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ENERGY POLICY PROGRAM

REFURBISHMENT AND UP-GRADATION WORK AT MANGLA HYDROELECTRIC POWER STATION

ENVIRONMENTAL DOCUMENTATION FORM/EMMP

NOVEMBER 2013

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ENVIRONMENTAL DOCUMENTATION FORM/EMMP

Contract No: AID-EPP-I-00-03-00004
Order No: AID-391-TO-12-00002

©USAID Energy Policy Program
House 4, Street 88, Sector G-6/3
Ataturk Avenue, Islamabad, Pakistan
Tel: +92 (51) 835 7072, Fax: +92 (51) 835 7071
Email: rsmith@aeai.net

Advanced ENGINEERING
Advanced Engineering Associates International

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Acknowledgement

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Environmental Documentation Form

Refurbishment and Up-gradation Project

A. Applicant Information

Contractor/grantee (Organization):	Parent grant of project
Individual contact and title:	Address, phone and email (if available)
Activity (brief description) Refurbishment and Up-gradation of Mangla Hydropower Plant	Amount USD: 150,000,000.0
Location of activity Mangla Hydroelectric Power Station (MHPS), Mirpur, Azad Jammu and Kashmir	Start and end date of activity FY 2012 to FY 2017

B. Activities, screening results, and recommended determination

Activity Breakdown	**Screening Result** (Step 3 of instructions)			**Recommended Determinations** (Step 6 of instructions 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. Design of new components	Yes			Yes		
2. Procurement of equipment	Yes			Yes		
3. Transportation of equipment from port in Karachi to the site and possibly from location in the country		Yes			Yes	
4. Removal of installed equipment and installation of new equipment		Yes			Yes	
5. Repair of existing equipment		Yes			Yes	
6. Disposal of waste and replaced material and equipment		Yes			Yes	

C. Summary of recommended determinations (check all that apply)

The activity contains	*(equivalent regulation 216 terminology)*
☐ Very low risk sub-activities	1. Design of new components 2. Procurement of equipment 3. Staff training Categorical exclusion per 22 CFR 216.2 c(1)(i) and (c)(2)(i)
☐ After environmental review, sub-activities Determined to have no significant adverse impacts	*Negative determination(s)*
☑ After environmental review, sub-activities determined to have no significant adverse impacts, given appropriate mitigation and monitoring	1. Transportation of equipment from port in Karachi to the site and possibly from location in the country 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)*
☐ After environmental review, sub-activities determined to have significant adverse impacts	*Positive determinations(s)*

D. 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 Rehabilitation and Up-gradation Work at Mangla 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-12-JUL-PAK-0032) 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.
   - An Environmental Impact Assessment (EIA) of the project has been submitted to and approved by the Azad Jammu and Kashmir Environmental Protection Agency (EPA-2222-28 date July 26, 2013). Compliance with the conditions stipulated in the EIA will be regularly confirmed and documented by on-site inspection during the activity and after its completion.

Confidential information redacted

Confidential information redacted

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1 Introduction

The Government of United States of America (USG) through United States Agency for International Development (USAID) is funding the Refurbishment and Up-gradation work (the "Project") at Mangla Hydropower Station (MHPS). For the implementation of the projects, USAID has tasked Advanced Engineering Associates International (AEAI) to carry out due diligence, recommendation, advice, assistance, monitoring and support for the implementation of the projects, part of which is to ensure that all refurbishment and up-gradation works are environmentally compliant in accordance with the applicable USG and Government of Pakistan policies and regulations.

AEAI acquired the services of Hagler Bailly Pakistan (HBP) to develop on the Environmental Documentation Form (EDF) including the Environmental Monitoring and Mitigation Plan (EMMP) for the project.

1.1 Terms of Reference

The terms of reference of the assignment are included as Appendix A. Briefly it includes review of the existing initial environmental examination (IEE) of the proposed activities and other relevant documents, visit to the plant site, development of environmental document form (EDF) and subsequently development of the EMMP for moderate risk activities, and addressing the comments from AEAI and USAID mission officers on the draft EMMP. The assignment focused on the scope of activities under the USAID funded refurbishment and up-gradation works.

1.2 Legislative and Regulatory Framework

1.2.1 National Requirements

The project shall comply with following regulatory and other requirements of Government of Pakistan:

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. Pakistan IEE/EIA Regulation, 2000 http://www.environment.gov.pk/act-rules/IEE-EIA-REG.pdf
4. Hazardous Substances Rules, 2003 http://www.environment.gov.pk/pro_pdf/HAZ-RU03.pdf
5. Draft Guidelines for Solid Waste Management, 2005 http://www.environment.gov.pk/EA-GLines/SWMGLinesDraft.pdf
6. Environmental, Health, and Safety General Guidelines http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf

The Pakistan Environmental Protection Act 1997 requires that initial environmental examination or environmental impact assessment shall be carried out for every 'project'. The types of project for which the requirement is applicable are listed in *Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment (EIA) Procedures 2000*. The definition of the project under the law includes both construction of a new project and modification to the existing project.

WAPDA has undertaken an environmental assessment of the Mangla Power Station Rehabilitation, Refurbishment and Up-gradation Project. The assessment report was submitted to the Azad Jammu

and Kashmir Environmental Protection Agency (AJK-EPA). An environmental approval was granted by AJK-EPA. The approval is included as Appendix B.

1.2.2 United States Requirements

The United States laws require that all activities financed by USAID shall comply with the requirement of the US law 22 CFR 216. The IEE for the proposed activities (see Appendix C) 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, the 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. The PERSUAP will be shared with the management of the MHPS. If any chemical required by the project falls in the regulated category, management of MHPS shall inform USAID or its designated Project Manager.

1.2.3 International Conventions

The main international convention that is relevant to this project is the Stockholm Convention on Persistent Organic Pollutants (POPs). The convention entered into force on 17 May 2004. Pakistan signed the convention on December 6, 2001 and ratified it on 17 April 2008. The convention focuses on eliminating production, use, and trade of POPs and thus reducing their negative impact on human health and the environment. One obligation under the Convention is for parties to eliminate the use of polychlorinated biphenyls (PCBs) in equipment (e.g. transformers and capacitors) by 2025 and to make determined efforts towards the environmentally sound management of waste PCBs by 2028.

1.3 Diary of Activities

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

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

Site visit: A visit to the MHPS was undertaken on 18th and 19th October 2013. The activities undertaken during this visit included:

- Meeting with the plant management, in particular with the following staff who helped to provide valuable information:
  - Mr Fazal Karim, Chief Engineer (Power)
  - Mr Khawar Nazir, Resident Engineer (Power), MHPS
  - Mr Mirza Arshad, Additional Resident Engineer (Mechanical), MHPS
- Walk through visit of the plant by HBP team to inspect all the equipment's and sites where refurbishment and up-gradation work will be carried out except some equipment, which was embedded and was not visible.
- General review of the existing site conditions and occupational, health and safety (OHS) practices
- Review of the detailed plans for the proposed refurbishment and up-gradation works

Waste Management Plan: The existing practices of environmentally sound waste management were observed. Safe disposal of old equipment after replacement in future is a particular focus of the

study. During the site visit and subsequently, an inventory for the possible amount of waste, during the rehabilitation and repair activities was made.

Preparation of EMMP: Following the visit, HBP team prepared an initial draft of the EMMP and EDF.

Second Site Visit: A second visit to the MHPS was undertaken on October 23, 2013 as part of the USAID and AEAI team. The activities during the second visit included meetings with the plant management, presentation of the plant management on the project, walk through visit of the MHPS, and discussion with the concerned staff on the implementation.

Revised Documents: Following the visit and based on the review of the first draft the revised EDF and EMMP is produced.

1.4 Observations at the Site

During the visit, the team reviewed the existing site conditions, measures adopted to mitigate environmental impacts, OHS practices, and the associated operational procedures for the normal power plant operation. In general no major HSE concerns were observed. There were safety signs and the necessary warning, which all the lower level staff and senior management and anyone working the area can comprehend. It was also observed that there was staff presence near the equipment that needed to be monitored on regular basis like 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 mentioning of the dates of expiry, refill that is due and the last refill date. Inside the buildings and in the lower compartments of Mangla HPS where there is lack of natural light, resulting in higher probability of incidents, there was adequate lighting. All the stair cases had safety railings to avoid falls.

MHPS appears to have good practices with respect to occupational safety and health and also have some safety related procedures. These include firefighting and prevention, permit to work, and dealing with emergencies caused by natural events. However, the plant lack a formal occupational health and safety system based on modern standards such as OHSAS 18001.

The team also visited the waste disposal site and storage area at the MHPS. The warehouse which will be used for the storage of the replaced equipment/ spares was shown in during the visit. The staff of the warehouse informed the HBP team that there will be designated place for storage of new equipment to be arrived and old equipment to be generated due to the proposed activity. Furthermore they told the team that, all the equipment will be labeled and demarcated.

1.5 Lessons Learned from Tarbela Dam Project

USAID is already financing similar project at Tarbela Hydropower Station operated by WAPDA. Regular monitoring is being undertaken of the rehabilitation work. The monitoring reports indicates show that the main concerns during the rehabilitation work includes the observance of safe work practices particularly by the contractors and management of waste generated by the rehabilitation work. Some of the common issues included:

- Delay in formulation of HSE team and organization and delay in training
- Non-provision of proper fall protection during repair work
- Non demarcation of storage area for equipment and waste
- Personal protection equipment (PPE) not being used by the workers
- Used oily gloves, clothing and packaging material thrown at different places
- Waste not segregated in waste storage area

However, after persistent reminders during the audits a clear improvement in the HSE performance was observed and the number of reported non-compliances decreased.

1.6 Environmental Benefits of the Project

Other than the economic benefits of the project, the project will result in off-setting greenhouse emission. Among the non-renewable resources, the most feasible power generation option currently available is thermal power through coal. It is estimated that a 70 MW plant on coal will release nearly 0.5 million metric tons of GHG annually. This project will avoid this release. In addition to this other pollutants such as sulfur dioxides, nitrogen oxides and particulate matter emission will also be avoided.

1.7 Study Team

The study team includes the following:

3. Hidayat Hasan, Environmental Specialist and team leader
4. Aziz Karim, Environmental Scientist
5. Noor Kamal, Environmental Scientist
6. Liaqat Karim, Environmental Engineer

2 Mangla Hydropower Project

The Mangla Dam is located about 80 km[1] southeast of Islamabad at a driving distance of 120 km. The project was conceived in 1950s as a dual purpose project for irrigation water management and power generation. It is an earth-fill dam constructed across Jhelum River near Mirpur in Azad Jammu and Kashmir. Construction of the dam was completed in 1967. An artist's rendition of the Mangla Dam is presented in Exhibit 2.1.

2.1 Mangla Dam Raising

At completion the capacity of the reservoir was 5.88 million acre-feet (MAF) [equal to 7.253 million cubic meters (MCM)]. As sediments carried by the river to the reservoir settles down in the reservoir, the capacity of the lake to store water gradually reduces. By 2002, the reservoir had lost nearly 17% of its capacity. As this was anticipated when the project was developed, a provision was kept in the original design of the Mangla Dam to raise the dam height to increase the reservoir capacity to recover the lost capacity. The Mangla Raising Project (MRP) was launched in 2004 and completed in 2009 with the objective of restoring the original capacity of the reservoir. Salient features of the project highlighting the changes after MRP are presented in Exhibit 2.2.

2.2 Power Generation

Between 1967 and 1994, ten power generation units were installed at Mangla Hydroelectric Power Station (MHPS) with a total installed capacity of 1,000 megawatt (MW). The plant is operated by the Pakistan Water and Power Development Authority (WAPDA).

2.3 Need for the Refurbishment Project

The need for the refurbishment and up-gradation work at Mangla stem from:

1. The MRP has resulted in availability of higher water head of 40 ft (12.2 m) and availability of additional water storage capacity of 2.88 MAF (3,553 MCM). This has increased the power generating potential of the reservoir. It is estimated that due to availability of more water and rise in net head of machines 644 Gigawatt-hour (GWh) of additional energy can be generated.
2. The installed power generating units are old. Most of the equipment were installed between 20 and 46 years ago. The issues identified with the old equipment include:
   - Efficiency of turbines has reduced from their designed values;
   - The hydraulic and mechanical equipment have become unreliable due to wear and tear;
   - Replacement of insulation required in some of the generators from the older type insulations to latest insulations with higher temperature tolerance;

[1] Crow-flight distance

Exhibit 2.1: Artist's Rendition of Mangla Dam

Exhibit 2.2: Salient Features of Mangla Dam

	Pre Raising	Post Raising
Reservoir		
Normal maximum water level	1,202 ft (366.4 m)*	1,242 ft (378.6 m)*
Minimum operation level	1,040 ft (317.0 m)*	1,040 ft (317.0 m)*
Live storage capacity	4.5 MAF (5,551 MCM)	7.457 MAF (9,198 MCM)
Dead storage capacity	0.098 MAF (121 MCM)	0.098 MAF (121 MCM)
Main Embankment		
Maximum height	454 ft (138.4 m)**	484 ft (147.5 m)**
Crest length	10,300 ft (3,139 m)	11,150 ft (3,399 m)

* Above mean sea level

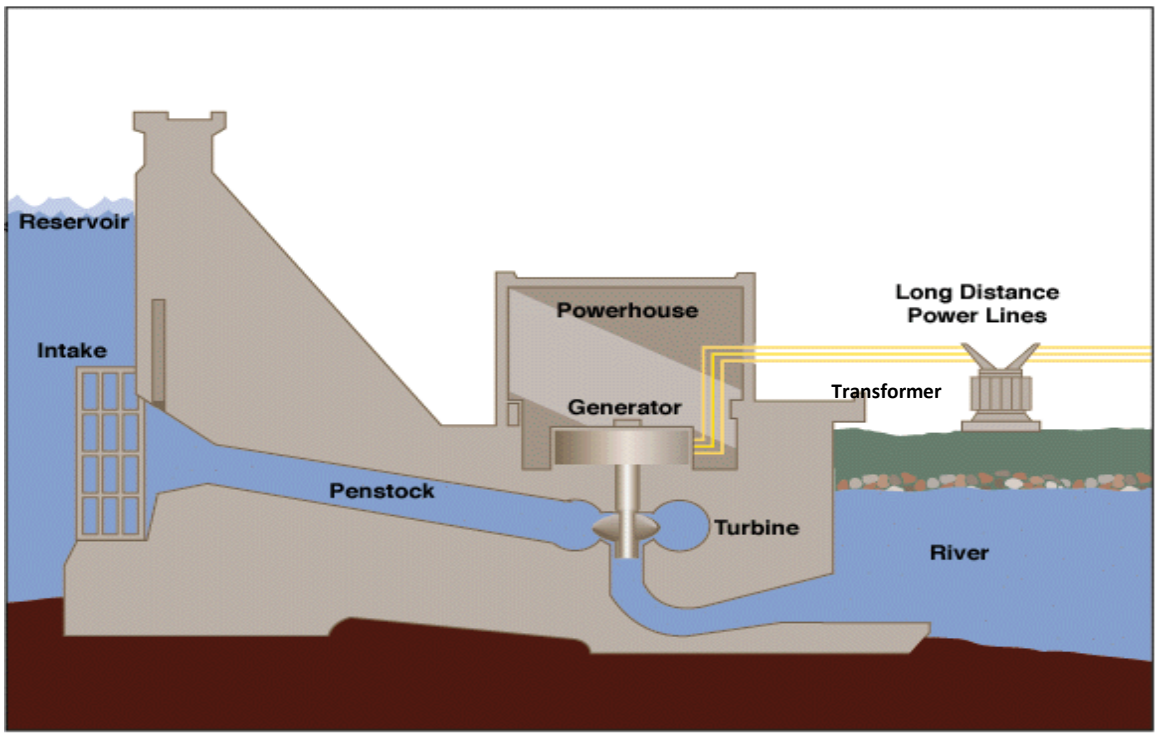
** Measured from the base of the structure

- Control and protection equipment have become obsolete and their spare components are no longer produced by manufacturers.

2.4 General Description of Hydropower Project

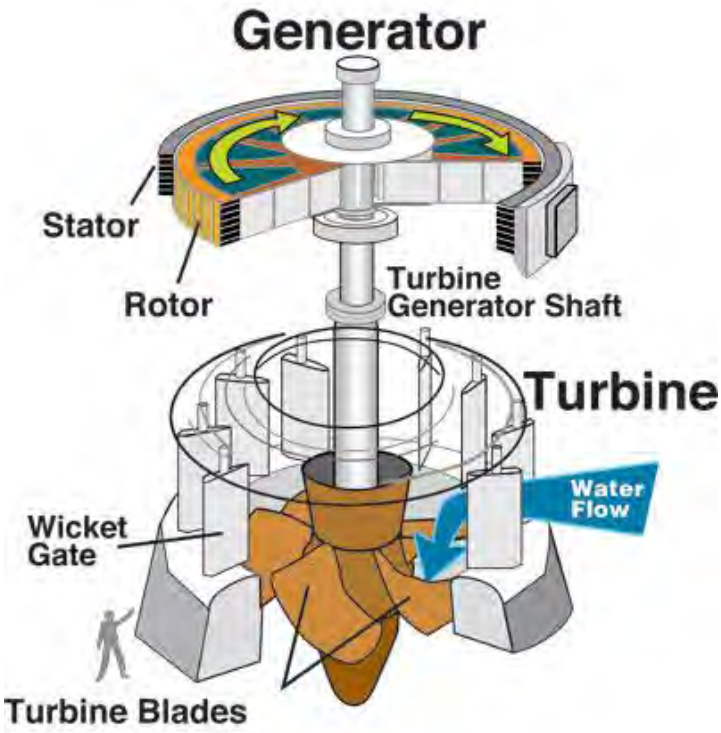
The schematic drawing in Exhibit 2.3 shows the main components of a hydroelectric power plant based on a dam and reservoir. This type of project is built on a large river that has a large drop in elevation in a relatively short distance. By constructing a dam across the river a reservoir is created which stores a large amount of water. Near the bottom of the dam wall there is the water intake. Gravity causes it to fall through the penstock inside the dam. At the end of the penstock there is a turbine propeller, which is turned by the moving water. The shaft from the turbine goes up into the generator, which produces the power. Power lines are connected to the generator through a transformer. The high-voltage power transmission lines than carry the electricity to consumers for distribution. The water continues past the propeller through the tailrace into the river past the dam.

Exhibit 2.3: A Typical Hydropower Project



The heart of the hydroelectric power plant is a hydraulic turbine and generator (Exhibit 2.4). A hydraulic turbine converts the energy of flowing water into mechanical energy. A hydroelectric generator converts this mechanical energy into electricity. In a large generator, electromagnets are made by circulating direct current through loops of wire wound around stacks of magnetic steel laminations. These are mounted on the perimeter of the rotor. The rotor is attached to the turbine shaft, and rotates at a fixed speed. When the rotor turns, it causes the electromagnets to move past the conductors mounted in the stator. This, in turn, causes electricity to flow and a voltage to develop at the generator output terminals.

Exhibit 2.4: A Hydroelectric Generator and Turbine



2.5 References

The materials in this chapter have been obtained primarily obtained from the following sources:

1. Pakistan Paedia. http://www.pakistanpaedia.com/mega/mangla_dam.html. Accessed November 2013.

2. Pakistan Water and Power Development Authority (WAPDA)
   a) http://www.wapda.gov.pk/htmls/water-dams-mangla.html,
   b) http://wapda.gov.pk/vision2025/htmls_vision2025/mangla.html
   Accessed November 2013

3. United States Geological Survey http://ga.water.usgs.gov/edu/hyhowworks.html Accessed November 2013

4. Pakistan Water and Power Development Authority (WAPDA). *A presentation on Mangla Dam Project*. Presented in October 2013

3 Description of Proposed Activity

Under an agreement, between the USG and the Government of Pakistan, USAID will be financing the planned refurbishment and up-gradation at MHPS. The proposed program will produce additional peaking capacity of at least 70 MW in summer months when there is an acute shortage of power.

3.1 Project Components and Activities

The activities that have been identified for USAID funding under the MHPS rehabilitation project includes replacement of two complete turbines and generators and other damaged or worn-out equipment.

The proposed activities can be categorized as follows:

- Designing of new components
- Procurement of equipment
- Transportation of equipment from port in Karachi to the site and possibly from location in the country
- Removal of installed equipment and installation of new equipment
- Repair of existing equipment
- Disposal of waste and replaced material and equipment

In Exhibit 3.1, the proposed components of the projects and the associated activities are listed.

3.2 Work Sites and Activities

All proposed activities at the project site will be confined to the premises of the existing MHPS. Within the sites the activities will take place at the following locations:

- Components 1, 2, 4.1 and several of the other subcomponents will be within the Turbine Hall of the MHPS
- Component 3.1 will be located inside the Turbine Hall of MHPS
- Component 3.2 will be outside the Turbine Hall but within the secured premises of the MHPS
- All other components will be located either at the switchyard or in the vicinity but all within the secured premises of MHPS.

Satellite image showing locations of major work sites is shown in Exhibit 3.2. Photographs of the activities are shown in Exhibit 3.3.

Exhibit 3.1: Proposed Activities of the MHPS Refurbishment and Up-gradation Project

Item No.	Component and Subcomponent	Activities					
		Design	Procurement	Transportation	Removal and Installation	Repair	Disposal of Waste and Replaced Material
1	**Unit 5 and Unit 6 Generators**						
1.1	Replacement of Stator cores, frames, windings, excitation system	Y	Y	Y	Y		Y
1.2	Repair and servicing of soleplates and other components as required	Y			Y	Y	Y
2	**Unit 5 and Unit 6 Turbines**						
2.1	Replacement of runners, isolated phase bus, and power train equipment	Y	Y	Y	Y		Y
2.2	Repair and servicing of components as required	Y			Y	Y	Y
3	**Other Components of Unit 5 and Unit 6**						
3.1	Replacement of disc bronze seal and slip ring joint of main water inlet valve	Y	Y	Y	Y		Y
3.2	Replacement of Main Power transformer	Y	Y	Y	Y		
3.3	Replacement of plant control and protection system	Y	Y	Y	Y		Y
3.4	Replacement of switchyard control and protection system	Y	Y	Y	Y		Y

Item No.	Component and Subcomponent	Activities					
		Design	Procurement	Transportation	Removal and Installation	Repair	Disposal of Waste and Replaced Material
4	**Balance of Plant Equipment (Mechanical)**						
4.1	Replacement of Power House Crane	Y	Y	Y	Y		Y
4.2	Replacement of Tunnel 1-5 intake gate seal, draft tube gates installation, turbine runner wearing, spiral case and stay vanes, upper/lower GV facing plates,	Y	Y	Y	Y		Y
	Repair of tunnel concrete, power intake gates and trash, irrigation valve, turbine water passage, guide vanes operating mechanism, head cover blast, shaft seal, discharge ring and shaft. Cooling water system, draining and dewatering system, sewage system	Y	Y	Y	Y	Y	Y
5	**Balance of Plant Equipment (Electrical)**						
5.1	Improvement and repair of fire protection system, communication with load dispatch system, miscellaneous switchyard equipment, switchyard grounding system, fire detection system.	Y	Y	Y	Y	Y	Y

Exhibit 3.2: Satellite Image Showing Locations of Major Work Sites

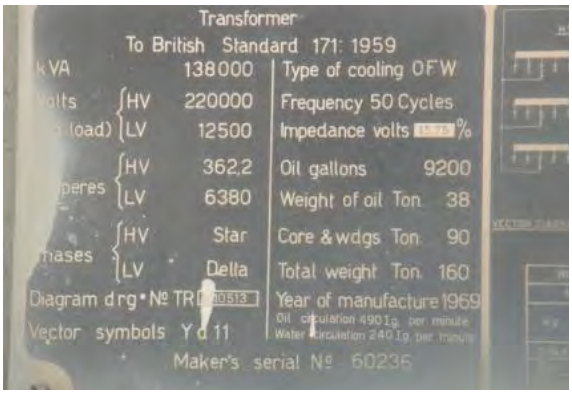
Source: Google Earth, Imagery Dated February 12, 2013

Exhibit 3.3: Selected Photographs from the Site Visit

Mangla Power Station

Inlet Gate No. 5

Transformer of Unit 5



Details of the Transformer No.5

Firefighting Equipment (A)

Auto triggered Firefighting Equipment (B)

One of the Fire Extinguishers Tag

Irrigation Valve of Unit No.5 (A)

Irrigation Valve (B)

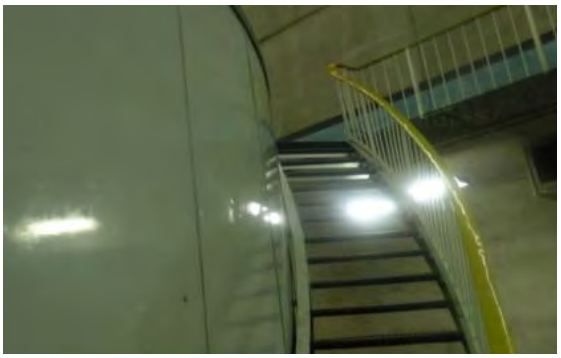
Switchyard for Mangla Power Station (A)

Switchyard for Mangla Power Station (B)

Switchyard for Mangla Power Station (C)

Control Station for Unit 5 and Unit 6 (A)

Control Station for Unit 5 and Unit 6 (B)



Staircase near Unit 5 (A)

Unit No 5 Generator Casing

Power Station Crane

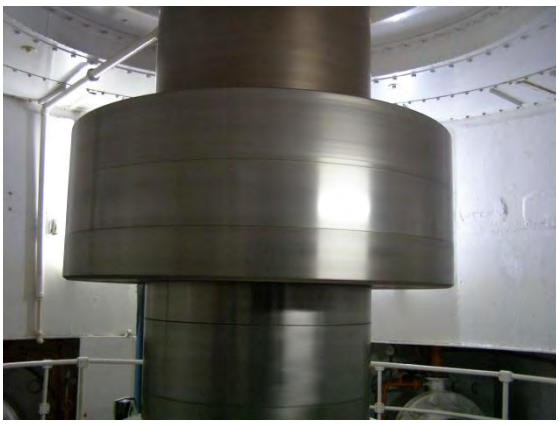
Hydraulic Piston at the Inlet Gates(A)

Hydraulic Piston at the Inlet Gates(B)

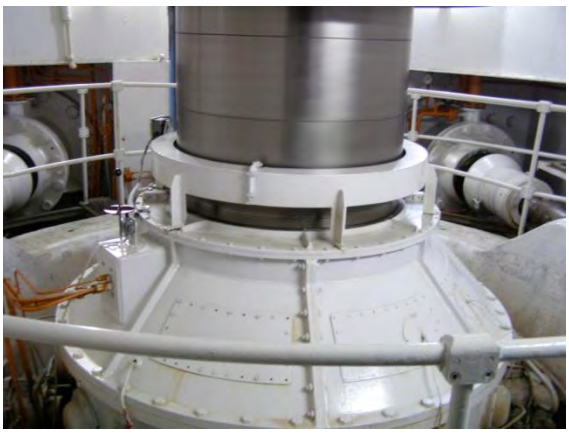
Rail Track for Transport of Crane at Inlet Gates

Turbine Hall (A)

Turbine Hall (B)



Unit 5 shaft connecting Turbine and Generator



Turbine Unit 5

Penstock Unit 5

General View of Control Room

Tagging for Permitting Procedure

Transformer Unit 5

4 Environmental and Social Concerns, Mitigation and Monitoring Measures

4.1 Environmental and Social Aspects

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

1. **Designing of new components:** This is an office based exercise with no direct environmental aspects. However, during the designing it the requirements described in this document needs to be taken into consideration to ensure compliance with the requirements of EDF, EMMP, IEE, EIA and the applicable approvals.

2. **Procurement of equipment:** This is an office based exercise with no direct environmental aspects.

3. **Transportation of equipment from port in Karachi to the site and possibly from location in the country:** The equipment will be transported in large flat-bed trucks (trailers). The material will be transported using existing national highways. This includes M-9 from Karachi to Hyderabad, and N-5 from Hyderabad to Jhelum. These roads are already are used for the heavy traffic. The number and frequency of the vehicles due to the project will not affect the existing number and frequency of traffic. Similarly, the equipment is not expected to be oversized to require removal of power and telephone lines. Therefore transportation is not expected to produce major issues and no specific mitigation measures are proposed. Except some local issues including traffic jams and potential accidents at the road section between town of Dina and MHPS which is a two-lane road with a width (including shoulders) of 44 ft (13.4 m). To avoid such events, trucks should be mobilized during nighttime (10pm to 06am) in this section.

4. **Removal of installed equipment and installation of new equipment:** The main concern in this phase will be the occupational health and safety. Occupational health and safety are the main issues during onsite storage and handling of equipment and during project activities–whether carried out by MHPS staff or by contractors. The issues are discussed in **Section 4.6**.

5. **Repair of existing equipment:** Occupational health and safety issues are also the main concern during this activity.

6. **Disposal of waste and replaced material and equipment:** Waste disposal issues have been identified in **Section 3**.

4.2 Mitigation Measures and their Schedule

The mitigation measures corresponding to the issues discussed in the previous section are presented in **Exhibit 4.1**. The implementation responsibilities are also discussed in the same exhibit.

The schedule of the mitigation measures is as follows:

- The mitigation measure corresponding to a project activity shall be in place before the initiation of the activity and shall remain in place until the completion of the activity.
- The training shall be completed as per the schedule described in **Section 4.5** and **Exhibit 4.2**.
- All designation related to HSE shall be made within 30 days of signing of this document or one week before commencement of any project activity, whichever is earlier.

4.3 Key Obligations of WAPDA

Key obligations of WAPDA are as follows:

1. Ensure adherence to the mitigation and monitoring requirement laid out in this document
2. Report any major environmental or health or safety related incident to USAID or its designated Project Manager immediately
3. Follow the reporting requirements as mandated
4. Keep main transformer from Units 5 and 6 intact during the course of funding. In case, any dismantling is required report it to USAID or its designated Project Manager before undertaking any activity.

