 10.2 to this procedure.

5.0 CONFINED SPACE ENTRY PROCEDURES

5.1 Initiating a Confined Space Entry Permit (CSEP)

The department Supervisor responsible for the employees in the confined space shall initiate the CSEP by filling out the permit (Attachment 10.2). At this time, a determination shall be made of the potential hazards that exist in that space.

5.2 Electrical and Mechanical Clearance

A confined space shall be isolated electrically and mechanically in accordance with established clearance procedures, prior to entry.

5.3 Confined Space Atmosphere Monitoring

5.3.1 The atmosphere of every confined space shall be monitored for O2 level and flammable gas level (LFL).

5.3.2 Initial monitoring shall be performed by the Supervisor in charge of the employees that will be working in the space, or by those Authorized Entrants and Safety Attendants themselves, provided they have been given proper training.

Note: *Because the O2 level indicator is self-calibrating, carefully monitor calibration and use. Upon instrument start-up it should be turned on in an area with normal ventilation. Likewise, the LFL indicator should read zero upon instrument start-up. If not, it should be zeroed in an area free of combustible vapors.*

5.3.3 The Confined Space Atmosphere must contain between 19.5 and 23.5 percent oxygen and have a LFL of <10%. If these conditions are not met, see Attachment 10.3 for guidance.

5.3.4 If the confined space was previously determined to have a potential to contain hazards other than low O2 or flammable gas, the confined space will be tested for those potential hazards before entry is authorized.

5.4 Hot Work

5.4.1 If hot work is to be done inside a confined space, a Hot Work Permit shall be completed in accordance with established procedures.

5.4.2 No hot work or any other spark or flame producing operation is permitted in or near the opening of a confined space unless that confined space has been tested and the LFL is found to be <10%.

5.4.3 Hot work in a confined space requires continuous O2 level monitoring, and requires the use of mechanical ventilation.

5.4.4 Compressed gas cylinders shall not be allowed inside a confined space with the exception of Self Contained Breathing Apparatus (SCBA) when hot work is being performed.

5.4.5 Aerosol containers shall not be used in a confined space when hot work or any other spark or flame producing operation is being performed.

5.4.6 Equipment shall be inspected prior to each use when working in a confined space. Gas welding and cutting equipment shall be pre-tested for leaks prior to entry into a confined space. The torch and hose shall be removed from the confined space whenever the hot work is completed or the confined space is vacated, even temporarily.

5.4.7 Any time hot work is being performed inside a confined space, appropriate extinguisher media will be present in the event of a fire. An appropriate extinguisher will be chosen before entry upon the discretion of the Supervisor(s) in charge of the work. In all likelihood, water is preferred over chemical extinguishers because of the danger of asphyxiation associated with carbon dioxide or other agents.

5.5 Mechanical Ventilation

5.5.1 Mechanical ventilation is required for hot work. All sources of air used for ventilation shall be from a safe area. When ventilating, care shall be taken to prevent an unsafe buildup of flammable or explosive vapors/gasses in other areas of the plant.

5.5.2 Oxygen shall not be used to ventilate a confined space.

5.5.3 If ventilation equipment fails, all personnel shall vacate the confined space immediately.

5.6 Safety

5.6.1 A trained Safety Attendant shall be stationed outside the confined space and remain in visual or auditory contact with the Entrants at all times.

5.6.2 No other duties that would conflict with the Attendant's ability to monitor the safety of the Entrants shall be assigned.

5.6.3 The most important responsibility of a Safety Attendant is to recognize a problem or emergency and respond appropriately. In the event of an emergency, **the Safety Attendant is NOT to enter the confined space**, but is to call the Control Room using the radio or page phone.

5.6.4 The Control Room is to be provided the following information:

5.6.4.1 nature of the emergency;

5.6.4.2 the location of the emergency;

5.6.4.3 the number of people involved;

5.6.4.4 the Safety Attendant shall stay on the line until all pertinent information is conveyed. The Control Room will hang up first;

5.6.4.5 in the event of an emergency elsewhere in the plant, the Safety Attendant shall initiate Entrant evacuation immediately.

5.6.5 The Control Room shall call the appropriate emergency numbers which will be posted on or near the telephone.

5.6.6 In situations where flammable vapors or gasses cannot be totally removed from a confined space, non-sparking tools and explosion proof lighting shall be used.

5.6.7 Whenever electrical equipment is used in a confined space, it shall have ground fault interrupter protection. The ground fault circuit interrupter shall be tested prior to use and shall be located safely outside of the confined space.

5.6.8 Before entry into a confined space, all employees shall be verbally given specific safety instructions on their job assignments and the precautions required by the Supervisor in charge of the work.

5.6.9 If any monitoring instrument alarm sounds, all personnel in the confined space shall immediately leave the space.

Note: *re-entry shall not be permitted until monitoring instrumentation indicates the confined space atmosphere has returned to within acceptable limits and the reason for the alarm determined.*

5.6.10 If anyone working in the confined space should experience dizziness, faintness, nausea, buzzing or ringing in the ears, rapid heartbeat, or smells something abnormal, they shall signal for help and everyone shall immediately leave the confined space.

5.6.11 Personnel assigned to work in a confined space shall be trained, qualified and physically able to wear respiratory equipment, including SCBA.

5.6.12 The use of flammable/toxic materials within a confined space shall be avoided whenever possible and quantities kept to an absolute minimum when needed. These materials shall be kept in approved containers. The need for such materials shall be noted on the Confined Space Entry Permit. Continuous monitoring shall be conducted while such materials are being used in this space.

5.6.13 When toxic substances are present for which no equipment to test the atmosphere is available, the employee shall be permitted to enter the confined space-only-with the use of appropriate respiratory equipment and other appropriate personal protective equipment as specified in the Confined Space Entry Permit.

5.6.14 A harness and retrieval line shall be used anytime a worker enters a permitted confined space unless such equipment increases the hazard for rescue.

5.7 Equipment

The following equipment shall be available at the confined space job site to aid in an emergency:

5.7.1 retrieval lines;

5.7.2 harnesses;

5.7.3 Self Contained Breathing Apparatus (SCBA);

5.7.4 air monitoring instruments.

6.0 CONFINED SPACE RESCUE

This section defines the actions to be taken in the event that an emergency or accident should occur while employees are working within a confined space.

