



GOVERNMENT OF THE PEOPLE'S
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MINISTRY OF POWER, ENERGY &
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POWER DIVISION
BANGLADESH POWER DEVELOPMENT BOARD



Vol 3: BOILER DECOMMISSIONING PLAN

Prepared under
Environmental
Impact Assessment
(EIA) Study for
Repowering of
Unit-4 of Ghorashal
Power Station

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1. RATIONALE

This report contains the technical assessment of decommissioning of 210 MW Unit of Ghorashal Power Station.

The conditions of the boilers and steam turbines of Unit #3, #4 and #5 are fair. Unit #6 is not in operation since July 2010 due to steam turbine damage. The present maximum output of the Units #3, #4 and #5 are between 180 to 190 MW.

Several repowering options have been studied during feasibility study. For Full Repowering the existing Boiler will be replaced by a Gas Turbine with a HRSG that supplies steam to the existing Steam Turbine.

Full Repowering is technically the most justified option for repowering Unit #4 of Ghorashal Power Station because the expected output and efficiency is much higher compared all other options.

2. CONDITION OF UNIT #4

Unit #4 was commissioned in 1989. The unit was operated for 168,096 hours since commissioning. One overhauling of Unit #4 was carried out in 2002. Presently Unit #4 is out since 5th January, 2015 for "Life Assessment Study" of Turbine. The planned duration of outage is seven months.

The Boiler and Steam Turbine of Unit #4 experience more shut downs compared to other units. The present maximum output of the Units #4 is in the range of 180 to 190 MW.

The boiler is in bad shape. Tubes of two boiler panels of side sections (one each in left & right hand side of the boiler) are in poor shape. While tubes of one side have been replaced, work on other side is yet to be done. Scale deposits inside the boiler tube are higher than normal.

Total outages of the unit due to boiler tube leakages during 2009, 2010 and 2011 of the boilers # 4, is 1,397 operation hours. In 2011, boiler #4 was shut down for 948 operation hours due to boiler tube leakages.

In the condenser, 30% of the tubes had been blocked due to leakages. Frequent condenser leakage of this unit has resulted in high hardness of condensate water.

One of the two Forced Draught Fans (FD Fan A) has vibrations problems. Also, its speed cannot be changed. Furthermore, there are cracks in the foundation.

There are leakages in the seals of both Regenerative Air Heaters (RAH), thereby affecting efficiency of the boiler and increasing load on FD & ID Fans.

Due the frequent forced outage of the boiler and problems in above mentioned auxiliary equipment, this Unit was identified for the Full Repowering option.

In this option new Gas Turbine and HRSG will be installed and existing boiler will be decommissioned. New HRSG will be installed on present boiler's foundation, which will supply steam to existing steam turbine.

3. BOILER DESCRIPTION:

The boiler is conventional drum type boiler. It is mainly fired with natural gas, and was designed and built by Taganrog (Russian manufacture). The boiler is equipped with two rotating air heaters and flue gas recirculation.

The high pressure water-steam loop encompasses an economizer, an HP drum, HP evaporator, a low temperature ceiling super heater (SH), a radiant wall SH, a platen SH and a convective final SH. Between each SH stage injection coolers control the steam temperature.

After the HP steam passed through HP turbine, the steam (cold re-heat steam) is returned to the intermediate pressure (IP) boiler. Steam is reheated in two steps. An injection cooler controls the steam temperature between step one and two. Re heated (hot- heat steam) returns and passes through IP and LP turbine. LP steam is condensed in the condenser and return back to the economiser of boiler through condensate and feed water cycle.

A summary of the main characteristics is presented in the table below.

Table of Characteristics of Boiler:

Boiler Taganrog Type TGME-206 COB	
Steam Capacity (t/h)	670
Pressure Of HP Steam (Boiler Outlet) (barg)	137.3
Temperature Of HP Steam (Boiler Outlet) (°C)	545
Pressure Of IP Steam (Boiler Outlet) (barg)	25.8
Temperature Of IP Steam (Boiler Outlet) (°C)	545
Allowable Minimal Load (%)	30
Rated Efficiency (%)	93

Note: The Consultant has visited the library of Ghorashal Thermal Power Station to search for relevant documents pertaining to the erection work execution of the thermal and mechanical equipment of Boiler (No.4). The Consultant found only a small fraction of the weight of boiler parts in the erection work execution documents. In this situation it was not realistic to mention the quantity of materials in the decommissioning document.

Boiler has a left and a right part which are clearly separated, without any cross-linking. Boiler has 2 layers with 6 back side gas burners installed.

The air pre-heater is situated after the economizer (end of boiler). This is a rotating type. After air pre heaters flue gas passes to atmosphere through 60 meter high chimney.

4. STATUTORY COMPLIANCE BEFORE START OF BOILER DECOMMISSIONING WORK

The statutory permits are required before starting Decommissioning work of Boiler.

Statutory compliance can be divided into two broad categories:

- Owner's statutory requirements
- Contractor's statutory requirements

4.1 OWNER'S STATUTORY OBLIGATIONS

- Government Authorization granting permission for site clearance on the basis of the "Initial Environmental Examination Report" from Department of Environment (DoE).
- Government Authorization approving the project for environmental and social impact ("EIA Approval") on the basis of the "Environmental Impact Assessment".
- License for the term of the Power Purchase Agreement permitting the Company to generate and supply electricity under the Power Purchase Agreement from Ministry of Power Energy and Mineral Resources (MOPEMR), Office of the Electrical Adviser and Chief Electric Inspector (OEACEI) and Bangladesh Energy Regulatory Commission (BERC).
- Easement or lease agreement and approval for construction of shoreline work, jetty, intake and outfall structures of once through cooling system, use of river water and dredging of river from Bangladesh Inland Water Transport Authority (BIWTA) and Bangladesh Water Development Board (BWDB).
- No objection certificate to build an exhaust stack and bypass stack at the site as part of the plant from Civil Aviation Authority of Bangladesh (CAAB).
- All import permits, certificates, licenses and other required consents allowing the Company and the Contractor(s) to import into Bangladesh all plant, machinery, equipment, spare parts, materials and supplies required for the project from Ministry of Commerce (MOC) and Chief Controller of Import and Export (CCIE).
- Fuel supply agreement with the supplier Titas Gas Transmission and Distribution Company Limited (TGTDC).
- No objection certificate for the Project as per the Local Government (Union Parishad) Ordinance, 1983 and with reference to Circular No. 159/UP/047, dated 16 June 1993.
- No objection certificate for the Project as per Town Improvement Act 1953 (East Bengal Act XIII of 1953, as modified up to June 1991, and as per the Urban Area Plan, 1997 (SRO No. 184-Law/97, dated 3 August 1997) from Narsinghdi Poursabha.
- As per Local Government (Thana Parishads and Thana Administration, Reorganization) Ordinance, 1982 (Order No. LIX of 1982) as amended up to 1992 from Thana Authority of Narsingdi Thana.
- Government Authorization for the installation, construction and operation of a deep tube well at site from Department of Public Health Engineering (DPHE).
- Work permit for Project personnel including the Company's and Contractor(s)' employees and

resident visas from Board of Investment (BOI) and Ministry of Home Affairs (MOHA).

- National security clearance for expatriate employees of Company and the Construction and O&M Contractor(s).
- Government Authorization for remittance of up to fifty percent (50%) of salaries and savings by expatriate employees of the Company without restriction from Bangladesh Bank.

4.2 CONTRACTOR'S STATUTORY OBLIGATIONS

- License under the Petroleum Act, 1974 (Act LXIX of 1974) for storage of petroleum products at or proximate to the Facility from Department of Explosives.
- Approval of installations of boilers at the Facility under Sections 6 and 7 of the Boiler Act, 1923 (Act V of 1923) from Department of Explosives and Chief Inspector of Factories and Establishment (CIFE).
- Permission for transporting chemicals, toxic wastes and hazardous materials on land and water routes from Ministry of Home Affairs (MOHA).
- Approval of the Facility as satisfying the fire safety and protection standards under the Fire Service Ordinance, 1959 (Ord. No. XVII of 1959) and Civil Defence Act 1952 (Act. XXXI of 1952) from Department of Fire Service and Civil Defence (DFSCD).
- Special Order for the term of the Power Purchase Agreement exempting the Company from the application of Section 30 of the Electricity Act, 1910 (Act IX of 1910), so as to permit the Company to use electricity within the Facility for auxiliaries (other than supply of electricity to the residential area of Facility) from Ministry of Power Energy and Mineral Resources (MOPEMR), Office of the Electrical Adviser and Chief Electric Inspector (OEACEI) and Bangladesh Energy Regulatory Commission (BERC).
- Special sanction for the term of the Power Purchase Agreement under Section 34 of the Electricity Act, 1910 (Act IX of 1910) permitting the connection of the Facility to the earth by the Company from Ministry of Power Energy and Mineral Resources (MOPEMR), Office of the Electrical Adviser and Chief Electric Inspector (OEACEI) and Bangladesh Energy Regulatory Commission (BERC).
- "Certificate of Registration" of Facility under Factories Act, 1965 (Act IV of 1965) from Chief Inspector of Factories and Establishment (CIFE).
- Approval of the Facility as satisfying the fire safety and protection standards under the Fire Service Ordinance, 1959 (Ord. No. XVII of 1959) and Civil Defense Act 1952 (Act. XXXI of 1952) from Department of Fire Service and Civil Defense (DFSCD).

5. SAFETY PREPARATION BEFORE STARTING REMOVAL OF ASBESTOS INSULATION

5.1 ASBESTOS AND HEALTH RISKS

Asbestos is a group of naturally occurring fibrous silicate minerals. It was once used widely in the production of many industrial and household products because of its useful properties, including fire retardation, electrical and thermal insulation, chemical and thermal stability, and high tensile strength. Today, however, asbestos is recognized as a cause of various diseases and cancers and is considered a health hazard if inhaled.

Over 90% of asbestos fibre produced today is chrysotile, which is used in asbestos-cement (AC) construction materials: A-C flat and corrugated sheet, A-C pipe, and A-C water storage tanks. Other products still being manufactured with asbestos content include vehicle brake and clutch pads, roofing, and gaskets. Though today asbestos is hardly used in construction materials other than asbestos-containing products, it is still found in older buildings in the form of friable surfacing materials, thermal system insulation, non-friable flooring materials, and other applications. The maintenance and removal of these materials warrant special attention.

Because the health risks associated with exposure to asbestos are now widely recognized, global health and worker organizations, research institutes, and some governments have enacted bans on the commercial use of asbestos, and they urge the enforcement of national standards to protect the health of workers, their families, and communities exposed to asbestos through an International Convention.

Detailed procedure for Asbestos removal is described in Article 11.

5.2 PREPAREDNESS BEFORE START OF REMOVING ASBESTOS INSULATION:

The Ghorashal Power Station Unit #4 Boiler was installed in year 1990. Due to best property of thermal insulation in the olden days Asbestos was extensively used for insulation of Boiler and Steam piping. In this unit also main Boiler and steam piping were insulated by Asbestos. While decommissioning boiler, firstly the insulation of the boiler and steam piping is required to be removed and disposed safely without causing health hazard to workers, their families and environment by air pollution and soil contamination by absorbing asbestos.

Hence before starting removal of insulation activity following preparedness shall be completed;

- Cordon of Unit # 4 boiler from all sides by GI sheet fencing with only two entries.

5.2.1 Measures to avoid soil contamination:

- The boiler floor is concrete but is damaged at many places. Spreading the concrete layer of three inches with slope on ID fan side on entire boiler floor is recommended.
- After proper curing of concrete and finishing, apply water proofing coat on entire area. This will prevent the water seepage in soil.
- On the perimeter of boiler floor which is concreted and ready with water proofing built a side wall of one feet height. After curing side wall apply water proofing coat on it, this will prevent water seepage/leakage on nearby area around boiler.
- On ID fan side of boiler construct two concrete slab tanks side by side of size 6 ft x 6 ft x 4 ft. Base as well as all the sides shall be water proofed. One of these tanks shall be connected to by proper double valve arrangement to boiler area to drain out collected water.

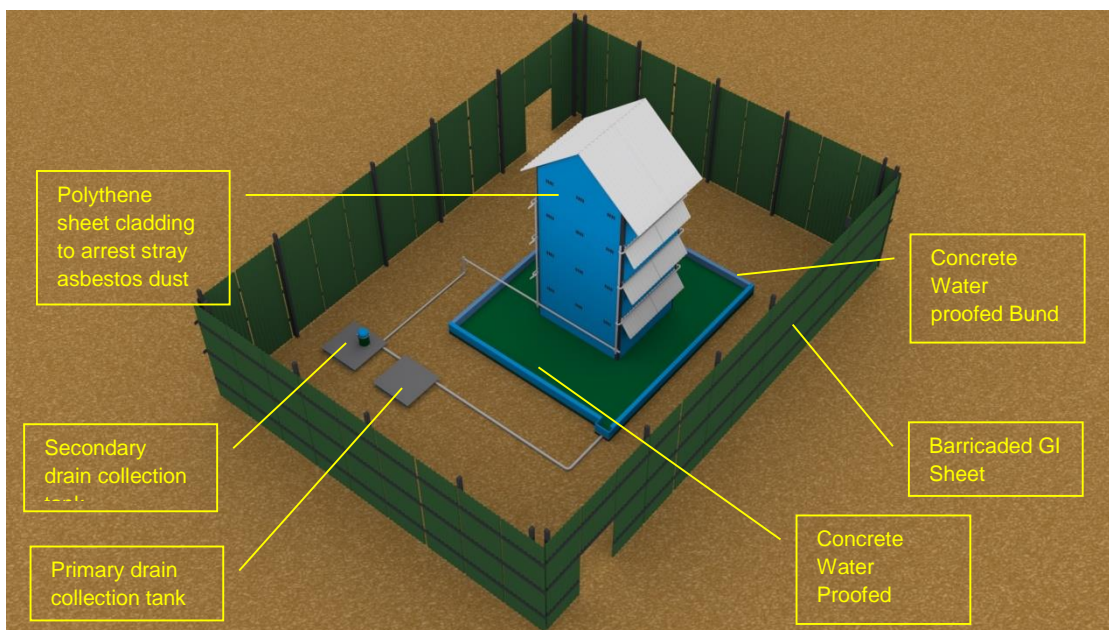


Figure 1: Delineation of asbestos removal preparedness during Boiler Decommissioning

5.2.2 Measures to avoid air pollution:

- Other tank shall be used for transferring collected asbestos contaminated water after proper filtration. Filter papers shall be disposed as per disposal procedure explained in “Asbestos Disposal Procedure” chapter.
- Install high pressure pump in filter water tank.
- Install water spray system on all sides of boiler on each floor. Nozzles shall be located at appropriate locations.
- Connect pump discharge to spray system piping. (This system shall be designed during detailed engineering stage).
- Whenever asbestos fibres appears in air while removing asbestos particular floors water spray shall be manually operated. This will minimise spreading of asbestos fibres in the atmosphere.
- Insulation removals shall be started from the top floor.
- Spread thick plastic sheet on three consecutive floors. Seal all the openings with adhesive tape.
- Erect the scaffolding on all the sides of two consecutive floors and tie properly thick plastic or tarpaulin on small portion of area (on two consecutive floor) where insulation removal work to be started. (Tarpaulin shall be properly tied to avoid accidental flying by wind).
- Spray the water on insulation before starting removal.
- Immediately pack in plastic bags. Procedure for this operation is detailed in “Asbestos Disposal Procedure” chapter.
- Transfer carefully these bags on boiler ground floor at designated place.

5.2.3 Other Measures:

- All storm drains of Unit #4 area should be blocked, so no water from Unit #4 will flow in the plant storm water drain system.
- Asbestos insulation from boiler and piping shall be always wet removed (spray water on insulation before stripping).
- Following doors from boiler area shall be closed and sealed by adhesive tape during insulation removal activity.
 - a) Ground floor entry to feed cycle area.
 - b) Entry to turbine/control room floor.
 - c) Entry to stair case of Unit #4 plant building.
- Provide portable two toilet blocks near ID fan on boiler ground floor for employees working for removal of insulation.
- Provide two portable bath room blocks near ID fan outside boiler area. One used as dirty bathroom for first stage wash and other as second stage wash for employees before leaving work area. Drains of these bathrooms shall be connected to dirty tank.
- Without storing removed asbestos for more than a day, dispose to designated area. Procedure for this operation is detailed in the “Asbestos Disposal Procedure” chapter.

5.2.4 Base Line Data Collection:

Before starting any activity of boiler decommissioning, collect and analyse following samples. The analysis shall include presence of Asbestos in all these samples. Record all data to compare analysis of following during and at the end of Asbestos removal activity.

- Ambient air quality at different location in plant.
- Ambient air quality in the surrounding area at different location in periphery of one kilometer.
- Collect river water sample and carry out detailed analysis.
- Collect operating plant Effluents sample at discharge points from plant and carry out detailed analysis.
- Collect storm water sample at discharge point from plant and carry out detailed analysis.
- Analyze soil sample collected from a solid waste disposal site around Unit #4 boiler.

6. PERMIT PROCEDURE:

Detailed requirement of statutory permits required for starting boiler decommissioning job is discussed above in section 4.

The preparedness of the operational body (BPDB management) need to check on the basis of the existing local legal regulations and compared with Bangladesh applicable rules to obtain a decommissioning/ deconstruction license for Unit #4 of Ghorshal Power Station in due time.