4.4 Monitoring

The above mentioned environmental aspects have been assessed and mitigation measures for potential adverse impacts identified during this study. In order to ensure that the proposed mitigation measures are implemented, the monitoring requirements including indicators and specific requirements are listed in **Exhibit 4.1**. The overall responsibility of EMMP's monitoring rests with plant Management. This monitoring arrangement can be carried out either by using the existing staff with requisite expertise or a dedicated HSE officer may be hired in case of time and/or capacity constraints. The monitoring results will be reported to USAID or its designated Project Manager as described below in **Section 3.7**.

4.5 Training Requirements

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

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

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

4.6 Occupational Safety Measures

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

- HSE Policy
- Occupational health and safety management measures
- Use of personal protection equipment
- Trainings requirement and management
- Documented procedures

- Monitoring and audit, and
- Reporting to USAID or its designated Project Manager.

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

4.7 Staffing

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

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

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

4.8 Responsibilities

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

1. Ensure that the refurbishment and up-gradation work is carried out in accordance with this EMMP and the corresponding IEE
2. Ensure that all resources are made available to implement the provisions of the EMMP
3. Maintain appropriate records (checklist, receipts, inspection reports, audit reports, monitoring data) to demonstrate that the EMMP is implemented
4. Prepare a brief monitoring report and submit to the USAID or its designated Project Manager at the end of every month. 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. A proposed format for the inspection and monitoring of the project activities has been presented in **Appendix G**.
6. In case of any accident involving occupational safety issue or environmental issue (accidental release of pollutant) report the incident to USAID or its designated Project Manager within 48 hours of the incident.

7. 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 or its designated Project Manager for approval.

4.9 Reporting

An effective mechanism for storing and communicating of HSE related information during the project is required. The Chief Engineer of MHPS through his designated HSE officer shall undertake the following activities in this regard:

- Precisely record and maintain all HSE related information generated during the project.
- Process the information to produce monthly reports.
- Submit the monthly HSE reports to USAID its designated Project Manager, and other stakeholders upon completion of each month
- Provide information and answer to any queries on HSE related matter of the project from USAID and other stakeholders.
- Develop and submit a final HSE report of the project to state the overall compliance of the requirements of this EMMP.
- Monitoring checklist and audit report shall be included with monthly reports.
- The monthly report shall also include information about the status of project activities. Information shall be provided, if no activities undertaken during a month.
- Record all HSE incidents (accidents, near miss, spills and emissions). Report all major incidents to USAID or its designated Project Manager immediately.

4.10 Budgetary Estimates

The budgetary requirements for implementation of the EMMP cannot be fully monetized. Whereas, MHPS has some internal systems, the actual budget would depend on whether the new systems are developed to cater for the project only or are implemented plant-wise. However an indicative budget has been developed and shown in **Exhibit4.3**. The total financial impact for the implementation of this EMMP is estimated to be PKR 1,809,000. The major components of the budget include salaries for the HSE personnel, capacity building, and purchasing of HSE related equipment.

Exhibit 4.1: Environmental Management and Monitoring Plan

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

Activity	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring	Party(s) Responsible	Cost
Refurbishment and Up-gradation Activities –Working in confined Spaces and Working at Height	• All confined spaces[2] 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 • Proper scaffolding platforms should be provided for all work areas located more than 1 m above floor level.	• Visual inspection of the confined space prior to activity • Temperature measurement before commencement of activities • Visual inspection	• A checklist-based monitoring shall be undertaken prior to entry into confined space, covering: • Inspection of entrance • Measurement of temperature • Risk of fumes or gases • Availability of equipment	Contractor RE of each unit	
Waste Management	• Waste management plan is presented separately in Section 3.	• Quantity of waste generated, their classification and disposal mechanism • Waste disposals contracts for inclusion of appropriate clauses	• Inventory of all waste shall be prepared. For each type of waste the quantity and disposal mechanism shall be identified • Where necessary, audit of the waste contractor	Store Supervisor	

Notes: See **Exhibit 4.3** for Cost

[2] Confined space" means a space that:

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

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Exhibit 4.2: Proposed Training Program

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

Exhibit 4.3: Indicative Budget for Monitoring and Management Plan

Core Activity	Budgeted Activity	Budget Rationale	Indicative Budget
Transportation of equipment from Karachi to MHPS	• Monitoring of vehicles for emissions and noise	• Monitoring of 15[3] vehicles at PKR 5,000 each	PKR 75,000
Onsite handling and storage of new equipment	• Storage of new equipment	• No additional cost	–
	• Implementation of safety specifications for lifting equipment (cranes)	• No additional cost	–
	• All types of materials shall be purchased along with respective Material Safety Data Sheet (MSDS)	• No additional cost	–
Repair, rehabilitation and installation activities–General	• Purchase of required PPEs'	• 30 Sets of PPEs' at PKR 15,000 for each	PKR 450,000
	• Proper scaffolding platforms for all work areas located more than 1 m above floor level.	• Should be included in the repair and maintenance contract	–
	• First Aid facilities and fire protection devices	• Cost of five first aid boxes at PKR 4,000	PKR 20,000
	• Monitoring of noise levels	• Purchase of noise meter	PKR 200,000
Staff Hiring	• Recruitment of one HSE Officer	• Salary of HSE Officer for 3 months at the cost of 60,000/month	PKR 180,000
	• Recruitment of HSE Inspectors	• Salary of an HSE Inspector is estimated at 30,000 per month. The project requires maximum of two HSE Inspectors for three months	PKR. 180,000
	• Recruitment of Sanitary Workers	• Salary of a sanitary worker is estimated at 10000/month. The project may require two sanitary workers at maximum for three months	PKR 60,000
Repair, rehabilitation and installation activities–Working in confined Spaces	• Identification of confined spaces	• This cost is included in staffing of HSE officer	–
	• Managing temperature, lighting and risk of gases or fumes in confined spaces	• This cost is included in staffing of HSE officer	–
	• Monitoring and inspection	• Cost of HSE officer for inspection and monitoring at PKR 4,000 per day for three days	PKR 12,000
Waste management	• Onsite collection, segregation and storage of wastes	• Cost of waste bins	PKR 5,000

[3] 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
Trainings	• Occupational Health and Safety	• HSE Trainer fee for two days at PKR 40,000 per day; travel and boarding at PKR 60,000 per visit	PKR 140,000
	• HSE Audit	• HSE Trainer fee for one day at PKR 40,000 per day; travel and boarding at PKR 40,000 per visit	PKR 80,000
	• Waste Management and Handling	• HSE Trainer fee for one day at PKR 40,000 per day; travel and boarding at PKR 40,000 per visit	PKR 80,000
HSE Audit	• Conducting and reporting of HSE audit	• HSE Auditor fee for four days for two audits at PKR 40,000 per day; travel and boarding at PKR 60,000 per visit	PKR 280,000
Analyses of oil for PCBs	• Transformer oil need to analyze for possible presence of PCBs	• PKR 7500/ sample (7500*2= 15000) • Containers and Transportation of sample to overseas testing laboratory[4] PKR 30000	PKR 45,000

[4] Recommended: ALS Laboratory (http://www.alsglobal.com.my/)

5 Framework Waste Management Plan

The existing practices of environmentally sound waste management and safe disposal of old equipments and spares were a particular focus of this EMMP. A framework waste management plan (FWMP) is presented in this section. Details of waste management related companies are presented in **Appendix H**.

5.1 Inventory of Waste

As part of the EMMP, an inventory of the possible amount of waste that may be generated during the refurbishment and up-gradation activities was developed in consultation with the WAPDA staff. The inventory which is based on specifications of installed equipment is presented in **Exhibit 5.1**. In the table, the nature and estimated quantity of waste generated from each proposed activity has been shown. The estimated quantity is based on observations at the site and provided only to indicate the relative magnitude of the generated waste. The actual quantity of waste generated from each activity may be significantly different.

5.2 Hazardous Waste

From the available inventory and information, asbestos is not likely to be present in any material that will be removed. However, WAPDA will be obligated to report to USAID or its designated Project Manager if asbestos is encountered or suspected in any waste. Safe work procedures for asbestos will be followed in this case. A framework for asbestos is provided in **Appendix I**.

Polychlorinated biphenyls (PCBs) are likely to be present in the main transformers. However, WAPDA is planning keep the transformers intact after removal for use as back-up transformers to those installed on the station. In case, WAPDA decides to dismantle these transformers it will be obligated to inform USAID or its designated Project Manager and follow safe practices. Examples of these are provided in **Appendix J**.

5.3 Handling and On-Site Storage of Waste

Exhibit 5.2 shows the aggregated inventory of various types of waste that is likely to be generated during the rehabilitation project. The category, source and quantity of the waste are identified. The hazard or issues associated with each category during disposal and handling is discussed and the recommended procedures for handling and storage are provided. The wastes with potential of hazard or prohibited substances, like PCBs, shall be tested prior to handling and storage.

5.4 Re-use and Recycling of Waste

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

A comprehensive waste management plan based on this FWPM shall be instituted at MHPS during which re-use opportunities for waste generated from the plant during routine operation and maintenance shall be actively investigated.

As a standard practiced all metal (mainly iron and copper) parts generated as waste during the rehabilitation project will be recycled. Similarly, wood[5] will also be recycled. Part of the recycling may be done internally, within MHPS.

[5] Unless the supplier of the wood packaging certifies that the wood is not treated with pesticides, testing will be required before recycling or reuse is undertaken.

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

5.5 Disposal of Waste

This section discusses the ultimate disposal of various wastes that will be generated during the rehabilitation project. The preferred disposal options are presented in **Exhibit 5.3**.

Exhibit 5.1: Estimated Generated Waste from Each Activity

Item #	Component	Sub-component	Estimated Generated Waste					
			Iron (kg)	Copper (kg)	Other Metals (kg)[a]	Wood, Cloth and Packaging (kg)	Electronics (kg)	Oil (l)
1	Unit 5 and Unit 6: Generators	Stator cores and frames	310,000	–	2,000	–	–	–
		Windings	–-	50,000	–	–	–	–
		Stator Generator connections and isolated phase bus	–	–	6,000	–	–	–
		Soleplates removal and repairs, different design support.	–	–	–	–	–	–
		Excitation system	30,000	44,000	–	–	–	–
		Thrust bearing improvement may be required	–	–	–	–	–	–
		Other generator repairs as required	–	–	–	–	–	–
2	Unit 5 and Unit 6: Turbines	Runners	85,000	–	–	–	–	–
		Power train equipment replacement						
		Other repairs as required	–	–	–	–	–	–
3	Unit 5 and Unit 6: Main Inlet Valves	Disc bronze seal replacement			1,400			
4	Unit 5 and Unit 6: Main Power Transformer [b]	–	190,900	53,100	–	–	–	76,000
5	Plant Control System and Protection	–	240	–	–	–	20	

Item #	Component	Sub-component	Estimated Generated Waste					
			Iron (kg)	Copper (kg)	Other Metals (kg)[a]	Wood, Cloth and Packaging (kg)	Electronics (kg)	Oil (l)
6	Switchyard Control and Protection System	–	–	–	–	–	–	–
7	Power House Crane	–	6,000	–	–	–	–	–
8	Balance of Plant Equipment (Mechanical)	• Tunnel 1-5: Intake Gate Seal	–	–	2,500	–	–	–
		• Tunnel concrete Repairs	–	–	–	–	–	–
		• Tunnel 1-5: Power intake gates & Trash racks repairs	–	–	–	–	–	–
		• Draft tube Gates: Add guide extension and inspection and repair	–	–	–	–	–	–
		• Irrigation Valve recoat surface	–	–	–	–	–	–
		• Turbine water passage. Downstream of inlet valve	–	–	–	–	–	–
		• Turbine Runner Wearing: Replace	1,000	–	–	–	–	–
		• Spiral Case and Stay Vanes: Replace upper/lower GV facing plates, Inspect and Recoat surface.	2,000	–	–	–	–	–
		• Guide Vanes operating mechanism (inspect ,test and repair)	3,000	–	–	–	–	–
		• Head Cover Blast inspect test & recoat inner HC	–	–	–	–	–	–

Item #	Component	Sub-component	Estimated Generated Waste					
			Iron (kg)	Copper (kg)	Other Metals (kg)[a]	Wood, Cloth and Packaging (kg)	Electronics (kg)	Oil (l)
		• Shaft Seal inspection and repairing	–	–	–	–	–	–
		• Discharge ring and Shaft tube inspect all lined & unlined surface for soundness damage and leak.	–	–	–	–	–	–
		• Cooling water system: Reconfigure system for closed loop operation, including water to water heat exchanger, pumps, valve and piping.	10,000	–	–	–	–	–
		• Draining & dewatering Replace all existing drainage and dewatering pumps draft tube wall Gallery Rehabilitation /Man door Leakage/Intake Concrete Repair	15,000	–	–	–	–	–
		• Compress Air System: Modification and addition as per requirement	–	–	–	–	–	–
		• Sewage System as per requirement	–	–	–	–	–	–

Item #	Component	Sub-component	Estimated Generated Waste					
			Iron (kg)	Copper (kg)	Other Metals (kg)[a]	Wood, Cloth and Packaging (kg)	Electronics (kg)	Oil (l)
9	Balance of Plant Equipment (Electrical)	• Fire Protection System (Non Generator): Test/replace fire detectors in control room, 11 kva switch gear room, cable tunnel and transformers bay. Increase cable tunnel sprinkler coverage.	–	–	–	–	–	–
		• Switchyard Equipment: Repair of Misc. Equipment	–	–	–	–	–	–
		• Switchyard Grounding System: Upgrade grounding system	–	–	–	–	–	–
		• Fire Detection System: Add new detection system	–	–	–	–	–	–
		• Communication with Load Dispatch System.	–	–	–	–	–	–
		• Switchyard Protection, Metering and Control System: Replace with modern Substation Atomization System including Protective Relays.	–	–	–	–	–	–

a Includes aluminum, brass

b The transformers will remain intact

c A dash ('–') indicates that this type of waste is not likely to be present.

Exhibit 5.2: Handling and Storage of Waste

No.	Waste Category	Sources and Forms	Estimated Quantity	Associated Hazard	Recommended Handling and Disposal
1	Iron	• Stator cores and frames • Excitation system	660,000 kg	• Sharp edged metal from cuttings can cause cuts and bruises at any stage of handling or disposal • All the waste generated from the power plant if left unattended or in the passage ways of the may pose threat to the safety of the staff and hamper the movement of the workers	• While handling sharp edged metals protective leather gloves shall be used • After dismantling, all parts and machines shall be dispatched from site to storage yard as soon as possible, preferably on the same day • In the store yard all waste shall be properly marked and segregated. A clear passage way marked by lines on the ground shall be left for walking of staff. No waste shall be stored within the passage way. • Sharp edged metal shall not be left unattended at any time. It shall be moved to storage yard immediately after removal. In the storage yard, the storage area for such metal shall be cordoned off using clearly visible tapes.
2	Copper	• Windings • Excitation system • Main Power transformers	147,000 kg	• All the waste generated from the power plant if left unattended or in the passage ways of the may pose threat to the safety of the staff and hamper the movement of the workers	• While handling sharp edged metals protective leather gloves shall be used • All parts and machines after dismantling shall be dispatched from site to store yard as soon as possible, preferably on the same day • In the store yard all waste shall be properly marked and segregated. A clear passage way marked by lines on the ground shall be left for walking of staff. No waste shall be stored within the passage way. • Sharp edged metal shall not be left unattended at any time. It shall be moved to storage yard immediately after removal. In the storage yard, the storage area for such metal shall be cordoned off using clearly visible tapes.

No.	Waste Category	Sources and Forms	Estimated Quantity	Associated Hazard	Recommended Handling and Disposal
3	Other Metals	• Stator cores and frames • Windings • Main inlet valves	11,900 kg	• As the nature of such waste is not clearly established it is possible that the waste may contain heavy metal. Unless otherwise established through tests or known composition of waste, all such waste material shall be treated as hazardous and treated accordingly	• The waste shall be segregated from other waste and shall be clearly marked with a proper hazard sign. • Before final disposal, any potentially hazardous substance such as lead or material containing lead shall be identified and disposed off accordingly.
4	Oils	• Transformers[6] • Accidental release of additive oils and paints	< 100 kg	• Spills and leaks will contaminate the soil and potentially water resources • Oil on floor poses tripping hazard to the workers. • The possible presence of Polychlorinated Biphenyl's (PCBs) in the transformer oil	• 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 • Analyze a sample from transformer oil for PCBs for each transformer to be removed
5	Plastic	• From packaging material	600 kg	• Nuisance and littering • Open air burning may affect in local air quality	• All type of plastic shall be collected and stored in separate bins marked for this purpose • Plastic waste shall not be burned in open air or disposed of by dumping in the areas surrounding the plant site

[6] The transformers contain oil (35,000 liters x 2= 70,000.0). WAPDA has committed not to dismantle the transformer. Therefore transformer oil waste will not be generated.

No.	Waste Category	Sources and Forms	Estimated Quantity	Associated Hazard	Recommended Handling and Disposal
6	Wood, Clothing and Packaging Material	• Wood and packaging material from the packaging of procured equipment for the activity • Clothing as gloves and cleaning cloth	1,400 kg	• Wood may contain nails that may injure the staff • Nuisance and littering • Open air burning may affect in local air quality • Oil stained gloves and cleaning clothes may cause contamination of water if they are dumped in water bodies.	• Nails shall be removed from the wood • All type of waste shall be collected and stored in separate bins marked for this purpose • Waste shall not be burned in open air or disposed of by dumping in the areas surrounding the plant site
7	Air Emission	• The air emissions will be released due to welding and cutting and grinding	E	• Can affect the respiratory systems	• Standard protective equipment including eye protective glass, gloves and mask shall be used

Exhibit 5.3: Disposal of Waste

No.	Waste Category	Ultimate Disposal	Estimated Quantity	Associated Hazard or Issues	Recommended Procedure
1	Iron	• Recycling	660,000 kg	• Some parts may be contaminated with oil. The parts on melting in furnace may give out fumes that are hazardous or may constitute a nuisance	• Separate oil contaminated parts from the rest • Include in the contract agreement with waste disposal contractor condition that the oil contaminated parts will be cleaned before being fed into furnace. Alternatively, the cleaning may be undertaken at HPS.
2	Copper	• Recycling	147,000 kg	• Copper wires are covered with insulation, which if burned in low temperature can release hazardous materials	• Separate wires and other copper waste with insulation material from the rest • Include in the contract agreement with waste disposal contractor condition that such waste will either be incinerated in high temperature incinerators or alternatively, the insulation will be removed mechanically.
3	Other Metals	• Recycling	11,900 kg	• Some of the waste may be hazardous which can ultimately affect the human health if not appropriately handled	• Before final disposal, any potentially hazardous substance such as lead or material containing lead shall be identified. • The risk associated with the wastes. If any shall be identified, and accepted disposal methods for such waste shall be followed.
4	Oils	• Recycling through waste contractors	70,000 liters	• Contamination of soil and water bodies affecting human health and the flora and fauna of the area	• Only recycling contractors with certification from the concerned agencies shall be used for disposal • The transformer oil needs to analyze for possible presence of PCBs.
5	Plastic	• Recycling	600 kg	• Nuisance and littering • Open air burning may affect in local air quality	• Include in the contract agreement with waste disposal contractor condition that any unwanted plastic waste will be disposed at municipal landfill site
6	Wood, cotton waste and packaging material	• Waste contractor • Municipal landfill	14,00 kg	• Open burning and associated nuisance • Improper disposal resulting in littering	• Include in the contract agreement with waste disposal contractor condition that such waste will either be disposed at pre-identified municipal landfill site.

APPENDICES

Appendix A: Terms of Reference

See following pages.

ADVANCED
ENGINEERING
ASSOCIATES
INTERNATIONAL
CONTRACTOR OF USAID PAKISTAN

EPP/C1/RFP/009

August 16, 2013

Mr. Vaqar Zakaria
Managing Director
Hagler Bailly Pakistan
No. 39, Street 3
Sector E-7, Islamabad

Subject: **Technical Assistance for Development and Monitoring of Environmental Mitigation and Monitoring Plan (EMMP) including Environmental Documentation Form (EDF) for Refurbishment and Up-gradation of Mangla Hydropower Plant**

Dear Mr. Zakaria,

Advanced Engineering Associates International Inc. (AEAI) is implementing the **USAID Energy Policy Program (EPP).** The program is a multiyear initiative to increase power generation, reduce transmission losses, increase cost recovery, introduce new technologies and facilitate GOP reforms with technical assistance.

EPP is requesting Hagler Baily Pakistan provide a proposal for the subject assignment.

This request for proposal consists of:

- Attachment A: scope of work/services and deliverables/reports
- Attachment B: IEE report

Please submit simplified technical and financial proposal in sealed envelope clearly marked as "proposal for **EMMP** Mangla" before close of business on Monday, August 19, 2013. Any questions related to this request for proposal shall be in writing to the following email addresses tjaved@ep-ep.com.pk and a copy to asad@ep-ep.com.pk

The award shall be subject to the evaluation of both technical and financial proposals. The award shall also be subject to final approval from AEAI and USAID. AEAI reserves the right to not accept any of the proposals without assigning a reason. None of AEAI/EPP, USAID and any of their affiliates, employees, agents or officers shall be liable for any costs, expenses, losses, damages or other liabilities incurred by your company in the course of preparing and submitting sealed proposals.

Sincerely,

Richard P. Smith
Chief of Party

Attachment A

Terms of Reference

Technical Assistance required for the Development and Monitoring of Environmental Mitigation and Monitoring Plan (EMMP) including Environmental Documentation Form (EDF) for Refurbishment and Up-gradation of Mangla Hydropower Plant

Background:

USAID and GOP entities, in particular, Water & Power Development Authority (WAPDA) have jointly selected and planned the refurbishment and up-gradation of Mangla Hydro Power Station. This activity will give new life to this power station by making it more efficient, as it uses the increased water availability while also adding generation capacity. USAID's contribution will be financing of two units (5 & 6) and balance of plant with the possibility of funding additional units later subject to availability of funds and agreement of the Parties. It is estimated that these upgrades will enable the power house to operate productively for another 40 years.

Prior to proceeding with implementation of this Activity, it is required to ensure that conditions set forth in the Initial Environmental Examination (IEE) for Mangla have been satisfied to meet USG and Government of Pakistan environmental policies and regulations. For this purpose, technical services required to meet the recommendations specified in the IEE attached herewith, which includes, but not limited to, development of EMMP, EDF, review of settlement plan, monitoring implementation of EMMP, and other condition stipulated in the IEE.

Development and review of the environmental plans for Mangla is to be completed within 10 days of notice to proceed. However, the monitoring and auditing services for the implementation compliance of EMMP will be engaged on need basis. Details of the tasks are mentioned as under:

Tasks a: Development and review of the environmental plans for Mangla refurbishment project

1. Review the Initial Environmental Examination (IEE) for Mangla and address the recommendations to ensure compliance with USG and Government of Pakistan environmental policies and regulations. This includes, but not limited to, development of EMMP, EDF, review of settlement plan, monitoring implementation of EMMP, and other condition stipulated in the IEE.

2. For development of environmental plans, a field visit is recommended to physically examine the existing conditions and measures taken to mitigate the environmental impacts at the power plant. The EMMP in particular should elaborate environmentally safe and sound waste management and disposal of the old equipment/spares and wastes.

This task requires working closely with USAID Environmental Officers, WAPDA, federal and provincial EPAs and/or other entities.

3. Review and address comments of Mission's Environmental Officers for final approval of EMMP and EDF.

Task b: Monitoring and auditing services for the implementation compliance of EMMP

1. Develop a work plan for monitoring and auditing the implementation of the EMMP within two weeks subsequent to development of EMMP.

2. Visit the plants onsite to physically monitor and audit the implementation compliance of EMMP at Mangla power plants. This task includes but is not limited to: (1) Monitoring progress and meeting with concerned WAPDA, and contactors' staff, and facilitating and advising them on issues resolution; (2) Analyzing data collected at site and identifying deficiencies; (3) Advising and mentoring the implementers' staff for improvements; and (4) Briefing USAID and AEAI on the findings and solutions. The frequency of visits will be subject to work in progress at the power plants and will be approved by AEAI prior to each visit.

3. Prepare field visit reports for review of USAID and AEAI which should be submitted within 5 working days of each visit. The report should cover the progress on EMMP with photographs, implementation challenges and proposed remedial measures, improvements in exiting environmental measures, data analysis, meeting briefs or any other aspects that the contractor deem necessary to bring to immediate attention of USAID and AEAI.

4. The assignment requires traveling in remote areas and also working closely with USAID Environmental Officers, WAPDA (Environmental Cell), and provincial EPAs and/or other entities.

Appendix B: AJK-EPA Approval

See following pages.

AZAD GOVERNMENT OF THE STATE OF JAMMU & KASHMIR
ENVIRONMENTAL PROTECTION AGENCY
MUZAFFARABAD

Ref. #: EPA-2222-28 Date: 26-7-2013

1. **Name & Address of Proponent:** **WAPDA, Pakistan**
2. **Description of Project:** **Mangla Power Station Rehabilitation Requirement**
3. **Location of Project:** **Mangla, Mirpur, Azad Kashmir**

Mo-3076
5-8-13

CONDITIONAL ENVIRONMENTAL APPROVAL

In exercise of powers conferred under Section-11 of the Azad Jammu & Kashmir Environmental Protection Act, 2000, after the review of project documents (present brief and site occupational health of safety plan) and verification of proposed site, this is to accord Environmental Approval in favor of WAPDA, Pakistan for the "Mangla Power Station Rehabilitation- Refurbishment and UP-Gradation" subject to the fulfillment of following conditions by the proponent:

(i). The proponent will prepare detail Occupational, Health and Safety Plan (OHS) and will comply with in true spirit during implementation on the project and provide the safety gears to all work force especially during crane operation and machinery /equipment movement/replacement.

(ii). Blasting girt and painting activity will be performed under controlled conditions with air quality and dust control being carefully monitored for the safety of the entire work force.

(iii). Protective measures including adequate warning signs will be displayed around key project components to avoid any mishaps or accidents.

(iv). Road signage should be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic.

(v). Necessary environmental, social, and operational health and safety training should be provided to the project staff, EPC labor (skilled/unskilled) before start of physical work on the project in collaboration of AJK-EPA.

(vi). The project vehicle/construction equipment drivers/operators should be trained in defensive driving/operation of the machinery before start of the project.

(vii). Vehicle speeds near / within project area will be kept low, to avoid safety hazard and dust emission.

(viii). The proponent will establish the First Aid post with all necessary tools and medicines with the appointment of MBBS Doctor, to catch the emergency at the site.

(ix). As the major project components are to replace the heavy machinery and their spare parts, therefore, the Proponent shall appoint/recruit the specialized OHS manger to ensue the health and safety of the workforce.

(x). The proponent will get register the per annual health/life insurance premium of each worker of the project to insure their future in the case of any damage to their health for the entire work force.

(xi). Management practices will be employed to minimize leakage and spillage of oils, chemicals and fuels to the ground and nearby storage water pond. These include building containment waterway around fuels/oils/chemical storage, storing these in covered areas, constructing a concrete pad for machinery/vehicle maintenance areas, inspecting machinery and vehicles for any leakage, and removing contaminated soils for appropriate disposal.

(xii). AJK-EPA can make any surprise visit to monitor the project and the proponent will facilitate the team during monitoring visit

Kashmir Plan House, Block # 5, New Civil Secretariat Complex, Muzaffarabad, AJ&K
URL: www.ajkepa.gov.pk Email:info@ajkepa.gov.pk Ph: +92 5822 921082 Fax: +92 5822 921119

Ref. #:

Date:

(xiii). The AJK-EPA reserves the right to withdraw this approval at any time without assigning any reason thereof.

(xiv). This approval does not absolve the proponent of the duty to obtained any other approval or clearance that may be required under any law in force.

(Abdul QayyumChaudhry)
Director General
AJK-EPA

CC:

1. ACS(Dev)/ Secretary Environment GoAJK, Muzaffarabad
2. Member Power WAPDA, WAPADA House, Lahore.
3. Secretary Electricity/ HEB/PPC, GoAJK, Muzaffarabad
4. Chief Engineer Hydel WAPADA, Mangla Power Station.
5. Mangla Refurbishment and UP-Gradation Project.

Director General

Appendix C: Initial Environmental Examination of the Proposed Activity

See following pages.

OAPA Tracking #: OAPA-12-JUL-~~AFG~~ PAK-0032

USAID | PAKISTAN
FROM THE AMERICAN PEOPLE

INITIAL ENVIRONMENTAL EXAMINATION

PROGRAM/ACTIVITY DATA:

Country: Pakistan

Objective: To add about ~~135~~ 100-210 new MW and improve the performance of the Mangla Dam by reducing the administrative and technical losses, increasing the reliability of service to the customers by replacing outdated turbines, transformers and other equipment, thereby increasing investment in the entire system raising the competitiveness of the economy and improving the quality of the life the population.

