

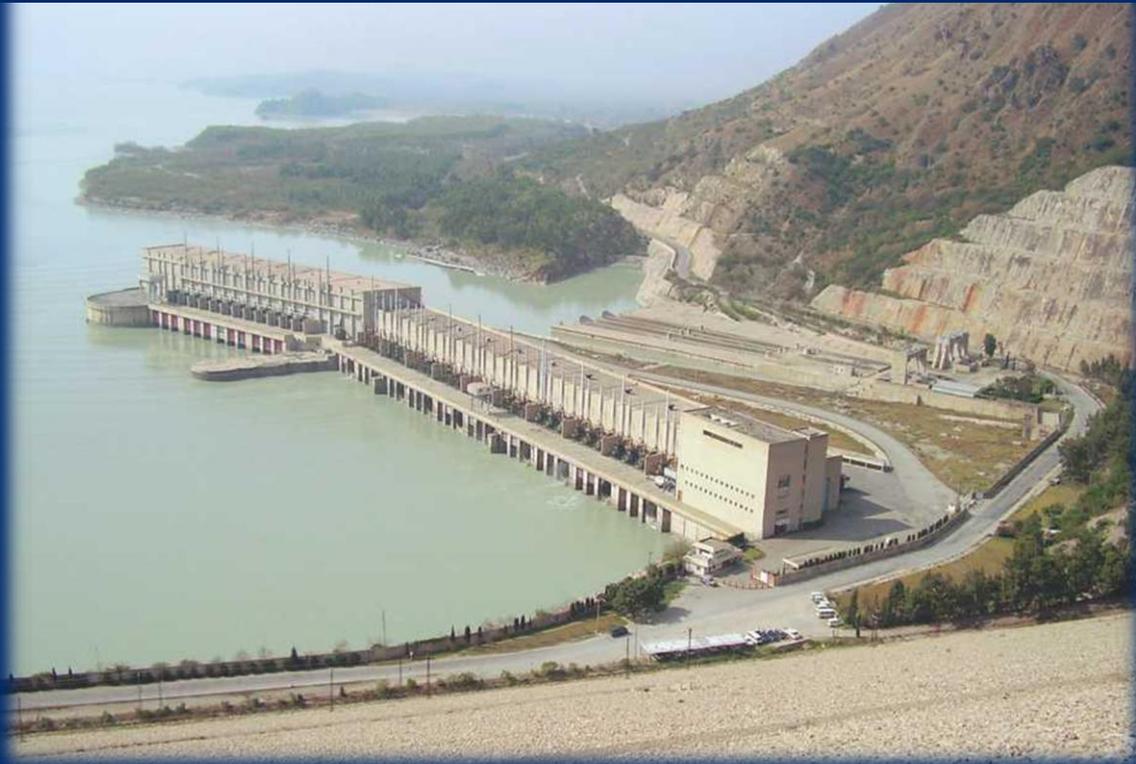


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ENERGY POLICY PROGRAM

ENVIRONMENTAL DOCUMENTATION FORM (EDF) & ENVIRONMENTAL MITIGATION & MONITORING PLAN (EMMP) - TARBELA DAM REPAIR & MAINTENANCE PROGRAM



March 2014

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ENERGY POLICY PROGRAM ENVIRONMENTAL DOCUMENTATION FORM & ENVIRONMENTAL MITIGATION & MONITORING PLAN - TARBELA DAM REPAIR & MAINTENANCE PROGRAM

Contract No: AID-EPP-I-00-03-00004

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Contents

Acronyms	iii
Environmental Documentation Form	iv
1. Introduction.....	1
1.1 Legislative and Regulatory Framework.....	1
1.1.1 National Requirements	1
1.1.1 United States Requirements	2
1.2 Diary of Activities	2
1.3 Study Team.....	4
2. Description of Proposed Activity.....	5
2.1 Procurement of One (01) Spare Turbine Runner for Unit 5-8.....	5
2.2 Procurement/Replacement of Existing 220 kV Air Blast Circuit Breakers with SF-6 Breakers with Disconnect Switches and Line Isolators for Unit 1-10	6
2.3 Procurement of 60 Ton Truck Mounted Mobile Crane	6
2.4 Procurement of Screw Type Compressors for Unit 1-10	6
2.5 Replacement of the Existing Rotary Excitation System with Static Excitation System for Unit 1-4.....	6
2.6 Procurement of Generator Surface Air Coolers for Unit 1-4 and Unit 11-14.....	7
2.7 Procurement of 500 kV SF-6 Circuit Breakers for Unit 11-14.....	7
2.8 Reconstruction/Rehabilitation of 02 No. Electric Overhead Travelling (EOT) Cranes for Unit No.1-10.....	7
2.9 UP- Gradation of Static Exciter of Unit No.7 & 8 (Design, Supply, Installation, Testing & Commissioning)	7
2.10 Project Location Map.....	7
3. Waste Management Plan.....	11
3.1 Types of Waste.....	11
3.2 Handling and Storage of Waste	11
3.3 Re-use and Recycling of Waste	11
3.4 Disposal of Waste	12
3.5 National Environmental Quality Standard (NEQS-2000).....	12
4. Environmental and Social Concerns, Mitigation and Monitoring Measures.....	16
4.1 Environmental and Social Aspects.....	16
4.2 Monitoring.....	16

4.3	Training Requirements.....	16
4.4	Occupational Safety Measures.....	17
4.5	Staffing.....	17
4.6	Responsibilities	17
4.7	Reporting	18
4.8	Budgetary Estimates	19
	Annex I: Initial Environmental Examination of the Proposed Activity	27
	Annex II: Waste Management Companies	29
	Annex III: Typical Occupational Health and Safety Procedures.....	33
	Annex IV: Environmental and Social Monitoring Report–Sample	68
	Annex V: Transformer Oil PCB Test Report	75
	Annex VI: Material Safety Data Sheet Transformer Oil	768

Tables

Table 1: National Standard on Noise	10
Table 2: Handling and Storage of Waste	13
Table 3: Disposal of Waste	15
Table 4: Environmental Management and Monitoring Plan.....	20
Table 5: Proposed Training Program.....	23
Table 6: Indicative Budget for Monitoring and Management Plan.....	23

Figures

Figure 1: Project Location Map (34°6'51" N, 72°45'55" E)	8
Figure 2: Satellite Image of the Plant	9
Figure 3: Replacement Activities Pictures	10

Acronyms

\$	US Dollar
AEAI	Advanced Engineering Associates International
CFR	Code for Federal Regulation
EDF	Environment Documentation Form
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EPA	Environmental Protection Agency
ERR	Environmental Review Report
GOP	Government of Pakistan
HSE	Health Safety and Environment
IEE	Initial Environmental Examination
KPK	Khyber Pakhtunkhwa
kV	Kilo Volt
MW	Megawatt
O&M	Operations and Maintenance
OHS	Occupational Health and Safety
PERSUAP	Pesticide Evaluation Report and Safer Use Action Plan
RE	Resident Engineer
SWM	Solid Waste Management
THPS	Tarbela Hydroelectric Power Station
USAID	United States Agency for International Development
USG	Government of United States of America
WAPDA	Water and Power Development Authority

Environmental Documentation Form

Energy Policy Program (EPP)

Activity: Tarbela Dam Repair and Maintenance Program Amendment No. 2, Haripur, Pakistan