6.1 Safety Attendant

6.1.1 Every Safety Attendant should be trained in accordance with Section 8.0 of this procedure which states that they shall not enter the confined space, but call the Control Room by page, phone, or radio, and convey the following in the event of an emergency:

6.1.1.1 The nature of the emergency

6.1.1.2 The location

6.1.1.3 The number of people involved

6.1.2 Safety Attendant shall remain on the line until all necessary information is received by the Control Room Operator.

6.2 Control Room

6.2.1 The Control Room Personnel will then call the appropriate emergency response agency(s) or personnel as required to respond to any emergency situation.

6.2.2 The Control Room will then announce over the plant alert system that there is a confined space emergency, and give the specific location.

6.3 Response Team

6.3.1 Members of the Response Team will be made up of individuals who have received training in the proper rescue techniques, use of SCBA, and trained in first aid and CPR.

6.3.2 The telephone numbers of the current list of individuals shall be kept in the Control Room.

6.3.3 When the Plant Response Team arrives at the scene, they will at that time assess the situation and take appropriate action at their discretion.

6.3.4 There will not be an attempt to move the victim(s) unless they are in immediate danger of life and health, or unless this can be done easily because of their proximity to the confined space opening.

6.3.5 All rescue personnel shall wear SCBA when entering the confined space unless it can be determined that the cause of the emergency is not space related (i.e.: heart attack, etc.).

6.4 Contractor Requirements

6.4.1 Any contractor that will be working in a confined space at the Plant will comply with these Confined Space Entry Procedures.

6.4.2 Contractor shall have a Confined Space Entry Procedure and Confined Space Entry Permit.

6.4.3 Any contractor which will be working in a confined space at the Plant shall be responsible for all monitoring requirements and documentation of monitoring.

6.4.4 Any contractor which will be working in a confined space at the Plant shall be responsible for supplying their employees with proper personal protective equipment as well as have a plan for confined space rescue.

6.4.5 All contractors working within confined spaces shall be given a list of emergency numbers to contact in case of an emergency.

6.4.6 A failure of any contractor to comply with any of these requirements is grounds for immediate termination of contract and removal from the site.

7.0 ANNUAL REVIEW

7.1 A copy of each canceled confined space entry permit must be retained for at least one year after which there shall be an annual review of the permit program.

7.1.1 This process shall include reviewing the comments for problems encountered during the permit period so that appropriate revisions to the program can be made.

7.1.2 This review is site specific.

7.2 The CEO or designee shall ensure that both the Supervisors in charge of work in confined spaces, and personnel authorizing and conducting confined space entry, receive annual refresher training.

8.0 TRAINING

8.1 General

8.1.1 The CEO or designee shall see that Supervisors in charge of work in confined spaces (Work Supervisors) and personnel authorizing entry receive annual refresher training.

8.1.2 An outline of the training and topics discussed as well as the attendance list shall be kept on file for record.

8.2 Work Supervisor Training

8.2.1 Work Supervisor training shall include the following topics:

8.2.1.1 the proper steps in initiating and filling out a Confined Space Entry Permit;

8.2.1.2 how to effectively determine the length of time for which the Permit is valid;

8.2.1.3 how to terminate or close out a Confined Space Entry Permit;

8.2.1.4 how to determine potential hazards in spaces and special requirements for those spaces;

8.2.1.5 the maintenance and proper use of monitoring and safety equipment;

8.2.1.6 the importance of the Electrical and Mechanical Clearance Procedure, the Hot Work Permit Procedure, and how they fit into confined space work;

8.2.1.7 guidelines to use in training Safety Attendants and Authorized Entrants;

8.2.1.8 guidelines for specific safety instructions to be given before the job;

8.2.1.9 how to make sure all the equipment is needed for safety and/or rescue is available.

8.2.2 Each Supervisor shall be given a copy of the Confined Space Entry Procedure.

8.2.3 An outline of the training and subjects discussed, as well as an attendance list, shall be kept on file for record.

8.2.4 The CEO or designee shall also review emergency procedures involving Control Room Operators who will be responsible for contracting local emergency response in the event of an emergency, on at least an annual basis.

8.2.5 Work Supervisors shall be responsible for knowing that all Safety Attendants and Authorized Entrants have been trained before they are allowed to work in or around confined spaces.

8.2.6 This training shall be done at a minimum annually, and ideally before each scheduled outage that includes any planned or possible confined space work.

8.2.7 No Supervisor should conduct, or be expected to conduct training, without approval to do so by the Site Superintendent.

8.3 Safety Attendant and Authorized Entrant Training

The training given to all Safety Attendants and Authorized Entrants shall include:

8.3.1 the definition of a Confined Space:

8.3.1.1 a Confined Space has or may have a limited means of access or egress;

8.3.1.2 a Confined Space is not intended for employee occupancy;

8.3.1.3 a Confined Space may have a known, or potential to contain, a hazardous atmosphere.

8.3.2 review of the list of all confined spaces at the Plant and labeling requirements for these spaces;

8.3.3 review of the importance of Electrical and Mechanical Clearance Procedures and Hot Work Permit as it relates to confined space;

8.3.4 review of the potential hazards that exist in some of the confined spaces at the plant. (e.g.: nitrogen blanketing of HRSG, flammable gas in the turbine oil tank, etc.);

8.3.5 discuss specific safety equipment that is to be worn in a confined space. (e.g. harness and retrieval lines for going down through openings.);

8.3.6 proper use of monitoring and safety equipment;

8.3.7 oxygen limits (>19.5 - <23.5%) and what to do in specific cases. (reference Attachment 10.1);

8.3.8 define/explain LFL (Lower Flammable Limit) and what to do in specific cases. Reference : Confined Space Monitoring and Ventilation.

8.3.9 review - Confined Space Entry Procedure

8.3.9.1 Duties of Safety Attendants: the most important duty is to initiate an emergency response by calling for help If an emergency should arise. In the event of an emergency:

8.3.9.1.1 DO NOT ENTER THE CONFINED SPACE!

8.3.9.1.2 call the Control Room for help;

8.3.9.1.3 state the nature of the emergency;

8.3.9.1.4 the location of the emergency;

8.3.9.1.5 the number of people involved.

8.3.9.2 The Safety Attendant shall remain in contact (audibly or visually) with Entrants at all times and cannot leave Entrants unattended at any time while in the confined space.

8.3.9.3 initiate Entrant evacuation in the event of an emergency in another area of the plant.

8.3.9.4 remain alert to any possible changes in conditions in and around the confined space, and initiate Entrant evacuation (e.g., failure of ventilation equipment) where necessary.