Activity Name: Mangla Dam Project

Funding Begins	Funding Ends	LOP Amount
FY 2012	FY 2015	$150,000,000

IEE Prepared By: Rosario Calderon **Date:** July 24, 2012

IEE Amendment (Y/N): NO

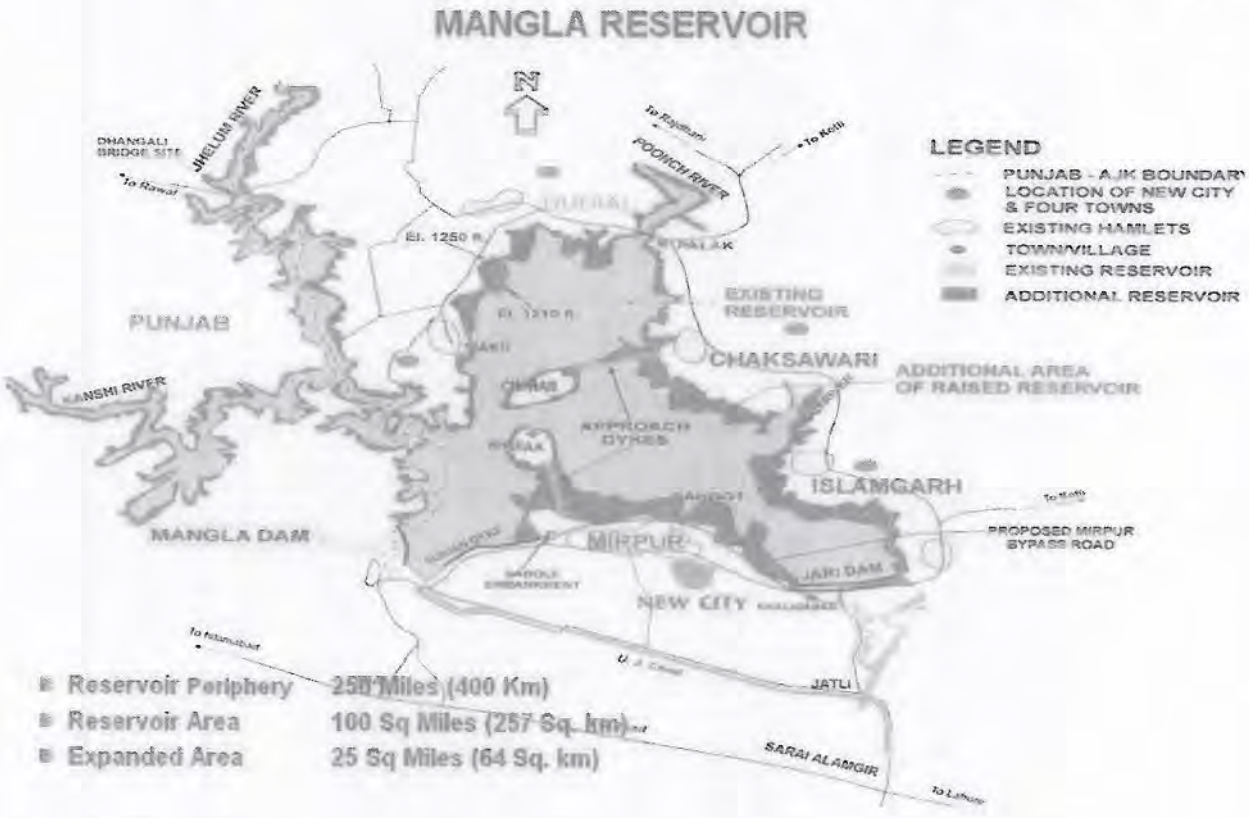
ENVIRONMENTAL ACTION RECOMMENDED: (Place X where applicable)

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

1.0 BACKGROUND AND PROJECT DESCRIPTION

1.1 Purpose and Scope of IEE

The purpose of this initial environmental examination (IEE), in accordance with 22 CFR 216, is to provide the first review of the reasonably foreseeable effects on the environment. This IEE provides a statement of the factual basis for the Threshold Decision of Categorical Exclusion and Negative Determination with Conditions. This recommended Threshold Decision is further discussed below.



1.2 Background

Mangla Dam Project was conceived in 1950's as a multipurpose project to be constructed at Mangla on the Jhelum River located about 30 km upstream of Jhelum city (120 km from Islamabad). The initial feasibility studies were completed in 1958. Later, the project was included in the Indus Basin Project. The construction of Mangla Dam was started in 1962 and completed in 1967 with World Bank and USG assistance.

Mangla Dam is a multipurpose dam, hydropower and irrigation project primarily meant for storage of water supplies of three eastern feeder rivers to the Jhelum River. The project was designed primarily to increase the amount of water that could be used for irrigation from the flow of the River Jhelum and its tributaries. Water from the Mangla Dam has the potential to irrigate 3 million acres. Its secondary function was to generate electrical power from the irrigation releases at the artificial head of the reservoir. The project was not designed as a flood-control structure, although some benefit in this respect also arises from its use for irrigation and water supply. The project consists of two dams (Main Dam & Jari Dam), two dykes, two spillways for outflow regulation, intake structures with five tunnels, and a power house and a tailrace canal.

Salient Features of Main Components of Mangla Dam and Power House[1]

Reservoir

Type	Earth-fill	
Max. Conservation Level	1202 ft. SPD	366.37 meters SPD
Min Operation Level	1040 ft. SPD	317.0 meters
Design Gross Storage	5.880 MAF	
Existing Gross Storage	4.674 MAF	
Design Live Storage	5.340 MAF	
Existing Live Storage	4.542 MAF	
Surface Area	100 sq. miles	259 sq. km.

Main Spillway

Type	Submerged Orifice	
Capacity (at pool elev. of 1202 ft. SPD)	870,000 cusecs	24,630 cusmecs
No. of Gates	9 (Nine)	
Size of Gate	36 ft. wide 40 ft. high	10.97x12.19 meters

Power House

UNITS	1~4	5~6	7~8	9~10
Turbine (Francis-Vertical)				

[1] From: http://www.wapda.gov.pk/htmls/pgeneration-dam-mangla.html

Output (BHP) **Rated Head (Ft. of Water)** **Make**	138000 295 Mitsubishi Japan	138000 295 CKD Blansko (Czech.)	138000 295 Escherwyse-ACEC Belgium	138000 295 SKODA (Czech.)
Generators (Umbrella Type)				
Output (MVA) **Output (MW)** **Output (P.F)** **Output (K.V)** **Rated Speed (RPM)** **Make**	125 15% overload 100 0.8 12.5 166.7 Hitachi Japan	125 15% overload 100 0.8 12.5 166.7 Skoda Czech.	125 15% overload 100 0.8 12.5 166.7 Hitachi Japan	125 15% overload 10 0.8 12.5 166.7 Skoda Czech.
Transformers (3-Phase)				
Capability (MVA) **Voltage Ratio (KV)** **Make**	138 • 12.5 / 132 [Unit 1~2] • 12.5 / 220 [Unit 3~4] Savigliano [1&4] Skoda [2&3]	138 12.5/220 Savigliano Italy	144 12.5/220 Italtrafo [Unit-7] Skoda [Unit-8]	144 12.5/220 Skoda Czech.

During 2005-2009 WAPDA implemented the Mangla Dam Raising Project (MDRP)[2]. MDRP is one of the mega projects included in WAPDA's Vision 2025 Program for Water Resources and Hydropower Development in Pakistan.[3] The 11,000 foot-long and 454 foot-high Mangla Dam was constructed in 1967 on Jhelum River as a part of Indus Basin Project and was inaugurated by President Muhammad Ayub Khan. Its 100-kilometer long reservoir originally had a storage capacity of 5.8 million acre feet (MAF) which was reduced to almost half resulting from heavy siltation

[2] From: http://www.wapda.gov.pk/vision2025/htmls_vision2025/mangladamprj.html
[3] From: http://www.thefreelibrary.com/Mangla+Dam+raising+project+nearing+completion.-a0220093180

resulting in severe water shortage for irrigation and other uses. This shortage necessitated the construction of MDRP which provided additional storage of 2.9 MAF. The construction of Mangla Dam Raising Project started in 2005 under the supervision of a consortium of Consulting Engineers including Mangla Joint Venture (MJV) and Nespak which provided engineering services. During the construction of MDRP, MJV provided high quality construction work confirmed by WAPDA and government officials and VIPs who visited the site during construction. The construction included renovation works in the Power House, rising height of the Main Dam thirty feet, Jari Dam, Sukian Dyke, Spillway, bridges, and bypass roads, etc.

The MDRP required resettlement of 50,000 people who were directly affected by the raised reservoir level of Mangla Lake. To accomplish the resettlement, a new city near Mirpur and four other towns near Islamgarh, Chaksawari, Dudial and Siakh were constructed. At this date ninety percent of the resettlement has been completed, final payment for compensation to affected persons for their land and houses is in progress. This issue will be fully discussed in a specific review in an Environmental Documentation Form (EDF) will review the resettlement progress and identify any remaining problems.

Description of Activities

The following two Components list activities that have been identified for USAID funding:

A. **Training of staff for the improved operation and maintenance.** Mangla technical staff will be trained by the manufacturer/supplier on the operation and maintenance of the improved generation system. To further improve management of the new systems, the staff and other WAPDA officers will receive training including study tours to advanced countries to learn the international best management practices to support sustainability of production of the new power hydropower units. This training is provided for additional assurance of reaching the expected economic life of the plants of a minimum of 25 years.

B. **Replacement and Upgrade of Equipment**

B.1 Replacement of 4-6 units of the 10 existing 100 MW turbines/generators

The present generation equipment and associated infrastructure is old and is close to reaching its economic life of 30-40 years. In addition, its design and efficiency low compared with modern designs. The cost of keeping the units on line is high as well as downtime and cost for repairs is excessive.

The hydraulic parameters of the dam changed after the dam was raised 30 feet; more water is now available to produce electricity from the ten hydro units currently rated at 100 MW each. A Feasibility Study resulted in the development of the Mangla Refurbishment Project. The feasibility study was conducted by MWH and NESPAK and completed December 2011. The condition assessment portions of this report have identified a number of units' rehabilitation requirements which included turbine/generator replacement and plant restoration work.

The recommended option for rehabilitation includes generator replacements and updates for associated infrastructure. This rehabilitation option will increase the capacity by 310 MW for an estimated cost of $369 million. USAID will support the refurbishment of 4-6 units of the hydroelectric plant's 10 Units at an estimated cost of $150 million. At this time the exact units that will be refurbished are not identified but all units have the same environmental concerns.

The USAID funded work on the generators and turbines may include:

Unit Capacity will be improved in 4 to 6 units of the existing 10 units. Improvement in Units 1, 2, 3, 4, 5, 6, 9 & 10 would be from 100 MW to 135 MW each If units 7 and 8 were selected, the improved capacity would be from 100 MW to 115 MW but would essentially require the same refurbishment activities.

Refurbishment activities for Generators include:

- New stator cores and frames
- New windings
- Stator soleplates removal and repairs, different design support
- Slightly larger excitation system
- Thrust bearing improvement may be required
- Other repairs as required

Refurbishment activities for Turbines include:
- New runners
- Other repairs as required

B.2 Power train equipment replacement may include:

- Generator connections and isolated phase bus
- Strengthening of 132 kVA lines to Switchyard

B.3 Spare Parts and Other Repairs

Spare Parts
- For reliability of the all the power units, an inventory of spare parts may be included as required in the proposed specifications for the refurbishment of the equipment.

Some Priority work will be completed before the units are shut down for refurbishment:

- Intake gates new seals replacement
- Trash rack design improvement for higher flows.
- Inlet valves seal improvement to allow single unit outages
- Crane upgrade
- Cooling water system conversion to a closed loop system

B.4 Upgrading Control system

- Control system will be replaced to in conformation with the capacities of the updated equipment and to support modern operations management.

2.0 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.

3.0 LEGISLATIVE AND REGULATORY FRAMEWORK

3.1 NATIONAL REQUIREMENTS

3.1.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (the Act/PEPA) is the basic legislative tool empowering the government to frame regulations for the protection of the environment [the 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses 'a' to 'f'.]

The Act is applicable to a broad range of issues and extends to socioeconomic aspects, land acquisition, air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) specified by the Pakistan Environmental Protection Agency (Pak- EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs), established under the Pakistan Environmental Protection Ordinance 1983, have also been considerably enhanced under the 1997 legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

The PEPA and corresponding Pakistan Environmental Protection Agency Review for IEE and EIA Regulations (2000) prescribe the environmental assessment requirements and procedures

applicable in Pakistan. The PEPA, Section 12 requires proponents of all development projects to prepare and submit environmental assessment reports for review and approval by the competent authority. It also lays down the requirements for Initial Environmental Examination (IEE) and EIA. "No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal EPA or Provincial EPAs as the case may be, or, where the project is likely to cause adverse Environmental effects, an EIA and has obtained from the Government Agency approval in respect thereof;"

'The Government Agency shall, subject to standards fixed by Pak EPA:

a) Review the IEE and accord its approval, or require submission of an EIA by the proponent or:

b) Review the EIA and accord its approval subject to such conditions as it may deem fit to impose, require that the EIA be resubmitted after such modification as may be stipulated or reject the project as being contrary to environmental objectives.

PAK-EPA in August 2000 issued "Policy and Procedures for Filing, Review and Approval of Environmental Assessment". Schedules A and B define the type of development projects requiring EIA or IEE respectively. Schedule A provides a list of projects which have potential to affect a large number of people. The impacts of these projects may be irreversible and could lead to significant changes in land use and in the social, physical and biological environment. For dams and irrigation projects Schedule A determines that EIA is required for "dams and reservoirs with a maximum storage volume greater than 50 million m^3 or surface area greater than 8 km^2 or irrigation serving more than 15,000 ha."

Schedule B defines projects which require IEE. It deals with projects where the range of environmental issues is comparatively narrow and issues can be understood and managed through less extensive analysis. Under the legislation of Pakistan, an IEE is required for 'dams and reservoirs with a maximum storage volume less than 50 million m^3 or surface area less than 8 km^2 or small scale irrigation systems."

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

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

3.1.3 National Environmental Quality Standards (NEQS) 2000

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

In addition to the aforementioned, following regulatory and other Government of Pakistan requirements should be complied with:

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. Draft Guidelines for Solid Waste Management, 2005
   http://www.environment.gov.pk/EA-GLines/SWMGLinesDraft.pdf
7. Environmental, Health, and Safety General Guidelines
   http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf

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

3.2 USAID REQUIREMENTS

The United States laws require that all activities financed by USAID shall comply with the requirement of the US law 22 CFR 216. To promote pesticide safety, the 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 likely, that certain waste material may contain chemicals that are regulated by PERSUAP. If any chemical from waste material falls in the regulated category, management of Mangla Hydropower Station shall inform USAID.

4.0 RECOMMENDED THRESHOLD DECISION

A. **Categorical Exclusion** per 22CFR216.2(c)(2)(i) and (iii); and (II) has determined for activities under Component A (approximately 5% or $7.5 million). These include:
   a) Training of staff for the improved operation and maintenance
   b) Designs and other such activities.
   c) Rehabilitation and renovation activities / Construction Supervision and Environmental mitigation and monitoring activities

B. **Negative Determination with Conditions** per 22 CFR 216.3 (a) (2) (iii.).

a. Equipment including spare parts and computers etc., procured under this project require appropriate disposal at the end of their useful life. The project will include requirements for proper disposal in all authorizations for such procurement. A Negative Determination per 22 CFR 216.3(a)((2)(iii) is recommended for purchase of all equipment and spare parts provided in the project in accordance with ADS 312

b. Review of the status of the resettlement required for the dam raising. This review will confirm that the resettlement has been accomplished and that there are no significant issues remain that could impact on USAID funding..

c. Activities under the Component B (approximately 95% or $142.5 million) may have potentially minor to moderate adverse environmental and social impacts and thus qualify for These include:
   i. Replacement and Upgrade of Equipment
   ii. Replacement of 4-6 100 MW turbines
   iii. Upgrading SCADA system
   iv. Spare Parts for Transformers

Required mitigations are the development of an Environmental Documentation Form (EDF) including en Environmental Monitoring and Mitigation Plan (EMMP)[4] for each of the activities under Component B and for the status of the resettlement plan it is required provision of housing, land and compensation. The EDF must be cleared by the COR/program Manager and approved by the USAID Pakistan Mission Environmental Officer (MEO)

5.0 Summary of Recommended Threshold Decisions

The originator of this action has determined that the following activities of the Mangla Dam Project have no adverse effect on the physical and/or natural environment under: (I) Categorical Exclusion per 22CFR216.2(c)(2)(i) and (iii); and (II) Negative Determination with Conditions per 22 CFR 216.3(2)(iii). The table below applies and provides environmental determinations to the illustrative activities of the Mangla Dam Project.

Activities	Effects on the natural or physical environment	Recommended Threshold Determination
Component A: Staff training	No adverse impact on the natural or physical environment	**Categorical Exclusion** per 22 CFR 216.2 (c)(1)(i) and (c)(2)(i)
Component A: **B.3** Provision of Spare Parts and computer equipment	Minor environmental effect. This requires disposal methods to be included in documents	**Negative Determination with Conditions.** per 22 CFR 216.3(2)(iii)

[4] These forms are Attachment 1 and 2 of this IEE

	authorizing purchase.	
Component B: **B.1** Replacement of 4-6 100 MW turbines **B.2** Rehabilitation of Power Trains and Other Repairs **B.4** Upgrade control system **B.5** Status of the resettlement plan, provision of land and housing, and compensation provided.	Minor to moderate potential adverse impact on the natural and physical environment.	**Negative Determination with Conditions** per 22 CFR 216.3 (a) (2) (iii), the Conditions (with reference to the Pakistani laws and guidance being: a) use of environmentally sound materials, monitoring and evaluation (M&E), and good international industry practices acceptable to USAID; b) an EDF shall be prepared for each activity including a specific EDF reviewing the resettlement status; c) based on the MEO approved EDF including an Environmental Mitigation and Monitoring Plan (EMMP, see Attachment 1) 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 shall be approved by MEO. Additional Conditions are stipulated below.

5.1 Other Conditions

The Implementer shall ensure that:

1. ALL activities including rehabilitation and renovation activities will be implemented in accordance with the Pakistani environmental, OHS, regulations, standards, norms and guidelines and national obligations under ratified international environmental agreements (see: **http://www.environment.gov.pk**) and in their absence in accordance with the best international practice appropriate to the seismicity levels in Pakistan and in the respective districts; these should be acceptable to USAID.

2. All activities will be implemented in accordance with best practice guidance provided in the Asia environmental guidelines at **www.usaid.gov/our_work/environment/compliance/ane/guidelines.htm**; Environmental Guidelines for Small Scale Activities in Africa, 2nd edition as provided at **http://www.encapafrica.org**; IFC *Environmental, Health and Safety Guidelines* as provided at: http://www.ifc.org/ifcext/sustainability.nsf/Content/EnvironmentalGuidelines and World Bank *1999 Pollution Prevention and Abatement Handbook* as provided at **http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187283&siteName=WDS&entityID=000094946_99040905052283**; EBRD Sub-sectoral Environmental and Social Guidelines (**http://www.ebrd.com/about/policies/enviro/sectoral/**); ADB Environmental Guidelines (**http://www.adb.org/Water/CFWS/Roadmap-Sectoral-Guidelines.pdf**); World Bank Environmental Assessment Handbook and Updates (**http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTENVASS/0,,contentMDK:20282864~pagePK:148956~piPK:216618~theSitePK:407988,00.html**)

3. The Implementer shall include environment compliance considerations into all aspects of the project implementation and will promote and train local counterparts on environmental

requirements and standards across all of the project's activities; such proposed activities will be included in annual work plans, and results will be reported in annual reports.

4. The Implementer will review the existing EMMP prepared by JV MWH and NESPAK, Volume 7, December 2011 (available from COR, USAID/Pakistan) and provide recommendations to USAID on the required modifications and improvements.

5. Upon receiving comments from USAID, the Implementer shall prepare the revised and comprehensive EMMP, and any other mandatory plans stipulated by the national legislation, covering all and each activity under Component B; the revised EMMP shall be reviewed and approved by MEO, USAID/Pakistan.

6. Implementer will seek concurrence and obtain all applicable permits and licenses from the national duly authorized environmental and relevant agencies. Implementer will also seek concurrence from the duly provincial environmental agency(ies) on each the EMMP. The Contractor is required to obtain a letter from the local or regional office for environmental protection stating that the office: a) has been contacted by the contractor concerning the project activities; b) will maintain contact with the project; and c) will be aware of the potential environmental impacts of the project to help ensure that no detrimental impact will result from this project.

7. The implementing partners shall minimize the use of, and properly dispose of hazardous materials and wastes for the small scale activities. The implementing partners will adhere to USEPA guidance at **www.epa.gov/asbestos** and **www.epa.gov/lead/pubs/renovation.htm** for dealing with asbestos and lead.

8. The implementing partners will screen all potential environmental impacts by preparing an Environmental Document Form (EDF) (**Attachment 1**). The implementing partners will prepare Environmental Mitigation and Monitoring Plan (EMMP) (**Attachment 2**) for all moderate risk activities and will monitor implementation to ensure enforcement of the mitigating measures. All such reviews and conditions will be documented, reviewed by the COR/AOR and the Mission Environmental Officer (MEO) for the program, and maintained in project files and documentation.

9. Recommendations from the Environmental Lessons Learnt from similar USAID funded signature energy projects in Pakistan will be duly addressed in each EMMP to be developed for project sub activities.

10. EMMP shall include measures to avoid / address all existing project related social issues.

11. The implementing partners will have adequate funds to implement any environmental mitigation and monitoring measures as well as it/they will have a qualified, MEO-approved environmental impact professional(s) (EIP) who will assess and recommend environmental actions to be taken by the project and will coordinate implementation of mitigation measures, monitoring and reporting.

12. The recipient will properly manage and dispose equipment when its useful life ends. For procuring of electronic and miscellaneous equipment and furniture, the implementing partners will adhere to USAID's general policies on commodity eligibility provided at http://www.usaid.gov/policy/ads/300/31251m.pdf and will not finance unsafe or ineffective

products, such as certain pesticides, food products, or pharmaceuticals and other commodities not eligible for financing under this policy.

13. When equipment (computers, laboratory equipment, etc.) is procured, at the end of its life, it will be disposed in an environmentally safe manner by a certified company in accordance with Pakistani laws, and in their absence, in accordance with international best practices acceptable to USAID (alternatively, when procuring equipment from a licensed provider/dealer an agreement may be reached that such equipment will be returned to the dealer for its environmentally safe disposal).

14. Monitoring will be conducted during the project (beginning with a baseline) to determine the environmental impact (positive and/or negative) of all project activities. Contractor shall use only qualified staff for overseeing the mitigation and monitoring work. Monitoring shall occur during implementation as stipulated in the MEO approved EMMP. The Contractor will ensure that the environmental procedures are implemented, potential impacts mitigated. If negative environmental impacts are discovered through regular monitoring and evaluation of project activities, immediate actions will be taken to rectify the situation.

15. When asbestos and/or lead-containing paints are encountered, these will be treated in accordance with the best international industry and management practice, acceptable to USAID in accordance with guidance at: **http://www.epa.gov**

16. All environmental Conditions established in this IEE shall be duly transposed in RFP and Contract.

17. USAID will arrange for mandatory environmental training for the key personnel of implementing partner and other stakeholders by the REA/Asia & OAPA and/or the MEO before rehabilitation and renovation activities begin.

18. COR, together with the MEO, USAID/Pakistan will explain and clarify, at the project launch, to the Implementer environmental conditions and compliance procedures established in this IEE and the Contract.

19. Implementer(s) shall document and regularly report to USAID on the implementation of the Negative Determination with Conditions (NDC) activities; reporting will include photographic documentation and site visit reports confirming implementation of the agreed EMMP, photos of site-specific activities prior to, during and after rehabilitation and renovation activities, during operation.

20. USAID/Pakistan COR and MEO/DMEO shall regularly audit the Contractor's processes and related documents including inspection reports to ensure 22 CFR 216 environmental compliance throughout the life of the Contract.

21. If any un-anticipated potentially significant environmental and social impacts are expected to arise, the COP shall promptly notify the COR and MEO/DMEO and seek guidance on the proper course of action.

22. New activities introduced into the project that are substantively different from those presented in this IEE will required submission of an amended IEE to the BEO/OAPA.

23. No additional activities will be conducted prior to receiving approval of the amended IEE by the BEO/OAPA. The implementing partners shall minimize the use of, and properly dispose of hazardous materials and wastes for rehabilitation and renovation activities.

24. In accordance with 22 CFR 216.2 (a), this IEE will be amended to reflect substantive amendments, including change in funding levels and scopes of activities, or extensions of ongoing projects, programs and activities.

25. Use of personal protection equipment should be in practice as is needed for the activities funded under the project.

6.0 Allocation, Training and Reporting requirements:

- Reports will be submitted to the Contracting Officer's Representative (COR) and Mission Environmental Officer (MEO) at the completion of activity.
- Reporting will include photographic documentation and site visit reports which fully document that all proposed mitigation and monitoring procedures were followed throughout implementation of the subject work
- The Contractor's progress report to USAID shall contain a section specific to environmental mitigation and monitoring and will include project summaries along with environmental impacts, success or failure of mitigation measures being implemented, results of environmental monitoring, and any major modifications/revisions to the project, mitigation measures or monitoring procedures.
- COR/MEO will explain to the Contractor(s) all environmental Conditions established in this IEE and their applicability to specific activities.

7.0 LIMITATIONS OF THE IEE

This assistance doesn't 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)(l)(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 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) and calcium ammonium nitrate (CAN) for agricultural or rehabilitation and renovation activities and construction/demolition purposes.
5. Activities involving support to wood processing, agro-processing, industrial enterprises and regulatory permitting
6. GDA and/or DCA.

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

8.0 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

Attachment 1

Environmental Documentation Form

INSERT PROJECT NAME

A. Applicant information

Contractor/grantee(organization)	Parent grant or project
individual contact and title	Address, phone and email (if available)
activity (brief description)	Amount
Location of activity	Start and end date of activity

B. Activities, screening results, and recommended determination

TABLE 1	**Screening result** (Step 3 of instructions)			**Recommended Determinations** (Step 6 of instructions. Complete for all moderate and high-risk activities)		
Proposed Sub-activities	Very Low Risk	Moderate Risk	High Risk	No significant adverse impact	mitigation, no significant	Significant Adverse impact
1.						
2.						
3.						
4.						
6.						
8.						
9.						

(continue on additional page if necessary)

C. Summary of recommended determinations **(check all that apply)**

The activity contains. . .	*(equivalent regulation 216 terminology)*
☐ Very low risk sub-activities	*categorical exclusion(s)*
☐ After environmental review, sub-activities	*negative determination(s)*

determined to have **no significant adverse impacts**	
☐ After environmental review, sub-activities determined to have **no significant adverse impacts, given appropriate mitigation and monitoring**	*negative determination(s) with conditions*
☐ After environmental review, sub-activities determined to have **significant adverse impacts**	*positive determination(s)*

D. 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 the Mangla Dam under the Code of Federal Regulations 22 CFR 216:
3.
   - 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 information will be implemented in their entirety.
   - Compliance with these conditions will be regularly confirmed and documented by on-site inspections during the activity and at its completion.

(Signature) (Date)

BELOW THIS LINE FOR USAID USE ONLY

Approval

USAID Project Officer ☐ Approved ☐ Rejected	(print name)	(signature)
USAID MEO or DMEO ☐ Approved ☐ Rejected	(print name)	(signature)

USAID comments: (if documentation is rejected, comments must be provided to applicant)

Attachment 2

Environmental Mitigation & Monitoring Plan (EMMP)

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

Environmental Mitigation and Monitoring Plan

Activity Title:

Implementer:

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

Appendix D: Sample Audit Protocol

See following pages.

Environmental Audit A Simple Guide

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FIGURE 1: Environmental Audit Process - An Overview

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CHECKLISTS AND PROTOCOLS

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PREFACE

This Simple Guide to Environmental Audit aims to help organizations conduct environmental audits in an effective and efficient manner. It is also a useful supplement to the Environmental Audit training video - "The Key to a Successful Environmental Audit"- jointly produced by the Environmental Protection Department and the Planning, Environment and Lands Bureau.

The Guide consists of 4 chapters. Chapter 1 provides a brief conceptual overview of the environmental audit process. Chapters 2, 3 and 4 cover the key elements involved from the planning of the audit to its execution and following up in a step-by-step format. This reference tool will lead users through the whole audit process to its successful completion.

This guide is designed so that the explanatory notes, practical tips, references to samplehecklists and protocols are put under the following representative collection of "Icons":

Tips and Hints

Proceed with Caution

Information

Pitfalls to Avoid

Resource

PREFACE

The appended sample checklists and protocols are for reference only. They are divided into three sections. The first section contains questionnaires and checklists for completion by the "Audit Site Facilitator" in the pre-audit phase. The second section comprises a series of legislative compliance audit protocols for use by "Internal Auditors" during the on-site audit. The third section includes suggested contents of the audit report and a framework for audit follow-up.

As each audit site will have its own unique characteristics, it is essential that the "Internal Auditors" assess the applicability of the checklists and protocols and make amendments where necessary. It will also be the responsibility of the "Internal Auditors" to update the legislative compliance audit protocols to reflect the latest developments in legislation.

This Simple Guide was adapted from the Environmental Protection Department's Environmental Audit Manual and the Environmental Audit Training Manual which were produced with the help of an expert consultant. Any site-specific environmental audit undertaken with the use of this reference tool should be the sole professional responsibility of the "Internal Auditors". The Environmental Protection Department WILL NOT take any responsibility as the provider of this reference Guide.

Hints for Users:

1. **This guide is intended for those who have completed some form of basic training or have previous working experience on environmental audit. Users without prior exposure on this subject are encouraged to attend a course on environmental audit before undertaking the process.**

2. **Users are encouraged to read through the document to familiarize themselves with the audit process before commencement.**

3. **As each audit site has its own unique set of conditions, the sample worksheets should be used as reference material only. Users are recommended to make modifications and adaptations that suit their own needs.**

1 WHAT IS AN ENVIRONMENTAL AUDIT

Environmental auditing is a systematic, documented, periodic and objective process in assessing an organization's activities and services in relation to:

- Assessing compliance with relevant statutory and internal requirements
- Facilitating management control of environmental practices
- Promoting good environmental management
- Maintaining credibility with the public
- Raising staff awareness and enforcing commitment to departmental environmental policy
- Exploring improvement opportunities
- Establishing the performance baseline for developing an Environmental Management System (EMS)

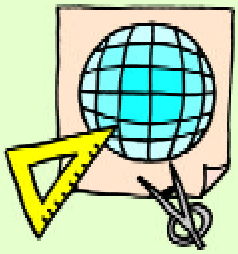
Conducting an environmental audit is no longer an option but a sound precaution and a proactive measure in today's heavily regulated environment. Indeed, evidence suggests that EA has a valuable role to play, encouraging systematic incorporation of environmental perspectives into many aspects of an organisation's overall operation, helping to trigger new awareness and new priorities in policies and practices.