A. Applicant Information

Contractor /Grantee(organization)	Advanced Engineering Associates International Inc. (AEAI)	Parent grant or project	Energy Policy Program (EPP)
Individual contact and title	Mr. Jimmy Roland Hicks, (COP)	Address, phone and email House # 04, Street # 88, G-6/3, Islamabad +92 51- 8357072, jhicks@aeai.net	
Activity (brief description)	<p>To enhance the existing power generation capacity through up-gradation and repair of Tarbela Dam’s generation units.</p> <p>On request of GOP, USAID is considering to fund additional \$25 million for the replacement of equipment that will add to the reliability and sustainability and enhance the life of Tarbela hydro power plant by at least 15-20 years. An additional 20 MW about 60 GWh of energy and oil saving of \$12 million per annum is also expected with this replacement.</p> <p>The purpose of Amendment No. 2 is to timely and duly reflect on the:</p> <ol style="list-style-type: none"> 1. Extension of LOP end date from Dec 31, 2012 to Sep 30, 2015 2. Increase of LOP funding by \$ 25 million. <p>Detail of equipment under the additional rehabilitation activity (IEE Amendment No.2) is provided below:</p> <ul style="list-style-type: none"> • Procurement of one (01) spare Turbine Runner for Unit 5-8 • Procurement/replacement of existing 220 		Amount: \$ 25 million

<p>kV air blast circuit breakers with SF-6 breakers with disconnect switches and line isolator for unit 1-10 Procurement of 60 ton tuck mounted mobile crane</p> <ul style="list-style-type: none"> • Procurement of screw type compressors for unit 1-10 • Replacement of the existing rotary excitation system with static excitation system for unit 1-4 • Procurement of generator surface air coolers for unit 1-4 and unit 11-14 • Procurement of 500 KV SF-6 circuit breaker for unit 11-14 • Reconstruction/Rehabilitation of electric overhead travelling cranes for unit 1-10 • Up-gradation of static exciter of unit 7 & 8 	
<p>Location of activity: Tarbela Hydroelectric Power Station, Haripur, Pakistan</p>	<p>Start and end date of activity FY 2009 - September 2015</p>

B. Activities, Screening Results, and Recommended Determination

Proposed Sub-activities	Screening result			Recommended Determinations (Complete for all moderate and high-risk activities)		
	Very Low Risk	Moderate Risk	High Risk	No significant adverse impact	With specified mitigation, no significant adverse impact,	Significant Adverse impact
1. Staff training on hydroelectric power station operation	√			√		
2. Procurement of equipment	√			√		
3. Transportation of equipment		√			√	
4. Removal of installed equipment and installation of new equipment		√			√	
5. Repair of existing equipment		√			√	

C. Summary of recommended determinations

The activity contains:	<i>(equivalent regulation 216 terminology)</i>
<input checked="" type="checkbox"/> Very low risk sub-activities	1. Procurement of equipment 2. Staff training Categorical exclusion per 22 CFR 216.2 c(1)(i) and (c)(2)(i)
<input type="checkbox"/> After environmental review, sub-activities determined to have no significant adverse impacts	<i>Negative determination(s)</i>
<input checked="" type="checkbox"/> After environmental review, sub-activities determined to have no significant adverse impacts, given appropriate mitigation and monitoring	1. Transportation of equipment 2. Removal of installed equipment and installation of new equipment 3. Repair of existing equipment 4. Disposal of waste and replaced material and equipment Negative determination(s) with conditions per 22 CFR 216.3(2)(iii)
<input type="checkbox"/> After environmental review, sub-activities determined to have significant adverse impacts	<i>Positive determination(s)</i>

C. Certification:

I, the undersigned, certify that:

1. The information on this form is correct and complete
2. The following actions have been and will be taken to assure that the activity complies with environmental requirements established for repair and maintenance work at Terbel Hydroelectric Power Station under the Code of Federal Regulations 22 CFR 216:
 - These design elements and best practices will be followed in implementing this activity, except with the approval of USAID.
 - Any specific mitigation or monitoring measures described in the attached document, including the Initial Environmental Examination of the proposed activity prepared by USAID (OAPA Tracking #: OAPA-13-May-PAK-0012) and the EMMP will be implemented in the entirety.
 - Compliance with these conditions will be regularly confirmed and documented by on-site inspection during the activity and after its completion.

(Signature) _____

(Date) April 10, 2014

(Print name) **Sadaf Iqbal**

(Title) **Environmental Expert (EPP)**

(Signature) _____

(Date) April 10, 2014

(Print name) **Jimmy Roland Hicks**

(Title) **COP (EPP)**

Confidential information redacted

1. Introduction

The United States Government (USG) through the United States Agency for International Development (USAID) is funding the repair and rehabilitation of three thermal power plants – Guddu, Muzaffargarh, and Jamshoro (GENCOs I, II & III), and one hydroelectric power station (Tarbela). For the implementation of these projects, USAID has tasked the Energy Policy Program (EPP) to carry out monitoring and support, 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 (GOP) policies and regulations. EPP is implemented by Advanced Engineering Associates International Inc. (AEAI).

This document presents the EMMP of Tarbela Dam Repair and Maintenance Program Amendment No.2. The Environmental Mitigation and Monitoring Plan (EMMP) was developed by EPP's Environmental Expert.

1.1 Legislative and Regulatory Framework

1.1.1 National Requirements

The project shall comply with following regulatory and other requirements of the GOP:

1. Pakistan Environmental Protection Act, 1997 <http://www.environment.gov.pk/act-rules/Brief-PEPA-Act1997.pdf>
2. National Quality Standards Regulation, 2000 <http://www.environment.gov.pk/NEQS/neqs2000.pdf>
3. Self-Monitoring and Reporting by Industry Rule, 2001 http://www.environment.gov.pk/NEQS/selfmon_ru01.pdf
4. Pakistan IEE/EIA Regulation, 2000 <http://www.environment.gov.pk/act-rules/IEE-EIA-REG.pdf>
5. Hazardous Substances Rules, 2003 http://www.environment.gov.pk/pro_pdf/HAZ-RU03.pdf
6. Sectoral Guidelines for Environmental Reports—Major Thermal Power Stations, 1997 http://www.environment.gov.pk/eia_pdf/h_Power.pdf
7. Draft Guidelines for Solid Waste Management, 2005 <http://www.environment.gov.pk/EA-GLines/SWMGLinesDraft.pdf>
8. Environmental, Health, and Safety General Guidelines [http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/\\$FILE/Final+-+General+EHS+Guidelines.pdf](http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf)

The Pakistan Environmental Protection Act of 1997 requires that initial an environmental examination or an 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 (IEE) and Environmental Impact Assessment (EIA) Procedures 2000*. The definition of a project under

the law includes both construction of a new project and modification to an 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.

1.1.1 United States Requirements

United States laws require that all activities financed by USAID shall comply with the requirements of the U.S. Law 22 Code for Federal Regulation (CFR) 216. The IEE for the proposed activities (see Annex I) 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.

To promote pesticide safety, USAID environmental regulations require that for any pesticide, or any chemical that can also be used as pesticide, a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) shall be prepared. USAID has prepared a program-level PERSUAP for its activities in Pakistan. It is unlikely that the project will require any chemical that is regulated by PERSUAP. If any chemical required by the project falls into this regulated category, management of Tarbela shall inform USAID.

1.2 Diary of Activities

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

Document review: At the start of the assignment, EPP's Environmental Team requested the concerned department for all relevant documents. The available documents were reviewed by the Team. From the review, potential environmental, social, and occupational safety issues at each plant were identified.

Site visit: A visit to Tarbela was undertaken in March 2014. The activities undertaken during this visit included:

- Meeting with the plant management, in particular with the following staff who helped to provide valuable information:
 - Chief Engineer (Power)
 - Resident Engineer (RE) Electrical
 - RE Mechanical
 - Deputy Resident Engineer
 - Manger stores
- A walk-through of the plant was conducted to inspect all the equipment and sites where rehabilitation work will be carried out.

- A general review of the existing site conditions and OHS practices was undertaken.
- A review was conducted 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 equipment and spares is a particular focus of the study. During the site visit and thereafter, an inventory of the waste generated during the rehabilitation and repair activities was generated.