8.3.10 Duties of Entrants

8.3.10.1 Must be trained before entering the space.

8.3.10.2 Shall look at the Confined Space Permit checklist to see that it has been completed and signed. If not, **NO ENTRY SHALL BE MADE!**

8.3.10.3 Use ground fault circuit interrupters on any electrical equipment in a confined space.

8.3.10.4 Evacuate the space in the event of an emergency or if any monitoring equipment alarm sounds.

8.3.10.5 Leave confined space if you feel dizziness, faintness, nausea, ringing of the ears, rapid heartbeat, or smell something abnormal..

8.4 Control Room Personnel Training

8.4.1 Control Room Personnel will take calls from Safety Attendants during emergencies. These personnel shall be trained on an annual basis. Items to be reviewed include:

8.4.1.1 list of emergency telephone numbers;

8.4.1.2 current list of Response Team members and their phone numbers and/or outside Response Team;

8.4.1.3 review of chain of events required, including:

8.4.1.3.1 receiving appropriate information;

8.4.1.3.2 nature of the emergency;

8.4.1.3.3 the location;

8.4.1.3.4 the number of people involved;

8.4.1.4 discuss which emergency response organizations should be contacted;

8.4.1.5 what to announce over the plant alert system.

9.0 REFERENCES

9.1 US Code of Federal Regulations, Occupational Safety and Health Standards, 29 CFR 1910.146.

9.2 W.J.Rowe, *Safe Working in Confined Spaces Manual*, 1997.

10.0 ATTACHMENTS

10.1 Possible List of Confined Spaces in the PLant

10.2 Confined Space Entry Permit

10.3 Confined Space Monitoring and Ventilation Requirements

Attachment 10.1

Possible List of Confined Spaces in the Complex

1. Boiler
2. Water Storage Tank
3. Generator
4. Unit and Main Transformer
5. Turbine etc

Attachment 10.2

Confined Space Entry Permit

Power Plant

A copy of this permit will remain at the job site until job is completed.

Location and Description of Confined Space_____

_____

_____

Purpose of Entry:_____ Date/Time:_____

Person in Charge of Work:_____ Expiration:_____

Supervisor(s) in charge of crews	Type of crew	Telephone

Special Requirements	Yes	No		Yes	No
Lockout De-Energize			Escape Harness		
Lines Broken - Capped or Blanked			Emergency Rescue Equipment		
Purge - Flush and Vent			Lifelines		
Ventilation			Fire Extinguishers		
Secure Area			Lighting		
Breathing Apparatus			Protective Clothing		
			Respirator		

Tests to be taken	P.E.L.	Yes	No	Date	Date	Date	Date	Date	Date	Date
% of Oxygen	19.5 +23.5									
% of L.F.L.	Any % Over 10									
Carbon Monoxide	50 ppm									
Toxics										
Organic Dust/Vapor										

CONFINED SPACE ENTRY PERMIT

Page 2

Name of person testing atmosphere:

_____

Note: *requirements for continuous or periodic atmospheric testing during work shall be established before beginning job.*

For questions concerning test requirements contact:

_____

Instruments Used Name	Type	Identification Number

Safety Attendant(s)	Authorized Entrant(s)

Supervisor authorizing all above conditions satisfied:

_____

Signature *Date*

_____

_____

_____

Print Name, Position & Shift

Attachment 10.3

Confined Space Monitoring and Ventilation Requirements

Condition	Special Requirements	Ventilation	Monitoring
Hot work being performed	Affix Hot Work Permit. No hot work if LFL >10%. Ideally, LFL should be lowered to near 0% Attendant must have access to appropriate fire extinguishing media (water extinguisher preferable).	Continuous permanent or portable ventilation	Continuous monitoring for O_2 content and LFL. O_2: = 19.5% to 23.5% LFL: = <10%
Oxygen level 19.5% or below on initial reading	NO ENTRY until O_2 level is above 19.5%! Otherwise, SCBA or air-line respirator with escape bottle required.	Permanent, portable or natural ventilation to bring oxygen level between 19.5% and 23.5%	Check periodically to ensure low O_2 condition does not return.
Oxygen level above 23.5%	NO ENTRY until oxygen level is into acceptable range. Determine cause of high O_2	Permanent, portable or natural ventilation to bring oxygen level between 19.5% and 23.5%	Check periodically to ensure high O_2 condition does not return.
Lower Flammable Limit (LFL) above 0% and below 10% range.	If possible, isolate and remove source of flammable gas from the confined space.	Continuous permanent or portable ventilation unless the source of LFL monitoring indicates 0%.	Continuous monitoring for LFL unless the source of LFL monitoring indicated 0%.
LFL 10% or above	NO ENTRY_NO HOT WORK until LFL is reduced to zero.	Continuous permanent or Portable ventilation	Continuous monitoring for LFL unless the source of LFL is removed and LFL monitoring indicates 0%.
Toxic or flammable materials present, believed to be present, or to be used in confined space.	Contact Supervisor for instructions	Continuous permanent or portable ventilation until source of toxic or flammable material is removed and monitoring indicates 0.	Monitor for toxic or flammable material periodically.
Level detected above PEL for material in Confined Space.	NO ENTRY until ventilation brings level below PEL. If possible, isolate and remove material source from confined space or wear appropriate respiratory equipment.	Continuous permanent or portable ventilation until source of toxic material is removed and monitoring indicates 0.	None if source of contamination is removed and level is 0. Monitor for toxic materials periodically.
Level detected above 0 and below PEL.	If possible, isolate and remove material source from confined space. Use of respiratory protection is at the discretion of the employee.	Continuos permanent or portable ventilation until source of toxic material is removed and monitoring indicates 0.	None if source of contamination is removed and level is 0. Monitor for toxic materials periodically.

Buildings and Floors

1.0 PURPOSE AND SCOPE

1.1 The purpose of this document is to specify the minimum standard for physical maintenance of buildings and floors in the Power plant to ensure safety of employees and persons visiting the plant.

1.2 The objective is to maintain Plant buildings and floors in a good state of repair and clear from scattered material, equipment, debris and spills. This eliminates or minimizes slips, trips and falls and resulting injuries and damage to equipment. Well-maintained buildings provide better working environment, motivate employees and also make a good impression on clients and members of the public. Following concerns are addressed through these specifications:

1.2.1 damaged or neglected structures

1.2.2 wet floors and spill of slippery materials, such as oil

1.2.3 scattered material and equipment on floor.