Resource

An overview of the audit Process at the end of Chapter 4 can be pulled out for ease of cross-referencing.

2 PLANNING AN ENVIRONMENTAL AUDIT

Any premises that wishes to conduct an environmental audit must have a clear idea of the objectives of the exercise and the steps required to achieve it. Before commencing an environmental audit, the following requirements must be fulfilled:



1. Commitment

- ❑ Obtain commitment at the Directorate level
- ❑ Communicate commitment to personnel at all levels

Tips & Hints

Communicate the environmental audit by a bilingual, clear and easily understandable open memo and during internal management meetings. The message should convey top management commitment, define audit objectives and rally support of personnel.

2. Define Audit Scope and Audit Site(s)

To include:

- ❑ Audit site and boundary
- ❑ Audit objective(s)
- ❑ Areas of audit

Audit objectives typically entail:

- Verification of legislative and regulatory compliance
- Assessment of internal policy and procedural conformance
- Establishment of current practice status
- Identification of improvement opportunities

Tips & Hints

The audit area does not have to cover every aspect of the environment, nor to undertake all aspects at once - just scale according to needs and resource availability.

Areas of audit normally encompass:

- Material management, savings and alternatives
- Energy management and savings
- Water management and economy of use
- Waste generation, management and disposal
- Noise reduction, evaluation and control (internal and external)
- Air emissions and indoor air quality
- Environmental emergency prevention and preparedness
- Transportation and travelling practices
- Staff awareness, participation and training in environmental issues
- Environmental information publicity
- Public enquiry and complaints response
- Environmental management system set up, suitability and performance

Information

Relevant environmental statutory issues include air quality, ozone layer protection, noise, water quality, waste management, dangerous goods storage, environmental impact assessment etc. Consult individual specialist groups on the pertinent legislation and regulations.

3. Assemble An Audit Team

An Audit Management Committee (AMC) established by management at Directorate level, is responsible for:

- Overseeing the audit process
- Appointing an Audit Team Leader to be in charge of the audit
- Securing the necessary resources and funding
- Reviewing the Audit Report
- Reporting to the organisation Directorate

The AMC in conjunction with the Audit Team Leader to:

- Appoint Audit Team Members
- Assess requirement for external assistance to ensure thoroughness and objectivity of audit
- Secure financial resources if external assistance is required
- Confirm availability of Audit Team members

At each audit site, Site Facilitator(s) is/are selected to provide local support to the Audit Team in gathering the necessary information and assistance during the audit.

Information

The Audit Team Leader must have experience in EA, knowledge of sectoral activities, appropriate qualifications and good interpersonal skills. He/she will be the focal point of contact between AMC and the audit team members.

Information

Auditors appointed should be familiar with the principles of environmental auditing and the operation of the audit site. To ensure objectivity of the audit, moreover, auditors should preferably be selected from an independent site or office.

Information

Necessary audit resources may include technical expertise from specialists, consultants, analytical service organisations, etc

3 CONDUCTING AN ENVIRONMENTAL AUDIT

An environmental audit is typically undertaken in three phases:

- Pre-audit
- On-site audit
- Post-audit

Each of these phases comprises a number of clearly defined Objectives, with each objective to be achieved through specific Actions, and these actions yielding results in the form of Outputs at the end of each phase.

A Pre-Audit Activities

Objectives

- To develop an audit plan for the on-site activities
- To make the necessary preparation and arrangements for the on-site audit

Actions

1. Develop an Audit Plan

The Audit Plan should address:

Where:	audit site & boundary with overview
What:	scope & objectives
How:	site personnel interview, site inspection, audit protocols; site logistics and administrative arrangement
Who:	audit team and site facilitation arrangement
When:	audit schedule and milestones

The Audit Team is subsequently to:

- Seek agreement from AMC on audit plan
- Establish the reporting structure

Tips & Hints

Audit logistics and administrative details such as confirming arrangements and schedules, receipt and follow-up of information can be time consuming. Designation of an Audit Team member to oversee such details is strongly suggested. Never ignore or underestimate the audit preparation and its logistics.

Tips & Hints

The same 5Ws principle will surface in different forms through out the environmental audit process.

2. Prepare Pre-Audit Questionnaire

Resource

Examples of pre-audit questionaires and operational document checklists are given in PAQ 1-28 and ODC 1-21.

To prepare questionnaire and document checklists on:
The "hard" issues:

- Overall environmental management
- Procurement policy
- Energy management
- Materials management
- Water and wastewater management
- Waste management
- Noise monitoring and control
- Air quality monitoring and control
- Emergency response procedures

The "soft" issues:

- Transportation and travelling
- Staff awareness and training
- Publicity of environmental information
- Response to public enquiries and complaints

The questionnaire and checklists are to be forwarded to the relevant site personnel for completion.

3. Review Background Information

To gain familiarity with audit site through review of:

- Site layout plan(s)
- Site history, use and activities
- Blue prints/as built drawings
- Organisational structure at audit site(s)
- Internal environmental policies, procedures and guidelines

4. Review Operational Information

To gain appreciation of site activities and operational practices on site through review of:

- Operational activities and process descriptions
- Management system policies, procedures and program documentation
- Relevant records (compliance, monitoring, training, maintenance, calibration etc.)
- Other relevant information pertaining to environmental management practices

Tips & Hints

The Audit Team may find it helpful to draw up a list of issues to be clarified during the initial site visit.

5. Conduct Initial Site Visit

To arrange with the site facilitator(s) for an initial visit during normal operation of audit site to:

- Meet with officer-in-charge to explain purpose of audit
- Assess whether background information gathered is up to date and accurate
- Follow-up on the list of preliminary audit impressions
- Identify and request additional site information as necessary
- Confirm thoroughness of audit scope
- Establish adequacy of resources for audit

6. Develop On-Site Questionnaire and Audit Protocols

To develop a series of step-by-step questions and evaluation criteria to assess:

- Compliance with pertinent legislative and regulatory requirements
- Conformance with internal environmental policies, procedures and guidelines
- Status of current environmental practices
- Staff awareness of internal environmental policies, procedures and guidelines

Resource

Examples of on-site audit protocols are provided in:
APC1-3 (Air Pollution Control),
OLP1 (Ozone Layer Protection),
WPC1-2 (Water Pollution Control),
NC1-2 (Noise Control),
CWM1-7 (Chemical Waste Management),
DGM1-18 (Dangerous Goods Management).
and
EIA-1 (Enironmental Impact Assessment).

7. Review Audit Plan and Arrange Logistics

All documents and arrangements should be updated or revised to reflect current knowledge and conditions.
Key points to review include:

- Audit scope
- Audit schedule
- Audit protocols
- Allocated resources

Proceed With Caution

The Audit Team Leader should ensure that all items identified are completed and the Audit Plan agreed by the AMC before commencing to the next phase.

Output

- ☐ Audit Plan
- ☐ Package of background information
- ☐ Completed Operational Information Questionnaire and Audit Checklists
- ☐ On-site Questionnaire and Audit Protocols

B On-Site Audit Activities

Objectives

The on-site audit objectives should reflect those of the environmental audit, which are:

- Verification of legislative and regulatory compliance
- Assessment of internal policy and procedural conformanc e
- Establishment of current practice status
- Identification of improvement opportunities

Actions

1. Opening Meeting

Conduct on-site audit Opening Meeting with Office manager and site personnel to:

- Introduce audit team members
- Present audit scope and objectives
- Outline the audit approach and methodology
- Address questions or concerns of site personnel
- Rally staff support and assistance

Proceed With Caution

Audits are unfortunately often perceived as part of a scheme to dig up ¡ §dirt ¡ ¨or find faults with personnel. Dispel misconception by stressing the audit is a systems performance assessment and that every staff can take part in contributing towards an overall performance improvement.

2. Document Review

Audit Team member to undertake a review of relevant document such as:

- Management policy
- Management system documentation
- Operational procedures
- Records (utility, inventory, monitoring, calibration,
- trans-portation, training etc.)
- Previous audit reports
- Green management team meeting minutes
- Green suggestions

Tips & Hints

Refer to Pre-audit questionnaire, Operational document checklists and other documents such as environmental license and permits, records and etc. for detailed list of documents to be reviewed during the audit.

In particular, to evaluate whether the records are:

- Current
- Properly completed
- Signed and dated
- Consistent
- Meet relevant requirements

3. Detailed Site Inspection

Conduct detailed site inspections with aid of on-site audit protocols to look for evidence on:

- Compliance with legislative and regulatory requirements
- Conformance with internal policies, procedures and guidelines
- Status of operational practice
- Staff participation in management system implementation

4. Staff Interview

To obtain information on

- Actual practices (current and past)
- Compliance with/or deviation from statutory and departmental requirements
- Awareness of requirements and expectations
- Ideas to ¡§do it better¡¨
- Comments and suggestions

Tips & Hints

1. *Keep a balance between records review, interviews, and observation.*
2. *Time is limited, better address all areas in the scope to some extent than to leave out entirely*
3. *Maintain a flexible agenda*
4. *Learn and use the protocols, but also use common sense and natural curiosity*
5. *Take time to observe events as they occur.*
6. *Use sound judgement despite the ¡§regulations and standards¡¨*
7. *Everyone can identify with this one- a well deserved compliment goes a long way!*

Information

Site inspection activities may also include sampling and analysis as defined by the audit scope.

Tips & Hints

<u>Whom to interview:</u>
Balanced representation from all levels of organisation, ie. from senior management to support personnel.
<u>Where:</u>
- *at or near the ¡§interviewees¡¨ work station*
- *private, one-to one*
- *minimal distraction*

<u>When:</u>
- *when not interfering with job performance*

Tips & Hints

How (the 3-Up Technique):

i Warm-Up
- *state objective of interview assure confidentiality and anonymity of information*
- *start by asking for job overview*
- *be informal and show courtesy*

ii Open-Up
- *ask open ended questions (i.e., the 5Ws)*
- *summarise and provide feedback to responses*

iii Follow-Up
- *ask funnelling question*
- *request examples from past experience to back up responses*

Pitfalls To Avoid

Always be on guard against:
- *excessive use of acronyms or foreign language(s)*
- *prolonged silence during interview*
- *speculation on the part of the interviewee*
- *personal advocacy of opinion*

5. Review Audit Evidence

Ensure adequacy of audit evidence at the conclusion of on site audit by:

- Reviewing information gathered
- Collecting additional information as needed
- Substantiating audit findings
- Summarising and documenting all findings and observations
- Identifying issues requiring immediate attention/mitigation
- Noting outstanding issues requiring follow-up
- Preparing debriefing material for the Closing meeting

Tips & Hints

To be effective, the presentation of the audit findings must be
- *clear and unambiguous*
- *linked to audit criteria as per audit*
- *verified by objective evidence*

Proceed With Caution

All audit findings should be evaluated in context to establish if the evidence represents an actual deficiency or a one time occurrence.

6. Closing Meeting

The Closing Meeting provides an opportunity at the conclusion of on-site audit to:

- Debrief the senior site management
- Summarise the audit activities and findings
- Highlight system strengths and weaknesses
- Discuss preliminary findings and recommended corrective actions
- Bring up findings requiring immediate attention
- Clarify any outstanding issues
- Address staff questions or concerns
- Agree on reporting schedule and chain of communication

Tips & Hints

1. *Identify and resolve all contentious issues before the meeting.*
2. *Open the meeting by acknowledging the co-operation of site personnel.*
3. *Start with the positive; give commendation where justified.*
4. *Focus on strengths and deficiencies on the systems level.*
5. *Listen attentively and respond directly.*
6. *Discuss all findings, no matter how minor.*
7. *Write down all evidences before leaving to minimize future site visits*

Pitfalls to Avoid

Under no circumstances during the Closing Meeting should the followings occur:

1. *Finger pointing*
2. *Lingering on the negatives.*
3. *Inflexibility towards different opinions and disagreements.*
4. *Argument.*
5. *Leaving without agreement on contentious issues or reporting schedule.*

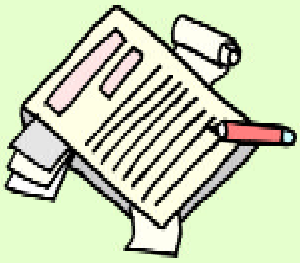
Output

- ☐ Documented audit findings and supporting evidence
- ☐ Basis for evaluating conformance status in relation to statutory and internal
- ☐ requirements
- ☐ Basis for assessing performance status and improvement recommendations

C Post-Audit Activities

Objectives

- To produce an Audit Report with audit findings and recommendations
- To contribute towards formulation of an Action Plan for continual performance improvement



Actions

1. Collate Information and Follow Up Outstanding Issues

Information to be organised should include:

- Completed pre-audit questionnaire, operational document checklists
- Completed on-site survey questionnaires, on-site audit protocols
- All relevant correspondence, memoranda, reports, diagrams and drawings
- Copies of records, photographs, and other information collected during the site visit
- Detailed inspection and interview notes and summaries

Proceed With Caution

Re-confirm validity of uncertain findings and follow-up on outstanding issues where necessary before proceeding to preparation of the Audit Report

2. Prepare the Audit Report

The Audit Report should include:

- An Executive Summary
- Introduction and background to the audit
- Audit scope and objectives
- Description of audit approach and methodology
- Summary of audit findings and recommendations
- Conclusions

Resource

Example of content list of an audit report is provided in CAR-1.

In particular, the findings summary should comprise the followings:

- Status of compliance with environmental legislative requirements
- Status of conformity with internal environmental policies, procedures and guidelines
- Status of good environmental practices implementation
- Level of staff awareness of operational issues relating to environmental performance
- Overall status of environmental performance
- Recommendations for environmental performance improvement

Resource

Format of summary findings given in AFS-1.Allow one summary for each operational group on specific findings,and a separate summary of common issues across the whole site.

3. Circulate Draft Audit Report For Comments

Include the following parties on the circulation list:

- The Audit Management Committee
- Senior audit site management
- Site Facilitator(s)
- Site personnel with responsibilities for implementing the major recommendations
- Other parties included on the agreed circulation list

Pitfalls To Avoid

The value of the EA will be severely entailed if bureaucratic defensiveness or internal power games are allowed to impair the truthfulness of the findings.

4. Final Reporting

- Incorporate or resolve all comments received before producing the Final Report
- Issue the report to the Audit Management Committee and site senior management for endorsement

Output

Final Audit Report addressing

- ☐ Environmental Legislation compliance status
- ☐ Departmental environmental policies,procedures andguide lines conformity status
- ☐ Status of current environmental performance
- ☐ Recommendations for performance improvement

4 FOLLOWING-UP AN ENVIRONMENTAL AUDIT

1. Develop Action Plan

Upon endorsement of the Audit Report, an Action Plan with the appropriate targets and objectives for environmental improvement may be developed in consultation with audit site senior management.

Resource

Example of an Action Plan is provided in APF-1.

An action plan should cover:

- Action objectives;
- Specific actions required;
- Responsible party(ies);
- Budget allotted; and
- Implementation program

2. Implement Action Plan

Responsible party(ies)to undertake actions according to the allotted budget, and the agreed timescale for completion.

3. Checking and Monitoring

To monitor progress of Action Plan implementation, a status report should be carried out and should include information on:

- Progress of action(s) undertaken
- Problem(s) encountered when action(s) taken
- Proposed solution(s) and revised timescale for completion

4. Review Action Plan

Review the Action Plan upon completion of Action Plan implementation.

Key points to review include:

- Review results of action plan implementation
- Establish levels of performance improvement achieved
- Address possible need for changes to Green management policy, objective(s) and procedure(s)
- Next audit scope and schedule

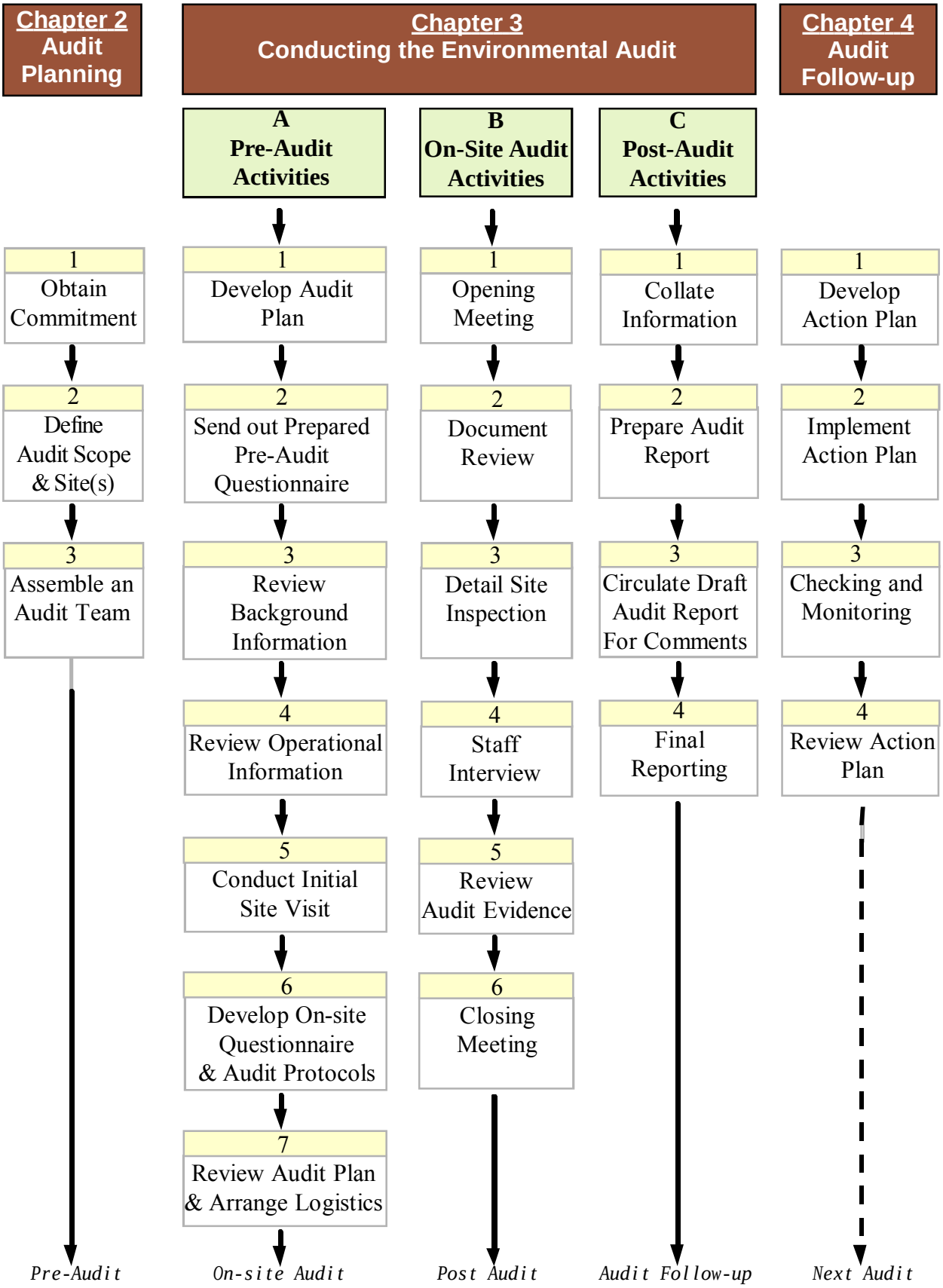
Output

- ☐ Action Plan
- ☐ Status report for implementation
- ☐ Sope and schedule of next audit

You have completed one full cycle of an environmental audit. In the last cycle you have identified the key environmental issues and their effects, established the current performance status, identified environmental performance improvement opportunities and established specific improvement objectives and targets as part of an Action Plan.

We hope that in the process you have also gained invaluable experience and confidence in conducting subsequent environmental audits.

Figure 1: Environmental Audit Process - An Overview



PRE-AUDIT QUESTIONNAIRE

Information Provided in Confidence

0 Introduction

The purpose of this questionnaire is gather the necessary information on the audit site prior to undertaking an on-site audit. The questionnaire covers each area of environmental concern, and is supplemented by information checklists for each of these areas. This questionnaire is designed to familiarize the environmental audit team with the site operations prior to the audit visit, while information checklists highlight a list of the documents required prior to the audit.

Please complete the forms as thoroughly and accurately as possible. Where a question does not apply or cannot be answered, please respond with not applicable or unknown. Respondents are encouraged to provide responses which reflect the actual conditions as opposed to the 'ideal' situation. Provision of pertinent information prior to the audit visit will allow the audit team to be adequately prepared resulting in a more effective audit.

Note: Unless otherwise specified, references made to 'premises' or 'area' in this questionnaire generally refer to premises which the respondent represents.

Information Provided in Confidence

1 General Departmental Information

(To be completed by the Designated Internal Auditor)

Building Information

A. i. Are the premises owned or leased?

ii. When were the properties first acquired by this department?

iii. What are the areas of the premises (break down by floor/functional area)?

iv. Are there any known cases of asbestos material use in the building construction? If so, are these uses indicated on the floor plans?

B. Indicate the dates, ownership, and use(s) of the properties prior to the date of acquisition or lease by this department.

C. Have there been any remedial investigations or corrective actions taken at these premises (e.g. indoor air quality monitoring, wastewater monitoring, etc.) ? Describe briefly:

D. Have there been any known discharges, investigations, or mitigation actions at neighbouring offices/adjacent buildings? If so, describe briefly.

E. List the names of environmental or building services consultants retained (i.e. IAQ monitoring, energy audit etc.) and briefly describe the projects involved.

Provide name of staff responsible for Departmental building services issues.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.1 Overall Environmental Management

Departmental Level
(Questions A to K to be completed by Designated Internal Auditors)

A. List number of staff at the premises (by location):

Professional _____

Technical/Field _____

Others (please specify) _____

B. Is there a Departmental Environmental Policy? If so, please provide a copy.

C. Describe the scope of existing Departmental Policy (i.e. application to resources used, pollution prevention, energy use and conservation, training, public relations etc.).

D. Is the Environmental Policy signed by the Director of the Department?

E. Has a Department Environmental Coordinator been formally appointed and given the responsibility of implementing the policy within the Department?

F. Has the Department Environmental Coordinator been given the responsibility for monitoring the effectiveness of policy implementation?

G. Is the Environmental Policy on prominent display at all Departmental premises?

H. Has every staff member been issued with a copy (or summary) of the Environmental Policy?

I. Is there a written procedure and schedule for reviewing the Environmental Policy?

Information Provided in Confidence

1.1 Overall Environmental Management (Cont'd)

J. Are all revisions of the Environmental Policy communicated to all parties concerned? (i.e., office managers, staff members, concerned public members)?

K. Have staff, financial and other necessary resources been allocated to cover specific environmental issues (i.e., emergencies, waste management, monitoring, audit, etc.) at Departmental level? Please specify.

Provide name of staff responsible for Departmental Environmental Policy issues.

Name and Title: _____

Location: _____

_____

Telephone: _____

Facsimile: _____

Premise Level

(Questions L to S to be completed by Site Facilitators or designated persons)

L. List number of staff at the premises (by floor):

Professional	_____	_____
Technical/Field	_____	_____
Others (please specify)	_____	_____

M. Indicate elements of Departmental Policy pertinent to the responsibility of this premise.

N. Has an office environmental coordinator been formally appointed and given the responsibility of implementing the policy within the office?

Information Provided in Confidence

1.1 Overall Environmental Management (Cont'd)

O. Has an office environmental coordinator been given the responsibility for monitoring the effectiveness of policy implementation?

P. Is the Environmental Policy on prominent display at this premise?

Q. Has every office member been issued with a copy (or summary) of the Environmental Policy?

R. Are all revisions of the Environmental Policy communicated to all members concerned?

S. Have staff, financial and other necessary resources been allocated to cover specific environmental issues (emergencies, waste management, monitoring of discharges/ emissions, environmental performance audit) at office level? Please specify.

Provide name of staff responsible for Office Environmental Policy issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.2 Materials Procurement Policy

Departmental Level
(Questions A to E to be completed by the Designated Internal Auditors)

A. Is there an inventory of all incoming supplies and materials for:

i. Office supplies (i.e., paper, stationery etc.)

ii. Computer related supplies (i.e., printer toner cartridges, paper etc.)

iii. Refreshment supplies (i.e., Styrofoam cups, packaged beverages etc.)

iv. Others (specify)

B. Are there any defined procedures for inventory keeping, updating and checking?

C. Is there a mechanism for verifying new supplies/materials for:

i. Nature, quality, quantity, and specification

ii. Compliance with environmental regulations and/or Departmental guidelines

iii. Potential environmental impacts

iv. Compliance with health and safety regulations and/or Departmental guidelines

v. Packaging materials (i.e., quantity, biodegradability, recyclability etc.)

D. Provide details on any policy/guidance for reviewing existing supplies and materials in relation to possible 'environmentally friendly' alternatives:

Information Provided in Confidence

1.2 Materials Procurement Policy (Cont'd)

E. Is there a similar system of controls on the materials introduced to the premises (i.e., contractors, laboratory samples etc.)?

Provide the name of staff responsible for Departmental procurement issues.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Premise Level

(Questions F to J refer to areas over and above procurement undertaken at the premise level, and are to be completed by Site Facilitators or Designated persons)

F. Is there an inventory of all incoming supplies and materials?

G. Are there any defined procedures for inventory keeping, updating and checking?

H. Is there a mechanism for checking of new supplies and materials for:

i. Nature, quality, quantity, and specification

ii. Compliance with environmental regulations and/or Departmental guidelines

iii. Possible environmental impacts

iv. Compliance with health and safety regulations and/or Departmental guidelines

v. Packaging materials (i.e., quantity, biodegradability, recyclability etc.)

Information Provided in Confidence

1.2 Materials Procurement Policy (Cont'd)

I. Provide details on any policy/guidance for reviewing existing supplies and materials in relation to possible 'environmentally friendly' alternatives:

J. Is there a similar system of controls on the materials introduced to the Departmental premises (i.e., contractors, laboratory samples etc.)?

Provide the name of staff responsible for procurement issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.3 Energy Management

(To be completed by the Designated Internal Auditor)

A. Are there records of energy use for the Department's premises (e.g. break down by floor)?

B. Have there been audits undertaken to identify energy use and minimisation opportunities? If so, where are the reports kept?

C. Are there defined maintenance programmes to ensure all equipment is operating at optimum efficiency?

D. Are there formal arrangements to replace energy inefficient equipment/fixtures?

E. Are there formal procedures to consider energy efficiency when purchasing new equipment?

F. Is there a written commitment to reduce energy use? If so, attach a copy.

G. Has the responsibility to reduce energy use been formally allocated in writing?

H. Programmes to monitor energy use and to quantify reduction? Where are the records kept?

Provide name of staff responsible for energy management issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.4 Material Management

(To be completed by the Site Facilitators or other appropriate persons)

Office Operation

A. Is there an inventory for all supplies and materials?

B. Is there a mechanism for managing existing supplies and materials for:

i. Nature, quality,quantity and specification

ii. Compliance with environmental regulations and/or Departmental guidelines

iii. Possible environmental impacts

iv. Compliance with health and safety regulations and/or Departmental guidelines

v. Packaging materials (i.e. quantity, biodegradability, recyclability etc.)

C. Describe any guidance or procedures to review current supplies and materials in relation to:

i. Eliminate/minimise use of 'environmentally unfriendly' materials

ii. Eliminate/minimise storage of 'environmentally unfriendly' materials

iii. Eliminate/minimise waste generation

iv. Recycling and reuse (i.e. printer toner cartridges, used paper etc.)

D. Describe any guidance or practice on material management leading to overall environmental performance improvement (i.e., double sided printed, single line spacing, use of non glossy report covers, use of recycled paper stock etc.).

Information Provided in Confidence

1.4 Material Management (Cont'd)

Laboratory Operation

E. Indicate activities where hazardous materials are used. Describe the nature and quantity of hazardous materials involved, including the following materials - acids, irritants, bases, sensitizers, asphyxiants, heavy metals, cryogens, flammables, carcinogens, poisons, biological/infectious materials, radioactive, explosive materials.

F. Is there an inventory of all incoming supplies and materials for:

i. Standard laboratory supplies
ii. Dangerous materials
iii. Chemicals
iv. Biological/infectious materials
v. Radioactive materials

G. Does the facility maintain a current file of material safety data sheets (MSDS) for all hazardous materials stored at the facility?

H. Provide details of any licences, permits or applications on file pertinent to hazardous materials storage and handling (i.e. title, number, materials covered, etc).

I. If applicable, describe investigations or corrective actions taken in the past (i.e. regarding fugitive emissions to atmosphere, major chemical spillages, etc.).

J. Provide details on any policy or practices relating to the prevention or reduction in overall environmental impact concerning:

i. Elimination of use of environmental or health and safety adverse substances (i.e., ozone depleting substances, asbestos etc.)

Information Provided in Confidence

1.4 Material Management (Cont'd)

ii. Proper storage and leakage containment of dangerous materials and chemicals (i.e., corrosive substances, explosives, poisons etc.)

iii. Appropriate storage and labelling of materials

iv. Scheduled inspection of storage and handling facilities

Provide name of staff responsible for hazardous materials handling at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Pesticides

K. Are pesticides used in the premises? If yes, indicate general types and indicate if the use of these pesticides are restricted by any sort of control:

Algicides	_____	Herbicides	_____
Insecticides	_____	Rodenticides	_____
Fungicides	_____	Other	_____

L. Are pesticides applied by Departmental personnel? If so, indicate whether any certification is required by pesticide handlers. Provide details of this certification (i.e., certification title and number, type of pesticide covered etc.).