The following planning items have to be considered:

Responsibility Matrix:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Appoint Owner's engineer for entire job of Unit #4 Repowering by proper bidding process	Y	Y			
2	Appoint Detailed Engineering Contractor for entire job of Unit #4 Repowering by proper bidding process	Y	Y			
3	Allocating of cleaning target (green or brown field) to be agreed	Y	Y			
4	Technical activities for a decommissioning application with responsibility, time and action	Y	Y	Y	Y	Y
5	Checking for hazardous materials potentially existing at the site	Y	Y	Y	Y	Y
6	Environmental impacts before decommissioning	Y	Y			
7	Social impacts before decommissioning	Y	Y			

8	Social impacts during and after decommissioning	Y	Y	Y		Y
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*Note: 'Detail Engineering Contractor' and 'EPC Contractor' may be the same party or different party.

7. DECOMMISSIONING AND DISMANTLING PLAN:

The decommissioning and dismantling plan is divided into eight (8) phases with the groups of works described below:

7.1 PHASE I - Minimum permits requirement

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Development of Terms of Reference for planning and engineering of decommissioning and dismantling	Y		Y	Y	
2	Examination of existing documents and as-built plans			Y	Y	
3	Definition of those plant systems which are necessary for operation for other units		Y	Y	Y	
4	Definition of those plants and facilities which can be dismantled for Unit # 4 and their terminal points		Y	Y	Y	
5	Definition of the scope of performance	Y		Y	Y	
a	As per the Local Government (Union Parishads) Ordinance, 1983 and with reference to Circular No. 159/UP/047, dated 16 June 1993.	Y	Note 1	Note 1		
b	As per Local Government (Thana Parishads and Thana Administration,	Y	Note 1	Note 1		

	Reorganization) Ordinance, 1982 (Order No. LIX of 1982) as amended up to 1992.					
c	Government Authorization, Department of Environment , granting permission to commence civil works on the basis of the “Initial Environmental Examination Report”.	Y	Note 1	Note 1		
d	Government Authorization, Department of Environment , approving the Project for environmental and social impact (“EIA Approval”) on the basis of the “Environmental Impact Assessment Report”.	Y	Note 1	Note 1		
e	Department of Explosive; License under the Petroleum Act, 1974 (Act LXIX of 1974) for storage of petroleum products at or proximate to the Facility.	Y	Note 1	Note 1		
f	Ministry of Home Affairs; License for the Authority to obtain and have arms for the purposes of the security of the Facility.	Y	Note 1	Note 1		
g	Department of Environment/ Department of Explosives; Permission for transporting chemicals, toxic wastes and hazardous	Y	Note 1	Note 1		

	materials on land and water routes.					
h	Factory Inspector	Y	Note 1	Note 1		
i	Gas Supply Agency	Y	Note 1	Note 1		
j	Department of Environment; Government Authorization to commission, startup and operate the Facility based on the implementation of measures identified in the EIA (“Environmental Clearance Certificate”).	Y	Note 1	Note 1		
k	Department of Fire Service & Civil Defence; Approval of the Facility as satisfying the fire safety and protection standards under the Fire Service Ordinance, 1959 (Ord. No. XVII of 1959) and Civil Defence Act 1952 (Act. XXXI of 1952).	Y	Note 1	Note 1		
l	Related authorities such as NGOs	Y	Note 1	Note 1		

Note 1: Support to BPDB in providing necessary documents

7.2 PHASE II - Detail Engineering:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Engineering of the decommissioning and disaggregation of unit and balance of plant.			Y	Y	

7.3 PHASE III - Preliminary and in-depth exploration of the power plant site considering laws:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Environmental Protection	Y	Y	Y	Y	
2	Waste disposal	Y	Y	Y	Y	
3	Examination of historical development of surrounding area	Y		Y	Y	
4	Sampling and analysis of soil and ground water before start of demolition	Y		Y	Y	
5	Hazard assessment for the demolition materials	Y		Y	Y	
6	Hazard assessment for the soil and ground water (if necessary)	Y		Y	Y	

7.4 PHASE IV - Development of the mass balance and disposal concept(s):

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Examination of structures and buildings	Y		Y	Y	
2	Study of existing building files, design documents, etc.			Y	Y	
3	Quantity surveying			Y	Y	
4	Drawing up a secondary usage or disposal concept(s)			Y	Y	
5	Asbestos survey			Y	Y	
6	Drawing up decontamination and safety plans (abolition of soil and groundwater contamination)			Y	Y	
7	Mass balance of the demolition materials			Y	Y	

7.5 PHASE V - Development of a dismantling strategy:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Elaboration of a health and safety plan			Y	Y	Y
2	Presentation and description of necessary safety and protection measures			Y	Y	Y
3	Planning of necessary measures to guarantee ground stability of adjoining facilities			Y	Y	Y
4	Specification measure to provide necessary utilities (water, energy compressed air,)			Y	Y	Y

7.6 PHASE VI - Compilation of licensing and tender documents for dismantling considering the Laws on Construction:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Presentation of the demolition project			Y	Y	Y
2	Development of building description including specification and preferable dismantling technology			Y	Y	Y
3	Development of scope of supplies and services			Y	Y	

7.7 PHASE VII - Cost and time schedule planning:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Ascertainment of the dismantling and disposal costs				Y	
2	Ascertainment of recoverable proceeds				Y	
3	Preparation of the dismantling time schedule				Y	Y

7.8 PHASE VIII - Contract award planning:

Serial	Description	BPDB	Ghorashal O&M Team	Owner's Engineering	Detail Engineering Contractor*	EPC Contractor
1	Compilation of the criteria catalogue for bid evaluation	Y		Y	Y	
2	Bid meetings	Y		Y	Y	
3	Evaluation of tenders	Y		Y	Y	
4	Award the contract	Y		Y	Y	
5	Appropriate a tender document for the disposal of	Y		Y	Y	

	residual materials must be drawn up					
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8. PRE- REQUISITE BEFORE TAKING UP DISMANTLING OF BOILER

Safety Measures:

The safety measures include rules for safe decommissioning in compliance with health, work, environment and fire protection. These measures shall be implied by EPC contractor. Owner's Engineer shall maintain the strict adherences of all safety requirements.

Implementation should preferably take place immediately after the shutdown of the Unit. Safety measures include the following work:

- Ascertain that all the measures described in article 5.2 are properly implemented.
- Ensure that facilities unwanted entries are locked up to prevent unauthorized access.
- Provide security at both the entries
- Issue identity passes to the employees going to work for decommissioning and dismantling activity.
- Allow only authorized person to enter Unit # 4 working area.
- Clearance of buildings. (Remove all the material such as equipment, files, computers, etc.).
- Idling of electrical installations relating to Unit # 4.
- Disconnect the water supply to the cooling water condenser.
- Disconnect the 132 kV and 230 kV facilities from switch yard.
- Utility separation (water, heating, electricity, compressed air, fuel).
- Emptying and cleaning of plant components (tanks, gearboxes, etc.).
- Disposal of the consumables such as fuels, lubricants, chemicals, etc. conventional disposal channels in Ghorashal Power Station should be used to dispose of the various removed material.
- Ensure that the fire load is zero' (disposal of oil, greases, chemicals, etc.)
- Ensure that the ground stability of abandoned installations and structures.
- This operational activity of isolating different systems shall be carried out by existing trained Operating Staff.
- Proper LOG IN LOG OUT procedure shall be used at all isolated valves, switch gear breakers and isolators.
- Safety tags shall be placed in such a manner that they will remain intact for entire duration of outage. This will avoid accidental charging of any auxiliary system.
- Support of existing plant personnel shall be obtained while implementing the above measures.

9. DISMANTLING PROCESS

To create a dismantling time schedule, the decommissioning and dismantling of the Boiler #4 has been divided into separate lots. The entire activity shall be scheduled by EPC Contractor in consultation with Detailed Engineering Contractor and Owner's Engineer. BPDB shall be kept informed.

Lot 1:

Before the shutdown of the Unit #4 (1 month):

- Clearance of the complete area of rubbish and waste of any kind (bins, waste boxes, containers)
- Cleaning of (disaggregated) equipment and buildings no longer in use
- Implementation of safety measures in these systems
- Dismantling of equipment's which were disconnected from Unit #4.
- Partial demolition of facilities that are directly assigned to Unit #4 and not required while unit is in operation.

Lot 2:

After the shutdown of the Unit #4:

Safety measures in Unit #4 facilities to be carried out before start of activity in lots 4-9.

Lot 3:

Dismantle the auxiliary equipment's and facilities before start of activity in lots 4-9.

Lot 4:

Demolition of:

- Ancillary buildings
- Pipe bridges

Lot 5:

Dismantling of all ancillary facilities down to ground surface:

- Chemical water dosing systems of Boiler
- Cooling water pipe lines (inlet and outlet) to condense, auxiliary cooling water pipes, demoralized water piping

Lot 6:

Structural facilities with high dismantling complexity requiring heavy lifting equipment Transformers (if required) and outdoor installations

Lot 7:

Smoke stacks' site clearance.

Lot 8:

- Underground pipelines, vessels, tanks, cables
- Dismantling of all Boiler parts is detailed in part 7
- Procedural organization depends on staffing, the number of contractors.
- The availability of the necessary demolition equipment
- Demolition is to be carried out using conventional equipment (ball and chain, breaking, cutting or with hand tools) or by explosives (only if there is no other alternative)
- Afterwards, the site clearance of the demolition areas should be carried out without impacting environment and social effect
- As well as removal can be carried out for the treatment, secondary usage or disposal of the demolition masses

Lot 9:

It includes the demolition of foundations, building pits with recycled construction materials. Approximate time schedule for the decommissioning process is six months.

10. DEMOLITION OF BOILER

Demolition of Boiler:

Repowering of Unit #4, 210MW, it has been necessary to install a 246MW Gas Turbine (SCGT) and a Heat Recovery Steam Generator to provide steam for the existing 210MW Steam Turbine. The existing boiler, being old having many problems (described in Article – 2) for the proposed repowering project. Thus existing boiler becomes redundant and has to be demolished and removed. In this study, a plan of demolishing has been worked out to estimate the time required to do the work.

The boiler consists of:

- Heavy oiler drum
- Economizer
- Water tubes
- Steam pipes
- FD, ID & recirculating Fans
- Chimney
- Air ducts, etc.
- Insulation sheets and material

The boiler parts mentioned above and its auxiliary systems shall have to be removed one by one, and stored at designated site(s).

The last item is the demolishing of the foundations.

It is further estimated that time required to implement the demolishing and removal of the existing boiler would take about six months and is critical to the implementation of inter - connection the 210MW Steam Turbine with the Heat Recovery Steam Generator. Dismantling should be so synchronized that the site is clear and steam pipes to and from turbine are cut and isolated at the entrance point of turbine hall to be welded with the new pipes of HRSG.

It is necessary to adopt very careful handling of the job of dismantling and removal of heavy parts so that no life is lost in the course of the work. Danger to people either directly involved with the work or not is envisaged and actions shall be taken to avoid it. Correct sequence of dismantling is considered very important. For example:

- Air ducts are to be brought down to make room for parts of higher location to be brought down.
- Chimney should be demolished for crane to enter in to strategic points to reach the super structures.
- Considering these a sequence of dismantling the existing boiler has been prepared.
- From this total time for the dismantling has been found out to be 6 months.
- The sequence has shown interrelated activities in critical path.

The precautionary measures shall be adopted by the EPC contractor during all times of implementation of the project; and bidders would be required to submit their proposal taking into consideration adequate safety measures and the time requirement.

During dismantling the boiler dust from breaking of insulation, flume from cutting different pipes and some such other pollutant may emit. Measures of water spray arrangement as described in Article – 5 shall be implemented to limit any pollutant to the prescribed value.

In view of the above activities related to the plan, the sequence of dismantling of the existing boiler has been developed with time schedule and attached herewith in the schedule of Plan & Sequence. The expected time of demolition is six months.

Sequence of activities for Demolishing Boiler:

- Remove the insulation from all around the boiler and store them at the designated place. Asbestos removal methodology and safety measures are described in detailed in Article 11.
- Disassemble the air duct, bring down and store them at the designated place.
- Disassemble the Gas recirculation duct/ gas duct, bring down and store them at the designated place.
- Disassemble the RAH, bring down and store them at the designated place and remove the foundation.
- Disassemble and remove the chimney and remove the foundation.
- Remove the FD fans, ID fan & Gas recirculation Fans and store them at the designated place and remove the foundation.
- Disconnect all pipes to and from the boiler drum.
- Disconnect the down corner pipes from boiler drum and from water wall headers down and bring them down and store them at the designated place.
- Bring down the boiler drum and store them at the designated place (Boiler drum may be brought down by cutting in to pieces).
- Disconnect the feed water pipe from the economizer with proper support.
- Dismantle, bring down the economizer and store them at the designated place.
- Disconnect the miscellaneous pipes.
- Disconnect interconnection between headers of different super heater coils and re-heater coils.
- Disconnect the Main Steam pipes line, re-heater inlet and outlet pipe lines providing proper supports.
- Remove the ceiling super heater and store them at the designated place.
- Remove the other super heater coil (SH & RH) and store them at the designated place.
- Remove the Boiler condenser (Right & Left) and store the designated place.
- Remove the Steam super heater (Right and Left) and store at the designated place.
- Remove the water walls and store them at the designated place.
- Remove the scaffoldings, stairs etc. and store them at the designated place.
- Remove the supporting structures, if necessary and store them at the designated place.
- Remove the foundations of Boiler, if necessary.

Note: Where ever dismantling and removal of any part as it is found difficult and risky, it may be cut in to the correct size for easy handling.

Demolition Schedule:

The schedule estimated time for demolition of boiler is presently six months. The schedule can be reduced in between four and half to five months once following information is known clearly:

- EPC contractor (Local or International)
- Capability of EPC contractor
- Past experience of EPC contractor
- Skilled man power available with EPC contractor (whether sourcing from International experience or local).
- Heavy handling equipment's to be arranged by EPC contractor. This will decide parallel working at different area of boiler.
- Site distance and storing area for storing removed material of boiler.
- Availability of trailers/trucks/ dumpers for removed material movements.
- These thing will be rightly spelt while drafting the Tender Enquiry and analyzing the received Bids.

10.1 SCHEDULE OF PLAN AND SEQUENCE OF DISMANTLING OF THE EXISTING BOILER AND REPOWERING

Schedule of plan and sequence of dismantling of the existing boiler:

Sl	Activities	Duration input in Months					
		1	2	3	4	5	6
1	Remove the insulation from all around the boiler and store them at the designated place	█					
2	Disassemble the air duct, bring down and store them at the designated place	█					
3	Disassemble the Gas recirculation duct/ gas duct, bring down and store them at the designated place		█				
4	Disassemble the RAH, bring down and store them at the designated place and remove the foundation		█				
5	Disassemble and remove the chimney and remove the foundation		█				
6	Remove the FD fans, ID fan & Gas recirculation Fans and store them at the designated place and remove the foundation		█				
7	Disconnect all pipes to and from the boiler drum		█				
8	Disconnect the down comer pipes from boiler drum and from water wall headers down and bring them down and store them at the designated place		█				
9	Bring down the boiler drum and store them at the designated place			█			
10	Disconnect the feed water pipe from the economizer with proper support			█			
11	Dismantle, bring down the economizer and store them at the designated place			█			
12	Disconnect the miscellaneous pipes		█				
13	Disconnect interconnection between headers of different super heater coils and reheater coils		█				
14	Disconnect the Main Steam pipes line, reheater inlet and outlet pipe lines providing proper supports			█			
15	Remove the ceiling super heater and store them at the designated place				█		
16	Remove the other super heater coil (SH & RH) and store them at the designated place				█		
17	Remove the Boiler condenser (Right & Left) and store the designated place			█			
18	Remove the Steam desuperheater (Right and Left) and store at the designated place			█			
19	Remove the water walls and store them at the designated place					█	
20	Remove the scaffoldings, stairs etc and store them at the designated place					█	
21	Remove the supporting structures, if necessary and store them at the designated place						█
22	Remove the foundations of Boiler, if necessary.						█

11. ASBESTOS HANDLING, ASBESTOS REMOVAL STANDARDS

11.1 Good Practice Note: Asbestos

The purpose of this Good Practice Note is to increase the awareness of the health risks related to occupational asbestos exposure, provide a list of resources on international good practices available to minimize these risks, and present an overview of some of the available product alternatives on the market. The need to address asbestos-containing materials (ACM) as a hazard is no longer under debate but a widely accepted fact.

Practices regarding asbestos that are normally considered acceptable by the World Bank Group (WBG) in projects supported through its lending or other instruments are addressed in the WBG's General Environmental, Health and Safety (EHS) Guidelines. This Good Practice Note provides background and context for the guidance in the WBG EHS Guidelines.

Good practice is to minimize the health risks associated with ACM by avoiding their use in new construction and renovation, and, if installed asbestos-containing materials are encountered, by using internationally recognized standards and best practices (such as those presented in Appendix 2) to mitigate their impact. In all cases, the Bank expects borrowers and other clients of World Bank funding to execute the Asbestos removal under strict International Standard.

In reconstruction, demolition, and removal of damaged infrastructure, asbestos hazards should be identified and a risk management plan adopted that includes disposal techniques and end-of-life sites.

11.2 Asbestos and Health Risks

11.2.1 What is asbestos, and why are we concerned with its Use?

Asbestos is a group of naturally occurring fibrous silicate minerals. It was once used widely in the production of many industrial and household products because of its useful properties, including fire retardation, electrical and thermal insulation, chemical and thermal stability, and high tensile strength. Today, however, asbestos is recognized as a cause of various diseases and cancers and is considered a health hazard if inhaled.

Because the health risks associated with exposure to asbestos are now widely recognized, global health and worker organizations, research institutes, and some governments have enacted bans on the commercial use of asbestos and they urge the enforcement of national standards to protect the health of workers, their families, and communities exposed to asbestos through an International Convention.

11.2.2 Bans on the Use of Asbestos and Asbestos Products:

A global ban on commercial use of asbestos has been urged by the Building and Wood Workers Federation (IFBWW), the International Metalworker's Federation, the International Trade Union Confederation, the government of France, and the distinguished scientific group Collegium Ramazzini. All member states of the European Union and over 40 countries worldwide have banned all forms of asbestos, including chrysotile. In June 2006, the General Conference of the ILO adopted a resolution to "promote the elimination of all forms of asbestos and asbestos-containing materials."