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

EPP's Environmental Team visited the THPS, specifically where the 'Tarbela Dam Repair and Maintenance Program' Project activity under USAID will be performed. Specific repairs include:

1. Procurement of one (01) spare Turbine Runner for Unit 5-8.
2. Procurement/replacement of existing 220 kV air blast circuit breakers with SF-6 breakers with disconnect switches and line isolator for unit 1-10.
3. Procurement of 60 ton tuck mounted mobile crane.
4. Procurement of screw type compressors for unit 1-10.
5. Replacement of the existing rotary excitation system with static excitation system for unit 1-4.
6. Procurement of generator surface air coolers for unit 1-4 and unit 11-14.
7. Procurement of 500 kV SF-6 circuit breaker for unit 11-14.
8. Rehabilitation of electric overhead travelling cranes for unit 1-10.
9. Up-gradation of static exciter of unit 7 & 8.

During the visit, the Team reviewed the existing site conditions, measures adopted to mitigate environmental impacts, OHS practices, and the associated operational procedures required for normal power plant operations. During the visit, it was observed that the overall HSE situation was in good condition. There were safety signs and the necessary warnings in Urdu, which all the lower-level staff, senior management and anyone working in the area could easily comprehend. It was also observed that there was staff presence near the equipment that needed to be monitored on a regular basis, such as in the control room, switch yard and the generator complex. There were no obvious signs of any oil spills, and all the fire extinguishing equipment was properly labeled with clear mention of the expiration dates, refill dates, and the last date of last refill. Inside the buildings and in the lower compartments of Tarbela HPS where there is no natural light (which could result in a higher probability of incidents) there was adequate lighting. All the stair cases had safety railings to avoid falls. The Team observed that staff who conducted normal power plant operations wore the required PPE's, and that senior management was present to monitor their activities. This generally results in higher efficiency and reduces chances of errors.

The Team also visited the waste disposal site and storage area at the Tarbela HPS. The warehouse, which will be used for the storage of the replaced equipment and spare parts (copper windings, metals and rubber seals, electronic parts etc.), was visited. Inside the warehouse, proper records were maintained of all the equipment that was on hand; as well as records of previous equipment. The waste material was segregated and, where necessary, was labeled with signs of care or danger, whichever the case may be.

Based on the field visit and desk review, this EMMP has been developed.

1.3 Study Team

The study team includes the following:

1. Mr. Sadaf Iqbal, Environmental Expert and Team Leader
2. Mr. Asif Majeed, Projects Monitoring and Implementation Engineer

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. m (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 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 additional financing the planned repair and maintenance of \$25 million at THPS. This repair and maintenance will be completed in September, 2015 as per approved IEE. The proposed program will produce additional energy of 20 megawatts about 60 GWh of energy and oil saving of \$12 million per annum is also expected with this replacement.

The existing electro-mechanical components of the generating units of Tarbela Hydro Power Station particularly for Units 1 to 10 have already completed their useful life. The spares of many systems are neither manufactured nor available in the International Markets. Therefore, replacement of some of the vital old equipment has become essential to enhance the reliability of Tarbela Hydro Power Station.

Details of equipment¹ under the additional rehabilitation activity are provided below:

2.1 Procurement of One (01) Spare Turbine Runner for Unit 5-8

Units 5-8 were installed and commissioned in the 2nd phase of Tarbela Power Station during 1982. The efficiency of the turbines has been reduced due to repeated weld build up on the runner after erosion and cavitation. The replacement will reduce the forced outage which occurs due to failure of equipment that has outlived useful life.

The new runner will improve the availability of the plant by improving the plant availability at least by 2% resulting in additional 17 GWh of energy/annum about oil saving of \$3.4 million/annum.

¹ Photographs of the replacement/rehabilitation activities can be seen in Figure 3

The new runner will enhance the stability, particularly at Unit 5 and control vibrations. The unit is currently restricted to operate at 175 MW; however with replacement it can go up to 195 MW adding another 20 MW about 43 GWh during summer season and saving \$8.6 million of oil annually.

2.2 Procurement/Replacement of Existing 220 kV Air Blast Circuit Breakers with SF-6 Breakers with Disconnect Switches and Line Isolators for Unit 1-10

The existing circuit breakers are obsolete and have outlived their useful life. A breakdown will result in shutting down any of the complete units 1-10, each having installed capacity of 175 MW. In particular, the replacement will also enhance the reliability of operations of Unit 1, 3 and 4 already rehabilitated under the existing Tarbela FARA and restored 128 MW.

2.3 Procurement of 60 Ton Truck Mounted Mobile Crane

At present, Tarbela Power Station has no mobile crane available at site, and it is hired frequently for loading/unloading of heavy components of Turbine/Generator. It is useful during frequent maintenance and repair problems in Power House I Switchyard and External Works/Barrage due to aging factor to ensure the safe and reliable operations. It will play vital role during flood season especially during removal of huge wooden logs from spillway gates.

2.4 Procurement of Screw Type Compressors for Unit 1-10

The performance of these air compressors has considerably deteriorated due to aging and may hamper the smooth operation of generating units in the future. The frequency of equipment breakdown has increased and thus frequent maintenance at very high cost has to be carried out as a regular feature. Moreover the compressors are of obsolete models and their spare parts are not easily available in the market. The new screw type air compressors will enhance the stability of units by minimizing the power swing phenomena.

2.5 Replacement of the Existing Rotary Excitation System with Static Excitation System for Unit 1-4

The existing excitation system of Units comprises rotary type exciters. These will be replaced with latest static excitation system for smooth and efficient operation of the power plant.

The excitation system is old and spare parts are not available. Any breakdown would result in shutting down the complete unit. Replacement will enhance reliability and sustainability of operations at units, and add to the sustainability of operations for three units rehabilitated under the FARA.

2.6 Procurement of Generator Surface Air Coolers for Unit 1-4 and Unit 11-14

The existing generator surface air coolers were installed in 1976 and have already outlived their useful life. These coolers are required to be replaced before it develops failure resulting in forced outages.

2.7 Procurement of 500 kV SF-6 Circuit Breakers for Unit 11-14

The existing circuit breakers have outlived their useful life – 20 years and need overhauling/replacement per recommendation from the manufacturer. Any breakdown would result in complete shutdown of units 11-14, each with capacity of 432 MW. The replacement of existing breakers with latest SF-6 technology is required to enhance the reliability of the 500 kV Switchyard equipment.

2.8 Reconstruction/Rehabilitation of 02 No. Electric Overhead Travelling (EOT) Cranes for Unit No.1-10

The existing electric overhead cranes were installed in 1974 and have already outlived their useful life. The performance of these cranes has considerably deteriorated due to aging and frequent failures occur delaying repair and maintenance of the power plant equipment.

2.9 Up- Gradation of Static Exciter of Unit No.7 & 8 (Design, Supply, Installation, Testing & Commissioning)

The existing excitation system of units 7 & 8 comprises rotary type static exciters. These will be replaced with latest static excitation system for smooth and efficient operation of the power plant.

2.10 Project Location Map

34°6'51" N, 72°45'55" E



Figure 1: Project Location Map (34°6'51" N, 72°45'55" E)



Figure 2: Satellite Image of the Plant



Air Blast 220 kV Circuit Breaker



Rotary Excitation System



Generator Surface Air Cooler



Screw Type Compressor



Warehouse



Used Oil Storage Area

Figure 3: Replacement Activities Pictures

3. Waste Management Plan

The existing practices of environmentally sound waste management and safe disposal of old equipment and spares were a particular focus of the study. Details of waste management-related companies are presented in Annex III.

3.1 Types of Waste

During the repair and rehabilitation works of Tarbela Hydropower project, solid, liquid and gas waste will be generated. Details of this waste are as follows:

1. Solid waste, which consists of iron, copper, porcelain material, plastic, electronics devices, wood, cloth and packaging material.
2. Liquid waste, which consists of oil, waste water.
3. Gas waste, which consists of air emissions.

3.2 Handling and Storage of Waste

Various types of waste are likely to be generated during the rehabilitation project. The category, source and quantity of the waste are identified and tabulated under Table 1. The hazard or issues associated with each category during disposal and handling is discussed, and the recommended procedures for handling and storage are provided.