Information Provided in Confidence

1.4 Material Management (Cont'd)

M. If pesticides are stored at these facilities, briefly describe the following:

i. Locations and storage practices

ii. Measures in pesticide storage, application and disposal

iii. Segregation practices

N. If outside contractors are utilized for pesticide application, indicate below:

Contractor	Service Provided	Initial Date of Application & Frequency	Certification Number

Indicate the name of staff responsible for pesticides issues at this premise.

Staff name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.4 Material Management (Cont'd)

Asbestos

O. Describe any formal asbestos management programme in place

P. Describe any formal procedures to audit compliance in the asbestos management programme.

Q. Have formal surveys and inspections been conducted at the site to identify areas if and where asbestos-containing materials are located?

R. If known, list the premises that have been identified as having asbestos-containing materials and indicate whether the buildings are leased or owned, whether abatement is occurring or is planned, and the type of asbestos-containing material(s) present.

Premises	Leased/Owned	Abatement Action	Asbestos-Containing Material Type*

* Use following codes: A = sprayed on insulation; B = pipe insulation; C = vessel/ tank insulation; D = equipment (describe, i.e. ovens etc.); E = other (describe, i.e. floor tiles, bench tops etc.)

Provide name of staff responsible for asbestos management issues.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.5 Water Supply Management

(To be completed by Site Facilitators or other appropriate persons)

A. Indicate the source of water supply at the premises.

B. What are the uses of water supplied?

C. Describe any on-site potable/process water treatment systems.

D. Indicate frequency of system maintenance/resin regeneration.

Provide name of staff responsible for water supply and quality issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.6 Wastewater Management

(To be completed by Site Facilitators or other appropriate persons)

A. List the sources of wastewater, type of discharge and daily volumes for the following types of wastewater.

	Source	Discharge Frequency	Volume (indicate units)
i. Laboratory Wastewater			
ii. Sanitary Wastewater			
iii. Cooling Water			
Contact			
Noncontact			
iv. Others (describe)			

B. Provide details of any licences or applications on file pertaining to water pollution control regulations (i.e. licence title and number, issuing agency, sources of wastewater covered, locations of discharge points, specific discharge standards etc.).

C. Describe type(s) of wastewater pre-treatment prior to discharge (i.e. oil separation, neutralization, filtration, ion exchange, carbon treatment etc.).

D. Indicate locations of all discharge points.

E. Describe operational specifications and maintenance schedules of the pre-treatment system. Have records been kept?

Information Provided in Confidence

1.6 Wastewater Management (Cont'd)

F. Is any wastewater recycled? If so, describe briefly (i.e. treatment and use).

G. Describe any formal criteria for reviewing the premises discharge strategies (i.e., reduce or eliminate discharges).

H. Describe any written procedures to be followed in the event of exceedence of discharge standards.

I. Are all relevant staff fully trained in the above procedures?

J. Describe any wastewater compliance monitoring programmes in place. Where are records of all monitoring results kept?

K. Were there ever any internal investigation and/or mitigation actions taken for wastewater related issues? If so, specify.

Provide name of staff responsible for premises related wastewater regulatory issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.7 Waste Management

(To be completed by Site Facilitators or other appropriate persons)

A. Provide details of internal classification, source, nature, quantity and frequency of waste generated (including waste samples brought in for analysis and used pesticides) for:

i. Dangerous waste

ii. Chemical waste

iii. Biological/infectious waste

iv. Solid waste (including obsolete equipment)

v. Radioactive waste

vi. Other wastes (specify)

B. Provide details of any licences, permits or applications on file (i.e. licence/permit and title, number, issuing agency, sources covered, special conditions etc.) in relation to generation, storage, handling, disposal or transportation of these wastes.

C. Provide details of any on-site waste or disposal systems (i.e. type of waste disposal system and capacity, type and quantity of waste disposed of etc.) for these wastes.

D. Describe operational specifications and maintenance schedules of the pre-treatment system. If records have been kept, indicate location.

E. Briefly describe any waste recycled (i.e. type, source, characteristics, treatment and use).

F. Briefly describe any current waste minimisation programmes (i.e., reduction, reuse and recycling) and indicate responsible staff.

Information Provided in Confidence

1.7 Waste Management (Cont'd)

G. Provide the following information for any off-site facilities used for waste treatment, storage or disposal in the past three (3) years.

Company Name	Premises Name	Type of Waste	Volume (Per Month)	Treatment/ Disposal Method

H. Existing programme to audit regulatory compliance in place at the premises? Describe briefly.

I. Has there been any internal investigation in relation to waste generation, storage, handling or disposal? If so, describe briefly.

Provide name of staff responsible for waste management issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.8 Air Quality Monitoring and Control

(To be completed by Site Facilitators or other appropriate persons)

General

A. Describe any formal policy or written guidance in relation to air quality (e.g. smoking policy, use of non-formaldehyde containing carpet underlay / furniture, substitute ozone depleting substances in solvents, refrigerants and fire extinguishers etc.).

Office Operation

B. Indicate the number of each type of the following equipment at this premise:

Laser printer _____

Xerox / Photocopier _____

Facsimile machine _____

Computer _____

Others(e.g. ozone generator, specify) _____

C. Indicate all other significant sources of indoor air emissions / pollutants not covered above.

D. Has indoor air pollution at this premise been monitored in the past? If so, are records of findings kept and where?

F. Is there a programme to monitor the indoor air quality at this premise? If so, describe briefly.

G. Describe any mitigation actions taken in the area with respect to indoor air quality improvement.

Information Provided in Confidence

1.8 Air Quality Monitoring and Control (Cont'd)

H. If applicable, indicate any known respiratory symptoms or irritations experienced by your premise members (i.e. frequent flu symptoms, sore throat, eye irritation etc.).

I. Describe known time pattern of symptoms occurrence and relief (i.e. morning, afternoon, weekend etc.).

Provide the name of staff responsible for indoor air quality issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Laboratory Operation

J. Identify operations conducted at the premises that involve air emissions (i.e. handling of chemicals and solvents, biological sample preservation etc.).

K. Is there an inventory of all emissions (including fugitive emissions) released from the area?

L. Describe any programme of updating emissions inventory.

M. Describe the air pollution control equipment installed and operating at the premises (i.e. particulate filters, scrubbers etc.).

Information Provided in Confidence

1.8 Air Quality Monitoring and Control (Cont'd)

N. Indicate the number and location of stacks, vents or other outside emission points originating from the area.

O. Provide details of any licences or applications on file pertinent to ambient air quality regulations (i.e. licence title and number, issuing agency, sources of air emissions etc.).

P. Describe any formal criteria for reviewing the premises emission strategy (i.e., eliminate or reduce emissions).

Q. Has this area ever been under any internal investigation and/or taken mitigation action related to ambient air emissions? If so, specify.

R. Describe any ambient air compliance monitoring programmes in place at the premises. Are records kept of all monitoring results?

S. Describe any written procedures to be followed in the event of standard exceedance.

T. Are all relevant staff fully trained in the above procedures?

Provide name of staff responsible for outdoor air quality issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.9 Noise Monitoring and Control

(To be completed by Site Facilitators or other appropriate persons)

A. Identify all operations or activities that may substantially elevate noise beyond normal premise background levels.

B. If applicable, describe any current practices to reduce noise levels at the premise.

C. Have there been any noise monitoring programmes undertaken at the premises? If so, describe briefly.

D. Have there been any formal complaints received on noise generated within the area? If so, provide details.

Provide name of staff responsible for noise monitoring and control issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.10 Transportation and Travel

(To be completed by Site Facilitators or other appropriate persons)

A. Describe any formal car fleet procurement policies or selection criteria related to overall environmental performance (i.e. fuel type and economy, refrigerant use, emissions standard, noise level, recyclability of materials, paint use etc.).

B. Is there an inventory of transportation devices operated by the Department? Describe scope of the inventory (i.e. fuel type and economy, emission level, maintenance requirements etc.).

C. Describe scope of maintenance programme in place for all transportation devices.

D. Is there any formal policy or guidance on spillage prevention and disposal of fleet maintenance wastes (i.e., engine oil, refrigerant, tyre etc.)?

E. Is there a programme in place to monitor air and noise emissions and to effect appropriate arrangement for corrective maintenance as required?

F. Describe training/instruction provided to drivers/operators on increasing the fleet's environmental performance (i.e. turn off idle engines, minimise number of trips etc.)?

G. Is there any written policy or guidance on use of Department vs. private vehicles?

H. Existing guidance on staff transport arrangements to encourage use of public transportation?

Provide name of staff responsible for transportation and travel related issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.11 Emergency Response Procedures

(To be completed by Site Facilitators or other appropriate persons)

A. Attach copy of any formal emergency response procedures and/or contingency plans on:

i. Disruption of water supply

ii. Supplied water treatment system failure

iii. Wastewater treatment system failure

iv. Chemical/chemical waste spillage

v. Dangerous materials/waste spillage

vi. Biological/infectious materials/waste release

vii. Radioactive materials/waste release

B. Provide details of any equipment located in areas where emergencies have the potential to occur.

C. Are the staff in these areas appropriately trained in emergency response procedures?

Provide name of staff responsible for emergency response procedures issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.12 Staff Awareness and Training

(To be completed by Site Facilitators or other appropriate persons)

Staff Awareness

A. Are there any regular general meetings on the improvement of the working environment?

B. Has there been wide participation in specific environmental management issues in the office (e.g. campaigns on reduction of paper and energy usage)? If so, are staff members adequately informed of the specifics (i.e. objectives, approach etc.)?

Training

C. Describe briefly the nature and topics of premises environmental training (workshops, seminars, campaigns/ activities etc.) offered in the past year.

D. Is the training programme offered to all relevant personnel?

E. Have there been regular reviews to ensure the effectiveness of the training programme?

F. Have the participants been involved in the training review process?

Provide name of staff responsible for staff awareness and training related issues at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.13 Publicity of Environmental Information

(To be completed by Site Facilitators or other appropriate persons)

A. Describe any formal programme to ensure staff members responsible for publicity of environmental information have the relevant experience and adequate training.

B. Are there any formal procedures to review adequacy of publicity materials?

C. Describe any programme to ensure that information contained in the publicity materials are correct and up to date.

Provide name of staff responsible for publicity of environmental information at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Information Provided in Confidence

1.14 Response to Public Enquiries and Complaints
(To be completed by Site Facilitators or other appropriate persons)

A. Describe any formal procedures or guidelines in enquiry referral (i.e. both internal and external).

B. Does the Department have any procedures in place to handle enquiries on environmental information that is publicly available? If so, describe the procedures.

C. Are there any procedures or guidelines available to handle complaints received from the public? If so, describe briefly.

Provide name of staff responsible for public enquiries and complaints at this premise.

Name and Title: _____

Location: _____

_____

Telephone no.: _____

csimile no.: _____

QUESTIONNAIRE COMPLETED BY:

Name and Title: _____

Premise: _____

Location: _____

_____

Telephone no.: _____

Facsimile no.: _____

Date: _____

1 GENERAL INFORMATION

Premise Information

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Diagrams of premises layout				
2. Drainage layout plans				
3. Environmental reports (prepared in-house or by external consultants)				
4. Diagrams of ventilation ducting layout				
5. Diagrams of lighting wiring layout				

2 OVERALL ENVIRONMENTAL MANAGEMENT

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Departmental Environmental Policy Statement				
2. Procedures and schedules for reviewing the Environmental Policy				
3. Record of overall environmental performance review meetings				
4. Departmental environmental management structure				

3 MATERIALS PROCUREMENT POLICY

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Procurement policy				
2. Procedures for inventory keeping, updating and checking				
3. Procedures for the review and selection of materials that are not environmentally detrimental				
4. Guidelines on 'green products' for suppliers				

4 ENERGY MANAGEMENT

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Energy use records for the past three years: - Gas - Electricity - Liquid Fuel - Solid Fuel Evaluation Frequency				
2. Audit reports or monitoring data on energy conservation				
3. Procedures or guidelines for energy conservation				
4. Documentation on energy conservation upgrades over past three years				

5 HAZARDOUS MATERIAL* MANAGEMENT

Office Operation

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Procedures or guidelines for material management (i.e. specific storage and handling procedures, etc.)				
2. List of any hazardous materials and chemicals stored within the office areas.				
3. Diagrams showing the routes for hazardous materials and chemicals transport				
4. Diagrams showing the storage areas, for hazardous materials and chemicals				

* Hazardous material denotes substances which can threaten public health; including substances controlled by the Dangerous Good Ordinance (Cap.295), Pesticides Ordinance (Cap.133) and Air Pollution Control Ordinance (Cap.311) and Factories and Industrial Undertakings Ordinance (Cap.59).

5 HAZARDOUS MATERIAL* MANAGEMENT (Cont'd)
Laboratory Operation / Public Service

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
5. Certification for the analyses being conducted (eg. HOKLAS** certification)				
6. Document on contracted out laboratory analyses and copies of the laboratories' certification for the analyses				
7. Evidence of analytical methods used in compliance with standard methods				
8. Dangerous goods / chemicals inventory				
9. List of permits for storage of dangerous goods and chemicals				
10. Procedures or guidelines for dangerous goods / chemical handling				

* Hazardous material denotes substances which can threaten public health; including substances controlled by the Dangerous Good Ordinance (Cap.295), Pesticides Ordinance (Cap.133) and Air Pollution Control Ordinance (Cap.311) and Factories and Industrial Undertakings Ordinance (Cap.59).

** HKOLAS denotes Hong Kong Laboratory Accreditation Scheme

5 HAZARDOUS MATERIAL* MANAGEMENT (Cont'd)

Laboratory Operation / Public Service (Cont'd)

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
11. Diagrams showing hazardous materials storage areas				
12. Hazardous materials inspection logs				
13. Material Safety Data Sheet (MSDS) file				
14. Guidelines provided for training of staff in handling hazardous materials / chemicals				
15. Documentation / training for personnel				
16. Violation notices received				
17. Alarm systems and evacuation procedures in case of an emergency				

* Hazardous material denotes substances which can threaten public health; including substances controlled by the Dangerous Good Ordinance (Cap.295), Pesticides Ordinance (Cap.133) and Air Pollution Control Ordinance (Cap.311) and Factories and Industrial Undertakings Ordinance (Cap.59).

5 HAZARDOUS MATERIAL* MANAGEMENT (Cont'd)

Pesticides

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
18. Pesticides inventory				
19. Pesticides storage area diagrams				
20. Guidelines for pesticide handling				
21. Records of the use of pesticides in office and laboratory areas for the past three years				
22. Violation notices received in the past three years				

* Hazardous material denotes substances which can threaten public health; including substances controlled by the Dangerous Good Ordinance (Cap.295), Pesticides Ordinance (Cap.133) and Air Pollution Control Ordinance (Cap.311) and Factories and Industrial Undertakings Ordinance (Cap.59).

5 HAZARDOUS MATERIAL* MANAGEMENT (Cont'd)

Asbestos

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
23. Formal asbestos management plan or policy statement				
24. Asbestos-containing materials (ACM) inspection or survey reports				
25. ACM management or monitoring plans and copies of any ACM abatement or removal plans or certifications				
26. Regulatory agency inspection reports				
27. Notices of violation received pertaining to asbestos				
28. List of any operations which generate asbestos waste				

* Hazardous material denotes substances which can threaten public health; including substances controlled by the Dangerous Good Ordinance (Cap.295), Pesticides Ordinance (Cap.133) and Air Pollution Control Ordinance (Cap.311) and Factories and Industrial Undertakings Ordinance (Cap.59).

6 WATER SUPPLY MANAGEMENT

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. List of sources of water supply (including that for flushing)				
2. Records of water consumption (office and laboratory)				
3. Water quality monitoring data				
4. Details of water pretreatment system				

7 WASTEWATER MANAGEMENT

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Wastewater discharge licence(s)				
2. Expedient connection & site drainage plan				
3. Effluent discharge monitoring data				
4. Regulatory inspection reports				
5. Violation notices received in the past				
6. Floor plans the wastewater storage and discharge points				
7. Accessibility of discharge point(s) for sampling				
8. Details of existing wastewater treatment facilities				
9. Operation and maintenance manual(s) for wastewater treatment facility(ies)				
10. Procedures or guidelines for collection, preparation and analysis of wastewater samples				

8 WASTE* MANAGEMENT

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Permit(s) or licence(s) for waste storage, transportation and disposal with specification of terms and conditions				
2. Procedures or guidelines for waste handling				
3. Guidelines for classification of waste				
4. Diagrams showing waste storage areas and routes for waste handling				
5. List of sources generating these wastes				
6. Waste analysis data and profiles for all current waste streams				
7. Waste surveys or reports prepared				
8. Copies of any regulatory inspection reports				

* Waste denotes dangerous waste, chemical waste, biological / infectious waste, solid waste, radioactive waste and other wastes.

8 WASTE* MANAGEMENT (Con'd)

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
9. Any violation notices received				
10. Waste transportation and disposal documentation (including waste contractor licences and any associated documents)				
11. Waste recycling and minimization plan and associated documents				
12. Documents related to the disposal facilities used				
13. Operating records of any disposal facilities				
14. Any incident reports for the past three years				
15. Waste control or management licences issued from the appropriate authorities				
16. Safety procedures or programmes.				

* Waste denotes dangerous waste, chemical waste, biological / infectious waste, solid waste, radioactive waste and other wastes.

8 WASTE* MANAGEMENT (Con'd)

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
17. Details of waste segregation programme(s)				
18. Dangerous Goods Licence(s)				
19. Training records for personnel				

* Waste denotes dangerous waste, chemical waste, biological / infectious waste, solid waste, radioactive waste and other wastes.

9 AIR QUALITY MONITORING AND CONTROL

General

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Air quality policy				
2. Air quality survey records or reports				
3. Air quality monitoring data				
4. Any complaints related to emissions to the atmosphere or indoor environment				

Indoor Air Quality

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Guidelines for the use of office machines or operations to minimize gaseous emissions				
2. Reports of any in-house investigation of emission sources				
3. Details of mitigation measures taken and evaluation of its effectiveness				
4. Details of indoor air quality improvement programme(s)				

9 AIR QUALITY MANAGEMENT AND CONTROL (Cont'd)

External Air Emission

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. All permits related to air emissions				
2. Any violation notices regarding air emissions issued within the past three years				
3. Investigation reports identifying any sources of air pollutant emissions.				
4. Diagrams of premise emission locations				
5. Compliance, assessments, and / or sampling reports				
6. List of control apparatus for air emissions				
7. Air quality monitoring logs				
8. Plan(s) for air emissions elimination or reduction				

10 NOISE MONITORING AND CONTROL

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Noise Control Policy				
2. Noise monitoring data or monitoring programmes being exercised				
3. Reports of any in-house investigations to identify the source of noise emissions				
4. Details of mitigation measures and their effectiveness				
5. Details of programme for improvement of noise emissions				
6. Complaints related to noise emissions				

11 TRANSPORTATION AND TRAVEL

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Departmental policy relating to transportation and travel				
2. Records or reports for the use of Departmental vehicles				
3. Maintenance and overhaul procedures or guidelines for Departmental vehicles				
4. Procedures for handling of chlorofluorocarbons (CFC)				
5. Procedures for handling of used oil & antifreeze				
6. Records of fuel consumption of Departmental vehicles				
7. Data on the environmental performance of the Departmental vehicles				

12 EMERGENCY RESPONSE PROCEDURES

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Emergency response procedures and contingency plans				
2. Staff training record in emergency response procedures				

13 STAFF AWARENESS AND TRAINING

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. List of any regular meetings on the improvement of the working environment				
2. Copy of any Departmental environmental policy on staff training				
3. List of staff training programmes relating to environmental matters				
4. Details of criteria for selection of staff to attend the relevant training programme				
5. Reports on the effectiveness of training programme				
6. Staff training record				

14 COMMUNITY RELATIONS

Information to be reviewed	Available	Not Available	Not Applicable	Location of Documents / Comments
1. Procedures or guidelines for the dissemination and/or publicity of environmental information				
2. List of regular publications				
3. Details of training programme for staff responsible for publicity of environmental information				
4. Procedures or guidelines on responding to public enquiries and complaints				
5. Records or reports of public enquiries and complaints				
6. Staff training programme on public enquiry and complaint response				

Pre-Audit	SAMPLE COVER LETTER

Address
Attn.: Internal Auditor / Site Facilitator
Date

Dear (Name of Addressee)

On behalf of (Name of Department), we appreciate your assistance with these environmental audits. The objective of these audits is to review the environmental management system and legislative and internal policy compliance status at (Name of Department) premises.

The intent of this Pre-Audit activity request is to gather information for use by the Audit Team. The information will allow for a more focused and efficient audit, avoiding the need for additional unscheduled onsite time. Planned time onsite will range from half to full day depending on the size and complexity of the operation.

The Pre-Audit Questionnaire should be completed and returned to the undersigned by (Date) ,two weeks in advance of the site visit to (Name) at (Address), (Fax #) . Feel free to hand write your responses on the questionnaire. As for The Operational Document Checklist, the objective is to assist each facility in locating the records and other information pertinent to the audit and ultimately make the audit more efficient. However, if the records are decentralised, it is not necessary to relocate them for this audit.

Several of the items on the Checklist may not have an application at your location. If you feel certain items do not apply or if you are uncertain as to the specific request, please indicate "NA" or "?" to the left of the listed item, respectively. The appropriate audit team member will further discuss that point with you to see if there is a potential application at your premises.

We thank you in advance for your time and for making our work together as beneficial as possible.

Yours sincerely

(Signature)
Audit Manager

On-site Audit

ENVIRONMENTAL AUDIT PROTOCOL - AIR POLLUTION CONTROL

This audit does not cover the audit for use of conventional liquid fuel, open burning and air pollution control on vehicles.

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Air Pollution Control Ordinance and the Subsidiary Regulations (Cap. 311, sub.leg. A, B, C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
sub.leg.A S.3	**Use of furnace, Oven or Chimney** (1)(a) Any furnace, oven or chimney which consumes (i) >25L of conventional liquid fuel per hour (ii) >35kg of conventional solid fuel per hour (iii) >1150 megajoules of any gaseous fuel per hour ***If none of the above is positive, then skip this subsidiary legislation (A).*** Examine approval from Authority & attach a copy					**Particulars of Furnace, Oven or Chimney -** Type, grade & quantity of fuel consumed: Operation time in each period of 24 hrs: Details of automatic or semi-automatic control connected: Rating of the boiler: Dimension & material of chimney: Mechanical stoking device (for solid fuel): Burner appliance (for liquid or gaseous fuel):
sub.leg.B S.5 S.3	**Use of Liquid Fuel** (1) Use of liquid fuel with a viscosity with point of ignition >30 centistokes or an equivalent viscosity ***If negative, then skip this subsidiary legislation (B).*** (2) Examine approval from Authority attach a copy **Sampling Points** (1)(a) Any notice from the Authority for providing a sampling point (1)(b) Any sampling point for the Authority taking samples of dust & grit					**Particulars of Sampling Sites -** Position: Design:

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Air Pollution Control Ordinance and the Subsidiary Regulations (Cap. 311, sub.leg. A, B, C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
sub.leg.C S.3	**Emission of Dark Smoke** Any chimney in operation ***If negative, then skip this subsidiary legislation (C).*** Examine monitoring records Emission of dark smoke for more than 6 mins in any period of 4 hrs Emission of dark smoke for more than 3 mins continuously in any time					
Cap.311 S.12	**Specified Process** (1) Any specified process listed in Schedule 1 of Cap.311 in the premises ***If negative, skip the following of S.12 in Cap.311*** Examine licence & attach a copy					
	Examine any record of previous prosecution / complaints on air pollution					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Air Pollution Control Ordinance and the Subsidiary Regulations (Cap. 311, sub.leg. A, B, C)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
Cap.311 S.69	**Asbestos Control Work** (1) Any asbestos containing material in the premise ***If negative, skip the following & remarks of S.69 in Cap.311*** Examine asbestos management plan & attach a copy Examine asbestos investigation report & attach a copy Confirm the qualification of the registered asbestos consultant					**Particulars on asbestos containing material-** Location: Quantity: Type: Composition: Physical condition: Accessibility:
Cap.311 S.79	Any record of asbestos abatement notice & attach a copy if there is any					

* N/A - not applicable; Unk - Unknown

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - OZONE LAYER PROTECTION

This protocol does not cover the import, export or manufacture of the ozone depleting scheduled substances.**

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Ozone Layer Protection (Controlled Refrigerants) Regulation (Cap. 403, sub.leg.B)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.5	**Approval** (1) Any use of controlled refrigerant ***If negative, then skip the following of this audit checklist.*** Examine approval from Authority & attach a copy					
S.7	**Record of Refrigeration Equipment Service** (1) Examine the record of refrigeration equipment service by authorized person & attach a copy (2) Confirm retention of the record for at least 1 year					**Particulars of Refrigeration Equipment Service-** Date of refrigerant removal: Date of refrigerant replacement: Registration No. of the authorized person:

* N/A - not applicable; Unk - Unknown0

** As defined in Schedule 1 of Ozone Layer Protection Ordinance (Cap.403) and the amendment to schedule in 1994, ozone depleting substances include chlorofluorocarbons (CFC), halons, other fully halogenated chlorofluorocarbons, methyl chloroform, carbon tetrachloride, methy bromide, hydrobromofluorocarbons (HBFC) and Hydrochlorofluorocarbons (HCFC).

As of January 1997

On-site Audit

ENVIRONMENTAL AUDIT PROTOCOL - WATER POLLUTION CONTROL

Audit Site_____
Audit Date_____
Auditor (s)_____
Site Personnel_____

Legislation: Water Pollution Control Ordinance (Cap.358)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk.	
S.19	**Licence** Discharge, other than domestic sewage and unpolluted water**, into (i) Water Control Zones (ii) Inland water (Iii) Communal sewers & drains Examine licence to discharge or from non-domestic premise & attach a copy Examine expedient connection & site drainage plan					Sources of discharge: Type of drainage connected:
S.20	**Licence Conditions (as per license)** (4) Compliance with licence terms & conditions Licence terms & Conditions: i/ _____ ii/ _____ iii/ _____ iv/ _____ v/ _____ Examine & attach effluent sampling/measurement records					**Particulars on the discharge -** Place: Time/period: Rate/total amount: Characteristics: Effluent treatment & equipment used: Asses the competence of treatment equipment & operators

* N/A - not applicable; Unk - Unknown
** For definition of domestic sewage and unpolluted water, please refer to attachment WPC-1.

As of January 1997

ATTACHMENT WPC - 1

Definition of Domestic Sewage and Unpolluted Water (Cap. 358, Section 9 - subsection 3)

Domestic Sewage means waste of a kind and quantity that is generated by the domestic use of toilet, watercloset, bath, shower, sink, basin or other sanitary fitment by person residing in a household or while at a place of work but does not include -

(a) the solid residue from a wastewater treatment facility;
(b) the effluent from a wastewater treatment facility that uses electrical or mechanical equipment in its operation; or
(c) waste that is generated by a food business that is subject of the Food Business (Regional Council) Bylaws (Cap. 132 sub. leg.) or the Food Business (Urban Council) By-laws (Cap. 132 sub. leg.);

Unpolluted Water means -

(a) rain water from any part of a building, including any area appurtenant of a building;
(b) water used -
  (i) for firefighting purposes;
  (ii) in connexion with an occurrence in which life or property is endangered;
  (iii) for the cleansing of streets, thoroughfares, and other areas.

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - NOISE CONTROL

This protocol covers only noise arising from public places and domestic premises only.