11.2.3 Health Concerns Linked to Asbestos-Containing Products

Health hazards from breathing asbestos dust include asbestosis, a lung scarring disease, and various forms of cancer (including lung cancer and mesothelioma of the pleura and peritoneum). These diseases usually arise decades after the onset of asbestos exposure. Mesothelioma, a signal tumor for asbestos exposure, occurs among workers' family members from dust on the workers' clothes and among neighbours of asbestos air pollution point sources. Some experimental animal studies show that high inhalation exposures to all forms of asbestos for only hours can cause cancer. Very high levels of airborne asbestos have been recorded where power tools are used to cut A-C products and grind brake shoes

From the industrial hygiene viewpoint, asbestos creates a chain of exposure from the time it is mined until it returns to the earth at a landfill or unauthorized disposal site. At each link in the chain, occupational and community exposures coexist. Workers in the mines are exposed to the fiber while extracting the ore; their families breathe fiber brought home on work clothes; workers in the mills and factories process the fiber and manufacture products with it; and their families are also secondarily exposed. Communities around the mines, mills, and factories are contaminated with their wastes; children play on tailings piles and in contaminated schoolyards; transportation of fiber and products contaminates roads and rights-of-way.

Tradesmen who install, repair, and remove ACM are exposed in the course of their work, as are bystanders, in the absence of proper controls.

Disposal of asbestos wastes from any step in this sequence not only exposes the workers handling the wastes but also local residents when fibers become airborne because of insufficient covering and erosion control.

11.2.4 International Convention and Standards for Working with Asbestos

International Convention

The International Labor Organization (ILO) established an Asbestos Convention (C162) in 1986 to promote national laws and regulations for the “prevention and control of, and protection of workers against, health hazards due to occupational exposure to asbestos.” The convention outlines aspects of best practice: Scope and Definitions, General Principles, Protective and Preventive Measures, Surveillance of the Working Environment, and Workers’ Health. As of March 4, 2008, 31 countries had ratified the Convention; 17 of them have banned asbestos.

Some of the ILO asbestos convention requirements:

- work clothing to be provided by employers;
- double changing rooms and wash facilities to prevent dust from going home on street clothes;
- training of workers about the health hazards to themselves and their families;
- periodic medical examinations of workers,
- periodic air monitoring of the work environment, with records retained for 30 years;
- development of a work plan prior to demolition work, to protect workers and provide for proper waste disposal; and
- protection from “retaliatory and disciplinary measures” for workers who remove themselves from work that they are justified in believing presents a serious danger to health.

Standard considerations for working with and procuring ACM are common to most projects. An overview of some basic ones is provided in Appendix 1.

11.2.5 International Standards and National Regulations

Standards and regulations for work involving ACM have been published by nongovernmental organizations and government agencies. Appendix 2 lists of some resources, including international organizations (e.g., WHO, ISO, ASTM) and national governments (e.g., UK, US, Canada, Australia, South Africa). The resources range from manuals to individual standards and cover a variety of work guidelines, including surveys, identification, inspection, maintenance, renovation, repair, removal, and disposal. Some of the key issues discussed in these standards and regulations are as follows:

- The scale of occupational hazards. The health risk is not simply a function of the properties of the ACM, but also reflects the type of work being done and the controls used. Although A-C products, for example, may seem to intrinsically present less of a risk than fire-proofing, air monitoring has shown that cutting dry A-C sheet with a power saw can release far greater amounts of airborne fibers than scraping wet, saturated fireproofing off a beam. The relationship between the nature of A-C products, the work being done and the controls used to control the release of fibers and debris is important (refer standard ASTM E2394 and HSG189/2).
- Controlling exposure to airborne fibers. Because asbestos fibers are primarily an inhalation hazard, the basic purpose of the regulations and standards is to control the concentration of asbestos fibers in the air inhaled by workers or others. Concentration limits have been set by regulations in numerous countries for workers whose duties involve contact with ACM; however, they do not purport to totally eliminate the risk of asbestos disease, but only to reduce it. Exposure limits for individuals other than workers, including occupants of buildings and facilities and the community, are lower than those for workers in deference to the very young and old as well as the physically compromised.
- Measuring exposure to airborne fibers. Compliance with exposure limits is demonstrated by air

sampling in workers' breathing zone or in the space occupied by the affected individuals, with analysis of the sample by optical or electron microscopy, as explained in Appendix 2. Abatement protocols determine whether a building/facility can be reoccupied or safe to continue work after asbestos abatement.

- Proper disposal. Proper disposal of ACM is important not only to protect the community and environment but also to prevent scavenging and reuse of removed material. ACM should be transported in leak-tight containers to a secure landfill operated in a manner that precludes air and water contamination that could result from ruptured containers. Similar requirements apply to remediation of sites such as mines, mills, and factories where asbestos fiber was processed and products manufactured. (refer EPA NESHAP regulations, Appendix 2.)
- Transboundary movement of waste. Waste asbestos (dust and fibers) is considered a hazardous waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The Basel Convention imposes use of a prior informed consent procedure for movement of such wastes across international borders. Shipments made without consent are illegal. Parties have to ensure that hazardous waste is disposed of in an environmentally sound manner. Strong controls have to be applied from the moment the material is generated, to its storage, transport, treatment, reuse, recycling, recovery, and final disposal.
- Identifying asbestos products. A-C products include flat panels, corrugated panels used for roofing, water storage tanks, and pressure, water, and sewer pipes. In some countries asbestos may still be used in making wallboard, heat-resistant gloves and clothes for industrial use, and brake and clutch friction elements and gaskets used in vehicles. Thermal insulation containing asbestos and sprayed asbestos for insulation and acoustic damping were widely used through the 1970s and should be looked for in any project involving boilers and insulated pipes. Insulation dating from before 1980 should be presumed to contain asbestos unless analyzed and found not to. The microscopic methodology for analyzing bulk samples for the presence of asbestos is widely available in industrialized countries and is not expensive; it is less available in developing countries. In a developing country samples may have to be mailed out for testing; alternatively, training may be available for a laboratory in the country.
- Training. It is impossible to overemphasize the importance of training for working with ACM in any capacity—whether it involves inspections, maintenance, removal, or laboratory analysis. The duration of the training and the course content depend on the type of work the individual will be doing. Quality control and proficiency testing for laboratories and individual analysts are also important.

11.2.6 World Bank Group Approach to Asbestos Health Risk

The WBG EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. When one or more members of the WBG are involved in a project, the EHS Guidelines are applied as required by their respective policies and standards.

The WBG's EHS Guidelines specify that the use of ACM should be avoided in new buildings and construction or as a new material in remodelling or renovation activities. Existing facilities with ACM should develop an asbestos management plan that clearly identifies the locations where the ACM is present, its condition (e.g., whether it is in friable form or has the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should be performed only by specially trained personnel following host country requirements or, if the country does not have its own requirements, internationally recognized procedures. Decommissioning sites may also pose a risk of

exposure to asbestos that should be prevented by using specially trained personnel to identify and carefully remove asbestos insulation and structural building elements before dismantling or demolition.

APPENDIX 1:

WORLD BANK GROUP ASBESTOS REFERENCES

Policy guidance	References
<p>ACM should be avoided in new buildings/Industries or as new material in remodeling or renovation.</p> <p>Existing buildings/Industries: ACM Survey and management plan needed</p> <p>Disposal of ACM shall be carried out by specially trained individuals only following host country requirements, or in their absence, internationally recognized procedures</p>	<p>Guidance: General Environment Health and Safety Guidelines April 2007, p 34 and 71.</p>
<p>Some examples of project requirements:</p> <p>Risk assessment to determine extent of problem; surveys to abate asbestos exposure; management plan; removal by trained personnel; prohibition of ACM; procedures for handling, removal, transport, and disposal of asbestos.</p>	<ul style="list-style-type: none">• Ukraine -Equal Access to Quality Education (Project ID PO77738)• KH- Health Sector Support (Project ID: P070542)• ID- Health Workforce and Services (Project ID: P073772)• Changchun, China -TBK Shili Auto Parts Co., (IFC, 2005)

APPENDIX 2:

LIST OF RESOURCES FOR ASBESTOS STANDARDS AND REGULATIONS

Note: This listing is not meant to be all-inclusive, but is a sample of available information.

INTERNATIONAL STANDARDS:

WHO Policy and Guidelines (www.who.org):

- www.searo.who.int/LinkFiles/Publications_and_Documents_prevention_guidelines.pdf (p. 70)
www.searo.who.int/en/Section23/Section1108/Section1835/Section1864_8658.htm

International Organization for Standardization (ISO) (www.iso.org):

- ISO 10312 (1995): Ambient air -- Determination of asbestos fibres -- Direct transfer transmission electron microscopy method. [Method similar to ASTM D6281]
- ISO 13794 (1999): Ambient air - Determination of asbestos fibres - Indirect-transfer transmission electron microscopy method.
- ISO/FDIS 16000-7: Indoor air - Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations.
- ISO 8672: Air quality -- Determination of the number concentration of airborne inorganic Fibers by phase contrast optical microscopy -- Membrane filter method (1993) [Method similar to AIA RTM1]

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal:

- Basel Convention Secretariat (www.basel.int)

International Labour Organization (www.ilo.org):

- Chemical Safety Card, ICSC 0014:

www.ilo.org/public/english/protection/safework/cis/products/icsc/dtasht/icsc00/icsc0014.htm

European Union:

- Directive 2003/18/EC amending Council Directive 83/477/EEC on the Protection of Workers from the Risks Related to Exposure to Asbestos at Work. (March 2003). Provides regulations including: worker protection, training and medical surveillance; inspections for asbestos-containing materials; notification of asbestos work; air sampling; exposure limits of 0,1 fibres per cm³ (8-hr TWA) measured by Phase Contrast Microscopy.

SPECIFIC COUNTRY STANDARDS:

ASTM International (www.astm.org):

- Manual on Asbestos Control: Surveys, Removal and Management - Second Edition (March 2005). Author: Andrew F. Oberta, MPH, CIH. Discusses in detail how E2356, E2394 and E1368 are used to support an asbestos management program.
- E2356 Standard Practice for Comprehensive Building Asbestos Surveys. July, 2004. Covers baseline surveys for management of ACM and includes assessment protocols to make and prioritize removal vs. maintenance decisions. ASTM E2356 provides information for long term management of ACM in a Baseline Survey and for preparation of the plans and specifications for a removal project. It contains detailed procedures and equipment (mostly ordinary hardware items) needed to take bulk samples of common types of suspect ACM. Once materials have been identified as asbestos-containing, an assessment is made as to which can be left in place. Quantitative assessment of the Current Condition and Potential for
- Disturbance of all friable and non-friable materials allows removal priorities to be tabulated and graphically displayed. Budgetary estimates for removal can be established on the basis of the quantitative assessments.
- E2394 Standard Practice for Maintenance, Renovation and Repair of Installed Asbestos Cement Products (October 2004). Describes materials, hazardous operations, necessary precautions and infrastructure requirements with detailed procedures in appendices. Not intended for installation of asbestos-cement products in new construction or renovation.
- E1368 Standard Practice for Visual Inspection of Asbestos Abatement Projects (May 2005). Provides an approach to managing a removal project to enhance prospects of passing final inspections and clearance air sampling. Describes preparation, removal and inspection procedures and criteria.
- E2308 Standard Guide on Limited Asbestos Screens of Buildings (2005). Provides the minimum amount of information needed to facilitate a real estate transaction.
- D6281 Standard Test Method for Airborne Asbestos Concentration in Ambient and Indoor Atmospheres as Determined by Transmission Electron Microscopy Direct Transfer (TEM). A method for distinguishing asbestos from non-asbestos fibers on an air sample filter and identifying and quantifying smaller and thinner fibers than Phase Contrast Microscopy
- D7201: Practice for Sampling and Counting Airborne Fibers, Including Asbestos Fibers, in the Workplace, by Phase Contrast Microscopy (with an Option of Transmission Electron Microscopy)
- Combines methodology of NIOSH 7400 and 7402

Australia:

(www.ascc.gov.au/ascc/AboutUs/Publications/NationalStandards/ListofNationalCodesofPractice.htm)

- Safe Removal of Asbestos 2nd edition [NOHSC: 2002 (2005)]
- Code of Practice for the Management and Control of Asbestos in the Workplace [NOHSC: 2018 (2005)]

U. K. Health and Safety Executive (<http://www.hse.gov.uk/asbestos/index.htm>)

- Asbestos Regulations (<http://www.opsi.gov.uk/si/si2006/20062739.htm>)
- Asbestos Essentials (<http://www.hse.gov.uk/asbestos/essentials/index.htm>). Includes sections on manager Tasks and methods and equipment.

Publications include:

- Working with Asbestos in Buildings INDG289 08/01 C600. An overview (16 pages) of asbestos hazards and precautions
- MDHS100 Surveying, sampling and assessment of asbestos containing materials (2001). Contains many illustrations and examples of asbestos-containing products as well as sampling and analytical methods. MDHS100 is comparable in thoroughness to ASTM in its discussion of bulk sampling techniques and equipment, organizing a survey and assessment of ACM using a numerical algorithm based on the product type, extent of damage, surface treatment and type of asbestos fiber. The document contains numerous photographs of typical ACM found in buildings.
- HSG189/2 Working with asbestos cement (1999). Describes asbestos-cement products and methods of repairing and removing them, including fiber concentrations for controlled and uncontrolled operations.
- "The Control of Asbestos at Work Regulations (2002). Requirements for the protection of people being exposed to asbestos, including the requirement for those with responsibility for the maintenance and/or repair of non-domestic premises, to identify and manage any risk from asbestos within their premises

National Institute of Building Sciences (<http://www.nibs.org/pubsasb.html>):

- Guidance Manual: Asbestos O&M Work Practices, Second Edition (1996). Contains procedures for small-scale work on friable and non-friable ACM including asbestos-cement products.
- Asbestos Abatement and Management in Buildings: Model Guide Specification. Third Edition (1996). Contains information on project design and surveillance as well as applicable US regulations, plus removal contractor requirements for abatement work in specification format.

Austrian Standards Institute (http://www.on-norm.at/index_e.html):

- ONORM M 9406, Handling of products containing weakly bound asbestos, 01 08 2001. Contains a protocol and algorithm for assessing the condition and potential fiber release from friable asbestos-containing materials.

International Chrysotile Association (www.chrysotile.com).

[Please note this organization represents asbestos industries and businesses]

- Recommended Technical Method No. 1 (RTM1), Reference Method for the determination of Airborne Asbestos Fibre Concentrations at workplaces by light microscopy (Membrane Filter Method). Method using Phase Contrast Microscopy for counting fibers on an air sampling filter that does not distinguish asbestos from other fibers
- Recommended Technical Method No. 2 (RTM2) Method for the determination of Airborne
- Asbestos Fibres and Other Inorganic Fibres by Scanning Electron Microscopy. Method that identifies smaller fibers than Phase Contrast Microscopy and can distinguish types of asbestos fibers.

U.S. National Institute for Occupational Safety and Health

(www.cdc.gov/niosh/topics/asbestos)

- Occupational Safety and Health Guidelines for Asbestos (www.cdc.gov/niosh/pdfs/0041.pdf)
- Recommendations for Preventing Occupational Exposure (www.cdc.gov/niosh/topics/asbestos/#prevention)
- Method 7400, Asbestos and other fibers by PCM (1994).Phase Contrast Microscopy method similar to AIA RTM1 that counts all fibers greater than 5 pm long with a 3:1 aspect ratio
- Method 7402 Asbestos by TEM (1994). Method using Transmission Electron Microscopy that identifies and counts asbestos fibers greater than 5 pm long and greater than 0.25 pm in diameter with a 3:1 aspect ratio

U.S. Environmental Protection Agency (www.epa.gov/asbestos):

- Resources include managing asbestos-containing materials in buildings, schools, and the automotive industry. Includes procedures for inspection, analysis of bulk samples, assessment of friable ACM, response actions (removal, encapsulation, and enclosure), Operations and Maintenance, and clearance air sampling.
- National Emission Standards for Hazardous Air Pollutants: Subpart M - Asbestos. 40 CFR Part 61. (1990). Regulations include: definitions of friable and non-friable asbestos-containing materials; notification requirements for renovation and demolition of buildings and facilities containing ACM; work practices to prevent visible emissions; disposal of ACM and waste material in approved landfills; and operation and closure of landfills.
- 20T-2003 Managing Asbestos in Place: A Building Owner's Guide to Operations and
- Maintenance Programs for Asbestos-Containing Materials "Green book" (1990)
- Guidance document covering: organizing an Operations and Maintenance (O&M) program including training O&M workers; recognizing types of O&M; work practices and precautions for O&M work.
- EPA-600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials (1993) Polarized Light Microscopy, Gravimetry, X-ray diffraction and Transmission Electron Microscopy methods of identifying and quantifying asbestos fibers in bulk building materials. The identification of materials as containing asbestos is done by analysis of bulk samples,

usually with Polarized Light Microscopy. The analytical procedures described and the equipment to perform the analyses is similar to that found in academic or commercial geology laboratories, but specialized training to identify and quantify asbestos fibers in bulk building materials is needed as well as quality control and proficiency testing programs.