1.3 The specifications provide the minimum design and operation standards that must be met at the Power plant to protect employee health and safety. In particular, the specifications shall be consulted in the following situations:

1.3.1 developing routine maintenance and operations procedures and work instructions for the Plant;

1.3.2 evaluating design of existing facilities;

1.3.3 designing new facilities and making structural changes to existing facilities; and

1.3.4 occupational safety and health audit of the plant.

1.4 Once these specifications are approved, any amendment will require approval of the CEO or designee.

1.5 The system specifications described in this document must be followed in letter and spirit throughout the Power plant. However, it is envisaged that there will be situations in which exceptions will be required. All exceptions must be approved by the CEO or designee and recorded in Section 5 of this document.

2.0 DEFINITIONS

2.1 *CEO* refers to the Chief Executive Officer/Chief Engineer

2.2 *MM* refers to Maintenance Manager

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 13

4.0 MINIMUM REQUIREMENTS

4.1 Damage to Buildings and Floors

4.1.1 All Plant area shall be allocated to supervisors by means of a plan or written description for maintenance and upkeep.[1]

4.1.2 The supervisors shall be responsible to conduct periodic inspections of the area allocated to them to observe any damage to the building or floor.

4.1.3 All damage to buildings and floors shall be reported promptly to the MM using the form included as Attachment 8.1.

4.1.4 The MM shall make arrangements to repair the damage, as soon as possible, after the damage is reported.

4.1.5 Any damage to buildings or floors detected by an employee shall be reported to concerned supervisor immediately.

4.2 Spills

4.2.1 The surfaces of floors shall not be permitted to become slippery. The use of high gloss paints or excessive polishing should be avoided.

4.2.2 Spills of slippery substances e.g. oil, must be treated and cleaned up immediately.

4.2.3 Water shall not be allowed to accumulate on the floor in any part of the plant.

4.2.4 Broom stations shall be provided corresponding to the cleaning needs of the workplace.

4.3 Demarcation

4.3.1 To prevent cluttering of floor and haphazard storage of materials and equipment use of floor area shall be planned and the floors shall be demarcated accordingly.

4.3.2 The Supervisor in charge of each area shall be primarily responsible for the demarcation process.

4.3.3 Aisles, storage areas, walkways and “keep clear” areas shall be demarcated according to the needs of the workplace.

4.3.4 Demarcation lines shall be clearly marked – 100mm wide depending on the needs of the workplace.

4.3.5 Aisle and walkways must be adequate width to allow free movement of potential traffic and must be obstruction free.

4.3.6 Demarcation lines must not be allowed to deteriorate or become indistinct.

4.3.7 Demarcation must be adhered to. No protruding shall be permitted beyond shortage demarcation lines and no storage is permitted in work or walking areas.

4.3.8 All colors used for demarcation should be consistent throughout the Plant.

4.3.9 For repair and maintenance work, temporary demarcation lines shall be drawn using tape to indicate area occupied by maintenance team.

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[1] The Unit Layout key plan of the plant may be adapted for this purpose.

4.3.10 The supervisors in charge of each area shall carry out monthly inspections to verify that the demarcation system is working and rectify any deviation.

4.3.11 ESH Manager shall inspect demarcation during his periodic inspection and must report any deviations.

4.4 Painting and Varnishing

4.4.1 All inside walls, partitions and ceilings of the Plant that have painted or varnished finish shall be cleaned at least once in every twelve months and repainted or re-varnished at least once in every five years.

5.0 ATTACHMENTS

5.1 Building and Floor Damage Reporting Form

Attachment 8.1

Building and Floor Damage Reporting Form

Zone	
Building	
Location of Defect	
Nature of Defect	☐ Masonry ☐ Steel Structure ☐ Floor ☐ Doors and Door Frames ☐ Walkways ☐ Ladders and Stairs ☐ Ceiling ☐ Other _____
Description of Defect	
Reported by:	
Date:	

Equipment Guarding, Safeguard and Safety Devices

1.0 PURPOSE AND SCOPE

1.1 These specifications for reporting and investigation of accident apply to the following:

1.1.1 All accidents occurring in the Power Plant—whether resulting in physical harm to persons or material damage or not—involving employees of plant or equipment owned by plant

1.1.2 All accidents occurring within the limits of the plant involving employees of Power Plant contractors or equipment owned by contractors and resulting in physical harm to the contractor's employees.

1.1.3 All accidents occurring outside the physical limits the plant involving equipment, including vehicles, owned by the plant or involving employees of the plant on official assignment.

1.2 Amendment to these specifications requires approval of the CEO or designee.

1.3 The system specifications described in this document must be followed in letter and spirit throughout the Power plant. However, it is envisaged that there will be situations in which exceptions will be required. All exceptions must be approved by the CEO or designee and recorded in Section 5 of this document.

2.0 DEFINITIONS

2.1 *AM* means the Administration Manager.

2.2 Plant refers to the Power plant.

2.3 *CEO* refers to the Chief Executive officer/Chief Engineer.

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 26

4.0 MINIMUM REQUIREMENTS

4.1 The guarding of machinery must comply with the requirements of the law.

4.2 During the design and tender stage, adequate specifications for effective guards must be laid down.

4.3 A guard must be a permanent part of the machine and must offer maximum positive protection, without holding any danger for the operation or hampering the effective performance.

4.4 Guards must be hard wearing, non-corrosive, heat resistant and easy to remove for maintenance or repair work.

4.5 Guards should not impede the ventilation of the machine.

4.6 Guards should be designed to follow the contour of the machinery.

4.7 Guards should create the minimum interference with the operation, cleaning, set-up, maintenance and other activities.

4.8 Guards should not pose any additional hazards, i.e. automatic operation of guards.

4.9 Interlocking guards should prevent the machine from operation, unless the guard is closed or prevents opening or access until the hazard has passed.

4.10 Electrical, mechanical, hydraulic or pneumatic trip devices must effectively provide a barrier to access to the danger area.

4.11 Two-handed control devices should not set the dangerous parts in motion unless the controls are operated within 0.5 seconds of each other and the process should be automatically stopped if one hand leaves a switch before the hazardous operation is complete.

4.12 Process material hazards and non-mechanical hazards (e.g. heat, electricity, radiation, etc.) must also be adequately guarded.

4.13 Abrasive wheels and grinders should be provided with a guard sufficient to contain a wheel that fractures. The operating speed of the wheel must be clearly indicated on the machine.