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Noise Control Ordinance (Cap.400)

Reference	Requirements	Activity Compliance				Comments/Remarks
		Yes	No	N/A	Unk	
S.4	**Noise at Night or on a General Holiday** Any annoying noisy activity produced - (1) Between 11 p.m. & 7 a.m. (1) At any time on a general holiday					
S.5	**Noise at Any Time** Any annoying noise produced from - (1)(a) Musical or other instrument operation (1)(b) Loud-speaker, megaphone, or other device for magnifying sound (1)(d) Trade or business activity (2) Air-conditioning or ventilating system (3) Animal or bird Examine any record of previous prosecution / complaints					

* N/A - not applicable; Unk - Unknown

As of January 1997

ENVIRONMENTAL AUDIT PROTOCOL - NOISE CONTROL

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Noise Control Ordinance (Cap.400)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.14	Manufacture of Noisy Product (For Use in 2nd Party Audit) (1) Any trade or business or manufacture or supply of noisy product ***If negative, skip the following of S.14 & S.16.*** (3)(a) Product equipped with prescribed device for minimizing noise emission (3)(b) Product fitted with prescribed label relating to noise emission (4) Product comply with all information stated on the prescribed label					
S.16	**Product Testing (For Use in 2nd Party Audit)** (1) Any product testing required by the Authority Examine & attach the notice ***If negative, skip the following & remarks of S.16*** (2)(d) Examine result of the product testing and attach a copy					Place of manufacture: Place of testing: Date of manufacture: Date of testing: Authorized officer at the product testing:

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit

ENVIRONMENTAL AUDIT PROTOCOL - CHEMICAL WASTE MANAGEMENT

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.6	**Registration** Examine Chemical Waste Producer Registration & attach a copy					Business activity: Type of chemical waste produced:
S.8	**Chemical Waste Disposal** (1)(a) Arrangement to deliver chemical waste to reception point(s) (1)(b) If disposal internally, examine license and attach a copy (2) If no suitable reception point in HK for the waste, examine & attach the approval for the present disposal arrangement					Reception point(s):
S.9	**Containment** Waste containers of - suitable design - suitable material (corrosion resistant) - well maintained					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.10	**Proper Packing** (1)(a) Waste stored to ensure handling safety and container effectiveness (1)(b) Containers properly & securely closed and surface free of waste (1)(c) Incompatible wastes not mixed, packed or stored in same container (1)(d) Sufficient air space allowed in containers of liquid chemical waste					
S.11	**Use of Large Containers** Examine the written approval of the Authority for use of containers over 450 litres in capacity & attach a copy					
S.12	**Labelling** (1)(a) Bilingual label on every container with proper design and dimensions as specified in Parts 1 to 4 of Schedule 2 of sub.leg.C in Cap.354 (1)(b) Accuracy and sufficiency of information on labels for safe storage, handling & transport (1)(c) Labels secured, kept clean and easily visible					

* N/A - not applicable; Unk - Unknown

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.16	**Storage in Working Area** (a) Wastes stored in working area (b) Quantity stored in single are below 50 litres (c) Containers properly stored and labelled (d) Containers kept in cabinet or receptacle of suitable material and construction (e) Containers of incompatible wastes separated by an impermeable partition inside cabinets ***If all of the above are positive, then skip S.13, S.14 &S.15***					
S.17	**Storage in Large Fixed Containers** (a) waste stored above ground in approved and fixed containers ***If positive, then skip S.13 & S.15*** (b) waste stored below ground in approved and fixed containers ***If positive, then skip S.13, S.14 & S.15***					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.13	**Storage Area** (2)(a) Dedicated storage area (2)(b) Enclosed on 3 sides with no less than 2m in height or height of tallest container or stack of containers (2)(c) Adequacy of area ventilation (2)(d) Isolation from surface water drains or foul sewers (2)(e) Adequacy of handling space (2)(f) Indoors storage area and building escape / exit not obstructed (2)(g) Outdoors storage area covered (2)(h) Storage area kept clean and dry					
S.14	**Liquid Waste Storage** (1)(a) Storage area floor / surface permeation proofed (1)(b) Capacity of retention structure sufficient to accommodate contents of the largest container OR 20% volume of waste in storage (1)(c) Walls or partitions of stacked container storage area constructed of impermeable material					

* N / A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.15	**Container Storage** (1)(a) Segregated storage of chemical waste containers posing health and safety risks (1)(b) Measures to prevent collapsing of stacked containers					
S.18	**Warning Signs on Storage Area** (1) Warning notice at / near the entrance or opening of every chemical waste storage area, cabinet and receptacle (2)(a) "CHEMICAL WASTE" in bold red on white background in both English and Chinese (>6 cm in height) on the panel (2)(b) Panel securely attached to or marked on vertical plane of storage structure (2)(c) Panels are durable, weather resistant and rigidly attached (2)(d) Kept clean and free from obstruction					
S.21	**Engagement of Waste Collector** Examine contract with a licensed waste collector & attach a copy					

* N/A - not applicable; Unk - Unknown

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - CHEMICAL WASTE MANAGEMENT

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
	Particulars on Waste Collection					
S.22	(1) Examine & attach a copy of trip ticket					Confirm complete details (type, nature, quantity etc.) of waste on trip tickets
S.28	(1) Confirm retention of trip ticket copies for 12 months					
	Particulars on Waste Collector (for use in 2nd party audit)					
S.23	(1)(a) Complete details required by the trip ticket and 2 copies					
	(1)(b) Confirm & certify details on the trip ticket and 2 copies					
	(1)(c) Comply with other requirement specified on the trip ticket					
	(2)(a) Confirm a securely packed and correctly labelled chemical waste before removal					
	(2)(b) Confirm completion of trip ticket before removal					
	(3) Return one copy of the completed trip ticket to waste producer					
S.24	(1) Possess the original and a copy of the completed trip ticket					
	(2) Deliver the waste to a reception point not later than 48 hours after the collection					
S.25	(1) Hand over the original and one copy of the completed trip ticket to the manager of the reception point					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor (s) _____
Site Personnel _____

Legislation: Waste Disposal (Chemical Waste)(General) Regulation (Cap.354 sub.leg.C)

Reference	Requirements	Activity Compliance*				Comments / Remarks
		Yes	No	N/A	Unk	
S.30	Emergency Procedures (1)(a) Availability of written emergency procedures (1)(b) Adequacy of employee instruction and training on emergency procedures					Assess employee competence & awareness

* N/A - not applicable; Unk - Unknown

The protocols for dangerous goods management do not cover those substances in Category 1 (explosives) & Category 9A (combustible goods exempted from section 6-11 of the Dangerous Goods Ordinance), as well as all categories of dangerous goods in freight containers and air cargo terminal.

Confirm manufacture, storage or use of the following goods at this premise -

Dangerous Goods Category	Dangerous Goods Type	Specify Activity Involved			Description of Dangerous Goods
		Mfg.	Store	Use	
1	Explosives				
2	Compressed Gases				
3	Corrosive Substances				
4	Poisonous Substances				
5	Substances Giving off Inflammable Vapour				
6	Substances become Dangerous by Interaction with Water				
7	Strong Supporters of Combustion				
8	Readily Combustible Substances				
9	Substances Liable to Spontaneous Combustion				
10	Other Dangerous Substances				

* For definition of different types of dangerous goods, please refer to Schedule 1 of Cap.295 sub.leg.A.

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 2) MANAGEMENT

This protocol does not cover the audit for filling and conveyance of Category 2 dangerous goods (Compressed Gases).

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 2 (Compressed Gases)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.62	**Licence** (1) Examine licence to manufacture/store compressed gases & attach a copy ***Exempt if the quantity of such gas listed in the 1st column of table in S.74 of sub.leg.B in Cap.295 not exceeding that specified in the 2nd column AND the total quantity of all gases in the same store <5 cylinders (i.e. 25L)***					Registration No.: Business activity: Type of compressed Gases: Quantity: Confirm with the table of section 74 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.63	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Equipped with appropriate fire extinguisher					Storage site: Material of construction: Means of ventilation: Method of fixing gas distributing pipeline: Fire extinguisher type:
S.64	**Use of Approved Cylinders** Use of appropriate cylinders for specific gas					
S.65	**Marking of Cylinders** Cylinders appropriately colour coded (i.e. red - inflammable; yellow - poisonous; half red & half yellow - both)					

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 2) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 2 (Compressed Gases)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.66 & S.67	**Cylinder Testing** Examine record of cylinder testing by Authority & attach a copy C Permanent & liquefied gases - every 5 years C Dissolved gases - every 12 months					
S.72	**Fire Precautions** (1) No smoking (2) No naked light and heating equipment in store (3) No unapproved electrical equipment (4) Sign prohibiting smoking and use of naked lights in English and Chinese outside store					
S.73	**Liquid Oxygen and Nitrogen Cylinder Storage** (1) Storage of liquid oxygen or nitrogen in approved place marked by bilingual notice(s) (2) Handling of liquid oxygen and nitrogen by experienced personnel					
S.74	**General Storage Provisions** (2) Cylinder labelled as prescribed in the Schedule 1 of sub.leg.B in Cap.295 (3) Segregated storage of such gases listed at 1st column which exceed the quantity specified in 2nd column of table in S.74 of sub.leg.B in Cap.295 (4)(a) Cool storage away from direct sun and any heat sources (4)(b) Cylinders located below or >600 mm from burner (4)(c) Licensed storage area (4)(d) No storage in common passageway, stairway or doorway (4)(e) Stored above ground levels, except with permission (4)(f) Provision of adequate ventilation					Confirm with the table of section 74 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 3) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 3 (Corrosive Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.81	**Licence** (1) Examine licence to manufacture/store corrosive substance & attach a copy) ***Exempt if the quantity of such corrosive substances listed in the 1st column of table in S.84 of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such corrosive substances listed in the 1st column not exceeding that specified in the 8th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of corrosive substance: Quantity: Confirm with the table of section 84 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.82	**Licence Conditions** (a) Conformation of storage area construction with the approved plan (b) impervious flooring and walls for total spill retention					Storage site: Material of construction:

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 3 (Corrosive Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.83	**Segregated Storage** (1) Segregated storage of corrosive substances (2) No co-storage of incompatible substances (Column 1 & Column 2)**					
S.84	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.84 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.84 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.84 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.84 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.84 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 84 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

**	**Column 1 Substances**	**Column 2 Substances**
	Acetic Anhydride	Chlorosulphonic Acid Nitric Acid
	Hydrobromic Acid Hydrochloric Acid	Perchloric Acid Sulphuric Acid (conc. or oleum)
	Hydrofluoric Acid Perchloric Acid	Nitric Acid
		Chlorosulphonic Acid Sulphuric Acid (conc. or oleum)

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 4) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 4 (Poisonous Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.87	**Licence** (1) Examine licence to manufacture/store poisonous substance & attach a copy ***Exempt if the quantity of such poisonous substances listed in the 1st column of table in S.92 of sub.leg.B of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such poisonous substances listed in the 1st column not exceeding that specified in the 8th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of corrosive substance: Quantity: Confirm with the table of section 92 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.88	**Licence Conditions** (a) Conformation of storage area construction with the approved plan (b) Provision of adequate ventilation					Storage site: Material of construction: Means of ventilation:
S.89	**Store to be Kept Locked** Entrance kept securely closed and locked					
S.90	No person under age of 14 & unauthorised persons permitted in store					

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 4) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) b _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 4 (Poisonous Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.91	Segregated storage of poisonous substances					
S.92	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.92 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.92 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.92 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.92 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.92 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 92 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 5) MANAGEMENT

This protocol does not cover the audit for conveyance and bulk storage of Category 5 dangerous goods (Substances Giving Off Inflammable Vapour).

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 5 (Substances Giving Off Inflammable Vapour)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.96	**Licence** (1) Licence to manufacture/store corrosive substance (Examine & attach a copy) ***Exempt if the quantity of such substances listed in the 1st column of table in S.99 of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 8th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of corrosive substance: Quantity: Confirm with the attached table of section 99 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.97	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Floors, walls, ceiling/roofing constructed of fire resisting materials (c) Surface of any part of store for liquid storage constructed of impervious material to totally retain spill (d) Adequate ventilation equipped with flame traps (e) Proper fitting and insulation of all electrical equipment (f) Isolation of store from sewer or drain (g) Equipped with appropriate fire extinguishing equipment (h) Notice (bilingual) and prohibition of smoking and naked lights					Storage site: Material of construction: Means of ventilation:
S.98	Segregated storage of substances giving off inflammable vapour					

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 5) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 5 (Substances Giving Off Inflammable Vapour)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.99	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.99 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.99 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.99 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.99 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.99 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 99 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.105	**Fire Sited Near Store** No fire or source of substantial heat within 6m of the store ***Exempt when it is approved by the Authority AND it is separated by an approved fire resisting wall*** Examine & attach a copy of permission					
S.106	**Storage of Containers** Stored >600mm from any wall or the ceiling Free air space >600mm if stored in stacks					
S.113	No person under age of 14 & unauthorised persons permitted in store					
S.114	**Store to be Kept Locked** Entrance kept securely closed and locked					

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 6) MANAGEMENT

This protocol is not applicable to the audit for storage of calcium carbide in Category 6 (Substances which become dangerous by interaction with water).

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 6 (Substances which become dangerous by interaction with water)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.136	**Licence** (1) Examine licence to manufacture/store substance which become dangerous by interaction with water & attach a copy ***Exempt if the quantity of such substances listed in the 1st column of table in S.139 of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 8th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of substance: Quantity: Confirm with the attached table of section 139 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.137	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Store secured against entry of water (c) Equipped with appropriate fire extinguishing equipment					Storage site: Material of construction: Means of ventilation:
S.138	Segregated storage of substances which become dangerous by interaction with water					

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 6) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 6 (Substances which become dangerous by interaction with water)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.139	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.139 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.139 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.139 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.139 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.139 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 139 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
	Specific Provisions					
S.140	Water not to be introduced into stores					
S.141	Containers to be kept closed					
S.142	Unauthorised persons not permitted in stores					

* N/A - not applicable; Unk - Unknown

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 7) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 7 (Strong Supporters of Combustion)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.150	**Licence** (1) Examine licence to manufacture/store strong supporters of combustion & attach a copy ***Exempt if the quantity of such substances listed in the 1st column of table in S.153 of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 8th column of the table stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of substance: Quantity: Confirm with the attached table of section 153 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.151	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Equipped with appropriate fire extinguishing equipment					Storage site: Material of construction:
S.152	Segregated storage of strong supporters of combustion					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 7 (Strong Supporters of Combustion)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.153	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.153 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.153 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.153 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.153 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.153 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 153 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 8) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 8 (Readily Combustible Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.156	**Licence** (1) Examine licence to manufacture/store readily combustible substance & attach a copy ***Exempt if the quantity of such substances listed in the 1st column of table in S.159 of sub.leg.B in Cap.295 not exceeding that specified in the 6th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 7th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of substance: Quantity: Confirm with the attached table of section 159 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.157	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Store of celluloid or film ***If negative, skip (i) to (v) of S.157*** (i) Floors, walls, ceiling/roofing constructed of fire resisting materials (ii) Self closing and outward opening door OR sliding door of store (iii) Store with no windows but fitted with an efficient explosion hatch (iv) Adequate ventilation equipped with flame traps (v) Word Acelluloid@ or Afilm@ (bilingual) displayed on the outside door of store					Storage site: Material of construction:

* N/A - not applicable; Unk - Unknown

As of January 1997

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 8) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 8 (Readily Combustible Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.158	(1) Segregated storage of readily combustible substances (2) Restriction on co-storage of incompatible substances**					
S.159	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.159 of sub.leg.B in Cap.295 (2) Maximum quantity/net weight as specified in the 3th column of table in S.159 of sub.leg.B in Cap.295 (3) Outer packing type as specified in the 4th column of table in S.159 of sub.leg.B in Cap.295 (4) Appropriate labelling (bilingual as specified in the 5th column of table in S.159 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 159 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.161, S.163, S.164	No naked light, unprotected flame and smoking					
S.160	**Storage of Celluloid** (1) Store no more than 1 tone of celluloid or film					

* N/A - not applicable; Unk - Unknown
** Celluloid or nitrocellulose based film with any other goods

As of January 1997

On-site Audit	ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 9) MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 9 (Substances Liable to Spontaneous Combustion)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.167	**Licence** (1) Examine licence to manufacture/store substance liable to spontaneous combustion & attach a copy ***Exempt if the quantity of such substances listed in the 1st column of table in S.170 of sub.leg.B in Cap.295 not exceeding that specified in the 6th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 7th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitioner; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of substance: Quantity: Confirm with the attached table of section 170 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.168	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Store with fire extinguisher					Storage site: Material of construction: Type of fire extinguisher:
S.169	**Storage** Segregated storage of substances liable to spontaneous combustion Segregated storage of cotton waste to any other dangerous goods in category 9					

* N/A - not applicable; Unk - Unknown

As of January 1997

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 9 (Substances Liable to Spontaneous Combustion)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.170	**General Provisions** (1) Packing type as specified in the 2nd column of table in S.170 of sub.leg.B in Cap.295 (2) Maximum quantity/net weight as specified in the 3th column of table in S.170 of sub.leg.B in Cap.295 (3) Outer packing type as specified in the 4th column of table in S.170 of sub.leg.B in Cap.295 (4) Appropriate labelling (bilingual as specified in the 5th column of table in S.170 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 170 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

On-site Audit ENVIRONMENTAL AUDIT PROTOCOL - DANGEROUS GOODS (CATEGORY 10)MANAGEMENT

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Dangerous Goods (General) Regulation (Cap.295 sub.leg.B) - Category 10 (Other Dangerous Substances)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.173	**Licence** (1) Examine licence to manufacture/store substance in category 10 & attach a copy ***Exempt if the quantity of such substances listed in the 1st column of table in S.176 of sub.leg.B in Cap.295 not exceeding that specified in the 7th column OR if the quantity of such substances listed in the 1st column not exceeding that specified in the 8th column stored solely for the use (i) in registered hospital or maternity home; (ii) in registered mental hospital; (iii) for practice of a registered medical practitionener; (iv) for practice of a registered dentist; (v) for business of an authorized poison seller; (vi) in any laboratory.***					Registration No.: Business activity: Type of substance: Quantity: Confirm with the attached table of section 176 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)
S.174	**Licence Conditions** (a) Conformation of storage construction with the approved plan (b) Equipped with appropriate fire extinguishing equipment					Storage site: Material of construction:
S.175	Segregated storage of Category 10 (other dangerous substances) substances					
S.176	**General Provisions** Storage or conveyance of substances relating to: (1) Packing type as specified in the 2nd column of table in S.176 of sub.leg.B in Cap.295 (2) Minimum Air Space as specified in the 3rd column of table in S.176 of sub.leg.B in Cap.295 (3) Maximum quantity/net weight as specified in the 4th column of table in S.176 of sub.leg.B in Cap.295 (4) Outer packing type as specified in the 5th column of table in S.176 of sub.leg.B in Cap.295 (5) Appropriate labelling (bilingual as specified in the 6th column of table in S.176 & Schedule 1 of sub.leg.B in Cap.295					Confirm with the table of section 176 in Dangerous Good (General) Regulation (Cap.295 sub.leg.B)

* N/A - not applicable; Unk - Unknown

As of January 1997

ENVIRONMENTAL AUDIT PROTOCOL – ENVIRONMENTAL IMPACT ASSESSMENT

This protocol covers the planning, construction, operation and/or decommissioning of a designated project.

Audit Site _____
Audit Date _____
Auditor(s) _____
Site Personnel _____

Legislation: Environmental Impact Assessment (EIA) Ordinance (Cap.499)

Reference	Requirements	Activity Compliance*				Comments/Remarks
		Yes	No	N/A	Unk	
S.5	**Application for brief or permission to apply directly for environmental permit** Any project covered in Schedule 2 or Schedule 3 of the EIA Ordinance requires: (1)(a) to apply for a Study Brief to proceed with an EIA study for the project; (1)(b) to apply for approval to apply directly for an environmental permit.					
S.8	**Approval of environmental impact assessment report** (5) Any approved EIA report of the designated project placed on the register. Examine any record of the report					Date of the report: Register reference no.:
S.9	**Prohibition against carrying out designated project without environmental permit** A designated project listed in Part I of Schedule 2 shall not be constructed or operated, or a designated project listed in Part II of Schedule 2 shall not be decommissioned: (1)(a) without an environmental permit for the project; or (1)(b) contrary to the conditions set out in the permit. Examine the environmental permit and attach a copy					Date of environmental permit: Permit reference no.:
S.26	**Offences relating to environmental permit** (1),(4) Offences are committed if a project is constructed, operated or decommissioned contrary to S.9. Examine the permit conditions and their required documents					Documents required in the permit (e.g. design/planning submissions, construction EM& A programmes, operational/decommissioning EM&A programmes, procedures for reporting environmental permit conditions implementation status, etc.):

N/A – not applicable; Unk - Unknown

As of February 1999

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- Executive Summary

1. Introduction
2. Audit Scope
3. Approach and Methodology
4. Audit Findings
5. Recommendations
6. Conclusion

Post-Audit

AUDIT FINDINGS SUMMARY

Findings Category	Legislative Compliance	Conformity with Corporate Policies, Procedures & Guidelines	Good Environmental Practice Recommendations
Material Management			
Energy Management			
Waste Management			
Water & Wastewater Management			
Air Quality			
Noise Emissions			
Transportation & Travelling			
Emergency Response Procedures			
Staff Awareness & Training			
Response to Public Enquiries & Complaints			
Environmental Management Systems			

Implementation levels:

[1] Relatively easy and simple to implement with minimal resource requirements
[2] Require some planning and coordination at moderate expense and time commitment
[3] Involve significant modification of existing system at high cost in protracted time period

Post-Audit	ACTION PLAN FRAMEWORK

Environmental Issue	Objective	Target	Action	Responsible Department	Personnel Responsible	Budget	Timescale for Implementation / Completion
Material Management							
Energy Management							
Waste Management							
Water & Wastewater Management							
Air Quality							
Noise Emissions							
Transportation & Travelling							
Emergency Response Procedures							
Staff Awareness and Training							
Response to Public Enquiries and Complaints							
Publicity of Environmental Information							
Environmental Management Systems							

Appendix E: Typical Occupational Health and Safety Procedures

Confined Space Entry

Buildings and Floors

Equipment Guarding, Safeguard and Safety Devices

Ladders, Stairs, Walkways and Working Platforms

Lifting Devices

Fall Protection

Confined Space Entry

1.0 PURPOSE AND SCOPE

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

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

2.0 DEFINITIONS

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

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

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

2.1.3 Is not designed for continuous employee occupancy.

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

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

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

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

2.2.4 contains any other recognized serious safety or health hazard.

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

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

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

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

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

2.6.2 reasons for entering;

2.6.3 any anticipated hazards;

2.6.4 precautions which have been taken to protect entrants;

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

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

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

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

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

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

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

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

2.8.5 any atmosphere immediately dangerous to life or health.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.0 RESPONSIBILITY AND AUTHORITY

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

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

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

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

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

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

4.0 IDENTIFYING CONFINED SPACES

4.1 Confined Space Listing

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

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

4.2 Labeling

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

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

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

4.3 Confined Space Entry Permit (CSEP)

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

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

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

5.0 CONFINED SPACE ENTRY PROCEDURES

5.1 Initiating a Confined Space Entry Permit (CSEP)

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

5.2 Electrical and Mechanical Clearance

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

5.3 Confined Space Atmosphere Monitoring

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

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

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

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

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

5.4 Hot Work

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

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

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

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

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

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

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

5.5 Mechanical Ventilation

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

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

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

5.6 Safety

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

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

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

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

5.6.4.1 nature of the emergency;

5.6.4.2 the location of the emergency;

5.6.4.3 the number of people involved;

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

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

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

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

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

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

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

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

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

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

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

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

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

5.7 Equipment

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

5.7.1 retrieval lines;

5.7.2 harnesses;

5.7.3 Self Contained Breathing Apparatus (SCBA);

5.7.4 air monitoring instruments.

6.0 CONFINED SPACE RESCUE

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

6.1 Safety Attendant

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

6.1.1.1 The nature of the emergency

6.1.1.2 The location

6.1.1.3 The number of people involved

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

6.2 Control Room

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

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

6.3 Response Team

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

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

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

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

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

6.4 Contractor Requirements

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

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

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

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

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

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

7.0 ANNUAL REVIEW

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

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

7.1.2 This review is site specific.

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

8.0 TRAINING

8.1 General

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

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

8.2 Work Supervisor Training

8.2.1 Work Supervisor training shall include the following topics:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8.3 Safety Attendant and Authorized Entrant Training

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

8.3.1 the definition of a Confined Space:

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

8.3.1.2 a Confined Space is not intended for employee occupancy;

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

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

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

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

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

8.3.6 proper use of monitoring and safety equipment;

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

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

8.3.9 review - Confined Space Entry Procedure

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

8.3.9.1.1 DO NOT ENTER THE CONFINED SPACE!

8.3.9.1.2 call the Control Room for help;

8.3.9.1.3 state the nature of the emergency;

8.3.9.1.4 the location of the emergency;

8.3.9.1.5 the number of people involved.

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

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

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

8.3.10 Duties of Entrants

8.3.10.1 Must be trained before entering the space.

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

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

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

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

8.4 Control Room Personnel Training

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

8.4.1.1 list of emergency telephone numbers;

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

8.4.1.3 review of chain of events required, including:

8.4.1.3.1 receiving appropriate information;

8.4.1.3.2 nature of the emergency;

8.4.1.3.3 the location;

8.4.1.3.4 the number of people involved;

8.4.1.4 discuss which emergency response organizations should be contacted;

8.4.1.5 what to announce over the plant alert system.

9.0 REFERENCES

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

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

10.0 ATTACHMENTS

10.1 Possible List of Confined Spaces in the PLant

10.2 Confined Space Entry Permit

10.3 Confined Space Monitoring and Ventilation Requirements

Attachment 10.1

Possible List of Confined Spaces in the Complex

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

Attachment 10.2

Confined Space Entry Permit

Power Plant

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

Location and Description of Confined Space_____

_____

_____

Purpose of Entry:_____ Date/Time:_____

Person in Charge of Work:_____ Expiration:_____

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

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

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

CONFINED SPACE ENTRY PERMIT

Page 2

Name of person testing atmosphere:

_____

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

For questions concerning test requirements contact:

_____

Instruments Used Name	Type	Identification Number

Safety Attendant(s)	Authorized Entrant(s)

Supervisor authorizing all above conditions satisfied:

_____

Signature *Date*

_____

_____

_____

Print Name, Position & Shift

Attachment 10.3

Confined Space Monitoring and Ventilation Requirements

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

Buildings and Floors

1.0 PURPOSE AND SCOPE

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

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

1.2.1 damaged or neglected structures

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

1.2.3 scattered material and equipment on floor.

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

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

1.3.2 evaluating design of existing facilities;

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

1.3.4 occupational safety and health audit of the plant.

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

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

2.0 DEFINITIONS

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

2.2 *MM* refers to Maintenance Manager

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 13

4.0 MINIMUM REQUIREMENTS

4.1 Damage to Buildings and Floors

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

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

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

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

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

4.2 Spills

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

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

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

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

4.3 Demarcation

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

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

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

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

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

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

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

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

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

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

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

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

4.4 Painting and Varnishing

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

5.0 ATTACHMENTS

5.1 Building and Floor Damage Reporting Form

Attachment 8.1

Building and Floor Damage Reporting Form

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

Equipment Guarding, Safeguard and Safety Devices

1.0 PURPOSE AND SCOPE

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

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

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

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

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

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

2.0 DEFINITIONS

2.1 *AM* means the Administration Manager.

2.2 Plant refers to the Power plant.

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

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 26

4.0 MINIMUM REQUIREMENTS

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

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

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

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

4.5 Guards should not impede the ventilation of the machine.

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

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

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

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

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

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

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

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

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

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

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

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

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

Ladders, Stairs, Walkways and Working Platforms

1.0 PURPOSE AND SCOPE

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

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

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

2.0 DEFINITIONS

2.1 *AM* means the Administration Manager.

2.2 *Plant* refers to the Power Plant.

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

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 33

4.0 MINIMUM REQUIREMENTS

4.1 Ladders

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

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

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

4.2 Fixed Steps

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

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

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

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

4.3 Fixed Staircases

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

4.3.2 The heights and widths of steps should be uniform.

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

4.3.4 Staircases must be free of any obstruction.

4.4 Scaffoldings

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

4.4.2 All defective scaffold parts must be replaced without delay.

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

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

4.5 Platforms

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

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

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

4.5.4 Toe-boards 100 mm high must be provided.

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

Lifting Devices

1.0 PURPOSE AND SCOPE

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

1.2 Amendment to these specifications requires approval of the CEO

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

2.0 DEFINITIONS

2.1 *Plant* refers to the Power Plant.

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

3.0 STATUTORY REQUIREMENTS

3.1 Factories Act, 1934 – Section 33

4.0 MINIMUM REQUIREMENTS

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

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

4.3 A register must be kept for all lifting gear.

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

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

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

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

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

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

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

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

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

4.13 Standard hand signals must be used.

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

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

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

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

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

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

4.20 Safe access to cranes must be provided.

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

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

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

Fall Protection

1.0 PURPOSE AND SCOPE

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

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

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

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

2.0 DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.0 RESPONSIBILITY AND AUTHORITY

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

4.0 STATUTORY REQUIREMENTS

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

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

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

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

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

5.0 FALL PROTECTION REQUIREMENTS

5.1 Unprotected Sides and Edges

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

5.2 Leading Edges

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

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

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

5.3 Hoist Areas

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

5.4 Holes

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

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

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

5.5 Excavations

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

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

5.6 Wall Openings

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

5.7 Other Walking/Working Surfaces

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

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

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

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

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

6.0 FALL PROTECTION SYSTEMS

6.1 Guardrail Systems

Guardrail systems will need to comply with the following provisions:

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

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

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

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

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

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

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

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

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

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

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

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

6.2 Safety Net Systems

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

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

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

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

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

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

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

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

6.3 Personal Fall Arrest Systems

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

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

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

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

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

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

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

6.3.8 Lifelines shall be protected against being cut or abraded.

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

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

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

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

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

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

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

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

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

6.4 Positioning Devices

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

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

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

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

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

7.0 TRAINING

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

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

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

7.3.1 The nature of fall hazards in the workplace.

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

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

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

7.4 Training of employees must be documented.

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

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

8.0 REFERENCES

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

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

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

Appendix F: Organizational Chart of MHPS

See following pages.

POWER STATION MANGLA

TOTAL SANCTIONED STRENGTH	561

CHIEF ENGINEER MANGLA 1

DEPUTY CHIEF ENGINEER P/S MANGLA 1

DIRECTOR T.&A.INS 1

Operation Sec.

Sr.Engineer	1
Shift Engineer	15
Turbine Optr.	9
Attendant	44
ASA	28
Sub.Engr(Trans)	1
Driver	30
Bus Conductor	2
Truck Cleaner	1
Cleaner	12
TOTAL	143

Mech.Maint (A) Sec.

Sr.Engineer	1
Junior Engineer	1
Foreman	2
Asstt.Foreman	1
Junior Techni.	6
Crane Operator	4
A.S.A	8
Crane Slinger	1
Crane Rigger	1
Mali	5
Male Nurse	1
Cleaner	18
Sanitary Worker	4
TOTAL	53

Mech.Maint(P)Sec.

Sr.Engineer	1
Junior Engineer	1
Foreman	2
Asstt.Foreman	6
Junior Techni.	12
Welder	5
A.S.A	15
Painter	1
Spray Painter	1
Diving Assistant	2
SLFP Operator	1
Carpenter	2
Diver Gd-II	1
Auto Mechanic	2
Auto Electrician	1
Turner	2
Miller	1
Diver Grade-I Proposed	3
TOTAL	59

O& M Ext.Work Sec.

Sr.Engineer	1
Junior Engineer	1
Foreman (E/M)	2
Asstt. Foreman (M)	1
Asstt. Foreman (E)	1
Junior Tech(M)	3
Junior Tech(E)	1
A.S.A(Operation)	12
A.S.A (Electrical)	3
Junir Clerk	1
D.E.D.	4
S.G.Operator	4
Crane Rigger	1
Crane Driver	1
Attendant	23
Crane Operator	2
Cleaner	5
TOTAL	66

Elect.Maint.(P) Sec.