- Polarized Light Microscopy, Gravimetry, X-ray diffraction and Transmission Electron Microscopy methods of identifying and quantifying asbestos fibers in bulk building materials

U. S. Occupational Safety and Health Administration (Department of Labor)
(www.osha.gov/SLTC/asbestos) / (www.osha.gov/SLTC/asbestos/standards.html)

- Occupational Exposure to Asbestos (Construction Industry Standard) 29CFR1926.1101. (1994). Regulations for: Permissible Exposure Limits of 0.1 f/cc over a full shift (8 hr time-weighted average) and short-term exposure limit of 1.0 f/ml for 30 minutes; employee exposure monitoring for compliance with the PELs; work practices for friable and non-friable ACM; respiratory protection; worker decontamination and hygiene facilities; notification of employees and other employers of employees; medical surveillance; record-keeping and training.
- OSHA Method ID 160 Asbestos in Air (1994). Phase Contrast Microscopy method similar to NIOSH 7400

Ontario Ministry of Labour (Canada)
(www.e-laws.gov.on.ca/DBLaws/Source/Regs/English/2005/R05278_e.htm)

- Ontario regulation 278/05 Designated Substance — asbestos on construction projects and in buildings and repair operations (2005). Regulations covering: respiratory protection and work procedures; inspections for asbestos; management of friable and non-friable asbestos; advance written notice; asbestos bulk sampling and analysis; glove bag requirements and procedures; negative air enclosures; and clearance air testing requirements (0.01 f/cc by Phase Contrast Microscopy).

Work Safe British Columbia (Canada)
(www2.worksafebc.com/publications/OHSRegulation/Part6.asp)

- Part 6 Substance Specific Requirements: Asbestos. Regulations covering: identification of asbestos-containing materials; substitution with non-asbestos materials; worker training; exposure monitoring; containment and ventilation of work areas; work practices; decontamination; respirators and protective clothing.

Republic of South Africa, Department of Labour
(www.acts.co.za/ohs/index.htm - type 'asbestos' in search box)

- Occupational Health and Safety Act, 1993; Asbestos Regulations, 2001. Regulations covering: notification; assessment and control of exposure; Occupational Exposure Limit of 0.2 f/cc - 4 hr TWA measured by Phase Contrast Microscopy; training; air monitoring; medical surveillance; non-employee exposure; respirators, personal protective equipment and facilities; asbestos building materials including asbestos cement sheeting and related products; disposal.

12. HOW TO MANAGE AND CONTROL ASBESTOS IN THE WORKPLACE

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FOREWORD

This Code of Practice on how to manage and control asbestos in the workplace is an approved code of practice of the Work Health and Safety Act (the WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the Work Health and Safety Regulations (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

This Code of Practice has been developed by Safe Work Australia as a model code of practice under the Council of Australian Governments' Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety for adoption by the Commonwealth, state and territory governments.

SCOPE AND APPLICATION

This Code provides practical guidance for persons conducting a business or undertaking on how to manage risks associated with asbestos and asbestos containing material (ACM) at the workplace and thereby minimise the incidence of asbestos-related diseases such as mesothelioma, asbestosis and lung cancer.

This Code provides information on how to identify the presence of asbestos at the workplace and how to implement measures to eliminate or minimise the risk of exposure to airborne asbestos fibres.

In some cases, the most appropriate control measure determined may be to remove the asbestos. The Code of Practice: How to Safely Remove Asbestos provides further guidance for asbestos removalists so asbestos can be removed whilst eliminating, or where this is not possible, minimising the exposure of workers and other persons to airborne asbestos.

How to use this Code of Practice?

In providing guidance, the word 'should' is used in this Code to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

1. INTRODUCTION

1.1 What are the prohibitions on asbestos in the workplace?

A person conducting a business or undertaking must not carry out or direct or allow a worker to carry out work involving asbestos if that work involves manufacturing, supplying, transporting, storing, removing, using, installing, handling, treating, disposing of or disturbing asbestos or ACM, except in prescribed circumstances.

Note: The prohibition on the supply of asbestos also prohibits the sale of asbestos or ACM.

The final prohibition for asbestos in the workplace came into effect on 31 December 2003. These prohibitions do not apply if the work involving asbestos is any of the following:

- genuine research and analysis
- sampling and identification in accordance with the WHS Regulations
- maintenance of, or service work on, non-friable asbestos or ACM, fixed or installed before 31 December 2003, in accordance with the WHS Regulations
- removal or disposal of asbestos or ACM, including demolition, in accordance with the WHS Regulations
- transport and disposal of asbestos and asbestos waste in accordance with jurisdictional legislation
- demonstrations, education or practical training in relation to asbestos or ACM
- display, or preparation or maintenance for display, of an artefact or thing that is, or includes, asbestos or ACM
- management in accordance with the WHS Regulations of in-situ asbestos that was installed or fixed before 31 December 2003
- work that disturbs asbestos during mining operations that involve the extraction of or exploration for a mineral other than asbestos
- laundering asbestos-contaminated clothing in accordance with the WHS Regulations where the regulator approves the method adopted for managing risk associated with asbestos.

Work involving asbestos-contaminated soil is not prohibited as long as a competent person has determined the soil does not contain any visible ACM or friable asbestos. If friable asbestos is visible, it should not contain more than trace levels of asbestos determined in accordance with AS4964:2004 *Method for the qualitative identification of asbestos in bulk samples*.

The management of naturally occurring asbestos (NOA) that stays in its natural state is not prohibited if managed in accordance with an asbestos management plan.

Although the ultimate goal of this prohibition is for all workplaces to be free of asbestos, it is only when these materials are being replaced or where they present a health risk that non-asbestos alternatives must be used.

If asbestos or ACM is identified in a workplace and demolition or refurbishment work is going to be carried out, the asbestos or ACM must be removed if it is likely to be disturbed before the work starts. If other maintenance or service work is to be carried out at the workplace, removal of asbestos should be considered as a control measure.

Where removal is not reasonably practicable, other control measures must be implemented to minimise exposure, including encapsulation or sealing.

In addition to the prohibition, there is also a restriction on who can remove asbestos. Asbestos removalists and their workers must be competent to carry out asbestos removal work and, except in limited circumstances, must be licensed.

1.2 Who has duties to manage and control asbestos or ACM?

The WHS Act requires all persons who conduct a business or undertaking to ensure, so far as is reasonably practicable, that workers and other persons are not put at risk from work carried out as part of the business or undertaking. The WHS Regulations include specific obligations to manage and control asbestos and ACM at the workplace. These are summarized in the table below.

Duty holder	Responsibilities
Person conducting a business or undertaking (PCBU)	<p>Control risk of exposure</p> <p>must ensure, so far as is reasonably practicable, that exposure of person at the workplace to airborne asbestos is eliminated, except in an area that is enclosed to prevent the release of respirable asbestos fibres and if possible in closed area/rooms negative pressure is used. If this is not reasonably practicable, the exposure must be minimised so far as is reasonably practicable</p> <p>must ensure the exposure standard for asbestos is not exceeded at the workplace.</p> <p>Health monitoring</p> <p>must ensure health monitoring is provided to a worker who is carrying out licensed removal work, other ongoing asbestos removal work or asbestos-related work and there is risk of exposure when carrying out that work</p> <p>must ensure the health monitoring is carried out under the supervision of a registered medical practitioner and information as specified in the WHS Regulations is provided to that medical practitioner</p> <p>must pay all expenses for health monitoring, obtain report and keep records of all health monitoring.</p> <p>Training and use of equipment</p> <p>must ensure that information, training and instruction provided to a worker is suitable and adequate and that it is provided in a way that is readily understandable by any person to whom it is provided</p> <p>must ensure that, if a worker is either carrying out asbestos-related work or may be involved in asbestos removal work, they are trained in the identification and safe handling of asbestos and ACM and the suitable control measures</p>

Duty holder	Responsibilities
	<p>Controlling the use of equipment</p> <p>must not use, or direct or allow a worker to use, certain equipment on asbestos and ACM.</p> <p>Asbestos-related work</p> <p>must, if there is uncertainty as to whether work is asbestos-related work, assume asbestos is present or arrange for an analysis of a sample to be undertaken to determine if asbestos or ACM is present</p> <p>must give information to a person who is likely to be engaged to carry out asbestos-related work</p> <p>must ensure the asbestos-related work area is separated from other work areas at the workplace, signs are used to indicate where the asbestos-related work is being carried out and barricades are used to delineate the asbestos-related work area</p> <p>must ensure a competent person carries out air monitoring of the work area if there is uncertainty as to whether the exposure standard is likely to be exceeded</p> <p>must ensure that decontamination facilities (including containers and labels labelled in accordance with the <i>Globally Harmonised System</i>) are available when asbestos-related work is being carried out</p> <p>must ensure that asbestos waste is contained and labelled in accordance with the <i>Globally Harmonised System</i> before it is removed, and is disposed of as soon as practicable</p> <p>must ensure, where personal protective equipment (PPE) is used and contaminated with asbestos, such PPE is sealed, decontaminated, labelled and disposed. If this is not reasonably practicable, the PPE must be laundered. PPE that is not clothing and cannot be disposed of must be decontaminated and kept in a sealed container until it is reused for the purposes of asbestos-related work.</p>
PCBU with management or control of a workplace	<p>Identifying or assuming asbestos or ACM</p> <p>must ensure, so far as is reasonably practicable, that all asbestos or ACM at the workplace is identified by a competent person or assume its presence</p> <p>may identify asbestos or ACM by arranging a sample of the material to be analysed.</p> <p>Indicating presence and location</p> <p>must ensure the presence and location of asbestos or ACM identified (or assumed to be identified) at the workplace is clearly indicated (by a label if reasonably practicable).</p>

Duty holder	Responsibilities
	<p>Asbestos register</p> <p>must ensure an asbestos register is prepared, maintained, reviewed and kept at the workplace. It must be readily available to workers, their health and safety representatives and other persons</p> <p>must ensure, when management or control of the workplace is relinquished, a copy of the asbestos register is given to the person assuming management or control.</p> <p>Asbestos management plan</p> <p>must, where asbestos has been identified at the workplace, ensure an asbestos management plan is prepared, maintained and reviewed. It must be accessible to workers, their health and safety representatives and other persons.</p> <p>Naturally Occurring Asbestos (NOA)</p> <p>must manage the risks associated with NOA at the workplace and, where identified at the workplace or likely to be present, ensure that a written asbestos management plan is prepared, maintained and reviewed.</p> <p>Demolition and Refurbishment Work</p> <p>prior to demolition or refurbishment work starting, must review the asbestos register and ensure all asbestos that is likely to be disturbed is identified and removed so far as is reasonably practicable</p> <p>must provide a copy of the asbestos register to the person carrying out the demolition or refurbishment work before the work commences</p> <p>must, if an emergency occurs and a structure or plant is to be demolished, ensure that before the demolition occurs there is a procedure to reduce the risk of exposure to asbestos to below the exposure standard and notify the regulator about the emergency.</p>

Duty holder	Responsibilities
PCBU carrying out demolition or refurbishment work	<p>Demolition and Refurbishment Work</p> <p>must, prior to the demolition or refurbishment work being carried out: obtain a copy of the asbestos register for the workplace from the person with management or control before the work commences</p> <p>if an asbestos register is not available, ensure the structure or plant to be demolished or refurbished has been inspected by a competent person to determine if any asbestos or ACM is fixed to or installed (or assume it's presence)</p> <p>where asbestos is determined to be fixed to or installed, tell the occupier, owner (if at a domestic premises) or the person with management or control in any other case</p> <p>ensure asbestos at domestic premises that is likely to be disturbed by the demolition or refurbishment is identified and, if reasonably practicable, removed before the work starts</p> <p>if an emergency occurs at domestic premises where asbestos is identified (or assumed) and it must be demolished, ensure there is a procedure to reduce the risk of the exposure to asbestos to below the exposure standard and notify the regulator about the emergency.</p>

In some cases, there may be more than one person with management or control of a workplace. For example:

- a person with management of a workplace is a tenant
- a person with control of a workplace has the power to make decisions and changes to the structure and use of the workplace. This person will usually be the owner of the workplace or a representative of the owner and may:
 - own the workplace and engage workers to carry out work there
 - own the workplace but lease it to another person conducting a business or undertaking at the workplace
 - have management or control over the workplace, for example a property management group or agent.

1.3 The meaning of key terms

Airborne asbestos means any fibres of asbestos small enough to be made airborne. For the purposes of monitoring airborne asbestos fibres, only respirable fibres are counted.

Asbestos means the asbestiform varieties of mineral silicates belonging to the serpentine or amphibole groups of rock-forming minerals, including actinolite asbestos, grunerite (or amosite) asbestos (brown), anthophyllite asbestos, chrysotile asbestos (white), crocidolite asbestos (blue) and tremolite asbestos.

Asbestos containing material (ACM) means any material or thing that, as part of its design, contains asbestos.

Asbestos-contaminated dust or debris (ACD) means dust or debris that has settled within a workplace and is (or assumed to be) contaminated with asbestos.

Asbestos-related work means work involving asbestos.

Asbestos removalist means a person conducting a business or undertaking who carries out asbestos removal work.

Asbestos removal work means the work involving the removal of asbestos or ACM

Competent person means a person who has acquired, through training, qualification or experience, the knowledge and skills to carry out the task.

Exposure standard for asbestos is a respirable fibre level of 0.1 fibres/ml of air measured in a person's breathing zone and expressed as a time weighted average fibre concentration calculated over an eight-hour working day and measured over a minimum period of four hours in accordance with the Membrane Filter Method.

Friable asbestos means material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos.

GHS means Globally Harmonised System of Classification and Labelling of Chemicals.

In-situ asbestos means asbestos or ACM fixed or installed in a structure, equipment or plant but does not include naturally occurring asbestos.

NATA-accredited laboratory means a testing laboratory accredited by the National Association of Testing Authorities (NATA), or recognised by NATA either solely or with someone else.

Naturally occurring asbestos (NOA) means the natural geological occurrence of asbestos minerals found in association with geological deposits including rock, sediment or soil.

Non-friable asbestos means material containing asbestos that is not friable asbestos, including material containing asbestos fibres reinforced with a bonding compound.

Respirable asbestos means an asbestos fibre that: i) is less than 3 microns (μm) wide, ii) is more than 5 microns (μm) long, iii) has a length to width ratio of more than 3:1.

2. MANAGING RISKS ASSOCIATED WITH ASBESTOS AND ACM

2.1 What is involved in managing risks?

A person conducting a business or undertaking must ensure, so far as is reasonably practicable, exposure of a person at the workplace to airborne asbestos is eliminated. If this is not reasonably practicable, the exposure must be minimised so far as is reasonably practicable.

The exposure standard for asbestos must not be exceeded at the workplace.

Managing the risks associated with asbestos involves:

- identifying asbestos and ACM at the workplace and recording this in the asbestos register
- assessing the risk of exposure to airborne asbestos
- eliminating or minimising the risks by implementing control measures
- reviewing control measures to ensure they are effective.

When choosing the most appropriate control measure, the following hierarchy of controls must be considered:

- eliminating the risk (for example, removing the asbestos)
- substituting the risk, isolating the risk or applying engineering controls (for example, enclosing, encapsulation, sealing or using certain tools)
- using administrative controls (for example, safe work practices)
- using PPE.

A combination of these controls may be required in order to adequately manage and control asbestos or ACM.

Consulting your workers

The WHS Act requires the person conducting a business or undertaking to consult, so far as is reasonably practicable, with workers who carry out work who are (or are likely to be) directly affected by a work health and safety matter.

If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with workers and their health and safety representatives is a critical part of managing work health and safety risks.

Consulting with and involving workers in the identification and safe handling of asbestos can assist in ensuring that safety instructions and safe work practices are complied with.

Health and safety representatives must have access to relevant information on matters that can affect the health and safety of workers, for example asbestos exposure data and the asbestos register.

Consulting, cooperating and coordinating activities with other duty holders:

The WHS Act requires that persons conducting a business or undertaking consult, cooperate and coordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable.

2.2 Identifying if asbestos or ACM is at the workplace

This section does not apply to naturally occurring asbestos (NOA).

A person with management or control of a workplace must ensure asbestos or ACM at the workplace is identified by a competent person.

Identifying asbestos or ACM is the first step in managing the risk of exposure to asbestos in the workplace. As there may be more than one person in the workplace responsible for this duty, it is important that all duty holders consult, cooperate and coordinate with each other as well as consulting with workers and health and safety representatives, for example the person with control of the workplace may carry out the task of identifying asbestos with the person who has day-to-day management of the workplace to ensure it has been done accurately.

If the person with management or control of the workplace assumes that asbestos or ACM is present, or if they have reasonable grounds to believe that asbestos is not present, a competent person does not need to be engaged to make this decision.

Who can be a competent person?

A competent person to be someone who has acquired knowledge and skills to carry out the task through training, a qualification or experience. This may mean that the competent person who can identify asbestos is:

- trained to handle and take asbestos samples, have the knowledge and experience to identify suspected asbestos and be able to determine risk and controls measures
- familiar with building, construction practices and plant to determine where asbestos is likely to be present
- able to determine that material may be friable or non-friable asbestos and evaluate its condition.

There may be a person within the business that is competent to identify asbestos. If there is not, an external competent person should be engaged. Persons who may be considered to be competent in the identification of asbestos include:

- occupational hygienists who have experience with asbestos
- licensed asbestos assessors
- asbestos removal supervisors
- individuals who have a statement of attainment in the unit competency for asbestos assessors
- a person working for an organisation accredited by NATA under AS/NZS ISO/IEC 17020: 2000 *General criteria for the operation of various types of bodies performing inspection for surveying asbestos.*

Factors to consider when identifying asbestos

The person who is carrying out the task of identifying asbestos should have all relevant information so they can correctly identify where asbestos is located in the workplace. For example, obtaining information on the products used in making the building, structure or plant, including building/plant plans, design specifications, and correspondence with builders and plant manufacturers. Consulting Workers in the workplace may also be able to assist the person with this task.