The waste with potential for hazardous or prohibited substances, like PCBs, shall be tested prior to handling and storage. As a policy, WAPDA has stopped using transformers that contain PCBs since 1969². WAPDA has also tested the PCB of transformer oil at the Orient Lab. Per the result of that report, there is no PCB in the transformer oil³.

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 opportunity for re-use. Some re-use opportunities may exist in so far as electronic equipment is concerned, and for components and in packaging material.

It is recommended that a comprehensive waste management plan be instituted at Tarbela during which re-use opportunities for waste generated from the plant during routine operation and maintenance shall be actively investigated.

As a standard practice, 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 Tarbela; or at other companies owned by Pakistan Electric Power Company.

² ADB IEE Report (Power Distribution Enhancement MFF Project PESCO Oct, 2012)

³ Annexure V: PCB Test Report

Cost recovery for scrap, if recycled through external vendors, shall be utilized for the development and improvement of HSE management systems and capacity building of the staff and contractors.

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 Table 2.

3.5 National Environmental Quality Standards (NEQS- 2000)

Table 1: National Standard on Noise

S. No	Category of Area	Standard Up to 30th June 1997 Limits in dB(A)		Standard from 1st July 1997 Limits in dB(A)	
		Day Time	Night Time	Day Time	Night Time
A	Residential Area	65	50	55	45
B	Commercial Area	70	60	65	55
C	Industrial Area	80	75	75	65
D	Silence Zone	55	45	50	45

Note:

- Day time hours: 6 .00 am to 10.00 pm
- Night Time hours: 10.00 pm to 6.00 am
- Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts and courts.
- Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.
- dB(A) Leq: time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Noise will be monitored at a distance of 100m from the boundary wall of any residential unit, and should follow the NEQS of 45dB (A).

Noise from construction of the power distribution lines and improvements to substations is not covered under any regulations; however, in order to keep in line with best international practices, it is recommended that no construction should be allowed during nighttime hours (9 PM to 6 AM). Any noisy equipment should be located within transmission activity, or as far from SRs as possible to prevent nuisances to dwellings and other structures. However, if the noise still exceeds NEQS, then noise barriers will be installed around the equipment to reduce the effects of the noise.

Vibration from the construction of piles to support pads may be required for some tower construction, and may produce a significant impact; but this should be short in duration. Where vibration could become a major factor (within 100m of schools, religious premises, hospitals or residences), a building condition survey will take place prior to construction.

Table 2: Handling and Storage of Waste

Waste Category	Associated Hazard	Recommended Handling and Disposal
Iron	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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.
Copper	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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.
Other Metals	<ul style="list-style-type: none"> 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 material and treated accordingly 	<ul style="list-style-type: none"> The waste shall be segregated from other waste and shall be clearly marked with a proper hazard sign. Before final disposal, any potentially hazardous material shall be identified and disposed-off accordingly.

Waste Category	Associated Hazard	Recommended Handling and Disposal
Oils	<ul style="list-style-type: none"> Spills and leaks will contaminate the soil and potentially water resources Oil on floor poses tripping hazard to the workers 	<ul style="list-style-type: none"> 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
Plastic	<ul style="list-style-type: none"> Nuisance and littering Open air burning may affect in local air quality 	<ul style="list-style-type: none"> 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
Wood, Clothing and Packaging Material	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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
Electronic and Circuit boards	<ul style="list-style-type: none"> Some of devices and equipment may contain toxic material. These can be a health hazard if opened in the plant 	<ul style="list-style-type: none"> The equipment shall be opened only under a qualified person. Any potentially hazardous material shall be identified prior to dismantling and appropriate safety measures shall be taken.
Air Emission	<ul style="list-style-type: none"> Can affect the respiratory systems 	<ul style="list-style-type: none"> Standard protective equipment including eye protective glass, gloves and mask shall be used

Table 3: Disposal of Waste

Waste Category	Ultimate Disposal	Associated Hazard or Issues	Recommended Procedure
Iron	Recycling	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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.
Copper	Recycling	<ul style="list-style-type: none"> Copper wires are covered with insulation, which if burned in low temperature can release hazardous materials 	<ul style="list-style-type: none"> 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.
Other Metals	Recycling	<ul style="list-style-type: none"> Some of the waste may be hazardous which can ultimately affect the human health if not appropriately handled 	<ul style="list-style-type: none"> Before final disposal, any potentially hazardous substance shall be identified. The risk associated with the wastes. If any shall be identified, and accepted disposal methods for such waste shall be followed.
Oils	Recycling through waste contractors	<ul style="list-style-type: none"> Contamination of soil and water bodies 	<ul style="list-style-type: none"> Only recycling contractors with certification from the concerned agencies shall be used for disposal
Plastic	Recycling	<ul style="list-style-type: none"> Nuisance and littering Open air burning may affect in local air quality 	<ul style="list-style-type: none"> Include in the contract agreement with waste disposal contractor condition that any unwanted plastic waste will be disposed at municipal landfill site
Wood, cotton waste and packaging material	Waste contractor Municipal landfill	<ul style="list-style-type: none"> Open burning and associated nuisance Improper disposal resulting in littering 	<ul style="list-style-type: none"> Include in the contract agreement with waste disposal contractor condition that such waste will either be disposed at pre-identified municipal landfill site.
Electronic equipment and circuit boards	Waste contractor	<ul style="list-style-type: none"> Some of devices and equipment may contain toxic material. These can be a health hazard if improperly handled 	<ul style="list-style-type: none"> 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 Monitoring 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). Material will be transported using existing national highways and roads which already are used for 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 Tarbela staff or by contractors.
3. Waste disposal issues have been identified in Section 3 (Waste Management Plan).

4.2 Monitoring

The above-mentioned environmental aspects have been assessed, and mitigation measures for potential adverse impacts identified during the study. In order to ensure that the proposed mitigation measures are implemented, the monitoring requirements, including indicators and specific requirements, are listed in Table 3. 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 Health, Safety and Environment (HSE) supervisor may be hired in case of time and/or capacity constraints.

4.3 Training Requirements

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

1. *Occupational Health and Safety*: All concerned staff will be provided training in use of PPE. Training may also be required in confined space identification and entry procedures. External sources may be needed for providing this training. At a later stage, this training can be provided internally.
2. *HSE Audit*: Relevant Tarbela staff will require training in HSE auditing and inspection. External sources may be needed for providing this 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 the training program table, which will be finalized before the commencement of the project.

4.4 Occupational Safety Measures

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

- HSE Policy
- Occupational health and safety management measures
- Use of personal protection equipment
- Training requirements and management
- Documented procedures
- Monitoring and audit
- Reporting

Although the development of such a system is beyond the scope of the present project, some standard procedures are provided in Annex III for reference.

4.5 Staffing

For the environmental performance during 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 the environment will be offal under the Head of the company or the Chief Engineer.

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

The total staff associated with the implementation of EMMP may be between three to five people, including one HSE supervisor and one or two sanitary workers. The number of sanitary workers may vary depending on the workload of project-related acuities.

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 it to USAID 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 an occupational safety issue or an 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 Annex IV.

4.7 Reporting

An effective mechanism for storing and communicating HSE-related information during the project is required. The head of the company or the Chief Executive through his designated HSE supervisor shall undertake the following activities:

- Precisely record and maintain all HSE-related information generated during the project.
- Process the information to produce monthly reports.
- Submit the HSE reports to USAID and other stakeholders upon completion of each quarter.
- Provide information and answers to any queries on HSE-related matters from USAID and other stakeholders.
- Develop and submit a final HSE report that states the overall compliance of the requirements of this EMMP.
- Monitoring checklist and audit report will be included with monthly reports.
- The monthly report will also include information about the status of project activities. Information will be provided if no activities are undertaken during a month.