4.14 Machinery may under no circumstances be operated unless the machine guards are in place and in good condition.

4.15 Moving parts and the inside of a guard must be painted orange.

4.16 Any projecting shaft or spindle within reach and which projects more than one quarter of its own diameter must be enclosed completely by a cap or casing. Flush shaft ends should be painted orange with a 5mm black line drawn across.

4.17 Limit switches, thermostats, thermocouples, level switches and other safety devices should also form part of the machine guarding and maintenance system.

4.18 No person shall be permitted to clean any dangerous part of the machinery in a workplace while the machinery is in motion by the aid of any mechanical power.

Ladders, Stairs, Walkways and Working Platforms

1.0 PURPOSE AND SCOPE

1.1 These specifications apply to all permanent or temporary ladders, stairs, walkways and working platforms in Power Plant, whether installed by Power Plant staff or by Power Plant contractors.

1.2 Amendment to these specifications requires approval of the CEO or designee.

1.3 The system specifications described in this document must be followed in letter and spirit throughout the Power Plant. However, it is envisaged that there will be situations in which exceptions will be required. All exceptions must be approved by the CEO or designee and recorded in Section 5 of this document.

2.0 DEFINITIONS

2.1 *AM* means the Administration Manager.

2.2 *Plant* refers to the Power Plant.

2.3 CEO refers to the Chief Executive Officer/ Chief Engineer.

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 33

4.0 MINIMUM REQUIREMENTS

4.1 Ladders

4.1.1 All ladders must conform to the requirements of relevant standards.

4.1.2 All ladders must be numbered, using a standardized method, 1000 mm from the bottom end of the ladder on one of the stiles.

4.1.3 A register for inspection purposes must be kept for all ladders.

4.2 Fixed Steps

4.2.1 Fixed steps must have at least a 255 mm wide tread.

4.2.2 Steps must be constructed as an angel of 30 degrees to 35 degrees.

4.2.3 A resting platform of 1000 mm x 750 mm should be provided at every tenth to twelve step.

4.2.4 The vertical height between steps should not exceed 180 mm.

4.3 Fixed Staircases

4.3.1 All fixed staircases with more than four steps must be provided with a single handrail on either side.

4.3.2 The heights and widths of steps should be uniform.

4.3.3 The surfaces of all staircases should be non-slip.

4.3.4 Staircases must be free of any obstruction.

4.4 Scaffoldings

4.4.1 Scaffolds must be erected, altered and demolished under the direct supervision of a competent person.

4.4.2 All defective scaffold parts must be replaced without delay.

4.4.3 Scaffolds must at all times be used on a surface of sufficient size and strength.

4.4.4 Training must be provided for all personnel using ladders and scaffolding.

4.5 Platforms

4.5.1 All work areas or platforms of more than 1m above floor level must be equipped with a handrail which should be at least 900 mm and not more than 1050 mm above floor/platform and should be equipped with a middle rail.

4.5.2 The top rail must be properly fixed to withstand impact pressure of 100 kg from any direction.

4.5.3 Vertical supports should be provided at intervals of not more than 2500 mm.

4.5.4 Toe-boards 100 mm high must be provided.

4.5.5 When painting handrails the verticals should be painted black and the horizontals painted yellow.

Lifting Devices

1.0 PURPOSE AND SCOPE

1.1 These specifications apply to all lifting devices in the Power Plant.

1.2 Amendment to these specifications requires approval of the CEO

1.3 The system specifications described in this document must be followed in letter and spirit throughout the Power Plant. However, it is envisaged that there will be situations in which exceptions will be required. All exceptions must be approved by the CEO and recorded in Section 5 of this document.

2.0 DEFINITIONS

2.1 *Plant* refers to the Power Plant.

2.2 *CEO* refers to the Chief Executive officer/ Chief Engineer.

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 33

4.0 MINIMUM REQUIREMENTS

4.1 All lifting appliances such as gears, cranes, jacks, wire and chain slings, steel blocks, and carrying beams must be identified.

4.2 All lifting appliances and lifting gears must bear a permanent mark on which the safe working load as well as the serial number. The serial number must also be entered in the register.

4.3 A register must be kept for all lifting gear.

4.4 All lifting equipment must be examined to ensure that it confirms with statutory requirement.

4.5 All inspection work should be carried out by a competent examiner in well-lit conditions and should be preceded by thorough cleaning. If there is any doubt at all about the competence of available personnel for inspection purposes, then the services of specialists should be called in. At no time shall repair work be done to slings by the user unless he is satisfied that he has all the required facilities to do so, maintaining the factor of safety.

4.6 All lifting appliances should be of good mechanical construction, made of strong and sound materials, free from patent defect and property maintained.

4.7 All lifting gear, whether rope, wire or chain, should be stored in a suitable store room when not in use.

4.8 All defective lifting gear that has been scrapped must be destroyed.

4.9 The safe working load of any lifting appliance and lifting gear should not be exceeded, except when test of such appliances are being done by competent examiners.

4.10 All hoisting beams, lifting lugs, etc. must bear a clear, permanent marking indicating the safe working load.

4.11 All personnel involved in lifting procedures must be adequately trained and competent.

4.12 If the operator of a lifting appliance does not have a clear and unrestricted view which is necessary for the safe working of the appliance, one person should be appointed and stationed to give effective signals to the operator of the lifting appliance to ensure its safe working.

4.13 Standard hand signals must be used.

4.14 The load should not be left suspended from a lifting appliance unless a competent person is in charge of it during the period of suspension.

4.15 Adequate arrangements should be made for fixing or anchoring the appliance to ensure its safety.

4.16 All hooks must bear a clear, permanent mark including the safe working load.

4.17 All steel hooks must be marked using the three punch marking method.

4.18 Hooks of which the opening is more than 15% of the original opening as a result of bending, must be replaced.

4.19 All crane operators must be at least 21 years old, adequately trained and identified.

4.20 Safe access to cranes must be provided.

4.21 The hoisting mechanism of a crane should not be used except for raising or lowering loads vertically, unless it can be used otherwise, without imposing undue stress or endangering the stability, and unless a competent person supervises the operation.

4.22 A crane (including a crane with a derricking jib) with variable operation radii should be marked with safe working load at various radii of the jib, trolley or grab.

4.23 In the case of a crane with derricking jib, the maximum permissible radius at which the job may be worked should be marked on it. Such crane should have an accurate indicator visible to the driver, showing the radius of the job, trolley or grab at anytime and the safe working load for that radius.