There are a number of factors that may be taken into account to identify or assume that asbestos is present in a workplace. These include:

When was the building/plant constructed?	Asbestos was widely used as construction and insulation material in buildings/plants until the late 1980s when bans on its manufacture and use were put in place. However, the use of asbestos was only completely prohibited on 31 December 2003. As the bans were not absolute prior to 2003 and building and insulation materials may have been stockpiled, stored, or recycled and used, it is possible that asbestos may be present in buildings/plants that were constructed up to 31 December 2003 and possibly later.
Were there any refurbishments or additions to the building/plant prior to 31 December 2003?	Any refurbishment or extensions to the original building/plant prior to 1990 and potentially up to 31 December 2003 may have involved the use of asbestos. Even if the original parts of the building/plant did not contain asbestos, it should not be assumed that subsequent additions have no asbestos.
What type of material was used to construct the building/plant?	The main construction materials used are made from timber, brick, steel, concrete, thermal insulation and cement sheet. If thermal insulation and cement sheets are present and were installed up until 1990, it is likely to contain asbestos bonded to the insulation and cement particles. For example, a roof made from corrugated cement sheeting is likely to contain asbestos. Areas of buildings that are prone to wet conditions may contain asbestos in the walls and floors due to its hardness and waterproofing qualities compared to other materials. Steam piping, boiler and its auxiliaries were insulated which contains asbestos.

<p>Talk to designers, manufacturers or suppliers of plant, or refer to design plans</p>	<p>Asbestos may be present in specific parts of the plant in a workplace as it was used for insulations, in gasket and friction brake products. Despite a large reduction in its use, chrysotile asbestos was still being used in some specific applications until recent years, including rotary vane vacuum pumps and in gaskets for certain types of equipment. If there is plant that was designed, built and installed prior to 1 January 2004, the supplier, manufacturer or designer of the plant should be consulted to find out if asbestos is present and, if possible, obtain this advice in writing. If this is not possible, review the design plans and seek advice from an experienced engineer or plant designer. Quality assurance systems or checks should be in place to confirm whether asbestos is present.</p>
<p>Talk to workers who have worked at the workplace for a long time</p>	<p>Speaking with experienced workers will assist in the identification process as they may be aware of the history of the building/plant, including its age, construction, renovation or repairs, and may know where asbestos is located in the workplace.</p>
<p>Visually inspect the workplace to identify asbestos, ACM and inaccessible areas</p>	<p>A thorough inspection of all areas of the workplace must be conducted, including all buildings, structures, plant equipment's piping, boiler, etc.</p> <p>Material needs to be considered to contain asbestos unless proven otherwise if:</p> <ul style="list-style-type: none"> it cannot be identified there is uncertainty as to whether it contains asbestos it is inaccessible. <p>The design plans for a building, structure or plant may assist in identifying inaccessible areas, as would discussion with builders, architects, manufacturers of plant and maintenance workers. Knowledge of materials used in the construction of the building or experience and findings from inspections of similar sections of the building/plants may also assist.</p>
<p>Take notes and photographs</p>	<p>Taking notes and photographs while the inspection is being conducted can assist in producing the asbestos register.</p>

2.3 Assuming asbestos or ACM is present

This section does not apply to naturally occurring asbestos (NOA).

A person with management or control of a workplace must:

assume the material is asbestos or ACM if it cannot be identified but a competent person reasonably believes it is asbestos or ACM, and

assume asbestos is present if part of the workplace is inaccessible and it is likely to contain asbestos or ACM.

It is not necessary to engage a competent person to identify asbestos if the person with management or control of the workplace assumes that asbestos is present or if that person has reasonable grounds to believe that asbestos is not present.

If there is uncertainty as to whether asbestos is present in any part of a structure or plant, the person with management or control of the workplace can either assume asbestos is present and treat it with appropriate caution based on the level of risk or have a sample analysed. If it is assumed to be asbestos, it is considered to be asbestos for legal purposes. There is no need to take a sample for analysis and identification in all circumstances. This means the suspect material can remain undisturbed and the time and cost of sampling and analysis is avoided.

The person with management or control of a workplace can assume asbestos or ACM is not present as long as this assumption is based on reasonable grounds, which may include:

- a workplace is constructed post 1990 and there is no plant or equipment made prior to 2004
- pre-2004 buildings/plants where the building is constructed (including the roof) wholly of metal, brick or concrete, and has no internal walls that are made of fibro, gyprock or similar cladding, for instance a corrugated iron shed or a colourbond type warehouse building constructed of double brick with bare brick internally or nowhere insulation material is asbestos. Flooring (vinyl tiles), switchboards and under eaves lining should also be considered
- where a register indicates that all the identified and assumed asbestos has been removed.

Once the presence and location of asbestos has been assumed:

- all requirements for managing asbestos must be followed until the material is removed or testing has confirmed that it is not or does not contain asbestos
- the workplace asbestos register must include all the presumptions made about materials in the workplace with a simple, generic statement such as, 'Roof sheeting is presumed to contain asbestos' or 'All underground conduits are presumed to contain asbestos.' or 'all thermal insulation presume to contain asbestos'.

Inaccessible areas

If there are inaccessible areas in the workplace that a competent person has identified as likely to have asbestos or ACM, it must be assumed they contain asbestos until they are accessed and it is determined whether asbestos is present or not.

As a general rule, an inaccessible area is an area that cannot be accessed during normal daily activities or routine maintenance. The following areas are not regarded as 'inaccessible areas' and must be inspected or assumed to contain asbestos:

- locked rooms
- crawl spaces
- basement and cellars
- storage areas
- ceiling spaces
- fire doors
- locked security safes.

Accessing fire door and security safe cores to determine whether they contain asbestos may create a risk, for example drilling can result in the release of airborne asbestos. If this is the case, cores should not be accessed and must be assumed to contain asbestos until otherwise proven (for instance, during maintenance when access is obtained) or information is obtained from the supplier. Fire doors may have a compliance tag on the door jamb stating the fire rating and a compliance date. This can provide an indication of whether the door is likely to contain asbestos.

Examples of inaccessible areas that may contain asbestos or ACM are:

- a cavity in a building/cable openings filled material in plant that is completely (or almost completely) enclosed and suspected of containing asbestos (based on where asbestos is located elsewhere in the building) and access is only possible through destruction of part of the walls of the cavity
- the inner lining of an old boiler pressure vessel (information on this type of vessel suggests it contains asbestos) and the inner lining is not accessible due to the design and operation of the boiler and access can only be via partial destruction of the outer layer
- vinyl tiles that may contain asbestos, which have had a number of layers of non-ACM placed over them and secured, where the layers above it have been well secured and require some form of destruction in order to access the vinyl that may contain asbestos
- enclosed riser shafts in multi-storey buildings/plants containing cables that may be insulated with ACM
- air-conditioning ducts that may contain asbestos gaskets and linings.

2.4 Arranging a sample to identify asbestos

This section does not apply to NOA.

A person with management or control of a workplace may identify asbestos or ACM by arranging for a sample of material at the workplace to be analysed for the presence of asbestos or ACM.

A sample must only be analysed by:

a NATA-accredited laboratory accredited for the relevant test method

a laboratory approved by the regulator, or

a laboratory operated by the regulator.

It can be difficult to tell whether a material contains asbestos simply by looking at it, unless it is labelled. If a material has been imported from overseas, it may not be labelled as containing asbestos or it may only be labelled if the materials contain more than 10% asbestos. Therefore, a sample should be taken and analysed unless the decision was made to assume it is asbestos.

Only a competent person may take the samples for analysis because of the increased health risk of fibres being released during the process. If the sampling process is conducted incorrectly, it can be more hazardous than leaving the material alone. All asbestos samples must be analysed by a NATA-accredited laboratory or one that is approved or operated by the relevant regulator. Any sample taken should be sealed within a container, or a 200 µm polythene bag, and appropriately labelled.

Once the results of the sampling are known, the person with management or control of the workplace must ensure the asbestos register is updated indicate that the material is asbestos or is assumed to be.

If asbestos is stable, non-friable and will not be disturbed, it should be left alone. Only material that is damaged or will be disturbed should be sampled. If the material may contain asbestos and it is decided not to take samples, an assumption must be made that the material contains asbestos.

Appendix A provides a procedure that a competent person can follow when undertaking sampling.

2.5 Indicating the presence of asbestos in the workplace

This section does not apply to NOA.

A person with management or control of a workplace must ensure the presence and location of asbestos or ACM identified at the workplace is clearly indicated. If reasonably practicable, the asbestos or ACM must be indicated by a label.

All identified or assumed asbestos, including where the asbestos is inaccessible, must be clearly indicated. If it is reasonably practicable, labels must be used to identify the material as containing asbestos. However, signs may be more appropriate to use.

Examples of labels or signs that can be used to indicate the location or presence of asbestos or ACM are shown at Appendix B. These examples provide an indication of the words that may be used—these words are not mandatory.

Labels

If labels can be used, a competent person should determine the number and positions of the labels required. The location of labels should be consistent with the location listed in the asbestos register.

If a risk assessment suggests asbestos may be disturbed or people are likely to be exposed and it is not reasonably practicable to label asbestos directly, a prominent warning sign must be posted in its immediate vicinity. For example, if floor tiles have been identified as containing asbestos, an appropriate warning sign may be displayed on an adjacent wall.

Warning signs

All warning signs should comply with AS 1319 Safety Signs for the Occupational Environment.

Any areas of a workplace that contain asbestos, including plant, equipment and components, should be signposted with warning signs to ensure the asbestos is not unknowingly disturbed without the correct precautions being taken. These signs should be weatherproof, constructed of light-weight material and adequately secured. Signs should be placed at all the main entrances to the work areas where asbestos is present.

Where direct marking of asbestos is not possible, identifying the presence and location of asbestos to workers such as plumbers, electricians and carpenters before they commence work may be achieved by implementing a permit-to-work system. The presence and location of the asbestos should be entered on site plans and the asbestos register and be accessible to all workers to ensure they are aware of the presence of asbestos.

2.6 Assessing the Risk of Exposure

This section does not apply to NOA.

If asbestos or ACM is in good condition and left undisturbed, it is unlikely that airborne asbestos will be released into the air and the risk to health is extremely low. It is usually safer to leave it and review its condition over time. However, if the asbestos or ACM has deteriorated, has been disturbed, or if asbestos-contaminated dust is present, the likelihood that airborne asbestos will be released into the air is increased.

The type of material that binds asbestos fibres will influence the potential for airborne asbestos to be released into the air from different asbestos or ACM. For example, a loosely bound sprayed (or limpet) coating is more likely to release fibres when disturbed than asbestos cement in which fibres are firmly bound.

The following list ranks different types of asbestos according to the likelihood that airborne asbestos can be released into the air if it has deteriorated or been disturbed. The potential risk to health is greater for items higher up the list if people are exposed to airborne asbestos, but any of the materials listed can produce asbestos fibres if they are disturbed.

Higher likelihood of airborne fibres

- Asbestos-contaminated dust.
- Sprayed (limpet) coatings.
- Loose fill lagging and packings (not enclosed).
- Asbestos insulating board.
- Rope and gaskets.
- Millboard and paper.
- Asbestos cement.
- Floor tiles, mastic and roof felt.
- Decorative paints and plasters.

Lower likelihood of airborne fibres

When deciding if there is a risk to health from asbestos, consider whether the asbestos or ACM is:

- in poor condition
- likely to be further damaged or to deteriorate
- likely to be disturbed due to work practices carried out in the workplace (for example, routine and maintenance activities and their frequency)
- in an area where workers are exposed to the material.

A visual inspection of the material, its location and an understanding of the work practices at the workplace will assist this decision.

Asbestos-related work activities (including maintenance) plus unusual and infrequent activities (such as emergency activities) need to be considered. Also take into account the proximity of the asbestos or ACM to where employees work, as this can affect the potential for exposure if asbestos fibres become airborne.

The following are examples of activities that could pose a risk to health:

- Forklifts driving adjacent to asbestos cement (AC) sheet walls may damage these sheets from accidental impacts during the course of work.
- Maintenance work on a long pipe that does not have asbestos insulation where the work is being done may cause disturbance to asbestos-containing insulation on the pipe some metres away.
- Electricians wiring in a ceiling space sprayed with material containing friable asbestos may disturb this material.
- Acid fumes from an acid bath located next to an asbestos cement wall and below an asbestos cement roof may cause deterioration of the asbestos material over time.

3. ASBESTOS REGISTER

This chapter does not apply to domestic premises or NOA.

A person with management or control of a workplace must ensure an asbestos register is prepared and kept at the workplace. The asbestos register must be maintained, to ensure the information in the register is up-to-date.

Note: An asbestos register is not required to be prepared when:
the workplace is a building that was constructed after 31 December 2003, and
no asbestos has been identified at the workplace, and
no asbestos is likely to be present at the workplace from time to time.

3.1 What is an asbestos register?

The asbestos register is a document that lists all identified (or assumed) asbestos in a workplace. The asbestos register must:

- record any asbestos or ACM that has been identified or is likely to be present at the workplace from time to time. This would include:
- the date on which the asbestos or ACM was identified
- the location, type and condition of the asbestos; or
- state that no asbestos or ACM is identified at the workplace if the person knows that no asbestos or ACM is identified or is likely to be present from time to time at the workplace.

Appendix C provides a template of an asbestos register, while Appendix D provides an example of how it should be completed.

A comprehensive asbestos register may also include:

- details of any asbestos assumed to be in the workplace
- results of any analysis that confirms a material at the workplace is or is not asbestos
- dates when the identification was carried out
- details of inaccessible areas.

It may also be useful to attach photographs or drawings to visually show the location of the asbestos or ACM in the workplace.

What if an asbestos register already exists at the workplace?

If an asbestos register already exists at the workplace there is no need to create another one. The existing register can be reviewed and revised.

Persons conducting a business or undertaking who are carrying out or intend to carry out work at a workplace, should obtain the current asbestos register and identify any asbestos or ACM that they have management or control of (for example, asbestos in items of plant). The person with management or control of the workplace should be advised if any asbestos or ACM is identified and not included in the asbestos register for the workplace.

If workers consider that the work they are about to do will disturb asbestos, they should talk to the person with management and control of the workplace or their health and safety representative.

Where asbestos is only temporarily in the workplace?

In some cases it may not be necessary to include asbestos or ACM that is only temporarily present in the workplace. For example, if plant that contains asbestos is being repaired at the workplace but it is only there for a short period while being repaired, it does not need to be recorded in the asbestos register. However, if plant is often at the workplace (for example, where the company specialises in repairing plant that typically contains asbestos), it would be important to include this in the asbestos register. Note that where work involving asbestos is carried out, there are requirements to ensure the safety of the worker.

Where there is no asbestos register at the workplace?

An asbestos register is not required if a workplace has been constructed after 31 December 2003 or if no asbestos has been identified.

If there is no asbestos register at the workplace but asbestos is identified during the course of any work being carried out, the person with management or control of the workplace should be advised who must then identify it (or ensure a competent person identifies it) and prepare a register.

3.2 Reviewing and revising an asbestos register

A person with management or control of a workplace must ensure an asbestos register is reviewed and where necessary revised by a competent person if:

- the asbestos management plan is reviewed
- further asbestos or ACM is identified at the workplace, or
- asbestos is removed from or disturbed, sealed or enclosed at the workplace.

The register should be reviewed at least once every five years to ensure it is kept up-to-date.

When reviewing the asbestos register, the person should carry out a visual inspection of the asbestos and ACM listed to determine its condition and revise the asbestos register as appropriate. Previous asbestos registers and records relating to asbestos removal jobs, for instance clearance certificates, can assist in identifying all asbestos and ACM in the workplace.

3.3 Accessing an asbestos register

The person with management or control of the workplace must ensure the asbestos register is readily accessible to:

- a worker who has carried out, carries out or intends to carry out work at the workplace
- health and safety representatives who represent workers that carry out or intend to carry out work at the workplace
- a person conducting a business or undertaking who has carried out, carries out or intends to carry out work at the workplace, and
- a person conducting a business or undertaking who has required, requires or intends to require work to be carried out at the workplace.

Where work is being carried out or is about to be carried out at the workplace by a person conducting a business or undertaking and that work involves a risk of exposure to airborne asbestos, the person with management or control of the workplace must provide a copy of the asbestos register to that person.

A copy of the asbestos register should be kept at the workplace to ensure it is accessible.

3.4 Transferring an asbestos register

If the person with management or control of a workplace plans to relinquish management or control (for instance, selling the workplace or the business or undertaking), they must ensure, so far as is reasonably practicable, that a copy of the asbestos register is given to the person who is assuming management or control of the workplace.

4. ASBESTOS MANAGEMENT PLAN

A person with management or control of a workplace must ensure a written asbestos management plan is prepared for the workplace if asbestos or ACM has been identified or assumed present, or is likely to be present from time to time at the workplace.

The asbestos management plan must be maintained to ensure the information is up-to-date.

4.1 What is an asbestos management plan?

An asbestos management plan sets out how asbestos or ACM that is identified at the workplace will be managed, for example what, when and how it is going to be done.

An asbestos management plan must include:

- the identification of asbestos and ACM, for example a reference or link to the asbestos register for the workplace, and the locations of signs and labels
- decisions, and reasons for the decisions, about the management of asbestos at the workplace, for example safe work procedures and control measures
- procedures for detailing accidents, incidents or emergencies of asbestos at the workplace
- workers carrying out work involving asbestos, for example consultation, information and training responsibilities.
- Other information that may be included in the asbestos management plan is:
 - an outline of how asbestos risks will be controlled, including consideration of appropriate control measures
 - a timetable for managing risks of exposure, for example priorities and dates for any reviews, circumstances and activities that could affect the timing of action
 - identification of each person with responsibilities under the asbestos management plan and the person's responsibilities
 - procedures, including a timetable for reviewing and, if necessary, revising the asbestos management plan and asbestos register
 - air monitoring procedures at the workplace, if required.