4.8 Budgetary Estimates

The budgetary requirements for implementation of the EMMP cannot be fully monetized. Whereas, Tarbela has some internal systems, the actual budget would depend on whether the new systems are developed to cater to this particular project, or are implemented plant-wise. However, an indicative budget has been developed and shown in Table 5. The total financial impact for the implementation of this EMMP is estimated to be PKR 1,270,000. The major components of the budget include salaries for the HSE personnel, capacity building, and purchasing of HSE-related equipment.

Table 4: Environmental Management and Monitoring Plan

Activity	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring	Monitoring and reporting frequency	Party(s) Responsible
Transportation of equipment from Karachi to Tarbela	<ul style="list-style-type: none"> Vehicles used for the transportation are NEQS compliant for the emissions and noise 	Results of the noise and emissions	<ul style="list-style-type: none"> Vehicles used for the transportation shall be monitored for the emissions and noise. 	Once before start the transportation	Contractor
Onsite handling and storage of new equipment	<ul style="list-style-type: none"> 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. 	<p>Availability of certification of lifting equipment</p> <p>Availability of MSDS</p>	<ul style="list-style-type: none"> 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 	Monthly	Resident Engineer (RE) of the concerned unit
Repair, rehabilitation and installation activities– General	<ul style="list-style-type: none"> 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 	<p>Installation of specified scaffolding</p> <p>Availability and use of PPE</p> <p>Availability of first aid</p>	<ul style="list-style-type: none"> 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, 	Weekly	Contractor, RE

Activity	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring	Monitoring and reporting frequency	Party(s) Responsible
	<p>provided for all work areas located more than 1 m above floor level.</p> <ul style="list-style-type: none"> • First Aid facilities and fire protection devices should be placed in areas where activities will be performed • Ear protection device shall be used if the noise level is above 85 dB(A) 	facilities	<p>rehabilitation or installation work</p> <ul style="list-style-type: none"> • Incidental, in case of an accident or reporting of noncompliance • Noise level monitoring once at the start and once at the peak of activities 		
Repair, rehabilitation and installation activities– Working in confined Spaces	<ul style="list-style-type: none"> • All confined spaces⁴ 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 	<ul style="list-style-type: none"> • Visual Inspection of the confined space prior to activity • Temperature measurement before commencement of activities 	<ul style="list-style-type: none"> • A checklist-based monitoring shall be undertaken prior to entry into confined space, covering: <ul style="list-style-type: none"> • Inspection of entrance • Measurement of temperature • Risk of fumes or gases • Availability of equipment 	Weekly	Contractor, RE of each unit
Waste management	<ul style="list-style-type: none"> • Waste management plan is presented separately in Section 3. 	<ul style="list-style-type: none"> • Quantity of waste generated, their classification and disposal mechanism 	<ul style="list-style-type: none"> • Inventory of all waste shall be prepared. For each type of waste the quantity and disposal mechanism shall be identified 	Weekly	Store Supervisor

⁴ 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.

Activity	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring	Monitoring and reporting frequency	Party(s) Responsible
		<ul style="list-style-type: none"> Waste disposals contracts for inclusion of appropriate clauses 	<ul style="list-style-type: none"> Where necessary, audit of the waste contractor 		

Reporting to USAID

- Submit the HSE reports to USAID upon completion of each quarter.
- Provide information and answers to any queries on HSE-related matters from USAID and other stakeholders.

Table 5: 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 Supervisor
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

Table 6: Indicative Budget for Monitoring and Management Plan

Core Activity	Budgeted Activity	Budget Rationale	Indicative Budget
Transportation of equipment from Karachi to Tarbela	Monitoring of vehicles for emissions and noise	Monitoring of 15 ⁵ 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	–

⁵ 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–General	Purchase of required PPEs'	10 Sets of PPEs' at PKR 15,000 for each	PKR 150,000
	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 HSE Supervisor	Salary of an HSE supervisor is estimated at 30,000 per month. The project requires maximum of one HSE supervisor for six 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
Repair, rehabilitation and installation activities–Working in confined Spaces	Identification of confined spaces	This cost is included in staffing of HSE supervisor	–
	Managing temperature, lighting and risk of gases or fumes in confined spaces	This cost is included in staffing of HSE supervisor	–
	Monitoring and inspection	This cost is included in staffing of HSE supervisor	-
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	PKR 80,000

Core Activity	Budgeted Activity	Budget Rationale	Indicative Budget
		per day; travel and boarding at PKR 40,000 per visit	
	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

ANNEXES

Annex I: Initial Environmental Examination of the Proposed Activity

See following pages.



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FROM THE AMERICAN PEOPLE

Initial Environmental Examination (IEE) - Amendment No. 2

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

Fund Begins	Funding Ends	LOP Amount
FY 2009	September 2015	\$41,500,000

IEE Prepared By: Rabia Bukhari

Date: March 22, 2013

IEE Amendment (Y/N): Yes If "yes", Filename & date of original IEE: Asia 10-76 Pakistan IEE-ETD approved on January 12, 2010; amended OAPA-12-OCT-PAK-0004 approved on October 21, 2011.

ENVIRONMENTAL ACTION RECOMMENDED: (Place X where applicable)

Categorical Exclusion	<input checked="" type="checkbox"/>	Deferral	<input type="checkbox"/>
Positive Determination	<input type="checkbox"/>	Negative Determination	<input checked="" type="checkbox"/>
With Conditions	<input checked="" type="checkbox"/>	Exemption	<input type="checkbox"/>

1. Purpose and Scope of IEE

The purpose of this IEE Amendment No 2 is to timely and duly reflect on the:

- i. extension of LOP end date from December 31, 2012 to **September 30, 2015** and
- ii. Increase of the LOP funding by **\$25,000,000** from \$16.5 million to \$41.5 million, to replace the equipment that will add to the reliability and sustainability, and enhance the life of Tarbela hydro power plant by at least 15-20 years. An additional 20 megawatts with about 60 GWh of energy and oil savings of \$12 million per annum is also expected with this replacement.

The scope of all earlier activities described in original IEE and all conditions as established in Original IEE and Amendment-1 remain the same and in force throughout the extended LOP.

2. Activity Description

On request of GOP, USAID is considering to fund additional \$25 million for the replacement of equipment that will add to the reliability and sustainability, and enhance the life of Tarbela hydro power plant by at least 15-20 years. An additional 20 megawatts about 60 GWh of energy and oil savings of \$12 million per annum is also expected with this replacement.

This Activity was analyzed using information through meetings with WAPDA and field visits that led to assess the time frame, implementation mechanism and identifiable risks. In the spirit of increased partnership between the USG and the GOP, USAID is considering support for the additional rehabilitation of \$25 million at Tarbela hydro power station to be completed within the next 18-24 months to enhance reliability and sustainability of the power plant operations.

The existing electro-mechanical components of the generating units of Tarbela Hydro Power Station particularly for Units 1 to 10 have already completed their useful life. The spares of many systems are neither manufactured nor available in the International Markets. Therefore, replacement of some of the vital old equipment has become essential to enhance the reliability of Tarbela Hydro Power Station.

Details of equipment under the additional rehabilitation activity are provided below:

2.1. Procurement of one (01) spare Turbine Runner for Unit 5-8

Units 5~8 were installed and commissioned in the 2nd phase of Tarbela Power Station during 1982. The efficiency of the turbines has been reduced due to repeated weld build up on the runner after erosion and cavitation. The replacement will reduce the forced outage which occurs due to failure of equipment that has outlived useful life.

The new runner will improve the availability of the plant by reducing the forced outages and improving the plant availability at least by 2% resulting in additional 17 GWh of energy/annum about oil saving of \$ 3.4 million/annum.

The new runner will enhance the stability, particularly at Unit 5 and control vibrations. The unit is currently restricted to operate at 175MW; however with replacement it can go up to 195MW adding another 20MW about 43 GWh during summer season and saving \$8.6 million of oil annually.