Fall Protection

1.0 PURPOSE AND SCOPE

1.1 The purpose of this procedure is to provide guidelines for the prevention of injuries to employees as a result of falling.

1.2 This procedure establishes minimum requirements and criteria for fall protection in the workplace.

1.3 This procedure does not apply when employees are making an inspection of workplace conditions prior to the actual start of the work or after the work has been completed. Employees making inspections, assessments, investigations, etc., are required to use precautionary measures to ensure they perform these duties in a safe manner.

1.4 This procedure does not cover fall protection from portable ladders for which a separate procedure is available (see reference).

2.0 DEFINITIONS

2.1 *Anchorage* means a secure point of attachment for lifelines, lanyards, or deceleration devices.

2.2 *Body Harness* means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with - for attaching it to other components of a personal fall arrest system.

2.3 *Buckle* means any device for holding the body harness closed around the employee's body.

2.4 *Connector* means a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together.

2.5 *Deceleration Device* means any Mechanical device (such as a toe grab, rip-stitch lanyard, specially-woven tearing or deforming lanyards, automatic self retracting lifelines/lanyards, etc.) that serves to dissipate a substantial amount of energy during an arrest, or otherwise limit the energy imposed on an employee during fall arrest.

2.6 *Equivalent* means alternative designs, materials, or methods to protect against a hazard which can be demonstrated that will provide an equal or greater degree of safety for employees than the methods, materials, or designs specified by OSHA.

2.7 *Free Fall Distance* means the vertical displacement of the fall arrest attachment point on the employee's safety harness between onset of the fall and just before the system begins to apply force to arrest the fall.

2.8 *Guardrail System* means a barrier erected to prevent employees from falling to lower levels

2.9 *Hole* means a gap or void 2 inches or more in its least dimension in a floor, roof, or other walling/working surface.

2.10 *Lanyard* means a flexible line of rope, wire rope, or strap, which generally has a connector at each end connecting the body harness to a deceleration device, lifeline, or anchorage.

2.11 *Leading Edge* means the edge of a floor, roof, or formwork for a floor or other walking/working surface(such as the deck) which changes locations as additional floor, roof,

decking, or formwork as placed, formed, or constructed, and is considered to be an unprotected side or edge.

2.12 *Lifeline* means a component consisting of a flexible line for connecting to an anchorage at one end vertically, or for connection to anchorage's at bottom ends to stretch horizontally, and which serves as a - for other components of a personal fall arrest system to the anchorage.

2.13 *Lower Levels* means those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

2.14 *Opening* means a gap or void 30 inches or more high, and 18 inches or more wide, in a wall or partition, through which employees can fall to a lower level.

2.15 *Personal Fall Arrest System* means a system used to arrest an employee in a fall from a working level, and consists of an anchorage, connectors, body harness, and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

2.16 *Positioning Device System* means a body harness system rigged to allow an employee to be supported on an elevated vertical surface which allows both hands free for working.

2.17 *Roof* means the exterior surface on the top of a building.

2.18 *Snaphook* means a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object, and, when released, automatically closes to retain the object. This snaphook is to be of the locking type.

2.19 *Unprotected Sides and Edges* means any side or edge of a walking/working surface, such as, a roof, ramp, or runway where there is no wall or guardrail system at least 39 inches high.

2.20 *Walking/Working Surface* means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel.

3.0 RESPONSIBILITY AND AUTHORITY

It shall be determined by a supervisor or delegated representative if the walking/working surfaces on which employees are to work have the strength and structural integrity to support employees safely.

4.0 STATUTORY REQUIREMENTS

4.1 All floors, stairs, passages and gangways shall be of sound construction and properly maintained and where it is necessary to ensure safety, steps, ladders, passages and gangways shall be provided with substantial handrails [Factories Act, 1934: Section 33D(a)].

4.2 Safe means of access to every place at which any person is at any time is required to work shall be provided and maintained, so far as reasonably practicable [Factories Act, 1934: Section 33D(b)].

4.3 All places of work from which a worker may be liable to fall a distance exceeding 1.07 meters (3.5 feet) shall be provided with fencing or other suitable safeguards [Factories Act, 1934: Section 33D(c)].

4.4 Adequate provisions shall be made for the drainage of floors in wet processes and for the use of slotted stands and platforms [Factories Act, 1934: Section 33D(d)].

4.5 Every fixed vessel, sump, tank pit or opening in the ground or in a floor which by reasons of its depth, situation, construction or contents, is or may be a source of danger, shall be either securely covered or securely fenced [Factories Act, 1934: Section 33E(1)]. The Provincial Government is empowered to exempt any vessel, sump, tank or pit from requirements of the clause. Such exemption shall be in writing, and may be subject to conditions as may be imposed by the Provincial Government.

5.0 FALL PROTECTION REQUIREMENTS

5.1 Unprotected Sides and Edges

Each employee on a walking/working surface (ANSI vertical) with an unprotected side or edge 6 feet or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

5.2 Leading Edges

5.2.1 Each employee who is constructing a leading edge 1 m or more above lower levels shall be protected from falls by a guardrail, safety net or personal fall arrest system.

Note: An exception is when it can be demonstrated that it is infeasible or creates a greater hazard to use these systems.

5.2.2 Each employee on a walking/working surface 1 m or more above a lower level where leading edges are under construction, but who is not engaged in the leading edge work shall be protected from falling by a guardrail, safety net, or personal fall arrest system.

5.3 Hoist Areas

Each employee in a hoist area shall be protected from falling 1 m or more to lower levels by a guardrail or personal fall arrest system. When an employee must lean over the top of or through the guardrail system to guide, receive, or work on equipment and/or materials, the employee shall be protected from fall hazards by a personal fall arrest system.

5.4 Holes

5.4.1 Each employee on walking/working surfaces shall be protected from falling through holes more than 6 feet above lower levels by personal fall arrest systems, covers, or guardrail systems erected around such holes.

5.4.2 Each employee on a walking/working surface shall be protected from tripping in, or stepping into, or through holes by covers.

5.4.3 Each employee on a walking/working surface shall be protected from objects falling through holes by covers.

5.5 Excavations

5.5.1 Each employee at the edge of an excavation 1 m or more in depth shall be protected from falling by guardrail systems, fences, or barricades.

5.5.2 Each employee at the edge of a well, pit, shaft, and similar excavations 6 feet or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.

5.6 Wall Openings

Each employee working on, at, above, or near wall openings where the outside bottom edge of the wall opening is 6 feet or more above lower levels, and the inside bottom edge of the wall opening is less than 3 inches above the walking/working surface, shall be protected from falling by the use of a guardrail, safety net, or personal fall arrest system.