4.2 Reviewing an asbestos management plan

The person with management or control of the workplace must ensure the asbestos management plan is reviewed and, if necessary, revised at least once every five years or when:

there is a review of the asbestos register or a control measure

asbestos is removed from or disturbed, sealed or enclosed at the workplace

the plan is no longer adequate for managing asbestos or ACM at the workplace

a health and safety representative requests a review if they reasonably believe that any of the matters listed in the above points affects or may affect the health and safety of a member of their work group and the asbestos management plan was not adequately reviewed.

4.3 Accessing an asbestos management plan

Plan is readily accessible to:

a worker who has carried out, carries out or intends to carry out work at the workplace
health and safety representatives who represent workers that carry out or intend to carry out work at the workplace

a person conducting a business or undertaking who has carried out, carries out or intends to carry out work at the workplace, and

a person conducting a business or undertaking who has required, requires or intends to require work to be carried out at the workplace.

The asbestos management plan should be kept at the workplace to ensure it is accessible.

5. MANAGING OTHER ASBESTOS-RELATED RISKS

5.1 Contaminated sites

Sites contaminated with asbestos become a workplace when work is carried out there. The WHS Regulations require that, where asbestos is identified as contaminating a workplace, a register and asbestos management plan be created for the site.

The management and remediation of sites contaminated with asbestos from illegal dumping and demolition is a specialised task. In some instances, site remediation may entail removal of asbestos and ACM from the site; in other cases this may not be practicable, and other management strategies should be used. Engaging specialists who may include asbestos removalists is highly recommended for all but the most minor of non-friable contaminations.

The Assessment of Site Contamination National Environmental Protection Measure (NEPM) sets out the general principles for assessment and remediation of sites contaminated with a number of hazardous materials including asbestos. It is recommended that a person conducting a business or undertaking who has a workplace that is, or is suspected of being, contaminated with asbestos should engage specialists in accordance with the competencies found in the NEPM.

5.2 Demolition and refurbishment work

This section applies to the demolition or refurbishment of a structure or plant constructed or installed before 31 December 2003.

Prior to any demolition or refurbishment work being carried out, a person with management and control of a workplace must:

review the asbestos register

provide a copy of the asbestos register to the person carrying out the demolition or refurbishment work, and

ensure asbestos that is likely to be disturbed is identified and, so far as is reasonably practicable, removed.

The person conducting a business or undertaking who will carry out demolition or refurbishment at a workplace must obtain a copy of the asbestos register before they commence the work.

Examples of demolition may include:

- complete dismantling of a decommissioned industrial plant
- total destruction of a building or part of a building
- total destruction of an old boiler for the purpose of disposal.

Examples of refurbishment may include the partial dismantling of:

- a boiler for the purpose of cleaning and repairing
- large plant in order to access and remove asbestos-containing gaskets for the purpose of replacement with non-asbestos-containing gaskets
- a building by removing sections of an asbestos cement roof
- part of a building for the purpose of renovation.

Demolition and refurbishment work does not include minor routine maintenance work, or other minor work.

- Minor maintenance work includes routine work that is small scale, often short in duration and may be unscheduled. This work may require the partial dismantling of a structure or plant and may include the removal of asbestos or ACM such as gaskets or brake components, for example a piece of plant to remove an asbestos-containing gasket, a passenger lift or press machine to remove an asbestos-containing brake component, or a piece of plant for the purpose of cleaning or repair.
- Minor work includes small tasks that are of short duration, such as cutting a small hole or hand-drilling up to a few holes in an AC sheet. It is not routine or regular such as planned maintenance. It is incidental work that can be done quickly and safely within minimal control measures required to ensure safety. Examples include cutting a small hole into an asbestos-containing eave to install a cable, removal of an asbestos-containing vinyl tile to install a plumbing fixture, or hand-drilling a few holes into an AC sheet to attach a fitting.

Reviewing the asbestos register

When reviewing the asbestos register, the person with management or control of the workplace or plant should consider the following questions:

- Where is the asbestos located in relation to the proposed demolition or refurbishment?
- Are there any inaccessible areas that are likely to contain asbestos and that will be disturbed as a result of the demolition or refurbishment?
- What is the type and condition of the asbestos?
- What is the quantity of asbestos?
- What is the method of demolition or refurbishment and how will it affect the ACM?
- If the asbestos will be disturbed during the demolition or refurbishment, can it be removed safely before work commences and how can this be done?

What to do if the asbestos register indicates that asbestos is present

If the asbestos register identifies that asbestos or ACM is present, the person with management or control of the workplace must ensure all asbestos likely to be disturbed is identified and removed, so far as is reasonably practicable, before the demolition or refurbishment work starts.

The WHS Regulations allow for the demolition of part of a structure or plant in order to access in-situ asbestos so it can be removed. For example, part of a wall may be demolished to access asbestos located in the wall cavity so it can be removed prior to further demolition.

For demolition work, if an emergency occurs, the person with management or control of the workplace must ensure a procedure is developed before the demolition work starts. The procedure must outline how to minimise the risk of exposure of workers and persons in the vicinity of the demolition site and ensure the exposure standard is not exceeded, so far as is reasonably practicable. The person must also provide the regulator with written notice of the emergency immediately after they become aware of the emergency and before the demolition starts.

Note: An emergency can occur if a building, structure or plant is structurally unsound or a collapse of the building, structure or plant is imminent.

If there is no asbestos register at the workplace

If there is no register for the workplace, the person who is carrying out the demolition or refurbishment work must not carry out the work until a competent person determines whether asbestos or ACM is fixed to or installed in the structure or plant.

If a competent person has reasonable grounds to be uncertain as to whether or not asbestos is present, before commencing demolition or refurbishment work the person carrying out the work must assume it is present. If it is determined or assumed to be present, the person carrying out the work must inform the occupier or owner (if it is domestic premises) or the person with management or control in any other case.

Demolition – Once the person with management or control of the workplace or plant has been notified that asbestos is present and demolition work is to occur, they must decide whether the asbestos is likely to be disturbed by the work. If it is likely to be disturbed they must ensure, so far as is reasonably practicable, that the asbestos is removed before the work commences.

Refurbishment – Once the person with management or control of the workplace or plant has been notified that asbestos is present and refurbishment work is to occur, they must decide whether the asbestos is likely to be disturbed by the work. If it is likely to be disturbed they must ensure, so far as is reasonably practicable, that the asbestos is removed. Where reasonably practicable, asbestos should be removed prior to refurbishment, renovation or maintenance rather than implementing other control measures, such as enclosure or sealing.

5.3 Asbestos-related work

While work with asbestos is generally prohibited, the WHS Regulations allow work to occur on asbestos in certain circumstances: this is referred to as asbestos-related work.

Under the WHS Regulations, asbestos-related work includes:

- genuine research and analysis
- sampling and identification in accordance with the WHS Regulations
- maintenance of, or service work on, non-friable asbestos or ACM, fixed or installed before 31 December 2003, in accordance with the WHS Regulations
- the transport and disposal of asbestos and asbestos waste in accordance with jurisdictional legislation
- demonstrations, education or practical training in relation to asbestos or ACM
- display, or preparation or maintenance for display, of an artefact or thing that is, or includes, asbestos or ACM
- management in accordance with the WHS Regulations of in-situ asbestos that was installed or fixed before 31 December 2003
- work that disturbs asbestos during mining operations that involve the extraction of or exploration for a mineral other than asbestos
- laundering asbestos-contaminated clothing in accordance with the WHS Regulations
- where the regulator approves the method adopted for managing risks associated with asbestos
- soil that a competent person has determined:
 - does not contain any visible asbestos
 - does not contain more than trace levels of asbestos determined in accordance with AS 4964:2004 *Method for the qualitative identification of asbestos in bulk samples*

NOA managed in accordance with an asbestos management plan.

When undertaking asbestos-related work activities, the WHS Regulations require that it only be performed in accordance with the following requirements:

- any worker undertaking asbestos-related work must be informed of the health risks of exposure to asbestos and that they will need to undergo health monitoring. Further information can be found in *Guidance: Health Monitoring [under development]*
- a competent person carries out air monitoring of the work area where asbestos-related work is being carried out if there is uncertainty as to whether the exposure standard is likely to be exceeded
- any asbestos that may be encountered by workers undertaking asbestos-related work must be identified, and if it is not possible to identify, it must be assumed asbestos is present
- the area in which asbestos-related work is undertaken is separate from the rest of the workplace, so far as is possible
- the asbestos work area must be signed and barricaded to ensure that other workers do not enter the area
- facilities must be provided to allow for the decontamination of workers, equipment and the items worked upon
- anything removed from the work area must be decontaminated before it is removed from the work area
- if material contaminated with asbestos is to be removed from the work area, it must be sealed within a container, which is decontaminated and labelled to indicate the presence of the asbestos and disposed of at a licensed disposal facility as soon as is practicable
- if personal protective equipment used in asbestos-related work is to be removed from the work area for disposal, it also must be sealed within a container, which is decontaminated and labelled to indicate the presence of the asbestos in accordance with the WHS Regulations and disposed of at a licensed waste facility as soon as reasonably practicable.

Managing risks associated with asbestos-related work

If there is uncertainty as to whether asbestos is present or used in a certain activity at the workplace, the person with management or control of the workplace must assume asbestos is present and treat the activity as asbestos-related work or arrange for a sample to be analysed to determine if asbestos is present.

If asbestos is identified or assumed to be present, it is essential that the asbestos register be obtained and a decision made as to whether work can be done without disturbing the asbestos, for example:

- instead of drilling a hole through an asbestos-contaminated sheeting wall to install electrical wiring, the wiring might be able to be routed over the wall
- if a ventilation flue or pipe has to be installed in an asbestos-contaminated ceiling or roof, an alternative option may be to run the flue or pipe through a non-asbestos wall.

It is also essential to ensure all people carrying out the work have the appropriate training, PPE including clothing, decontamination materials, labels and signs ready at the workplace before any work commences that may disturb the asbestos and to minimise the number of people in the area. For example:

Consultation and training – Consultation with a person who may be affected by any maintenance and service work that might disturb asbestos should occur. People performing the work must receive all necessary training and access to the asbestos register, and the work should be documented and supervised

Access to asbestos work area – The asbestos work area should be isolated and access restricted to only those people carrying out the asbestos work. Barriers and warning signs should be used

PPE – PPE needs to be selected to prevent the contamination of clothing and provide adequate respiratory protection

Replacing asbestos – Under the asbestos prohibition, wherever an asbestos component requires replacement the replacement product must be non-asbestos. It is illegal to reinstall or reuse any asbestos. Where an access hatch or panel that contains non-friable asbestos in good condition is moved in order to gain access, it may be replaced into its original position without modification

Disposing of asbestos – All asbestos must be disposed of correctly. Single-use PPE used during maintenance and service work must also be disposed of. The Code of Practice: How to Safely Remove Asbestos provides further information on disposing of asbestos.

Before commencing any asbestos-related work, plastic sheeting may need to be placed on the floor and any other surfaces that may become contaminated with asbestos dust. At a minimum, heavy-duty 200 µm (micron) thick plastic sheeting should be used for this purpose.

Control measures for asbestos-related work

Whatever the control method used, it should be effective in making all maintenance workers aware of the presence of asbestos and preventing any work activity that might expose them, or others nearby, to airborne asbestos. Particular attention should be paid to controlling work activities that affect inaccessible areas listed in the asbestos register, such as wall cavities, cable entries and ceiling spaces.

Control measures include the following:

- Eliminate the risk by not conducting the work.
- Minimise the risk by using either an isolation control, engineering control or a combination of these.
 1. An example of isolation by barrier is applying a small amount of substance, such as silicon or paste, to the surface of an asbestos cement sheet where a hole will be drilled. When the drill bit is drilled through the paste into the sheet and is removed, any loose fibres are collected in the paste, preventing them from becoming airborne. After drilling, the paste can be wiped clean with a rag and disposed of as asbestos waste.
 2. An example of isolation by distance is used in the automotive industry for the removal of asbestos-containing brake mechanisms from vehicles. A designated area in the workshop is isolated by distance from other work areas. Signs and barriers are used to communicate that access to the area is restricted during the activity. The activity also requires safe work procedures but the isolation control ensures that other workers are not at risk due to their distance from the activity. All workers must be provided with instruction and training so they understand the reason for the control measure and the relevant procedures.
 3. An example of engineering control is the use of a mini-enclosure to isolate the source of asbestos fibres combined with the use of extraction to capture and remove airborne fibres from the air in the work environment. This approach could be used for the task of removing and replacing the lock mechanisms from an asbestos-containing fire door. A purpose-built adjustable perspex box is fitted to the door surrounding the lock and handles on both sides of the door. Adjustments can be made to ensure a secure fit to the door and tape used to seal any possible gaps between the enclosure and the door. The box has access points for the operator's arms to enable work to be done on the lock, as well as an entry point for a vacuum hose. The vacuum can create a negative pressure inside the enclosure to prevent fibres from escaping and can also be held directly at the source to capture any fibres that become airborne as the lock is removed from the door. At completion of the task, the vacuum is used to clean and decontaminate the enclosure as well as the operator's arms (before removing them).

If the risk is still present and attempts have been made to minimise the risk to health, so far as is reasonably practicable, through elimination, isolation and engineering controls, administrative controls can be implemented.

Administrative controls are systems of work or work procedures designed to eliminate or minimise risk. These controls are lower order controls that cannot be relied upon to be as effective as the higher order controls such as elimination, isolation and engineering. This is because administrative controls are systems or procedures that rely on human behaviour to be effective and can easily fail. Administrative control measures must be understood, implemented and maintained. This requires training, information and supervision for workers but the control measure can still fail if procedures are not followed or understood.

For some activities, administrative controls are the only practicable controls that can be implemented. An example of an administrative control for asbestos-related work is a procedure for collecting samples of ACM for the purpose of analysis. Collecting the samples may involve breaking or dislodging ACM, which can lead to the release of airborne asbestos fibres and consequently a risk to health.

A safe work procedure for this task would include actions such as:

- isolating the area where the sample is to be collected
- assessing if the area is safe to enter
- minimising dust
- wearing suitable personal protective equipment
- sealing the samples, and storing and transporting them in a safe, secure manner

For the administrative control measure to be effective and reduce risk, the person conducting the sampling must understand the risk and implement all of the procedure. If the procedure is not followed, the health of the person conducting the sampling and others in the workplace may be at risk.

If a risk to health still remains after the higher order control measures have been implemented, PPE must be used to supplement higher order controls.

Although PPE can be effective in controlling the risk from airborne asbestos fibres, the successful implementation and maintenance of this control measure requires further action and resources, including:

- the correct selection of appropriate PPE, including respirator, cartridge and coveralls
- the issuing of PPE to each individual
- training and supervision – all employees who are required to conduct asbestos-related activities and wear PPE must be given adequate training and supervision to enable them to fit and use the equipment correctly and conduct the task in a safe manner
- maintenance of PPE – non-disposable respirators must be checked before and after use to ensure the components are in good working order and are not damaged
- employee compliance and support for the system – it is essential that employees use PPE when it is required. An understanding of the risk to health from asbestos, the higher order control measures already in place and the need to use PPE to further reduce the risk to health all contribute to employees' willingness to use PPE.

6. MANAGING EXPOSURE TO ASBESTOS OR ACM

6.1 Measuring the exposure standard

Airborne respirable fibre concentrations can be estimated using available data (for example, monitoring reports, data from scientific literature) or past experience (for example, monitoring reports) of the process in question. In cases of doubt, it may be necessary to confirm the estimates by measurement using the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres [NOHSC: 3003 (2005)].

Exposure monitoring measures the levels of respirable fibres in the breathing zone of the worker while work is being undertaken. Exposure monitoring must be carried out by a competent person, who may include a licensed asbestos assessor or a person who has undertaken the endorsed unit of competency for licensed asbestos assessors. An occupational hygienist who has experience in asbestos exposure monitoring may also be used.

Where exposure monitoring is carried out, it is good practice to stop work and investigate the cause if the level of airborne asbestos in the breathing zone reaches half the exposure standard.

Although the need for exposure air monitoring will depend on the particular circumstances, the results may assist in assessing risks associated with asbestos.

- control monitoring for ensuring that an enclosure or other controls used during asbestos removal are effective at preventing fibres from being found outside the work area
- clearance monitoring to ensure that the work area is free of asbestos fibres prior to being certified for reoccupation.

6.2 Health monitoring

A person conducting a business or undertaking must ensure health monitoring is provided to a worker if they are carrying out licensed asbestos removal work, other ongoing asbestos removal work or asbestos-related work and are at risk of exposure to asbestos when carrying out the work.

Health monitoring includes a medical examination to provide an initial baseline medical assessment. Health monitoring must include the following (unless another form of health monitoring is recommended by a registered medical practitioner):

- consideration of the worker's demographic, medical and occupational history
- consideration of records of the worker's personal exposure
- a physical examination of the worker with emphasis on the respiratory system, including standardised respiratory function tests unless another form of health monitoring is recommended by a registered medical practitioner.

Workers must be informed of any health monitoring requirements before the worker carries out work that may expose them to asbestos.

When should health monitoring occur?

Where a worker is at risk of exposure to asbestos due to work other than licensed asbestos removal, health monitoring must also be undertaken. Examples of work where there is a risk of exposure include ongoing unlicensed removal work, undertaking maintenance work on ACM regularly as part of another job (for instance, electricians or building maintenance staff in older buildings) and carrying out asbestos-related work. The need for health monitoring for these workers should be determined on the basis of:

- the potential for exposure
- the frequency of potential exposure
- the duration of the work being undertaken.

If a worker is carrying out licensed asbestos removal work, the health monitoring must be conducted prior to the worker commencing the work. Health monitoring should also be provided to the worker at regular intervals after commencing the asbestos-related work but at least once every two years.

Who can carry out health monitoring?

Health monitoring must be carried out under the supervision of a registered medical practitioner with the relevant competencies. Prior to deciding who the registered medical practitioner will be, the person conducting a business or undertaking must consult the worker.