2.2. Procurement/replacement of existing 220KV air blast circuit breakers with SF-6 breakers with disconnect switches and line isolators for Unit 1-10

The existing circuit breakers are obsolete and have outlived their useful life. A breakdown will result in shutting down any of the complete units 1~10, each having installed capacity of 175MW. In particular, the replacement will also enhance the reliability of operations of Unit 1, 3 and 4 already rehabilitated under the existing Tarbela FARA and restored 128 MW.

2.3. Procurement of 60 ton truck mounted mobile crane

At present, Tarbela Power Station has no Mobile Crane available at site, and it is hired

frequently for loading/unloading of heavy components of Turbine/Generator. It is useful during frequent maintenance and repair problems in Power House / Switchyard and External Works/Barrage due to aging factor to ensure the safe and reliable operations. It will play vital role during flood season especially during removal of huge wooden logs from spillway gates.

2.4. Procurement of screw type compressors for Unit 1-10

The performance of these Air Compressors has considerably deteriorated due to aging and may hamper the smooth operation of generating units in the future. The frequency of equipment breakdown has increased and thus frequent maintenance at very high cost has to be carried out as a regular feature. Moreover the compressors are of obsolete models and their spare parts are not easily available in the market. The new screw type air compressors will enhance the stability of units by minimizing the power swing phenomena.

2.5. Replacement of the existing rotary excitation system with static excitation system for Unit 1-4

The existing excitation system of Units comprises rotary type exciters. These will be replaced with latest static excitation system for smooth and efficient operation of the power plant.

The excitation system is old and spare parts are not available. Any breakdown would result in shutting down the complete unit. Replacement will enhance reliability and sustainability of operations at units. Also adds to the sustainability of operations for three units rehabilitated under the FARA.

2.6. Procurement of generator surface air coolers for Unit 1-4 and Unit 11-14

The existing generator surface air coolers were installed in 1976 and have already outlived their useful life. These coolers are required to be replaced before it develops failure resulting in forced outages.

2.7. Procurement of 500KV SF-6 circuit breakers for Unit 11-14

The existing circuit breakers have outlived their useful life ~ 20years and need overhauling/replacement per recommendation from the manufacturer. Any breakdown would result in complete shutdown of units 11-14, each with capacity of 432MW. The replacement of existing breakers with latest SF-6 technology is required to enhance the reliability of the 500KV Switchyard equipment.

3. Environmental Lessons Learned from similar USAID funded energy projects in Pakistan

Under the phase-I Signature Energy Program, the U.S. Government acting through USAID is funding the rehabilitation of four power plants, which includes three thermals (Jamshoro, Muzaffargarh and Guddu) and one hydro (Tarbela dam). The IEE's for rehabilitation were developed before the implementation began in May-Jun 2010 which identified 'Negative Determination with Conditions' per CFR 216, and recommended development of Environmental Mitigation and Monitoring plans (EMMPs) for each plant to elaborate environmentally safe and

sound waste management and disposal as well as ensure compliance with all Occupational Health and Safety (OHS) requirements acceptable to USAID. USAID supported the development of EMMP's for individual power plants through its Energy Policy Program (EPP). The implementation of the EMMP is being carried out by the GOP implementing partners' as per the G2G agreements.

Following are the lessons learned during the design and implementation of EMMPs:

- A main environmental concern was to ensure safe disposal of old equipment / spares and wastes to make sure that the rehabilitation was compliant with GOP and USG environmental policies and regulations. This concern was addressed by the development of EMMPs as part of a rapid Environmental Assessment for each plant by environmental experts hired by USAID. Observations regarding environmental mitigation, monitoring and OHS measures were recorded with photographs by the environmental experts during their initial site visits. The assessment was completed with support from the GOP implementing partners who also reviewed and agreed with the recommendations in the EMMPs.
- Tarbela dam is operated under WAPDA which has a separate environmental cell that supervises the implementation of environmental activities. Therefore the monitoring of EMMP is being carried out in close collaboration with WAPDA Environmental Cell with oversight from USAID. This program is acceptable to both parties.

4. Recommended Threshold Decisions & Mitigation Actions:

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

Summary Table

Activity	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 EDF/RR and 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 COR and MEO.

5. Limitation of the IEE

This IEE does not cover activities involving:

1. Assistance for the procurements (includes payment in kind, donations, guarantees of credit) or use (including handling, transport, fuel for transport, storage, mixing, loading, application, clean-up of spray equipment, and disposal) of pesticides (where pesticides cover all insecticides, fungicides, and rodenticides, etc. covered under the "Federal Insecticide, Fungicide, and Rodenticide Act" FIFRA) or activities involving procurement, transport, use, storage, or disposal of toxic materials. All the proposed activities involving assistance for the procurement or use, or both, of pesticides in the existing and expanded geographic areas shall be subject to the procedures prescribed in 22 CFR 216.3(b)(1)(i) through (v). USAID/Pakistan has BEO/OAPA-approved Programmatic PERSUAP, which shall be used for any procurement, use and/or recommendation for use of pesticides. Referred USAID/Pakistan programmatic "umbrella" PERSAUP (PPERSUAP), covers procurement, use or recommendation of use of pesticides in all sectoral ongoing and planned programs and projects in the country for the forthcoming 3-5 years.
2. Assistance, procurement or use of genetically modified organisms (GMOs), will require preparation of biosafety assessment (review) in accordance with ADS 201.3.11.2(b) in an amendment to the IEE reviewed by the Agency Biosafety Review Advisor and approved by Asia BEO.
3. Procurement or use of asbestos, lead and mercury Containing Materials (ACM) i.e. piping, roofing, etc., Polychlorinated Biphenyl's (PCB) or other toxic/hazardous materials prohibited by US EPA as provided at <http://www.epa.gov/asbestos> and/or under international environmental agreements and conventions e.g. Stockholm Convention on Persistent Organic Pollutions as provided at <http://chm.pops.int>
4. USAID/Pakistan restricts the use of USAID funds, directly or indirectly, to produce, acquire, use, transport, store, sell, or otherwise deal with ammonium nitrate (AN) for agricultural applications of calcium ammonium nitrate (CAN) for agricultural or construction/demolition purposes.
5. Activities involving support to wood processing, agro-processing, industrial enterprises and regulatory permitting GDA and/or DCA

Any of these actions would require an amendment to the IEE duly approved by the BEO.

6. Revisions

In accordance with 22 CFR 216.3(a)(9), if a project is revised or new information becomes available, including during preparation of an EDF, which indicates that a proposed action might be "major" and its effects "significant," the Determination will be reviewed and revised by the originator(s) of the program and projects and submitted through the MEO to the Bureau Environmental Officers, OAPA, for approval and, if warranted, an environmental assessment will be launched and scoping statement and environmental assessment report prepared. The scoping and EA process, if determined necessary during scoping, will follow and comply with 22 CFR 216.3(a)(4).