5.7 Other Walking/Working Surfaces

5.7.1 If not previously covered in sections 3.1 through 3.6, employees on a walking/working surface 6 feet or more above lower levels shall be protected from falling by a guardrail, safety net, or a personal fall arrest system.

5.7.2 When an employee is exposed to falling objects, the following measures shall be implemented:

5.7.2.1 Erect toeboards, screens, or guardrail systems to prevent objects from falling from higher levels; or,

5.7.2.2 Erect a canopy structure and keep potential fall objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced; or,

5.7.2.3 Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced.

6.0 FALL PROTECTION SYSTEMS

6.1 Guardrail Systems

Guardrail systems will need to comply with the following provisions:

6.1.1 Top edge height of top rails, or equivalent guardrail system members, shall be between 1 m and 115 m (39 and 45 inches) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 115-m (45-inch) height, provided the guardrail system meets all other required provisions.

6.1.2 Midrails, screens, mesh, immediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 53 cm (21 inches) high.

6.1.3 Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.

6.1.4 Screens and mesh shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.

6.1.5 Intermediate members shall be not more than 48 cm (19 inches) apart.

6.1.6 Other structural members (such as additional midrails) shall be installed such that there are no openings in the guardrail system that are more than 48 cm (19 inches) wide.

6.1.7 Guardrail systems shall be capable of withstanding, without failure, a force of at least 0.89 kN (200 pounds) applied within 5 cm (2 inches) of the top edge, in any outward or downward direction, at any point along the top edge.

6.1.8 Midrails, screens, mesh, intermediate vertical members, etc., shall be capable of withstanding, without failure, a force of at least 0.67 kN (150 pounds) applied in any downward or outward direction at any point along the midrail or other member.

6.1.9 Guardrail systems shall be surfaced so as to not cause injury to employees by puncturing or lacerating the body, or snagging of clothing.

6.1.10 The ends of all top and midrails shall not overhang the terminal posts in such a manner as to create a projection hazard.

6.1.11 When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

6.1.12 When guardrail systems are used around holes which are used as points of access (such as ladderways), they shall be provided with a gate, or be so offset that a person cannot walk directly into the hole.

6.2 Safety Net Systems

Safety net systems and their use shall comply with the following provisions:

6.2.1 Safety nets shall be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet below such level.

6.2.2 Safety nets shall extend outward from the outermost projection of the work surface as follows:

Vertical distance	*Horizontal distance*
Up to 1.5 m (5 feet)	2.4 m (8 feet)
1.5 m (5 feet) to 3 m (10 feet)	3 m (10 feet)
More than 3 m (10 feet)	4 m (13 feet)

6.2.3 Safety nets shall be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force.

6.2.4 Safety nets and their installations shall be capable of absorbing an impact force of 1.78 kN (400 pounds) dropped from a 76 cm (30 inch) height. These nets shall be drop tested every 6 months if left in place, and at the time of initial installation.

6.2.5 Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration while installed, and after any occurrence which could affect the integrity of the safety net system.

6.2.6 Size of mesh openings cannot exceed 15 cm (6 inches) on either leg of the opening nor more than 6 inches from center of opening to center of opening and must have a minimum breaking strength of 22.3 kN (5,000 pounds).

6.3 Personal Fall Arrest Systems

6.3.1 Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing components of the system.

6.3.2 Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

6.3.3 Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper. Snaphooks shall be of the locking type.

6.3.4 On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical life-lines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

6.3.5 Horizontal lifelines shall be designed, installed and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two (2).

6.3.6 Lanyards and vertical lifelines shall have a minimum breaking strength of 22.3 kN (5,000 pounds).

6.3.7 Each employee using a vertical lifeline shall be attached to a separate lifeline (no more than one person to a lifeline).

6.3.8 Lifelines shall be protected against being cut or abraded.

6.3.9 Self-retracting lifelines and lanyards which automatically limit free fall distance to 0.61 m (2 feet) or less shall be capable of sustaining a minimum tensile load of 13.4 kN (3,000 pounds) applied to the device. For self-retracting lifelines and lanyards which do not limit free fall distance to 0.61 m (2 feet) or less, the lanyards, lifelines, and strength components of body harnesses shall be made from synthetic fibers.

6.3.10 Anchorage's used for attachment of personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 22.3 kN (5000 pounds) per employee. These anchorage's shall be installed by a qualified person and have a safety factor of two (2).

6.3.11 Personal fall arrest systems, when stopping a fall, shall limit maximum arresting force on an employee to 8 kN (1800 pounds) using a body harness, and be rigged such that an employee can neither free fall more than 1.8 m (6 feet), nor contact any lower level, bringing an employee to a complete stop and limit maximum deceleration distance an employee can travel to 1.1 m (3.5 feet). Personal fall arrest systems must have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 1.8 m (6 feet).

6.3.12 The attachment point for body harnesses shall be located in the center of the wearer's back, near the shoulder level, or above the wearer's head.

6.3.13 Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again until inspected and determined by a competent person to be undamaged and suitable for reuse.

6.3.14 Personal fall protection systems shall be inspected prior to each use for wear, damage or deterioration. Defective components are to be removed from service.

6.3.15 Personal fall arrest systems shall not be attached to guardrail systems.

6.3.16 When a personal fall arrest system is used at hoist areas, it shall be rigged to allow movement of the employee only as far as the edge of the walking/working surface.

6.3.17 Prompt rescue of employee shall be made the event of a fall.

6.4 Positioning Devices

6.4.1 Positioning devices shall be rigged such that employees cannot free fall more than 1 m.

6.4.2 Positioning devices shall be secured to an anchorage capable supporting at least twice the potential impact load of an employee's fall, or 13.4 kN (3000 pounds), whichever is higher.

6.4.3 Connectors shall be drop forged, pressed or formed steel, or made of equivalent material.

6.4.4 Connectors shall have a corrosion-resistant finish with all surfaces smooth to prevent damage to interfacing parts.

6.4.5 Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement.

7.0 TRAINING

7.1 Each employee who might be exposed to fall hazards must be trained to recognize the hazards of falling.

7.2 Each employee must be trained in the procedures to be followed for minimizing fall hazards.

7.3 Training must be conducted by a competent person qualified in the following areas:

7.3.1 The nature of fall hazards in the workplace.

7.3.2 The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used.

7.3.3 The use and operation of guardrail, personal fall arrest, safety net, warning line systems, and other protection to be used.