Sr.Engineer	1
Junior Engineer	1
Foreman	3
Asstt.Foreman	7
Cable Jointer	1
Batt.Attendant	1
A.C Supervisor	1
Junior Tech.	12
A.S.A	10
A.C. Mechanic	3
D.H.P. Operator	1
Winder	1
Sanitary Worker	1
TOTAL	43

Elect.Maint(s/r) Sec.

Sr.Engineer	1
Junior Engineer	1
Foreman	1
Asstt.Foreman	1
Junior Tech.	7
Lineman	3
Mali	2
TOTAL	16

Store

Sr.Officer Store	1
Store Supervisor	1
Sr.Store Keeper	3
Jr.Stoe Keeper	2
Accounts Asstt.	1
Store Helper	5
Store Cleaner	3
Store Chowkidar	4
Naib Qasid	1
Sanitary Worker	1
Imam	1
Moazan	1
Gate Sargent	1
F.L.Driver	1
TOTAL	26

P& I Sec.

Sr.Engineer	3
Junior Engineer	3
Foreman	2
Asstt.Foreman	2
Lab. Asstt.	2
Junior Tech.	6
A.S.A	6
Tele.Supervisor	1
Tele.Lineman	5
Tele.Operator	4
Naib Qasid	2
Line Supdt.	1
TOTAL	37

I.T & R Sec.

Sr.Engineer	1
Junior Engineer	1
I T & R Asstt.	1
Head Draftsman	1
Asstt.Draftsman	1
Tracer	1
Gest.Operator	1
A.S.A	1
TOTAL	8

Admn.Section Sec.

Asstt.Dir(Admn)	1
Jr.Supdt.	1
Assistant	4
Sr.Clerk	6
Junior Clerk	7
Steno (S/Grade)	1
Steno-Gd-I	1
Steno Gd-II	4
Naib Qasid	9
TOTAL	34

Sub. & A/C Sec.

B& A.Officer	1
Asstt. B& O	1
Accounts Asstt.	4
Junior Clerk	1
Steno-II	1
Daftri	1
Barkandaz	1
Naib Qasid	2
TOTAL	12

Training Centre

Dy.Dir.Training	2
Foreman(inst)	2
Steno Gd-I	1
Steno Gd-II	1
Naib Qasid	2
Care Taker	2
Cook	4
Bearer	4
Mali	2
Sanitary Worker	3
Security Guard	2
TOTAL	25

School

Headmistress	
T.G.T.	
O.L.T	
Draw.Mistress	
Sr. P.T.I	
Jr.Clerk(Typist)	
Naib Qasid	
Aya	
H.E.Teacher	
Mali	
Chowkidar	
Librarian	
Lab.Assistant	
Library Attend.	
P.E.T.	
Comput.Teacher	
Sanitary Worker	
TOTAL	

Appendix G: Environmental and Social Monitoring Report–Sample

See following pages.

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

Project Activities Carried Out

Activity	*Status*

Waste Generated and Handled

Waste Type	*Sources*	*Quantity*	*Status*

Summary of Occupational safety and health and environmental issues Identified

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

Follow-up of Outstanding Issues

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

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

Inspection

A. Rating Codes for the Checklist

Rating Code	*Rating*	*Description*
3	Excellent	The activity, area, system, and/or knowledge are superior Comments detailing
2	Adequate	The activity, area, system, and/or knowledge meet the basic minimum requirements which 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.						
5. All parts and machines dispatched from site after dismantling to store yard as soon as possible, preferably on the same						

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

Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
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						
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. Waste is not burnt in open air or disposed off by dumping in the areas surrounding the plant site						
20. Standard protective equipment including						

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

Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
eye protective glass, gloves and mask are used						
B. Waste Disposal						
1. Separate oil contaminated parts from the rest.						
2. The oil contaminated parts of waste is cleaned before being fed into furnace. Alternatively, the cleaning may be undertaken at power station.						
3. Segregate wires and other copper material and insulation material from the rest						
4. Before final disposal, any potentially hazardous substance such as lead or material containing lead is identified.						
5. The risk associated with the wastes is identified, and accepted disposal methods for such waste are followed.						
6. Only certified recycling contractors are used for disposal from the relevant agencies.						
7. Agreement with the contractors for the disposal of plastic waste in the designated pre-identified municipal landfill site.						
C. Transportation of equipment						
1. Vehicles used for the transportation are NEQS compliant for the emissions and noise.						
D. Onsite handling and storage of new equipment						
1. The new equipment is stored in properly demarcated and identified areas						
2. Separate storage of each item is adopted and each area is marked either on floor or cordoned off by tapes						
3. Lifting equipment (cranes) used for the equipment follows the prescribed safety specification.						
4. Material Safety Data Sheet (MSDS) for chemicals, if any, shall accompany the consignment. A						

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

Requirement	*3*	*2*	*1*	*0*	*N/A*	*Details*
copy of the MSDS is available near the storage area at all times.						
E. Refurbishment and up-gradation activities—General						
1. Appropriate PPE is provided to the workers and ensured that the PPEs' are used						
2. The staff is provided with training in use of PPE.						
3. Proper scaffolding platforms are provided for all work areas located more than 1 m above floor level.						
4. First Aid facilities and fire protection devices are placed in areas where activates are to be performed						
5. Ear protection devise are used if the noise level is above 85 dB(A)						
F. Refurbishment and up-gradation activities–Working in confined Spaces and at Height						
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						
5. Proper scaffolding platforms should be provided for all work areas located more than 1 m above floor level.						

Appendix H: Waste Management Companies

See following pages.

Petro Waste Busters

Contacted person	Abdul Quyyum
Designation	Coordinator
Contact Number	+92 (51) 220 4348, 220 4350
Website	http://www.petrowaste.com.pk
Email adress	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 adress	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 adress	zraza@gel.com.pk
Type of waste	All types of waste
Transportation and collection	There is no regular arrangment but they can arrange
Internal and External audits	external auditers come and check at random intervals

Certifications	Certified for Quality managemnt systems and working for ISO 17025 accredition
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 adress	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 Coalescres Filters Printer and photocopier Cartridges Food waste Metal waste Wood waste Glass waste Rubber and Plastic waste Tyres 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 adress	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 adress	irshadramay@gmail.com
Type of waste	
Transportation and collection	
Internal and External audits	Regular internal and external audits are conducted
Certifications	EPA certification
Disposal certificate	
Comments	Detailed profile received

WD Systems

Contacted person	Shahid Shah
Designation	Manager (Implementation)
Contact number	
Website	Not found
Email adress	shahid.shah@wdsystems.com.pk
Type of waste	
Transportation and collection	
Internal and External audits	
Certifications	
Disposal certificate	
Comments	Information requested

Appendix I: Framework for Asbestos Management

I.1 Asbestos Management Plan

Asbestos is recognized internationally as a hazardous material because it can present a risk to human health. In many jurisdictions asbestos is classified as hazardous and is a controlled chemical waste or a hazardous waste because if it is mishandled it can release airborne fibers that are known to cause asbestosis and have also associated with other lung diseases and cancer. All forms of the asbestos mineral will release asbestos fibers if broken up and all types of asbestos containing material (ACM) will release asbestos fibers to some degree if damaged or abraded.

Asbestos has been widely used in numerous types of materials, usually because of its good qualities as a thermal insulation material. Asbestos has also been used extensively in numerous types of cement materials, pipe insulation plaster and in refractory brick work. Asbestos is often used because of its good qualities as a thermal insulation material but it is also useful as a binder to form complicated cement shapes and durable pipes. The amounts of asbestos used vary from product to product but certain types of asbestos cement can contain more than 50% asbestos. When bound in the cement matrix the asbestos is generally considered safe. However over time the cement surface can become corroded or abraded leading to the release of asbestos fibers. The surface of the ACM, such as pipe and corrugated sheets can gradually become more friable and release asbestos fibers. Exposure to chemicals and moisture also affects the rate of deterioration of ACM as they gradually wear out or become more fragile. The removal and replacement of ACM also give rise to some release of fiber as it is almost impossible to remove more fragile old material without breaking them. Therefore in addition to giving rise to a controlled waste the removal of the ACM can also easily lead to the release of asbestos fibers if the removal is not conducted under controlled conditions.

This plan has been prepared because the ACM is present in the power plants which may be broken or cracked during the rehabilitation work. The procedures to be adopted are outlined in this framework by reference to known asbestos in ACM. This framework will be applied whenever any ACM is identified. Prior to any removal work asbestos investigation will be carried out to check if there is any likelihood of ACM being present.

I.1.1 Requirement for Asbestos Management

Best practice asbestos management usually entails several stages. Survey and investigation are the first steps in which all structural elements, fixtures and fittings are checked for fibrous materials that are potentially asbestos. Samples are taken under controlled conditions and an accredited laboratory analyses the samples using polarized light microscopy. The type, location and condition of asbestos is assessed to undertaken a hazard assessment. If asbestos needs to be removed an asbestos abatement plan is usually prepared to cover removal with detailed work specifications for specialist

contractors. In all cases the asbestos will be labeled and safety procedures instigated to prevent disturbance, until such time as it can be removed safely.

There are as yet no statutory controls on hazardous waste in Pakistan. The *Hazardous Substances Rules* were drafted in 2003 but were never brought into force. Asbestos waste is listed in the draft *Hazardous Substances Rules 2003*. If enacted the HSR would require an entity licensed under the Pakistan Environmental Protection Act 1997 to have a waste management plan for any listed hazardous substance.

682. Therefore as there are as yet no local standards for asbestos control in Pakistan, any known asbestos waste requiring removal will be disposed of following best international practice.

I.1.2 Responsibilities/Authorities of Various Agencies

Potential environmental liabilities with respect to asbestos associated with subprojects will be minimized by implementing the requirements of the AMF and by prescribing the selection of alternative non-asbestos materials. All measures shall be in line with ADB's SPS 2009, the GOP's regulations and guidelines, the Environmental Assessment Review Framework and the *Guidance on Environmentally Responsible Procurement*[1]. The subprojects shall only involve asbestos activities that follow the AMF.

JPCL will:

- Prepare an asbestos investigation report (AIR) before undertaking any work on a equipment or work area.
- Ensure that adequate sampling and analysis has been carried out to ensure all environmental liabilities with respect to asbestos have been identified, review the asbestos assessments AIR and submit the AIR to ADB.
- Ensure that the contracts have specified the asbestos management procedure (AMP) to be used in the construction of the subproject to control environmental liabilities to acceptable levels.
- Ensure that the asbestos abatement procedures, including all proposed mitigation measures and monitoring are properly implemented.
- Monitor the implementation of AMPs and present its monitoring report.

I.1.3 Minimizing Asbestos Liabilities

Potential environmental liabilities with respect to asbestos associated with subprojects will be minimized by taking the following measures:

- Implementing the requirements of the AMF and by prescribing the selection of alternative non-asbestos materials.
- Where ACM must be disturbed in a equipment the ACM shall only be removed under controlled conditions for disposal in line with the provisions of the AMF or any rules subsequently promulgated by the Sindh EPA.
- All Contractors shall agree through their agreement to carry out the asbestos abatement procedures in line with the procedures included in the AMF.

- Conducting sampling of potential asbestos containing materials (ACM) and compiling an asbestos investigation report (AIR) with adequate implementation.

I.1.4 Monitoring During the Construction Period

Monitoring during construction will be the responsibility of the PIC. The PIC may acquire the services of an Asbestos Specialist. The monitoring will relate to compliance with construction contracts. The Asbestos Specialist will inspect the ongoing works regularly and systematically; checking that the above-mentioned the asbestos abatement mitigation measures specified in the AMP have been implemented effectively during the design and construction stages of the project and ensure the implementation and effectiveness of mitigation measures. Reporting will be to the JPCL on a regular basis and to ADB semi-annually.

The PIC will also be responsible for coordinating and supervising monitoring of asbestos abatement, quality control, and writing the periodic progress reports on implementation of the AMF.

I.1.5 Asbestos Abatement Procedures

Removal of ACM

The principle will be that asbestos cement pipes shall be carefully excavated, lifted on to plastic sheets for wrapping, wrapped in polythene and sealed with duct tape and then lifted and lowered on to the transport lorry for transport to the designated storage area or landfill.

The procedure shall follow the measures indicated below:

Preparation

- The Contractor shall make available the materials required for the work.
- The Contractor shall be prepared and agree to remove and transport, on lorries covered with tarpaulins, all the ACM, from the site to the designated facility or secure temporary store to await disposal.
- The Contractor shall provide approved protective clothing to all workers. Protective clothing shall consist of an approved disposable full body coverall, with head cover. Hard hats and boots shall also be made available to all workers by the Contractor.
- Workers handling the ACM shall wear approved half face dust masks protective coverall and goggles. The Contractor shall ensure all workers wear the protective clothing provided.

Abatement Method

- The ACM shall be removed in sections carefully using manual labor and hand tools to expose the old ACM so that it can be lifted carefully to avoid cracking as far as possible. Any accidentally fractured loose pieces of asbestos picked up and stored in plastic bags or barrels and sealed.
- The drums / barrels to contain the fractured pieces of ACM shall be made of plastic or metal. If made of some other material the drums / barrels shall be lined

with two layers of 0.15mm polythene sheeting. When the drums are full the plastic lining shall be folded over the pipe segments and secured in place with duct tape and the lid placed on the drum and secured in place with duct tape.

- Before commencing with the removal of the ACM the surface of the asbestos shall be wet. Any dry areas of exposed existing ACM shall be sprayed with water (preferably containing a wetting agent) to reduce fiber release. The wetting agent shall be of a correct mix and concentration in accordance with the manufacturer's instructions as specified under materials (**Section 9.6.6**).
- The wetting solution (amended water) shall be sprayed using equipment capable of providing a, mist application to reduce the release of fibers. The existing asbestos material shall be sufficiently saturated to wet it thoroughly. The existing asbestos material shall be sprayed repeatedly during the removal processes to maintain a wet condition and to minimize asbestos fiber dispersion.
- The fixed asbestos cement pipes shall be carefully separated and prized off any supporting brackets and separated from any attached asbestos cement pipes or cement screed base and taken up in manageable sections taking care not to drop, crack, break or damage the asbestos cement pipes. Powered mechanical equipment (such as backhoe) shall not be used to remove the asbestos pipes because this will increase the risk of cracking and fiber release.
- The asbestos cement pipes shall then immediately be wrapped in two layers of polythene or smaller pieces can be double bagged and goose neck tied with duct tape and the polythene shall be wet wiped clean.
- The bottom 10cm of soil below the old ACP shall be assumed to be contaminated with asbestos fragments or fibers and shall be loosened and shoveled or picked up and stored in plastic bags or barrels and sealed as ACM.
- The bottom 5cm of soil below the old ACM pipe, loose debris and rubble will be removed to create a level floor to the trench and to designate the completion of the removal work
- The exposed surfaces of the partially wrapped pipes and the surface of the trench to be sprayed with adhesives (PVA) to be used as "lock down" on surfaces during the final cleanup of the area. This is to bind any traces of asbestos fiber which may remain on exposed surfaces.
- All wrapped asbestos cement packs shall be transferred to the lorries for immediate transportation to the temporary buffer store to await disposal. All wrapped asbestos cement packs shall remain at the temporary buffer store and <u>not</u> be removed
- The workers shall immediately wet wipe down the overalls and mask and wash hands and face and any accidentally exposed areas of skin to decontaminate. The dust masks and overalls, gloves, wet wipes and any other litter shall then immediately be double bagged and goose neck tied for disposal as asbestos waste.
- The PIC will then carry out a visual inspection to certify that all visible asbestos cement pipe and fragments have been removed to a satisfactory standard. If the

visual inspection indicates a satisfactory standard all the asbestos cement packs shall be counted and picked up and transferred to the lorries for transportation to the temporary buffer store to await disposal.

- The PIC will then carry out a reassurance visual inspection to certify that all remaining polythene packs and equipment and visible asbestos has been removed to a satisfactory standard and proper decontamination of tools and equipment has taken place.
- The PIC will then check and record the number of packs of waste transferred to the lorries are the same as those that arrive at the temporary buffer or landfill using a trip ticket system.
- The PIC will monitor and periodically audit the buffer store and landfill security to ensure no pilfering or theft of the stockpiled waste.

I.1.6 Materials and Equipment

Containment Materials

- At least two layers of transparent plastic (0.15mm thickness low density polythene (B.S.4932:1973) shall be used for wrapping the ACM in sizes which minimize the need for jointing. Polythene transparent bags and containers used for packing of asbestos waste should be able to resist puncturing by the sharp edges of the asbestos cement.
- The wrappings shall be carefully joined and sealed with wide duct tape, spray adhesive capable of sealing adjacent sheets of polythene and facilitating attachment of polythene to the asbestos cement. The adhesive agents should be capable of adhering and maintaining the wrapping in place under both wet and dry conditions.
- Pipe sections and fragments of 2m or less shall be completely wrapped in polythene or collected in polythene bags. Pipe sections and fragments of greater than 2m shall have the end up to 1m and any cracked or broken areas completely wrapped in polythene. Intact pipe sections greater than 2m shall have the ends end up to 1m and any cracked or broken areas completely wrapped in polythene.
- The access to the asbestos waste shall be guarded at all times by security personnel.

Wetting Agent and Lock Down

- It is strongly recommended to apply amended water containing a wetting agent on the asbestos materials prior to removal so as to minimize the release of asbestos fibers during the removal process. Electrical equipment is not likely to be present in the excavated trenches but if electrical cables are present these should be de-energized and isolated prior to the application of wetting agents.
- The recommended wetting agent for the amended water to enhance penetration should be 50% polyoxyethylene ester and 50% polyoxyethylene ether or equivalent. The wetting agent shall be diluted in accordance with the manufacturers' instructions. As a fall back option household washing up detergent

mixed at 10% to amend wetting water can be substituted Water based polyvinyl acetate adhesives (PVA) to be used as "lock down" for spraying onto surfaces during the final clean up of the area shall be able to bind traces of asbestos fibre which may remain on exposed surfaces. The adhesive shall be dyed to indicate where it has been sprayed and facilitate a check as to whether they have been applied or not and to facilitate cross-checking at a later stage.

Lifting Gear & Ladders

- All lifting appliances, i.e. wire slings, ropes and chain blocks, must comply with the local construction sites safety regulations. Valid test certificates must be kept on site for checking at all times.
- Ladders shall be used in line with general safety procedures. Joints and ends of ladders, scaffolds and parts of lifting gear where appropriate shall be sealed with tape to prevent the incursion of asbestos fibers and finished to create a smooth surface to facilitate cleaning.

Respirators (dust mask)

- The respirators to be provided by the Contractor shall be of an approved type contained appropriate for protection against the level of asbestos fibers reasonably expected in the particular stage and environment of work. In this case half face dust mask shall be required.
- The Contractor shall provide disposable paper respirators to all workers with a protection factor of 4 (*e.g. recommended 3M8812 or equivalent*).
- The respirators shall be removed when wet and be treated as contaminated waste. A new half face dust mask shall be provided to each worker prior to each shift, and the Contractor shall hold sufficient spare masks on site at all times for replacement purposes.

Protective Clothing

- The Contractor shall provide approved protective clothing to all workers. Protective clothing shall consist of an approved disposable full body coverall, with head cover. Hard hats and boots shall also be made available by the Contractor. Coveralls will be of a disposable type:
  - made from material which does not readily retain asbestos dust and
  - prevents, so far as is reasonably practicable, dust penetration;
  - is close fitting at the neck, wrists and ankles; and
  - without external pockets or unnecessary pleating or accessories.

Preferred disposable coveralls, mask and sprayer ***Workers handling drummed high risk friable asbestos***

Laboratories in Pakistan with Capability to Identify Asbestos

1. Pakistan Council of Scientific & Industrial Research
   PCSIR Labs Complex
   Off University Road, Karachi
   Tel#: +92-21-8141841
   Fax#: +92-21-8141847
2. National Physical and Standards Laboratory (NPSL), Islamabad
   Plot No.16, Sector H-9, Islamabad
   Tel#: +92-51-9257459, 9257462-7
   Fax#: +92-51-9258162
3. Pakistan Council of Scientific & Industrial Research
   PCSIR Labs Complex
   Ferozepur Road, Lahore
   Tel#: +92-42-9230688-95, 9230704
   Fax#: +92-42-9230705

Appendix J: Protocol for PCB Handling

See following pages.

MINISTRY OF HEALTH
MANATŪ HAUORA

Safe Management of PCBs Code of Practice

(December 1988, Department of Health
Revised May 2008 – Ministry of Health)

Citation: Department of Health. 1988 (Revised edition 2008). *Safe Management of PCBs Code of Practice*. Wellington: Ministry of Health.

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http://www.moh.govt.nz

MINISTRY OF HEALTH
MANATŪ HAUORA

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Preface

The purpose of this code of practice is to describe recommended practices for the handling, storage, transport and disposal of polychlorinated biphenyls (PCBs). It is intended for all holders of PCBs, for transporters of PCBs, and for all those with statutory or other responsibilities in managing PCBs.

This code of practice gives practical information to enable all those involved in the management of PCBs to carry out their duties and thus achieve the objectives of the legislation that controls PCBs.

This version of the 1988 Guidelines includes amendment made by the Ministry of Health in May 2008, replacing the revision released in September 2007.

1. Introduction

The Toxic Substances Regulations 1983 have been superseded by the Hazardous Substances and New Organisms (Stockholm Convention) Amendment Act 2003. The main purpose of that Act is to provide for the absolute prohibition of the manufacture, import or use (with a specific, time-limited exemption for PCBs) of the 12 persistent organic pollutants (POPs) listed in the Stockholm Convention.

The Stockholm Convention recognises that PCBs are still in use and that their elimination or, in some cases, replacement in accordance with more environmentally friendly substances, must be undertaken in accordance with a managed replacement plan. The Stockholm Convention came into force for New Zealand in December 2004.

The responsibility for managing PCB exemptions was transferred from the Ministry of Health to ERMA New Zealand, however, ERMA New Zealand has delegated the issuing of extensions to existing exemptions for the use or storage of PCBs in New Zealand under section 25 of the Hazardous Substances and New Organisms Act 1996 ('the HSNO Act') back to the Ministry of Health for the time being.

The HSNO (Stockholm Convention) Amendment Act 2003 continues to allow the holder of a current PCB exemption to apply for an extension to the exemption until 2016. After 2016 it will not be possible to issue any new exemptions for the storage of PCBs. This means that all PCBs will need to be removed from the site prior to 2016.

The Hazardous Substances (Storage and Disposal of Polychlorinated Biphenyls) Notice 2007 came into force on 30 May 2007. This Notice specifies requirements for safe handling and storage for the purposes of environmentally sound disposal of PCBs. Please note that it does **not** cover the **use** of PCBs.

The Gazette Notice is available on online at http://online.gazette.govt.nz

The Notice allows persons currently storing PCBs without a valid exemption to apply to the Environmental Risk Management Authority for an exemption in the same way and under broadly the same conditions as for existing holders of exemptions.

Because there are no facilities in New Zealand suitable for the destruction of PCB-containing equipment, such material must be sent to an approved overseas facility for destruction.

This code of practice contains basic information about PCBs, along with instructions for managing them throughout their life cycle.

2. General Information on PCBs

PCBs comprise a group of 209 possible aromatic chlorinated hydrocarbons having the chemical composition C12H10-nCln. Their manufacture produces a mixture of compounds, the properties of each depending on the amount of chlorination. In general, they are thermally and chemically stable, are insoluble in water but can be mixed with oils, and are fire-resistant.

These characteristics led to the use of PCBs in a wide range of products: in transformers and capacitors as dielectrics; as heat transfer fluids; as hydraulic fluids; and as components in brake linings. They were also used in the manufacture of adhesives, sealants, varnishes and printing inks, as plasticisers and in the production of marine antifouling paints.

Unfortunately, the properties that made PCBs so useful meant that they remained intact once their usefulness was over. Concern arose in the 1960s when overseas experience showed that these compounds were widely distributed, persistent and accumulating in the environment.

Overseas experience has shown that, apart from occupational exposure or misadventure, diet is the principal source of PCBs for humans. Fish provides the greatest input, although PCBs have been found in small concentrations in poultry, meat, produce and dairy products.

PCBs are absorbed by fatty tissues and bi-accumulate; that is, they tend to concentrate up the food chain, particularly in fish-eating birds, animals and humans.

In recent decades, their production, importation and use have been banned or tightly controlled in many countries. They were considered suitable for use in capacitors and transformers in fire sensitive locations. However, fires involving equipment containing PCBs can produce toxic by-products such as polychlorinated dibenzopara-dioxins (commonly known as dioxins) and polychlorinated dibenzofurans. Consequently, PCB-containing equipment is being phased out for all uses.

3. Identification of PCBs

PCBs range in appearance from colourless, oily liquids to darker, viscous liquids, to yellow and black resins. The characteristics of the substance depend on the chlorine content. Viscosity varies from highly mobile to very thick and syrupy. Flash points can be as low as 140°C to 200°C; however, most have no flash point at all as measured by the standard test. The vapour is invisible and there is a characteristic strong odour.

Do not smell the vapour in order to identify PCBs. Inhalation should be strictly avoided.

PCBs used as dielectric fluids are usually mixed with organic solvents, such as chlorinated benzenes, that change the chemical and physical properties of the fluids. In addition, used PCB fluids may be contaminated with dirt, moisture, black carbon particles and pieces of insulation from the inside of the equipment. This contamination may change the appearance of the fluids.

3.1 Simple tests for PCBs

PCBs are heavier than water, whereas mineral oils are lighter than water. This can be used as a simple test to help identify PCBs.

Simple density test

Observe all relevant electrical safety precautions.

1. Clean the drain valve at the base of the transformer with a clean rag.
2. Drain a few drops of the liquid into a clean glass bottle and add a small amount of water.
3. If the liquid sinks to the bottom, it is a PCB fluid. Dispose of the sample in accordance with the procedures in this code of practice.
4. If the liquid is mineral oil it will float. If the liquid does neither it is contaminated and will need to be tested by another method.

Do not pour test material back into the transformer – water will degrade its electrical performance.

Rather than rely on appearance or density, a test for the presence of chlorine can be made.

Simple Test for Chlorine

1. Heat one end of a length of clean uncoated heavy copper wire (preferably 2 to 3 mm diameter) in a pale blue gas flame. If the wire is initially clean there will be no coloration of the flame until the copper reaches red heat when an orange hue will be imparted to it.
2. Allow the wire to cool, somewhat below red heat, then dip it in the unknown chemical and again heat it. There may be an initial bright yellow and smoky flame, but as the copper nears red heat, the presence of chlorine will be indicated by a bright green coloration (the yellow should have disappeared at this stage), as it reacts with the copper to produce copper ions in the flame.

Note: When PCBs are decomposed at high temperatures, gases are produced that contain a high proportion of hydrogen chloride, a highly irritating and corrosive chemical.

Conduct this test in a well-ventilated place.

The above test for chlorine is not infallible. However, it will usually suffice to distinguish between chlorinated hydrocarbons and non-toxic mineral, vegetable or silicone oils, greases or waxes.

If these screening tests are positive the material should be dealt with as if it is a PCB liquid, but the composition of the PCB liquid can only be determined by laboratory analysis.

3.2 Manufacturers' trade names

PCB fluids are often known by the term *askarel*, which is a generic name for synthetic electrical insulating material. Askarels generate only non-explosive gases or gaseous mixtures when decomposed by an electric arc.

Commercial mixtures contain PCBs, chlorinated benzenes and contaminants, in a range of concentrations. Manufacturers have used a wide variety of trade names, including:

Aroclor
Asbestol
Chlorextol
Clorinol
Chlorinol
Clorphen
Diaclor
Diconal
Dk
Duconal
Dykanol
Elemex
Eucarel

Fenclor
Hyvol
Inerteen
Kanechlor
No-flamol
Phenoclor
Pyralene
Pyranol
Pyroclor
Saf-t-Kuhl
Sat-t-America
Sovol
Therminol.

A schedule of all known trade names is presented in Appendix A.

Other PCB products and their possible applications include:

- Santothern FR (UK) – Heat transfer (prior to 1972)
- Therminol FR (USA) – Heat transfer (prior to 1972)
- Pydraul (USA) – Hydraulic applications (before 1972).

These three trade names may still be in use but now refer to non-chlorinated products. For Santothern and Therminol only the FR series contained PCBs, and present-day products are not labelled as FR. For Pydraul, the present series of hydraulic fluids, which do not contain halogenated compounds, are designated E.

4. Legal Requirements

The HSNO Act is the principal piece of legislation that regulates the use of chemicals in New Zealand. Specifically, the Act regulates the importation, manufacture and use of hazardous substances and imposes life-cycle controls on those substances. The Act was amended in 2003 to bring it into line with the legal requirements of the Stockholm Convention. The HSNO (Stockholm Convention) Amendment 2003 prohibited or restricted imports and the use of certain persistent organic pollutants (POP) substances. The amendment came into force on 23 December 2004, the same day the Stockholm Convention came into force for New Zealand. This means that:

- pesticides and industrial chemicals specified as POPs under the Stockholm Convention (including PCBs) are banned from importation, production and use in New Zealand
- New Zealand has adopted a timetable to monitor and phase out, by 2016, any PCBs still in use, such as PCBs in electrical transformers, ballasts and capacitors (this timetable is in advance of the Stockholm Convention deadline of 2025)
- exemptions allow for the importation of POPs for small-scale research and the laboratory use of analytical standards, as provided for under the Stockholm Convention.

The Import Control Act 1988 (renamed the Imports and Exports (Restrictions) Act 1988) was also amended so that import/export controls could be put in place by Order in Council, as required under the Stockholm Convention. Regulations under the Act (the Imports and Exports (Restrictions) Prohibition Order (No. 2) 2004) came into force on 29 July 2004. These regulations allow for the export of a POP chemical as provided for under Article 3.2 of the Stockholm Convention, and also require that POP waste be administered as a hazardous waste in accordance with the requirements of the Basel Convention, for the purpose of environmentally sound disposal.