Confidential information redacted

Confidential information redacted

Annex II: Waste Management Companies

Petro Waste Busters

Contacted person:	Abdul Qayyum
Designation:	Coordinator
Contact Number:	+92 (51) 220 4348, 220 4350
Website:	http://www.petrowaste.com.pk
Email:	aquyyum@petrowaste.com.pk
Type of waste:	Industrial and hazardous waste
Transportation and collection:	They provide transportation
Internal and External audits:	Not mentioned
Certifications:	ISO 9000 and EPA certified
Disposal certificate:	Yes
Comments:	Detailed profile and NOCs received

Waste Busters

Contacted person:	Zillay Mariam
Designation:	
Contact number:	+92 (42) 667 2632, +92 (42) 667 2065
Website:	http://www.wastebusters.com.pk
Email:	zillay.m@gmail.com
Type of waste:	Mostly Industrial Waste
Transportation and collection:	Not mentioned
Internal and External audits:	Not mentioned
Certifications:	Not mentioned
Disposal certificate:	Not mentioned
Comments:	Demands project details and specifications before providing company profile

GEL (Pvt.) Ltd /Global Environmental Management Services Pvt Ltd

Contacted person:	Zahid Raza
Designation:	General Manager
Contact number:	+92 (21) 351 13804 5

Website: <http://www.gemspakistan.org>
Email: zraza@gel.com.pk
Type of waste: All types of waste
Transportation and collection: There is no regular arrangement but they can arrange
Internal and External audits: external auditors come and check at random intervals
Certifications Certified for Quality management systems and working for ISO 17025 accreditation
Disposal certificate: Yes
Comments: Details requested

Waste Management Company

Contacted person: Shariq Moazzam
Designation:
Contact number: +92 (21) 3431 1466
Website: <http://www.wmc.com.pk>
Email: shariq@wmc.com.pk
Type of waste: Waste oils and lubricants
Waste oil sludge
Oil contaminated soil
Activated carbon
Spent catalysts and exhausted media
Waste chemicals/solvents
Waste OBM and WBM and cuttings
Oil Filters, Air Filters
Amine Filters
Coalesces Filters
Printer and photocopier Cartridges
Food waste
Metal waste
Wood waste
Glass waste
Rubber and Plastic waste
Tires and tubes
Insulation Materials
Clinical and biological Waste
Used batteries and cells
Waste tube-lights and bulbs
Transportation and collection: WMC (Pvt) Ltd. hires from reputable companies third party audited vehicles having FTW "fit to work" status as and when requires, WMC also ensures that the drivers and their

companions engaged for the waste transportation are PPE clad have trainings pertained to Safe Driving and Road Safety besides the reasonable knowledge of HSE and have inductions about the sensitivity of activity with a satisfactory track record of Driving rules and Policy compliance /work (Driving) experience, awareness about ROW (Right of Way).

Internal and External audits: Not mentioned
Certifications: ISO 9001, ISO 14001, OHSAS 18001
Disposal certificate: Not mentioned
Comments: Demands project details and specifications before providing company profile

Bizxperts (Pvt) Ltd.

Contacted person: Muhammad Suffian Sabir
Designation: Director
Contact number: +92 (300) 833 1693
Website:
Email: info@biz-xperts.com
Type of waste: Hazardous & Non Hazardous Waste
Pharmaceutical Waste
Clinical Waste
Dental Waste
School Waste
Oil-Absorbent Materials
Textiles, Rubber, Paper, Carpet, Treated Wood

Transportation and collection: Waste collection service is provided usually
Internal and External audits: Materials Recycling Audit that assesses and continually monitors entire waste handling process.
Certifications: Not mentioned
Disposal certificate: Yes
Comments: Detailed profile received

National Cleaner Production Center (NCPC)

Contacted person: M Irshad Ramay
Designation: Coordinator NCPC
Contact number: +92 (51) 548 7041
Website: Not found

Email: irshadramay@gmail.com

Type of waste:

Transportation and collection:

Internal and External audits: Regular internal and external audits are conducted

Certifications: EPA certification

WD Systems

Contacted person: Shahid Shah

Designation: Manager (Implementation)

Contact number:

Website: Not found

Email: shahid.shah@wdsystems.com.pk

Type of waste:

Transportation and collection:

Internal and External audits:

Certifications:

Disposal certificate:

Comments: Information requested

Annex III: 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

Possible List of Confined Spaces in the Complex

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

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
% 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

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	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	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	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	Continuous permanent or portable ventilation unless the source of LFL	Continuous monitoring for LFL unless the source of LFL monitoring indicated
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
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	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	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	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 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.
 - 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

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

Building and Floor Damage Reporting Form

Zone	
Building	
Location of Defect	
Nature of Defect	<input type="checkbox"/> Masonry <input type="checkbox"/> Steel Structure Floor Doors and Door Frames Walkways <input type="checkbox"/> Ladders and Stairs <input type="checkbox"/> Ceiling
Description of Defect	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
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 angle 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 conforms 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 snap hook 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:

<i>Vertical distance</i>	<i>Horizontal distance</i>
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 Health 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)

Annex IV: 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

<i>Activity</i>	<i>Status</i>

Waste Generated and Handled

<i>Waste Type</i>	<i>Sources</i>	<i>Quantity</i>	<i>Status</i>

Summary of Occupational safety and health and environmental issues Identified

<i>No</i>	<i>Issue</i>	<i>Location</i>	<i>Discussion</i>	<i>Decision/Action</i>	<i>Responsible Person</i>	<i>Target Date</i>
1						
2						

Follow-up of Outstanding Issues

<i>No</i>	<i>Date Issue Raised</i>	<i>Issue and Action</i>	<i>Status</i>	<i>Discussion</i>	<i>Responsible Person</i>	<i>Revised Target Date</i>

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 include 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 Handling 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.						

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

<i>Requirement</i>	3	2	1	0	N/A	<i>Details</i>
5. All parts and machines dispatched from site after dismantling to store yard as soon as possible, preferably on the same day						
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						

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

<i>Requirement</i>	3	2	1	0	N/A	<i>Details</i>
18. The equipment is 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.						
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.						

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

<i>Requirement</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>N/A</i>	<i>Details</i>
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.						
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 activities are to be performed						
5. Ear protection devices are used if the noise level is above 85 dB(A)						
F. Repair, rehabilitation and installation activities–Working in confined Spaces						

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

<i>Requirement</i>	<i>3</i>	<i>2</i>	<i>1</i>	<i>0</i>	<i>N/A</i>	<i>Details</i>
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						

Annex V: Transformer Oil PCB Test Report



Orient Oils (Private) Limited

Orient Energy Group of Companies

LAB TEST REPORT

SOS LABORATORY COMPLEX

Plot # 14, Sector-16 Korangi Industrial Area, Karachi.,

TEST REPORT NO : EL-270214-10250

Tel: +92-21-35122406-10, +92-21-35121822-3 FAX: +92-21-35121821

Dated : 27-Feb-2014

ELECTROIL TEST REPORT

Customer : PAKISTAN WAPDA FOUNDATION		Batch #:	
SPECIFICATION : IEC 60296-2012		Date Of Sample : 27-Feb-2014	
Quality check		TRV: 2	
		Tank/ Tank Lorry : TUB 289	
Properties	Test Methods	Unit (limits)	Test Result
Color	D1500	-	L0.5
Function:			
Kinematic Viscosity at 40°C	ISO 3104	mm ² /s(12Max)	10.13
Kinematic Viscosity at -20°C	ISO 3104	mm ² /s(1800Max)	270.18
Pour Point	ISO 3016	C (-30Max)	-30
Water Content	IEC 60814	ppm(30Max)	16
Break Down Voltage	IEC 60156	Kv(30Min)	87
Density at 20°C	ISO 12185	0.895 gm/ml(Max)	0.8515
DDF @ 90C	IEC 60247	(0.005max)	0.0029
Refining/Stability:			
Appearance	-	-	Clear
Acidity	IEC 62021-1	mg KOH/gm(.01Max)	0.0052
Potentially Corrosive Sulphur*	IEC 62535	Not Corrosive	Not Corrosive
Corrosive sulphur	DIN 51353	Not Corrosive	Not Corrosive
Anti Oxidant Additives	IEC60666/FTIR	%(ND)	ND
Furfural Contents	IEC 61198	mg/kg(0.05×5Max)	ND
Performance:			
Oxidation Stability*	IEC 61125©	-	-
Total Acidity	-	mg KOH/gm(1.2Max)	0.5
Sludge %	-	%(0.8Max)	0.35
DDF @ 90C	IEC 60247	(0.5Max)	0.21
Health, Safety and Environment:			
Flash Point PMCC	ISO 2719	C(135Min)	160
PCA Content*	BS 2000/IP- 346	%(3Max)	<2
PCB Content	IEC61619	ND(<2mg/kg)	ND
COMMENTS :- The sample confirm to the product specification with respect of test carried out. 1 ltr sample bottle is being sent with the consignment. ND= Not Detectable .			
* Reported from Bulk Material.		Density @ 85F= 0.8452	
<small>(Orient Electroil Contains PPD of Olefin Derivative, separate storage is advised for transformer oil containing PPD's of different Manufacturers in case, mixing is required to be done in any previous sample is recommended to be tested for pour point prior to Mixing)</small>			
Analysed by:	Checked by:	Chief Chemist	

Annex VI: Material Safety Data Sheet Transformer Oil

MATERIAL SAFETY DATA SHEET

76 Transformer Oil

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: 76 Transformer Oil
Product Code: 1041410
Intended Use: Insulating Oil
Synonyms: Conoco Transformer Oil
Phillips Transformer Oil
Chemical Family: Petroleum Hydrocarbon

Responsible Party: Conoco Lubricants
A Division of ConocoPhillips
600 N. Dairy Ashford
Houston, Texas
77079-1175

Customer Service: 800-255-9556
Technical Information: 800-255-9556

The intended use of this product is indicated above. If any additional use is known, please contact us at the Technical Information number listed.