Who pays for health monitoring?

The person conducting a business or undertaking must pay all expenses relating to health monitoring.

Where there are two or more persons that have a duty to provide health monitoring to a worker, they may choose that one person organises health monitoring (known as the person who commissions the health monitoring), however the costs must be shared equally between each person unless they agree otherwise.

What information must be provided to the registered medical practitioner?

The person who commissions health monitoring must provide the following information to the registered medical practitioner:

- their name and address
- the name and date of birth of the worker
- a description of the work the worker is, or will be, carrying out that has triggered the requirement for health monitoring
- whether the worker has started the work or, if the worker has commenced carrying out the work, how long this has been for.

Health monitoring report

A person who commissions health monitoring must take all reasonable steps to obtain a report from the registered medical practitioner as soon as practicable after the monitoring is carried out.

The health monitoring report must include the following information:

- the name and date of birth of the worker
- the name and registration number of the registered medical practitioner
- the name and address of the person conducting the business or undertaking who commissioned the health monitoring
- the date of the health monitoring
- any advice that test results indicate the worker may have contracted a disease, injury or illness as a result of carrying out the work that triggered the need for health monitoring
- any recommended remedial measures, including whether the worker can continue to carry out the work

Whether medical counselling is required for the worker. That person must also give a copy of the report, as soon as reasonably possible after obtaining it from the medical practitioner, to:

- the worker

- the regulator, if the report contains:
- any test results that indicate the worker may have contracted a disease, injury or illness as a result of the work that triggered the need for health monitoring
- any recommended remedial measures, including whether the worker can continue to carry out the work
- all other persons conducting a business or undertaking who have a duty to provide health monitoring for that worker.

Reports must be kept as a confidential record for at least 40 years after the record is made and identified as a formal record for the particular worker. The report and results must not be disclosed to anyone unless the worker has provided their written consent. However, if the person was releasing the record under a duty of professional confidentiality, the worker's written consent is not required.

6.3 Training workers about asbestos or ACM

A person conducting a business or undertaking must ensure that information, training and instruction provided to a worker is suitable and adequate, having regard to:

the nature of the work carried out by the worker

the nature of the risks associated with the work at the time the information, training or instruction is provided, and

the control measures implemented.

The person must, so far as is reasonably practicable, ensure the information, training and instruction is provided in a way that is readily understandable by any person to whom it is provided.

A person conducting a business or undertaking must ensure workers who they reasonably believe may be involved in asbestos removal work in the workplace or the carrying out of asbestos-related work are trained in the identification, safe handling and suitable control measures for asbestos and ACM.

This training may include the following topics:

- purpose of the training
- health risks of asbestos
- types, uses and likely presence of asbestos in the workplace
- persons conducting a business or undertaking and the worker's roles and responsibilities under the asbestos management plan

Where the asbestos register is located, how it can be accessed and how to understand the information contained in it,

- processes and safe work procedures to be followed to prevent exposure, including exposure from any accidental release of airborne asbestos
- where applicable, the correct use of PPE including respiratory protective equipment (RPE)
- the implementation of control measures and safe work methods to eliminate or minimise the risks associated with asbestos to limit the exposure to workers and other persons
- exposure standard and control levels for asbestos
- purpose of any exposure monitoring or health monitoring that may occur.

This training is more general than the training that a worker undertaking asbestos removal work would receive. Workers who are undertaking licensed asbestos removal work are required to complete specific units of competency. Further information on these specific training requirements is available in the *Code of Practice: How to Safely Remove Asbestos*.

Records of all training must be kept while the worker is carrying out the work and for five years after the day the worker stops carrying out the work. These records must also be available for inspection by the regulator.

6.4 Limited use of equipment

A person conducting a business or undertaking must not use, or direct or allow a worker to use, specific equipment on asbestos or ACM unless the use of the equipment is controlled.

High-pressure water spray and compressed air must not be used on asbestos or ACM. However, high-pressure water spray can be used for firefighting or fire protection. Power tools, brooms and any other equipment or tool that may release airborne asbestos in the workplace may only be used if it is controlled by it being:

- enclosed
- designed to capture or suppress airborne asbestos
- used in a way that is designed to capture or suppress airborne asbestos safely.

A combination of the controls mentioned above may be required to ensure that airborne asbestos is not generated.

Refer to Section 7.2 of this Code for further information on tools and equipment.

7. CONTROLLING THE RISKS

As mentioned in Chapter 3 of this Code, to eliminate risk of exposure, or if this is not reasonably practicable, minimising them so far as is reasonably practicable, a risk management process should be followed that involves identifying whether asbestos or ACM is at a workplace and including them in the asbestos register, assessing the risk of exposure and then implementing appropriate control measures.

When choosing the most appropriate control measure, the following hierarchy of controls must be considered:

- eliminating the risk (for example, removing the asbestos)
- substituting for the risk, isolating the risk or applying engineering controls (for example, enclosing, encapsulation, sealing or using certain tools)
- using administrative controls (for example, safe work practices)
- using PPE.

A combination of these controls may be required in order to adequately manage and control asbestos or ACM.

7.1 Removing asbestos

The ultimate goal is to have a workplace free from asbestos. Removal may be the most appropriate way to achieve this. For example:

Friable asbestos – If asbestos is friable and it has been determined that it should be removed, it must be removed by a Class A licensed removalist as soon as reasonably practicable. Instances where removal should be of the highest priority would include friable asbestos that is in poor condition and is located in an area where it poses a significant risk of exposure.

Non-friable asbestos – If asbestos is non-friable, is more than 10 m² and has been determined that it should be removed, it must be removed by a licensed asbestos removalist as soon as reasonably practicable. Where it is not reasonably practicable to remove it, control measures must be put in place to eliminate any exposure, so far as is reasonably practicable, or to minimise exposure so far as is reasonably practicable, but always ensuring the exposure standard is not exceeded.

Specific instances where removal may be the best control measure include:

- asbestos lagging on pipes
- asbestos in plant
- asbestos-contaminated dust (ACD)
- loose fibre insulation
- cracked or damaged fibreboard containing asbestos.

The Code of Practice: How to Safely Remove Asbestos provides detailed guidance on appropriate work methods and additional controls for the removal of asbestos.

If it is not reasonably practicable to remove asbestos, then other control measures must be implemented to ensure people are not exposed to airborne asbestos, including either enclosing or sealing the asbestos.

7.2 Tools and equipment

As mentioned in Section 6.4 of this Code, certain equipment must not be used on asbestos. It is therefore important to select the correct equipment to minimise the generation of airborne asbestos.

Manually operated (non-powered) hand tools should be used wherever possible. If they will not provide sufficient physical force to perform the required operation, low-speed, battery-powered tools that are able to be used in conjunction with wet methods for dust control are preferred.

Battery-powered tools should be fitted with a Local Exhaust Ventilation (LEV) dust control hood wherever possible. If an LEV dust control hood cannot be attached and other dust control methods—including pastes and gels—are unsuitable, then shadow vacuuming techniques should be used.

Where power tools with dust suppression/extraction are used, exposure monitoring should be carried out to ensure the controls used are effective in reducing the generation of fibres. It is good practice to ensure that the levels of airborne fibres do not exceed one half of the exposure standard (0.1 fibres/ml). If more than half the exposure standard is exceeded, work should be stopped and improvements made to the controls being used.

The use of high-pressure water and compressed air is prohibited under the WHS Regulations as they can cause asbestos to become friable.

Asbestos vacuum cleaners

Asbestos vacuum cleaners should comply with the requirements in AS/NZS 60335.2.69:2003 *Household and similar electrical: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use* (IEC 60335-2-69 Ed 3.2 MOD).

Household vacuum cleaners must never be used where asbestos is or may be present, even if they have a HEPA filter.

7.3 Safe work practices

It is important that safe work practices are in place when carrying out asbestos work or asbestos-related work. Wherever possible, dry asbestos should not be worked on. Techniques that prevent or minimise the generation of airborne asbestos fibres include:

- the wetting of asbestos using surfactants or wetting agents, such as detergent water
- the use of thickened substances, pastes and gels, including hair gel and shaving cream, to cover the surfaces of asbestos being worked on (these substances should be compatible with the conditions of use, including the temperature, and should not pose a risk to health)
- performing the task in a controlled environment

When selecting the best technique, the work should first be assessed for any electrical hazards that might result from the use of water or other liquids. If an electrical hazard exists, primary consideration should be given to removing the asbestos, rather than relying on dry work methods.

If asbestos-related work or maintenance or service tasks are assessed by a competent person as involving similar levels of risk, they too may be performed only after the risks for that task have been assessed and appropriate control measures implemented.

The use of high-speed abrasive power and pneumatic tools, including angle grinders, sanders and saws, and high-speed drills, is prohibited under the WHS Regulations, except where used with dust suppression/extraction controls. These controls include local exhaust ventilation (LEV) dust control hoods that attach to the tool and isolate the area being worked on (drilled, sanded etc.) from the environment, ensuring that the dust is captured.

7.4 Personal protective equipment

PPE will need to be used, in combination with other effective control measures, when working with asbestos. The selection and use of PPE should be based on a risk assessment.

The ease of decontamination should be one of the factors considered when choosing PPE.

For PPE that is not clothing and cannot be disposed of, it must be decontaminated and kept in a sealed container until it is reused for the purposes of asbestos-related work.

Coveralls

- Protective clothing should be made from material capable of providing adequate protection against fibre penetration.
- When selecting protective clothing, other hazards—including heat stress, fire and electrical hazards—should also be considered.
- Disposable coveralls with fitted hoods and cuffs should be worn. Coveralls with open pockets and/or velcro fastenings should not be used, because these features can be contaminated and are difficult to decontaminate. Fitted hoods should always be worn over the straps of respirators and loose cuffs should be sealed with tape. Disposable coveralls rated type 5, category 3 (prEN ISO 13982–1) or equivalent would meet this standard.
- Asbestos fibres must be prevented from being transported outside the workplace by thoroughly vacuuming asbestos fibres from work clothes using an asbestos vacuum cleaner or, depending on the level of contamination and risk, the use of a water spray bottle or damp cloths may be appropriate.
- Disposable coveralls need to be of a suitable standard to prevent penetration of asbestos fibres so far as is practicable. Disposable coveralls rated type 5, category 3 (prEN ISO 13982-1) or the equivalent would meet this standard.
- Non-disposable coveralls are not recommended and would require specialist laundering if used.
- Any clothing worn under coveralls must be disposed of or suitably bagged for laundering as asbestos-contaminated clothing.

Footwear and gloves

- Laced boots should be avoided as they can be difficult to clean and asbestos dust can gather in the laces and eyelets. Laceless boots such as gumboots are preferred where practicable. If boot covers are worn, they should be of a type that has anti-slip soles to reduce the risk of slipping.
- Safety footwear must be decontaminated before being removed from the asbestos work area or sealed in double bags, the exterior of which is decontaminated, for use only on the next asbestos maintenance task. Alternatively, work boots that cannot be effectively decontaminated should be disposed of as asbestos waste at the end of the work.
- The use of protective gloves should be determined by a risk assessment. If significant amounts of asbestos fibres may be present, disposable gloves should be worn. Protective gloves can be unsuitable if dexterity is required. Personal decontamination including hand and fingernail washing should be carried out each time workers leave the asbestos work area and at the completion of asbestos maintenance and service work. Any gloves used must be disposed of as asbestos waste.

Respiratory protective equipment (RPE)

- In general, the selection of suitable RPE depends on the nature of the asbestos work, the probable maximum concentrations of asbestos fibres that would be encountered in this work and any personal characteristics of the wearer that may affect the facial fit of the respirator (for example, facial hair and glasses).
- A competent person should determine the most efficient respirator for the task.
- RPE should comply with AS/NZS 1716-2003 *Respiratory Protective Devices* and be selected, used and maintained in accordance with AS/NZS 1715-1994 *Selection, Use and Maintenance of Respiratory Protective Devices*. They must always be worn under fitted hoods. Face pieces should be cleaned and disinfected.
- RPE should be used until all contaminated disposable coveralls and clothing has been vacuum cleaned and/or removed and bagged for disposal and personal washing has been completed. RPE should be properly stored when not in use.

7.5 Laundering clothing

Disposable coveralls should be used as protective clothing unless it is not reasonably practicable to do so. When non-disposable protective clothing is used, the contaminated clothing must be laundered in a suitable laundering facility that is equipped to launder asbestos-contaminated clothing. Contaminated protective clothing must not be laundered in homes. Any clothing worn under coveralls must be disposed of or suitably bagged for laundering as asbestos-contaminated clothing.

The laundering facility that is equipped to launder asbestos-contaminated clothing:

- should be informed of the asbestos contamination
- should have a management plan in place to control the release of respirable fibres
- should be constructed of smooth surfaces that are able to be lined with polythene sheeting or easily wiped clean
- may use conventional washing machines provided they are not used for other clothing
- may need to have a laundry room that is under negative pressure to eliminate or minimise the release of airborne asbestos fibres during the laundering process. This can be determined during the risk assessment
- should have procedures established for cleaning up spills and for the prevention of flooding of neighbouring areas.

The contaminated clothing should:

- be removed damp and thoroughly wet, then placed in impermeable containers or bags the outside of which are decontaminated and labelled to indicate the presence of asbestos before being sent to the commercial laundering facility
- not be allowed to dry out before washing.

At the laundry facility:

- the containers and bags holding the asbestos contaminated clothing should be opened in the washing machine while being further saturated. As a minimum, P1 respiratory protection must be worn while unloading clothes into the washing machine
- the empty containers or bags should be disposed of as asbestos waste. Waste water must be filtered and the filtering medium disposed of as asbestos waste.

7.6 Cleaning up

Following any asbestos work carried out, there are requirements to ensure the work area, tools and workers are decontaminated and asbestos waste is disposed of properly. In addition to this, for licensed removal work a clearance certificate will be required before the work area can be reoccupied for ordinary use.

APPENDIX A – SAMPLING PROCESS

A competent person should take the following steps to carry out sampling:

Step 1 – Preparation

- Make sure no one else is in the vicinity when sampling is done.
- Shut down any heating or cooling systems to minimize the spread of any released fibres.
- Turn off any fans if you're inside. If outside, then sample on a non-windy day.
- Do not disturb the material any more than is needed to take a small sample.
- Collect the equipment you will need for sampling, including:

pliers, resealable plastic bags, disposable coveralls, waterproof sealant, plastic drop sheet, water spray bottle P2 respirator, rubber gloves.

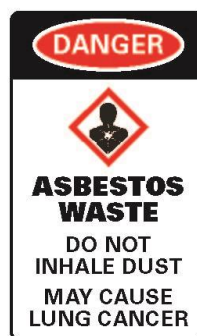
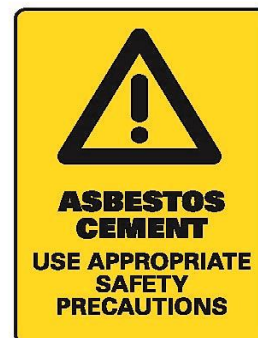
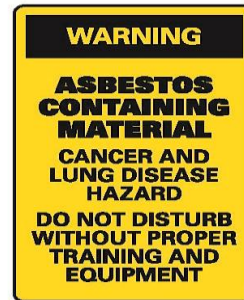
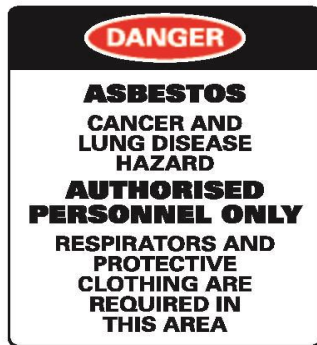
Step 2 – Taking the sample

- Wear disposable gloves.
- Put on respiratory protective equipment (RPE).
- Wear a pair of disposable coveralls.
- Lay down a plastic drop sheet to catch any loose material that may fall off while sampling.
- Wet the material using a fine mist of water containing a few drops of detergent before taking the sample. The water/detergent mist will reduce the release of asbestos fibres.
- Carefully cut a thumb nail piece from the entire depth of the material using the pliers.
- For fibre cement sheeting, take the sample from a corner edge or along an existing hole or crack.
- Place the small piece into the resealable plastic bag.
- Double bag the sample, include the date and location and an asbestos caution warning.
- Tightly seal the container after the sample is in it.
- Carefully dispose of the plastic sheet.
- Use a damp paper towel or rag to clean up any material on the outside of the container or around the area sampled.
- Dispose of asbestos materials according to state or territory and local procedures.
- Patch the sampled area with the smallest possible piece of duct tape to prevent fibre release.
- Send the sample to a NATA-accredited laboratory or one that is either approved or operated by the relevant regulator.

Step 3 – Cleaning up

- Seal the edges with waterproof sealant where the sample was taken.
- Carefully wrap up the plastic drop sheet with tape and then put this into another plastic rubbish bag.
- Wipe down the tools and equipment with a dampened rag.
- Place disposable gloves and coveralls into a rubbish bag, along with the damp rag and drop sheet.
- Seal plastic bag.
- Wash hands.
- Keep RPE on until clean-up is completed.
- Follow a decontamination procedure (personal washing) upon completion of the task.

APPENDIX B – EXAMPLES OF WARNING SIGNS AND LABELS



APPENDIX C – TEMPLATE OF AN ASBESTOS REGISTER

ASBESTOS REGISTER					
Workplace address:			Name of Competent Person:		
Date of Identification	Type of Asbestos	Is it Friable or Non-Friable?	Condition of Asbestos	Specific Location of Asbestos	Is this an inaccessible area?