The HSNO Act 1996 is administered by ERMA New Zealand, while the Imports and Exports (Restrictions) Act 1988 is administered by the Ministry of Economic Development. The New Zealand Customs Service (Customs) is the border enforcement agency and monitors the cross-border movement of goods for compliance with the relevant legislative requirements. This includes a requirement for importers and exporters to lodge electronic entries with Customs for goods imported into and exported from New Zealand. In practice, shipments identified as being covered by an import or export prohibition are held by Customs until the importer/exporter produces the required approval from the government agency administering the legislation.

4.1 Definitions

PCB liquid	Any liquid containing greater than 500 ppm (parts per million) PCBs.
PCB contaminated liquid	Any liquid containing between 50 and 500 ppm (parts per million) PCBs.
Non PCB liquid	Any liquid containing less than 50 ppm (parts per million) PCBs.
PCB article	Any manufactured article, other than a PCB packaging, which contains PCB liquids or PCB solids and whose surfaces have been in direct contact with PCBs, eg, transformers, capacitors and heat transfer systems.
PCB equipment	Any manufactured item, other than a PCB packaging, which contains a PCB article, eg, fluorescent light ballasts and electronic equipment.
PCB packaging	Any receptacle or enveloping material used to contain or protect PCB wastes, eg, drums, tanks and bags.
PCB solid	Any substance other than a PCB liquid, PCB equipment or PCB packaging containing 50 ppm or more PCBs, eg, contaminated soil, rags and greases.
PCB material	Any material containing PCB liquids or PCB solids containing 50 ppm or more PCBs.
PCB waste	Any PCB material that is no longer wanted.

4.2 Register of PCBs

All owners of PCBs and PCB-filled equipment, whether in use or in store, and of material contaminated by PCBs must inform ERMA New Zealand of their holdings. All changes in holdings of PCB materials, including removal of PCBs from being in service to either storage or for disposal, are also to be notified to ERMA New Zealand. Note that PCB equipment must not be reinstalled or relocated, or resold for use.

4.3 Transport of PCBs

Transportation of PCBs on land must be carried out in accordance with the requirements of the Land Transport Rule – Dangerous Goods 2005 (Rule 45001/1). This particular transport rule refers to the NZS 5433:2007Transport of Dangerous

Goods on Land. In NZS 5433, PCBs are classified as a class 9: dangerous goods for the purposes of transport on land in New Zealand.

4.4 Storage and removal of PCBs

All storage of PCBs, PCB-filled equipment, and material contaminated by PCBs must be by methods approved by ERMA New Zealand. Further information on types of storage facilities suitable for PCBs is given in section 8.

Disposal of PCBs shall be by approved methods. Further information is given in section 9.

5. Adverse Health Effects

The acute toxicity of PCBs is relatively low with an LD50 ranging from 1 to 4 kg per kg of body weight in rats. Therefore few concerns were originally raised about the possible effects of PCBs on human health.

PCBs accumulate in the fatty tissues of humans and animals. PCB exposure has caused toxic effects in both, particularly if repeated exposure occurred. The skin and liver are the major target organs. The most commonly observed adverse health effects in humans exposed to large amounts of PCBs are skin conditions such as acne and rashes. The International Agency for Research on Cancer (IARC) has also determined that PCBs are probably carcinogenic to humans, based largely on animal evidence of liver cancer. A few studies of workers indicate that PCBs are associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract.

Some studies in exposed workers have shown changes in biochemical indices measured in blood and urine that may indicate liver damage. In the Yusho and Yu-Cheng incidents, each involving about 2000 cases, Japanese and Taiwanese people were exposed to high concentrations of PCBs and polychlorinated dibenzo-furans (PCDFs) through consumption of contaminated rice oil. Among other diseases, fatal liver diseases were significantly more frequent than national rates in both cohorts.

PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population have examined the children of mothers who were exposed to PCBs, which showed that PCBs may be associated with developmental or endocrine effects. Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies of women who did not have these levels of exposure. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behaviour. Some of these behaviours, such as problems with motor skills and a decrease in short-term memory, lasted for several years.

For further information see the Agency for Toxic Substances and Disease Registry's Toxicological Profile on PCBs: www.atsdr.cdc.gov/toxpro2.html

Pure PCBs have very low but detectable vapour pressures. The Workplace Exposure Standard (WES) in New Zealand is 0.1 mg/m3 for PCBs and for tetrachlorobiphenyl (TCB) 37mg/ m3 (ceiling 5ppm) (Department of Labour 2002).

5.1 Exposure pathways

The general population's main route of exposure to PCBs appears to be via air, drinking water and soil, and the consumption of contaminated foods. Evidence suggests that

consumption of fish is the main non-occupational intake of PCBs is from consuming fish.

Occupational exposure occurred among mechanics and foundry workers in contact with lubricating oils and hydraulic fluids, among workers exposed to varnishes and paints. Office workers who had contact with pressure-sensitive duplicating paper (carbonless copying paper), were exposed if using some brands which readily transferred PCBs through skin contact. Exposure may also arise in discontinuous work, such as the inspection and repair of transformers and capacitors containing PCBs, now the most common remaining use of PCBs in New Zealand.

The volatility of PCBS is known to be low; however they were found in high concentration in the workroom air in areas subject to long-term open use of PCBs, and in the air during acute or temporary events where evaporation was possible.

Soot produced in emergency situations such as fire and/or explosions may contain high levels of PCBs. In these situations, ingestion, skin contamination (including from surfaces and tools) or inhalation of soot particles can result in serious exposure.

5.2 First aid

Contact with clothes

Remove contaminated clothing promptly.

Contact with skin

Wipe off any splashes. Wash thoroughly with soap or detergent and water or a waterless cleaner. Apply cold cream (skin lotion) to reduce the irritation, particularly if PCBs have contacted open cuts or abrasions. See a medical practitioner.

Contact with eye(s)

Irrigate immediately with a gentle stream of lukewarm water for 15 minutes, keeping the eyelids apart while flushing. See a medical practitioner immediately.

Ingestion

Do not cause vomiting. Do NOT drink anything. Thoroughly rinse mouth with water. Proceed to a hospital emergency department or a medical practitioner immediately. Take information on the PCB, both brand name and PCB content if known, with the patient.

Inhalation

Get fresh air. See a medical practitioner.

Note: Any person developing skin irritation or a respiratory tract irritation should be placed under the supervision of a medical practitioner.

5.3 Protective clothing

In situations where workers may come in direct contact with PCB-containing liquids, they should wear protective clothing impervious to PCBs. The proper clothing and gear will vary with the circumstances, such as quantity and concentration of PCBs.

If the PCBs are in closed containers such as capacitors, transformers or drums, and **there is no direct contact**, special clothing is not needed,

Protective gear and clothing should be available in all areas where there are significant amounts of PCB liquids, whether in service, in store, or while being transported.

Protective clothing consists of gloves, gumboots or overshoes, overalls and bib-type aprons that cover the boot tops. Safety glasses with side shields, chemical safety goggles, or face shields should also be worn. Impervious coveralls made of butyl rubber, neoprene, nitrile rubber, polyvinyl alcohol, viton, saranex or teflon (**not** ordinary rubber) should be worn when handling PCB liquids. A respiratory protection device with a full face mask and a cartridge or canister suitable for use with PCBs is required when handling PCBs liquids hotter than 55°C, where there is a significant amount of PCB liquid exposed to the air, or where adequate ventilation is not possible. In a fire situation involving PCBs, self-contained breathing apparatus should be used.

Any reusable protective equipment should be thoroughly cleaned after use with paper tissues and soapy water. No attempt should be made to wash PCB contaminated clothing for reuse. If available, lightweight disposable clothing should be used and then stored with other solid PCB waste for safe disposal.

Hands should be washed thoroughly with warm water and soap, detergent or industrial hand cleansers before eating, drinking, smoking or using toilet facilities. Because people may need copious amounts of drinks while working in protective clothing, they should be provided with plenty of beverages that can be drunk with straws should be supplied (fruit juice in cartons, for example).

Advice on protective gear may be obtained from the Department of Labour or any safety equipment company.

The Health and Safety in Employment Act 1992 requires hazards to be identified and all practicable steps taken to eliminate, isolate, or minimise any significant hazards (sections 7–10). This includes ensuring the employee is supplied with protective gear and that it is worn. The Act also requires employees to be trained (section 13).

5.4 Safe handling of PCBs

When working with PCBs, certain precautions should be taken to protect the health of personnel:

- PCB liquids should be pumped and not poured, to minimise splashes and spills
- all equipment used with PCBs should be regularly inspected and replaced if necessary
- pumps and hoses used for PCB liquids should not be used for other purposes
- careful consideration should be given to the type of pump used for handling hot oils containing PCB liquids.

5.5 Training

Before staff carry out work on PCB-filled equipment they should understand the safety procedures to be followed in handling PCBs and the emergency and first aid requirements (see sections 5.1 and 5.3). Managers or supervisors should ensure that all employees are trained in the procedures specified in this code of practice.

All major PCB handling and dismantling projects should be well organised in advance and properly engineered so that all risk contingencies are catered for. Part of this planning is to identify the safe work procedures to be followed and the staff training that will be required.

Staff needing to use protective clothing should be trained in its use. Employers are responsible for providing training courses.

6. Management of PCBs

While PCBs are still in use awaiting replacement, management should ensure that all steps are taken to prevent PCBs from affecting their staff and entering the environment. The owner of the PCBs is responsible for ensuring that all regulations (see section 4) are complied with.

Preventive maintenance is essential to preclude operational and environmental hazards.

When PCB equipment is taken out of service, the procedures outlined below should be followed.

6.1 Precautions against leaks or spills

At all locations where PCB-filled equipment is located, the following steps should be taken:

- warning notices are placed near drain valves on transformers
- all drain valves are securely closed in a way that will prevent inadvertent or unauthorised opening
- regular inspection is undertaken to look for early signs of weeping or leakage
- spill containment measures such as curbs or dykes, metal drip trays, stand pipes or absorbent mats are fitted to installations where appropriate
- floor drains should be able to be controlled in the event of a spill, or arranged so that PCB oil interceptor tanks are fitted before the drain reaches natural outfalls or sewers **(remember that PCBs are heavier than water)**
- facilities for recovery and clean up work must be available.

A contingency plan should be prepared and known to all staff (see section 10).

Any leakage or spillage of PCB liquid should be cleaned up and stored as outlined in sections 8 and 10. PCB liquids should only be moved from one location to another in sealed metal containers, which should not be used for any other liquid.

6.2 Decommissioning

No PCB equipment may be removed for reinstallation or resale.

PCB equipment can only be removed from service to be stored while awaiting disposal or to be transported for disposal.

When PCB-filled capacitors have to be taken out of service, do not drain them unless they are leaking. If they need to be drained, the precautions given in section 5.3 should be taken. The drained unit should be sealed or plugged.

Under no circumstances should drained capacitor cans be reused for any other purpose.

Sealed small capacitors and small transformers may be stored or transported without draining. They should be wrapped in a heavy plastic bag and placed into 200 litre steel drums or similar steel drums with removable steel lids that can be resealed. Capacitors should be placed in the drums with the terminals upwards to prevent leakage. As many capacitors as space allows may be placed in one drum. The drum should be packed with absorbent material (see section 7.3 for suitable materials) so that any leaks will be absorbed. The drum should then be sealed and labelled.

Solid wastes should be wrapped in heavy-duty plastic bags, tied shut and placed in drums as above. Large capacitors that cannot fit into drums should be packaged in heavy-gauge plastic bags and heat-sealed.

Large transformers should be drained and the PCB liquid stored in double-bung steel drums. Spill containment measures must be in place while this is being done. Precautions given in section 5.3 should be observed while removing the PCBs.

The PCB liquid should be stored in suitable drums as follows.

- Sound steel drums should be used.
- Spouts or valves should be removed and replaced with leak-proof bungs. These should be tight.
- All drums should be properly and securely labeled. Paint over any old non-relevant drum markings.
- An air space of 7 to 10 centimetres should be left to allow for liquid expansion.

Once the PCB liquid has been drained out of the transformer over a period of 48 hours, all openings should be capped or sealed. The equipment should then be placed in containment for protection against the weather and other damage, with sufficient material to absorb the remaining liquid.

Although it is possible to replace PCB liquid in transformers by retrofilling, the new liquid is likely to become contaminated with PCBs. Special flushing and cleaning procedures must be followed. To remove PCB liquid impregnated in the paper insulation, transformers may need to be flushed at least three times with a solvent such as trichlorobenzene, kerosene or fuel oil. For each rinse, the transformer filled with solvent must sit for at least 18 hours to allow the solvent to penetrate the core so as to achieve a low enough residual PCB level. The flushing fluid must be treated as PCB waste, and drummed as described above. It is impossible to remove all traces of PCBs because the fluid impregnates the insulation in the windings and laminations.

It is preferable to replace the whole transformer to ensure that PCB contamination does not remain.

7. Transportation of PCBs

The following guidelines are intended to protect the transport company staff, communities en route, and to ensure that the shipment of PCBs arrives safely.

7.1 Before transport

ERMA New Zealand should be notified of the change in holding.

All transport operations involving PCBs should comply with the requirements of the Land Transport Rule – Dangerous Goods 2005 (Rule 45001/1), and with NZS 5433: 2007.

NZS 5433 states that PCBs are not subject to the Standard when in concentrations of not more than 50mg/kg (special provision 305).

Sealed small capacitors and small transformers may be transported without draining. They should be packed as described in section 6.2 in suitable drums. Large transformers should be drained and packed as described in section 6.2. Precautions given in section 5.3 should be observed during this operation. Large capacitors may be secured in appropriate sets on a standard pallet with the insulator uppermost. Note that this is **only acceptable if the capacitor is not leaking and is not bulging** as a result of internal failure. Otherwise, the capacitor must be drummed or secured in a tight container.

The owner should arrange transportation with a company that is experienced in handling hazardous materials and has the necessary equipment and staff to comply with this code. If the owner chooses to provide transportation, the requirements of this code must be met as well as any other legal requirements. This includes two people trained in handling PCBs, who should travel with a second support vehicle carrying PCBs spill contingency materials (see section 7.3 for details of these).

Note: A second support vehicle is not required when the volume of PCB being carried is less than two 200-litre drums. However, all necessary equipment should be carried.

If the goods are being transported to storage, the owner should ensure that personnel at the destination are prepared to receive the PCBs. Transport for disposal is usually organised by the company that is exporting the wastes. In all cases, proper consignment notices are required during transport.

It is advisable to inform local authorities and the Commercial Vehicle Investigation Unit of the Police of your intention to transport PCBs and provide details of the route, destination and date of transport.

7.2 Loading the PCBs

The vehicle driver should be told:

- what is in the load
- what emergency equipment is provided and how to use it
- what to do in the event of an accident or incident
- the requirements in terms of this code and appropriate legislation.

The Emergency Procedure Guide (EPG) should be prepared for each consignment of PCBs, as set out in NZS 5433:2007 Code of Practice for the Transport of Hazardous Substances on Land.

A vehicle with tray sides at least two-thirds the height of the largest item should be used. If the vehicle has a metal-lined tray, plywood should be put over the tray.

Line the tray of the truck with heavy plastic sheeting. Strap all drums vertically to pallets and horizontally to each other. Secure the load to the tray, then cover. Check documentation.

Security of loads on vehicles is covered by the Truck Loading Code, which is a code of practice for the safety of loads on heavy vehicles.

7.3 Support vehicle

Except as mentioned in section 7.1, when transporting PCBs and PCB equipment, transporters need to provide a second support vehicle to carry equipment for cleaning up a spill in the event of an accident.

The following emergency equipment must be carried when transporting any PCBs:

- ‘Do Not Approach’ notices (for use in the event of a spill)
- disposable polylaminated coveralls
- handy plastic rubbish bags (2 packs)
- broom (2)
- waterless hand cleaner
- gloves (viton or nitrile or vitrile) (3 pairs)
- gumboots (3 pairs)
- sawdust or sand (200- litre drum) or 200 kg diatomaceous earth (‘kitty litter’)
- paper towels (2 packs)
- solvent such as 111 trichloroethane, turpentine, or kerosene for wiping contaminated areas

- 50 kg bail of cotton waste for use with the solvent
- shovels (2)
- a quantity of plastic sheeting (sufficient for area of vehicle)
- 24-hour emergency telephone contact list
- copy of this code of practice
- spare empty drums (wide mouth type) and hand operated pump and hose
- full face mask fitted with a canister suitable for organic vapours
- two 10 kg dry-powder fire extinguishers.

7.4 During transport

The support vehicle should travel behind the vehicle carrying the PCB material. The security of the load should be checked every two hours or 100 km, whichever is sooner. Special attention should be paid to any signs of leakage.

The driver should adhere strictly to safe driving practices appropriate to road conditions and the vehicle.

PCB materials should only be transported between 9.00 am and 4.00 pm Monday to Friday, but not on public holidays.

Information about what to do in the event of an emergency is given in section 10.

7.5 Transfer of load

When the destination is reached and the PCB material is safely unloaded, the driver should hand over the transport documentation.

Any contingency materials used during the journey should be placed in drums and labelled as PCB-contaminated material. Tools used should be cleaned thoroughly with solvent.

Check that the vehicle is clean.

8. Storage of PCBs

Storage is required for a wide range of PCB materials:

- discarded articles such as capacitors and transformers
- PCB liquid wastes drained from equipment and collected from drip trays
- PCB-contaminated materials such as soil, absorbent material, clothing, rags and handling equipment.

Storage installations must be well away from food processing/preparation facilities.

8.1 Drum storage

PCB materials should be stored after being packed in the manner described in section 6.2. Sound heavy-duty steel drums with close-fitting lids and drain bungs must be used. Solids and liquids should be stored in separate drums. Storage drums should comply with NZS 5433:2007 Code of Practice for the Transport of Hazardous Substances on Land.

The drums should be clearly labelled and numbered with details of:

- type of PCB (if known)
- type of solid contaminated material, oil, rags, soil, sawdust, clothing, etc
- percentage of PCB and solvent (where totally in liquid form)
- solvent type
- origin of PCBs such as: from XYZ Co, factory transformer type, serial number.

Labelling during transport must comply with the current NZS 5433:2007 Code of Practice for the Transport of Hazardous Substances on Land. Suitable labels are available from commercial suppliers.

The Hazchem emergency information label should also be attached to each drum of PCB waste during transport.

8.2 Small storage facility

If owners of PCB materials have two or fewer 200-litre drums of material for storage, then they do not need to provide a special purpose-built store.

The drums should be stored in a securely locked place under cover, with plenty of ventilation, raised on a pallet to prevent condensation and corrosion under the drums. The storage area should be isolated from the active areas of the site. Drums must be

secured in such a manner that they will not be displaced during an earthquake nor be damaged by unsecured falling objects.

The pallet should be placed over a steel drip tray with sufficient capacity to hold 125 percent of the total volume of liquid.

Emergency equipment, including protective clothing, should be stored nearby. Records of the holdings must be maintained and the store inspected at regular intervals, at least monthly.

An alternative store is the use of an international shipping container with a suitable steel pan as a floor.

8.3 Special storage facility

The store should be sited away from manufacturing and other routine activities, and be securely locked. Access must be restricted so that only personnel trained in handling PCBs and responsible for the operation of the store are allowed into the storage area.

The store should be indoors. If the store must be outside, the storage area should be covered with a waterproof barrier, and be adequately ventilated.

The store building should have bunding facilities that will trap twice the liquid content of the largest piece of equipment or container, of up to 25 percent of the total quantity of PCB stored, whichever is larger. In the event of any accidental spillage, precautions should be taken to block off any drains that would allow PCB to escape into storm water drains. The floor should be a sealed surface, allowing for easy cleaning.

There should be no storage of combustibles within 10 metres of a PCB store.

As for the small store, drums should not be stacked, in case they fall, and should be secured against risk or earthquake.

Labelling must comply with the current NZS 5433:2007 Code of Practice for the Transport of Hazardous Substances on Land. Hazchem warning labels and requirements of the code of practice on warning signs for premises storing hazardous substances issued by the New Zealand Chemical Industry Council should be met. A notice should be placed where the fire brigade can easily read it, stating where the code of practice and protective clothing are held. PCB caution notices should be mounted at all entrances to the PCB store, and should include who is in charge of the store.

A register of all PCB movements should be maintained in the store and at another location for security. The store should be regularly inspected to check on the condition of the stored PCBs. A log of inspections should be maintained and be available for inspection by ERMA New Zealand delegated officers. Any leaking drums should be replaced with sound drums.

Drip trays must be placed under all drain valves or leaks on stored transformers. Valve handles should be removed before long-term storage. Spill clean up facilities (clothing, absorbent material and tools) must be kept in the PCB store.

9. Disposal of PCB Wastes

The HSNO (Stockholm Convention) Amendment Act 2003 continues to allow the holders of PCBs to apply for an exemption until 2016. After 2016, it will not be possible to issue any new exemptions for the storage of PCBs. This means that all PCBs will need to be removed from the site prior to 2016. Any change in the location of PCBs must be notified to ERMA New Zealand.

PCBs must be disposed of in an environmentally sound manner, as per clause 5 in the Hazardous Substances (Storage and Disposal of Persistent Organic Pollutants) Notice 2004. (December 2004, Gazette Notice 174, see www.gazette.govt.nz).

PCB materials for disposal should be decommissioned as described in section 6.2 and prepared for transport as described in section 7. All necessary documentation must be completed in accordance with the disposal facility chosen. The contractor undertaking the removal to disposal should be able to assist with this. Owners of small quantities of PCBs are advised to co-operate in removal to lessen the costs for disposal.

10. Emergency Response and Preparedness

Because of the known persistent nature of PCBs and their tendency to bio-accumulate, it is important to prevent entry of PCBs into the environment.

1. It is essential to avoid PCB leaking into drains or natural waterways.
2. All wastes and residues containing PCBs shall be collected for disposal.
3. Carry out necessary recording and notification as set out in section 4 of this code of practice.

10.1 Emergency procedure priorities

In the event of serious PCB discharge, the following priority steps should be taken.

1. Wear protective clothing.
2. Stop the flow of PCBs.
3. Contain PCBs.
4. Report incident so that the hazardous substances technical liaison committee (HSTLC) is activated.
5. Keep non-essential staff away from affected area.
6. Recover all PCB contaminated material.

10.2 Protection of personnel

1. All non-essential personnel shall be kept out of the immediate leak or spill area. The area should be roped off to prevent any spread of PCB material by vehicle or pedestrian traffic.
2. Personnel entering the leak or spill area shall be provided with and use protective equipment, as set out in section 5.2.
3. Only personnel familiar with PCB safety procedures will be used to shut off the source of the PCB spill, contain the spilt PCB, and carry out recovery and clean-up work.
4. The repair of equipment or the clean-up of spillages and leaks containing PCBs should be carried out by competent staff only. Protective clothing as described in section 5.2 must be worn.

5. Where a significant area of PCB liquid is exposed to the air in an indoor situation or where adequate ventilation is not possible, supplied air breathing apparatus must be worn.

6. Contaminated clothing that cannot be effectively cleaned for reuse is to be placed into storage containers as described in section 6.2.

7. Attention must be paid to personal hygiene.

10.3 Priority actions in the event of a leakage or spillage

Stop the flow of PCBs.

- Re-position the drum to stop the flow.
- If possible, stop the leakage.
- If necessary, transfer fluid to spare drum.

Contain the PCBs.

- Dyke major spills with soil or other material.
- If at all possible, prevent PCBs entering drains, waterways or spilling onto the ground.
- Use sand or sawdust to absorb and recover the PCB, all of this to be recovered into the wide mouth drum.
- Recover any PCB-contaminated soil.
- If leaking from the truck tray, drive the vehicle onto a sheet of plastic to contain the PCBs.

Report any spillage of PCB to the relevant regional council and the local public health unit as soon as practicable after the spillage, providing details on the estimated volume spilt and to what extent it has been recovered and the exact location of the spillage.

Keep non-essential staff and the public away from the affected area. If possible use a rope barrier to outline the contaminated area. 'Do Not Approach' notices should be displayed at the boundary of the affected area.

Recover all PCB-contaminated material, protective clothing and equipment and pack into suitably labelled drums.

Spill staff should wash thoroughly after the clean up is completed (see section 10.4 for further details).

10.4 Handling PCB spills and leaks

If PCBs leak or are spilt, the following steps shall be taken.

1. Shut off the source of the leak or prevent further spillage. Failing this, make arrangements to collect and contain the PCB.
2. Equipment filled with PCB that is found leaking should be removed from service as soon as possible to correct the leak. Where it is not possible to remove the equipment from service immediately, some means of collecting the PCB should be used. Polyethylene sheeting or metal trays can be used as temporary containment for leaking capacitors or transformers. Regular supervision of the containment is necessary.
3. If applicable, the area of the leak or spill shall be adequately ventilated to prevent the accumulation of any vapours.
4. Liquid PCB shall be collected or absorbed using dry sawdust, diatomaceous earth ('kitty litter'), rags or sand. As much free liquid should be recovered as possible for disposal (see section 9).
5. If there is going to be any delay in cleaning up the PCB spillage, the affected area should be roped off to prevent persons entering the contaminated site and 'Do not Approach' signs erected.
6. All Steps must be taken to prevent any spillage or accidental loss of PCBs, either by drainage into the sewer systems or percolation into the ground.
7. All PCB liquid and contaminated material must be collected for disposal. This may include the top layer of switchyard gravel in the affected area. Care should be taken to avoid stirring up subsoil layers. The work is best done by using hand shovels.
8. Where any spillage of a PCB fluid occurs, the equipment involved and the floor should be wiped clean using rags or absorbent material such as sawdust or sand, then solvents such as kerosene can be used to flush PCBs from crevices etc and the PCB-contaminated material collected for disposal. Ensure that the area is well ventilated while using solvents.

10.5 Notification and reporting of leaks or spillage

1. Regional council and local public health unit officers should be notified of any PCB spills or leakages that occur.
2. The local company manager or supervisor must be immediately informed when any PCB spill is discovered.
3. A report must be filed in company records, recording all spillage of PCBs and subsequent clean-up procedures.
4. Ongoing monitoring of a spill area may be required.

10.6 Precautions in the event of fire

In the event of a fire in an area containing PCBs, Fire Service personnel must be warned of the special danger and advised which equipment contains PCB. A notice should be located beside the main fire hydrant close to any PCB equipment stating the location of the PCB equipment.

It is possible in the event of a major fire that toxic decomposition products, such as polychlorinated dibenzofurans and dibenzodioxins, may be produced in small quantities from the incomplete combustion of the material.

If PCBs have been subjected to fire in a building, no access should be allowed to the building without breathing apparatus and protective clothing until it has been confirmed by the Department of Labour and/or the local public health unit that it is safe to re-enter.

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Appendix A: Trade Names for PCBs

Askerals	Manufacturer	Askerals	Manufacturer
Abestol	American Corp, USA	No-Flamol	Wagner Electric,USA
Asbestol	Monsanto, USA	Phenoclar DP6	Baylor, Germany
Auxol	Monsanto, USA	Phenoclar DP6	Prodelec, France
Aceclor	ACEC, Belgium	Pyroclar	Monsanto, UK
Aroc(h)lor 1221, 1232/1248, 1254, 1260, 1268, 1270, 1342, 2565/4465/ 5460	Monsanto, USA PR Mattory& CO, USA	Pyroclor Pyrochlor Pyronal	Monsanto, US General Electric, USA
Apirollo	Caffaro, Italy	Pysanol	
Apirollo	Caffaro, Italy	Pydraul†	Monsanto, USA
Bakola 131	Monsanto, USA	Physalen	
Chlorextol	Allis Chalmers, USA	Pyralene 1460	Prodelec, France
Chloroextol	Allis Chalmers, USA	Pyralene 1500, 1501	Prodelec, France
C(h)lophen A30	Bayer, Germany	Pyralene 3010, 3011	Prodelec, France
C(h)lophen A50	Bayer, Germany	Pyralene T1	Prodelec, France
Chloresil*		Pyralene T2	Prodelec, France
Cloresil		Pyralene T3	Prodelec, France
Chlorintol	Sprayue Electric Co, USA	Safe-T-America Safe-T-Kuhl	 Kuhlman Electric, USA
Clorinal		Sant(h)osafe	Mitsubishi, Japan
Delor		Santosol	
Diachlor	Sangamo Electric	Santowax	
Di(a)conal		Sant(h)otherm FR	Mitsubishi, Japan
Dykanol	Cornell Dubille, USA	Saut(h)otherm	Mitsubishi, Japan
Ducanol		Sorol	So(l)vol, USSR
DK	Caffaro, Italy	Sovol	So(l)vol, USSR
DP3, 4, 5, 6.5		Therminol FR	Monsanto, USA
E(d)ucarel	Electrical Utilities Corp, USA	Terpenylchlore	PCT, France
Electrophenyl	PCT, France	Chlorphen	Jard Corp, USA
Elaol	Bayer, Germany	Clophen	Bayer, Germany
Elemex	McGraw Edison, USA	EEC-18	Power Zone Transformer, USA
Fenclor 42, 54, 64, 70	Caffaro,Italy	Inclar	Caffaro, Italy
Hydol		Nepolin	USA
Hyvol	Aerovox, Italy/USA	Non-flammable Liquid	ITE Circuit Breaker, USA

Inerteen 300, 400, 600	Westinghouse, USA	Phyralene	Prodelec, France
Kan(e)c(h)lor (KC) 200-600	Kanegafuchi Japan	Santovac	Monsanto, USA
Kennechlor	Kanegafuchi Japan	Solvol	
Leromoll			

Energy Policy Program
House 4, Street 88, G-6/3, Islamabad, Pakistan
Tel: +92 51 835 7072, Fax: +92 51 835 7071
www.ep-ep.com.pk