EMERGENCY OVERVIEW

24 Hour Emergency Telephone Numbers:

Spill, Leak, Fire or Accident Call CHEMTREC:
North America: (800) 424-9300
Others: (703) 527-3887 (collect)

California Poison Control System: (800) 356-3219

Health Hazards/Precautionary Measures: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Keep away from all sources of ignition.

Appearance: Clear brown
Physical Form: Liquid
Odor: Mild petroleum

NFPA 704 Hazard Class:

Health: 1 (Slight)
Flammability: 1 (Slight)
Instability: 0 (Least)

HMIS Hazard Class:

Health: 1 (Slight)
Flammability: 1 (Slight)
Physical Hazards: 0 (Least)

2. COMPOSITION / INFORMATION ON INGREDIENTS

NON-HAZARDOUS COMPONENTS					
Component / CAS No:	Percent (%)	ACGIH:	OSHA:	NIOSH:	Other:
Hydrotreated Distillate, Light Naphthenic ..C15-30 64742-53-6	> 99	5 mg/m ³ TWA 10 mg/m ³ STEL	5 mg/m ³ TWA	2500 mg/m ³ IDLH	as Oil Mist, if Generated 5 mg/m ³ NOHSC TWA
Additives PROPRIETARY	< 1	NE	NE	NE	

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

1%=10,000 PPM.
NE=Not Established

All components are listed on the TSCA inventory.

3. HAZARDS IDENTIFICATION

Potential Health Effects:

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness, and a burning sensation. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin leading to dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): No harmful effects expected from ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the nose and throat, irritation of the digestive tract, nausea and diarrhea.

Cancer: Inadequate data available to evaluate the cancer hazard of this material.

Target Organs: Inadequate data available for this material.

Developmental: No data available for this material.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

4. FIRST AID MEASURES

Eye: If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.

Skin: Wipe material from skin and remove contaminated shoes and clothing. Cleanse affected area(s) thoroughly by washing with mild soap and water and, if necessary, a waterless skin cleanser.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Notes to Physician: High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. Often these injuries require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury.

Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

5. FIRE-FIGHTING MEASURES

Flammable Properties:

Flash Point:	> 293°F / > 145°C
Test Method:	(COC)
OSHA Flammability Class:	Not applicable
LEL%:	0.9
UEL%:	7.0
Autoignition Temperature:	No data

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

6. ACCIDENTAL RELEASE MEASURES

This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Spilled material may be absorbed into an appropriate absorbent material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Use good personal hygiene practices.

High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing of high pressure hydraulic oil equipment.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat and all sources of ignition. Storage temperatures above 113°F may lead to thermal decomposition, resulting in the generation of hydrogen sulfide and other sulfur containing gases. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits (see Section 2), additional engineering controls may be required.

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with a Type 95 (R or P) particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a NIOSH approved self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode if there is potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection. A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Skin: The use of gloves impervious to the specific material handled is advised to prevent skin contact and possible irritation (see manufacturers literature for information on permeability).

Eye/Face: Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.

Other Protective Equipment: A source of clean water should be available in the work area for flushing eyes and skin. Impervious clothing should be worn as needed.

Suggestions for the use of specific protective materials are based on readily available published data. Users should check with specific manufacturers to confirm the performance of their products.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm).

Appearance:	Clear brown
Physical Form:	Liquid
Odor:	Mild petroleum
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure (mm Hg):	<0.1
Vapor Density (air=1):	> 5
Boiling Point:	No data
Melting/Freezing Point:	No data
Solubility in Water:	Negligible
Partition Coefficient (n-octanol/water):	No data
Specific Gravity:	0.88 - 0.89
Bulk Density:	7.33 - 7.41 lbs/gal
Viscosity cSt @ 100°C:	2.2 - 3.0
Viscosity cSt @ 40°C:	9.4 - 12.0
Percent Volatile:	Negligible
Evaporation Rate (nBuAc=1):	< 0.01
Flash Point:	> 293°F / > 145°C
Test Method:	(COC)
Flammable/Explosive Limits:	No data
Autoignition Temperature:	No data
Decomposition Temperature:	No data

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Conditions to avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with strong acids, strong bases, oxidizing agents.

Hazardous Decomposition Products: Combustion can yield and carbon, nitrogen and sulfur oxides.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Hydrotreated Distillate, Light Naphthenic ..C15-30 - 64742-53-6

Target Organs: Administration of certain mineral hydrocarbon white oils in the diet to Fischer rats at 1500 mg/kg/day for 90 days resulted in the formation of microgranulomas in the liver. However, this response was not observed in studies conducted with other rat strains or dogs. Microgranulomas like those observed in the Fischer 344 rat studies have not been observed in humans.

Acute Data:

Hydrotreated Distillate, Light Naphthenic ..C15-30 - 64742-53-6

Dermal LD50 = No information available

LC50 = No information available

Oral LD50 = No information available

Additives - PROPRIETARY

Dermal LD50 = No information available

LC50 = No information available

Oral LD50 = No information available

12. ECOLOGICAL INFORMATION

Not evaluated at this time.

13. DISPOSAL CONSIDERATIONS

This material under most intended uses would become used oil due to contamination by physical or chemical impurities. RECYCLE ALL USED OIL. While being recycled, used oil is regulated by 40 CFR 279. Use resulting in chemical or physical change or contamination may also subject it to regulation as hazardous waste. Under federal regulations, used oil is a solid waste managed under 40 CFR 279. However, in California, used oil is managed as hazardous waste until tested to show it is not hazardous. Consult state and local regulations regarding the proper handling of used oil. In the case of used oil, the intent to discard it may cause the used oil to be regulated as hazardous waste.

Contents should be completely used and containers emptied prior to discard. Rinsate may be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or a drum reconditioner. To assure proper disposal of small empty containers, consult with state and local regulations and disposal authorities.

14. TRANSPORTATION INFORMATION

DOT Shipping Description: Not regulated

Note: Material is unregulated unless in container of 3500 gal or more then provisions of 49 CFR Part 130 apply for land shipment.

IMDG Shipping Description: Not regulated

ICAO/IATA Shipping Description: Not regulated

15. REGULATORY INFORMATION

U.S. Regulations:

EPA SARA 311/312 (Title III Hazard Categories)

Acute Health:	No
Chronic Health:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

SARA - Section 313 and 49 CFR 372:

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

--None Known--

EPA (CERCLA) Reportable Quantity:

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

-- None Known --

California Proposition 65:

Warning: This material contains the following chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

-- None Known --

Carcinogen Identification:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA.

TSCA:

All components are listed on the TSCA inventory.

Canadian Regulations:

Domestic Substances List:

Listed

WHMIS Classification:

Not regulated

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

16. OTHER INFORMATION

Issue Date: 19-Jan-2004
Previous Issue Date: 10/17/2000
Product Code: 1041410
Reason for revision: Changed responsible party from Conoco to ConocoPhillips. Other formatting changes.
MSDS Code: 775852

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Energy Policy Program

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