7.3.4 The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection.

7.4 Training of employees must be documented.

7.5 Retraining of employees shall be required when there is reason to believe that any affected employee trained in fall protection lacks the understanding and skills required.

7.6 Retraining of employees shall also be required when changes in the workplace renders previous training obsolete, and/or when changes in fall protection systems or equipment renders previous training obsolete.

8.0 REFERENCES

8.1 U.S. Code of Federal Regulations, Title 29, Part 1910, Occupational Safety and Heath Standards. Following Subparts:

8.1.1 Subpart D: Walking-Working Surfaces (1910.22: General requirements; 1910.23: Guarding floor and wall openings and holes; 1910.24: Fixed industrial stairs; 1910.27: Fixed ladders; 1910.28: Safety requirements for scaffolding; 1910.30: Other working surfaces)

8.1.2 Subpart F: Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms (Appendix C to 1910.66: Personal Fall Arrest System)

Appendix D: Environmental and Social Monitoring Report–Sample

See following pages.

Report No		Prepared By:	
Date		Distribution	
Reference		Page	
Reporting Period			
Monitoring/ Inspection Team			

Project Activities Carried Out

Activity	*Status*

Waste Generated and Handled

Waste Type	*Sources*	*Quantity*	*Status*

Summary of Occupational safety and health and environmental issues Identified

No	Issue	*Location*	*Discussion*	*Decision/Action*	*Responsible Person*	*Target Date*
1						
2						

Follow-up of Outstanding Issues

No	Date Issue Raised	*Issue and Action*	*Status*	*Discussion*	*Responsible Person*	*Revised Target Date*

Report No		Prepared By:	
Date		Distribution	
Reference		Page	
Reporting Period			
Monitoring/ Inspection Team			

Inspection

A. Rating Codes for the Checklist

Rating Code	*Rating*	*Description*
3	Excellent	The activity, area, system, and/or knowledge are superior Comments detailing
2	Adequate	The activity, area, system, and/or knowledge meet the basic minimum requirements which includes proper documentation and full implementation.
1	Deficient	The activity, area, system, and/or knowledge are weak and not up to acceptable standards (documented and not implemented or implemented and not documented). Comments outlining weaknesses required.
0	Unsatisfactory	The activity, area, system, and/or knowledge are missing or of such a nature to warrant serious no compliance. Comments detailing concerns required.
N/A	Not Applicable	The question is not applicable to the type of operation, or the item was unable to be addressed during the audit.

B. Checklist

Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
A. Waste Hadling and Storage						
1. Use of protective leather gloves while handling sharp edged metals						
2. All parts and machines dispatched from site to storage yard after dismantling, preferably on the same day						
3. Marking and segregation of wastes in scrap yard and a clear passage way marked by lines on the ground for walking of staff. No waste stored within the passage way.						
4. Sharp edged metal are not to be left unattended at any time. In the storage yard, the storage area for shard edged metals cordoned off using clearly visible tapes.						
5. All parts and machines dispatched from site after dismantling to store yard as soon as possible, preferably on the same day						

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Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
6. Before final disposal, any potentially hazardous substance such as lead or material containing lead are identified and disposed off accordingly.						
7. To the extent possible any oil or grease in the equipment to be replaced is removed before dismantling of the equipment						
8. All effort are made to avoid spilling the oil on the floor						
9. Any spillage is removed immediately. For this purpose, spill control kits are made available near the work areas.						
10. Waste oil is stored in leak proof containers						
11. Oil is stored in designated and clearly marked areas. The oil storage area is lined with impervious flooring						
12. The oil storage area is away from direct heat and fire source						
13. The oil storage area has dykes constructed around it to control accidental leakages and spills						
14. All type of plastic is collected and stored in separate bins marked for this purpose						
15. Plastic waste is not burnt in open air or disposed off by dumping in the areas surrounding the plant site						
16. Nails are removed from the woods						
17. All type of waste is collected and stored in separate bins marked for the designated purpose						
18. The equipment are opened only under the supervision of a qualified person. Any potentially hazardous material such as mercury is identified prior to dismantling and appropriate safety measures are taken.						
19. Masks are used to avoid respiratory infections while handling carbon soot						
20. Soot is transported and stored in covered containers						
21. Soot is preferably disposed as soon as it is removed from the duct. Prolonged storage, particularly at the site, is generally avoided.						

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Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
22. Waste is not burnt in open air or disposed off by dumping in the areas surrounding the plant site						
23. Standard protective equipment including eye protective glass, gloves and mask are used						
B. Waste Disposal						
1. Separate oil contaminated parts from the rest.						
2. The oil contaminated parts of waste is cleaned before being fed into furnace. Alternatively, the cleaning may be undertaken at power station.						
3. Segregate wires and other copper material and insulation material from the rest						
4. Before final disposal, any potentially hazardous substance such as lead or material containing lead is identified.						
5. The risk associated with the wastes is identified, and accepted disposal methods for such waste are followed.						
6. Only certified recycling contractors are used for disposal from the relevant agencies.						
7. Agreement with the contractors for the disposal of plastic waste in the designated pre-identified municipal landfill site.						
C. Transportation of equipment						
1. Vehicles used for the transportation are NEQS compliant for the emissions and noise.						
D. Onsite handling and storage of new equipment						
1. The new equipment is stored in properly demarcated and identified areas						
2. Separate storage of each item is adopted and each area is marked either on floor or cordoned off by tapes						
3. Lifting equipment (cranes) used for the equipment follows the prescribed safety specification.						

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Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
4. Material Safety Data Sheet (MSDS) for chemicals, if any, shall accompany the consignment. A copy of the MSDS is available near the storage area at all times.						
E. Repair, rehabilitation and installation activities–General						
1. Appropriate PPE is provided to the workers and ensured that the PPEs' are used						
2. The staff is provided with training in use of PPE.						
3. Proper scaffolding platforms are provided for all work areas located more than 1 m above floor level.						
4. First Aid facilities and fire protection devices are placed in areas where activates are to be performed						
5. Ear protection devise are used if the noise level is above 85 dB(A)						
F. Repair, rehabilitation and installation activities–Working in confined Spaces						
1. All confined spaces are identified						
2. The temperature of the confined space are in the human tolerance range						
3. Artificial and intrinsically safe lighting are provided in the confined spaces						
4. If there is a risk of gases or fumes in the confined space the provisions for ventilation is made						

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