**APPENDIX D – EXAMPLE OF AN ASBESTOS REGISTER FOR GHORASAL POWER STATION
UNIT NO. 4**

SAMPLE ASBESTOS REGISTER FOR GHORASAL POWER STATION					
Workplace address: Ghorasal Thermal Power Plant Unit 4, Business Activity – Power Generation and Transmission			Name of Competent Person: Mr. ----- Site OHS manager.		
Date of Identification	Type of Asbestos	Is it Friable or Non-Friable?	Condition of Asbestos	Specific Location of Asbestos	Is this an inaccessible area?
----/---/2015	Boiler Front side Insulation	friable/Non-friable	Good, minor deterioration on Western End	Boiler	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Boiler Rear side Insulation	friable/Non-friable	Good, minor deterioration on Western End	Boiler	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Boiler Left side Insulation	friable/Non-friable	Good, minor deterioration on Western End	Boiler	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Boiler Right side Insulation	friable/Non-friable	Good, minor deterioration on Western End	Boiler	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	HP main steam piping super heater outlet to turbine stop valve inlet	friable/Non-friable	Good, minor deterioration on Western End	Boiler to Turbine floor on pie rack	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Cold Reheat steam line Turbine to Re heater inlet	friable/Non-friable	Good, minor deterioration on Western End	Boiler to Turbine floor on pie rack	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Hot reheat steam line reheater to	friable/Non-friable	Good, minor deterioration	Boiler to Turbine	Accessible/In accessible/

	IP turbine inlet valve		on Western End	floor on pie rack	Not routinely accessed/ Unlikely to be damaged
----/---/2015	Auxiliary steam line	friable/Non-friable	Good, minor deterioration on Western End	All over boiler area	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
----/---/2015	Ducting	friable/Non-friable	Good, minor deterioration on Western End	All over boiler area	Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged
	So on ----				Accessible/In accessible/ Not routinely accessed/ Unlikely to be damaged

13. ASBESTOS MANAGEMENT PLAN

The following asbestos management plan has been extracted from Code of Practice from Safe Work Australia published in December, 2011. Safe Work Australia is an Australian Government statutory agency established in 2009. This agency consists of representatives of the Commonwealth, state and territory governments, the Australian Council of Trade Unions, the Australian Chamber of Commerce and Industry, and the Australian Industry Group.

Safe Work Australia works with the Commonwealth, state and territory governments to improve work health and safety and workers' compensation arrangements. Safe Work Australia is a national policy body, not a regulator of work health and safety. The Commonwealth, states and territories have a responsibility for regulating and enforcing work health and safety laws in their jurisdiction.

13.1 ASBESTOS MANAGEMENT PLAN

A person with management or control of the Ghorashal Power Plant Unit #4 must ensure a written asbestos management plan is prepared for the decommissioning and dismantling of the boiler. The identification of asbestos or asbestos containing material (ACM) has to be done from time to time.

The asbestos management plan must be maintained to ensure the information is up-to-date

13.2 WHAT IS ASBESTOS MANAGEMENT PLAN?

The asbestos management plan sets out how asbestos or ACM that is identified at the workplace of Boiler and steam piping will be managed, for example, what, when, and how it is going to be done.

The asbestos management plan must include:

- The identification of asbestos and ACM, for example a reference or link to the asbestos register for the workplace of Unit #4, and the locations of signs and labels
- Decisions and reasons for the decisions about the management of asbestos at the workplace of Unit #4, for example safe work procedures and control measures
- Procedures for detailing accidents, incidents or emergencies of asbestos at the workplace
- Workers carrying out work involving asbestos, for example consultation, information and training

Other information that may be part of the asbestos management plan include:

- an outline of how asbestos risks will be controlled, including consideration of appropriate control measures
- a timetable for managing risks of exposure, for example priorities and dates for any reviews, circumstances and activities that could affect the timing of action
- identification of each person with responsibilities under the asbestos management plan and the

person's responsibilities

- procedures, including a timetable for reviewing and, if necessary, revising the asbestos management plan and asbestos register
- air monitoring procedures at the workplace of Unit #4, if required.

13.3 REVIEWING THE ASBESTOS MANAGEMENT PLAN

The person with management or control of the Unit #4 Repowering Project must ensure the asbestos management plan is reviewed and, if necessary, revised when:

- there is a review of the asbestos register or a control measure
- asbestos is removed from or disturbed, sealed or enclosed at the workplace
- the plan is no longer adequate for managing asbestos or ACM at the workplace
- a health and safety representative requests a review if they reasonably believe that any of the matters listed in the above points affects or may affect the health and safety of a member of their work group and the asbestos management plan was not adequately reviewed.

13.4 ACCESSING THE ASBESTOS MANAGEMENT PLAN

The person with management or control of the workplace of Unit #4 Repowering Project must ensure the asbestos management plan is readily accessible to:

- a worker who has carried out, carries out or intends to carry out work at Unit #4, health and safety representatives who represent workers that carry out or intend to carry out work at the workplace of Unit #4
- a person conducting a business or undertaking who has carried out, carries out or intends to carry out work at the workplace of Unit #4, and

a person conducting a business or undertaking who has required, requires or intends to require work to be carried out at the workplace of Unit #4.

The asbestos management plan should be kept at the workplace of Unit #4 to ensure it is accessible.

14. ASBESTOS DISPOSAL PROCEDURE

DISPOSAL

Bangladesh has no statutory asbestos disposal licensing procedure. In this case disposal must only be at a landfill site suitable for waste asbestos.

Persons intending to dispose of waste asbestos should contact the disposal site operator.

EPA licence conditions require waste asbestos to be handled and covered in such a manner that no dust is generated. To achieve this and the long-term security of the disposal operation, the following measures or equivalent practices should be adopted:

- Before compacting, cover with a layer of soil at least 300 mm thick or with a layer of waste at

least 1 m thick.

- Asbestos must not be deposited within 2 m of the final tipping surface of the landfill.
- When not receiving waste, any containers used for temporary storage at a site must be covered.

It is preferable that a dedicated area of a landfill be used for asbestos disposal and that this area be clearly designated on site maps.

While landfilling of waste asbestos is generally appropriate, situations may arise where pre-treatment before landfilling should be considered. Acid treatment of white asbestos changes the nature of the asbestos fibers and appears to be the cheapest form of treatment available. Other treatment methods include thermal processes, chemical coagulation and immobilization.

PACKAGING

In relation to workplaces, packaging of waste asbestos must comply with the Occupational Health and Safety Regulations 2007 and should follow the guidelines set out in the Work safe Australia Asbestos Code of Practice. For non-workplaces, where such instructions are not available, the following guidelines, based on the Code of Practice should be observed:

Asbestos cement sheeting (AC sheeting) and asbestos cement pipes

- Thoroughly wet the articles and maintain in a wet condition until packaged for transport.
- Minimize cutting or breaking of articles to be packed.
- For packaging, place two layers of polythene sheeting approximately 200 µm (0.2 mm) thick, in the cargo-carrying compartment of the vehicle.
- Place articles carefully on polythene sheeting to a height of less than 1 m and completely wrap the articles. Seal with adhesive tape. Packages should be small enough to be handled easily.
- Label the package with the asbestos warning mark (see Appendix A (b)).

INSULATED LAGGED PIPES, BOILERS, HEATERS AND EQUIPMENT

- Double-wrap the entire article with polythene sheets, approximately 200 µm (0.2 mm) thick, and seal with adhesive tape.
- Label the package with the asbestos warning mark (see Appendix A (b)).

ASBESTOS DUST AND FRIABLE ASBESTOS

- Discharge dust into drums. (This should be carried out in wet condition, except where wetting down is not practicable.)
- Fix the drum lid securely using a suitable device (e.g., toggle clips, screws, or bolt).
- Label each drum with a dangerous goods label (see Appendix A (a)).
- Label each drum with the asbestos warning mark at least three times on one side of each bag (see Appendix A (b)).

Or

- Discharge dust directly into double polythene bags approximately 200 µm (0.2 mm) thick. A maximum bag size of 1200 mm (length) x 900 mm (width) should be used. The bagged dust should be wetted before the bags are tied and the loaded weight should not exceed 30 kg. Bags should be filled to not more than 50 per cent capacity.
- Tie each bag.
- Label each bag with a dangerous goods label (see Appendix A (a)).
- Label each bag with asbestos warning mark at least three times on one side of each bag (see Appendix A (b)).

SLURRY CONTAINING ASBESTOS FIBRE AND DUST

- Remove fibres through chemical coagulation followed by filtration.
- Place residue into drums, as above.
- Label the container with a dangerous goods label (see Appendix A (a)).
- Label each container with asbestos warning mark at least three times on one side of each drum (see Appendix A (b)).
- Or other methods of packaging, transport and disposal as approved in writing by EPA.

ASBESTOS TILES, GASKETS, BRAKE LININGS, CLUTCH PLATES, ACOUSTIC INSULATION, NON-BONDED TEXTILES, GLOVES, PROTECTIVE CLOTHING AND RESPIRATORS

- Place material in double polythene bags, approximately 200 µm (0.2 mm) thick.
- A maximum bag size of 1200 mm (length) x 900 mm (width) should be observed.
- Tie each bag.
- Label the package with the asbestos warning mark (see Appendix A (b)).
- Place the packages in an enclosed skip for transportation.

APPENDIX A1: LABELLING AND MARKING

Every package containing friable asbestos in excess of 2 kg or 2 L must be clearly marked on the outside.

a) Proper shipping name as shown below:

Proper Shipping Name	White Asbestos	Brown Asbestos	Blue Asbestos
UN Number	2590	2212	2212
Packing Group Number	III	II	II
Hazchem Code	2X	2X	2X
Class Label	9	9	9

Note: Packaged dangerous goods only need to be marked with UN number, proper shipping name and Dangerous Goods Class label.

b) Asbestos warning marking as shown below:

**CAUTION
ASBESTOS**

**DO NOT OPEN
OR DAMAGE BAG**

DO NOT INHALE DUST

Note: The height of this marking should be approximately 75 mm x 90 mm.

c) Placarding of road vehicles

Every vehicle carrying asbestos wastes in a quantity of 500 kg or 500 litres is considered a placard load and must display Dangerous Goods Class labels as shown below, at the front and the rear of the vehicle.



The Class label must not be less than 250 mm square and must be firmly affixed to the vehicle.

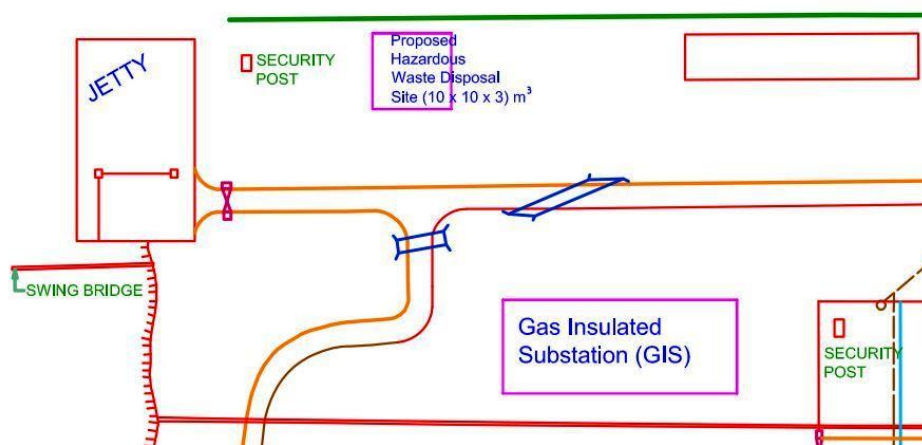
ASBESTOS DISPOSAL LOCATION AND ARRANGEMENT

Based on the Unit 4 EIA ToR, it is referred that approximately fifty tonnes of asbestos will be generated from boiler insulation materials, although there was no reference provided. The Consultant, after spending substantial time in GPS library identified some old erection report of Unit 4 and estimated the existence of about 17 tons of asbestos, although the list was partial. However, considering the total amount referred in the TOR, the decommissioning of Unit 4 boiler may produce 50 tons and repowering of Unit 3 will also generate similar amounts and in future other Units may also be repowered and as a result more asbestos containing material (ACM) will be generated. Presently some waste has been disposed and placed two meter below top soil in the form of trench. The trench has concrete pad at the bottom but no synthetic liners have been placed and there are neither storm water diversion channels nor any arrangement for collection and treatment of the leachates. Therefore, it is essential that all these issues require consideration while developing an on-site asbestos disposal pit. Since, the total amount of asbestos containing material is unknown, it is recommended that boiler decommissioning contractor should study carefully the ACM in the boiler and in consultation with GPS make the final judgement.

In the EIA study, it is recommended that due to the absence of specialized contractor to handle ACM in Bangladesh, an on-site asbestos disposal pit is developed with sufficient capacity to accommodate all ACM generated from current and future repowering and plant refurbishment work. There exists free space at the jetty site for disposal of asbestos (Figure 1).

A pit of approximately 10 x 10 x 3 meter will be constructed for disposal of ACM. There will be three compartments to accommodate all Asbestos. One compartment is for operating plant waste disposal.

Figure 1: Proposed plant layout with the location of asbestos disposal pit



Enlarged view of Asbestos Disposal location

Typical design for an Asbestos disposal pit is as shown in Figure 2. As disposal will be comparatively close to the river, it is preferable to have a pit for Asbestos disposal with “double Composite Liner”. Third pit for operating plant solid waste disposal may be single composite wall lining (Figure 3), to economise the expenses.

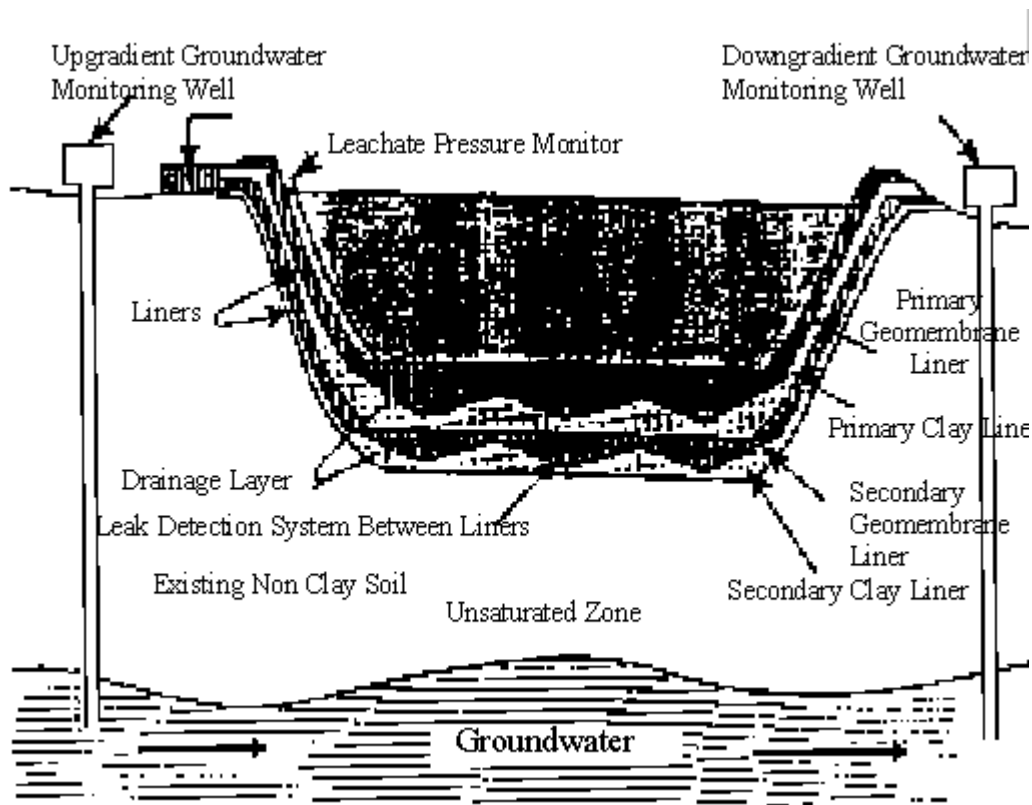


Figure 2: Pit with Double Composite Liner

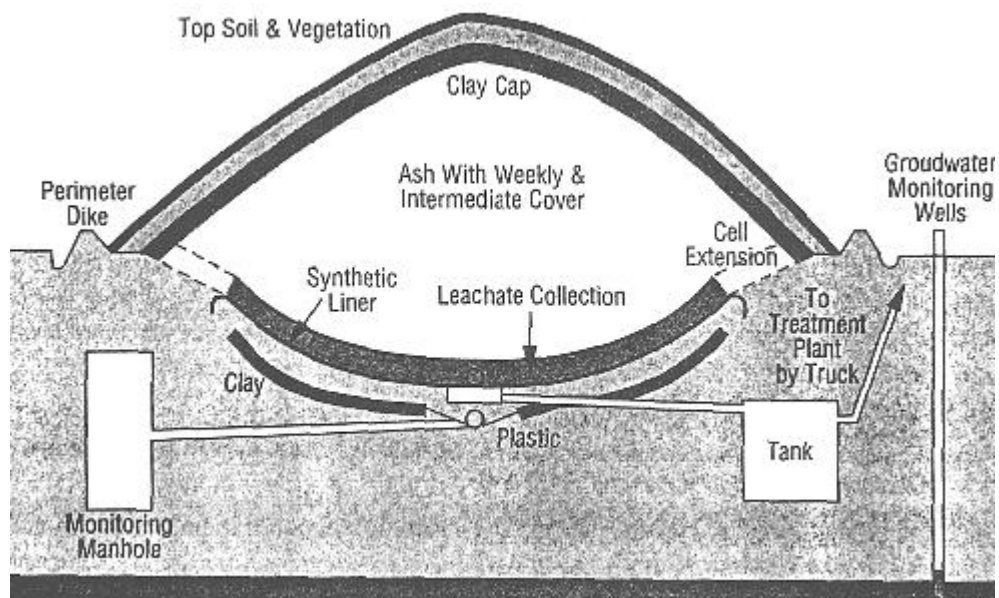


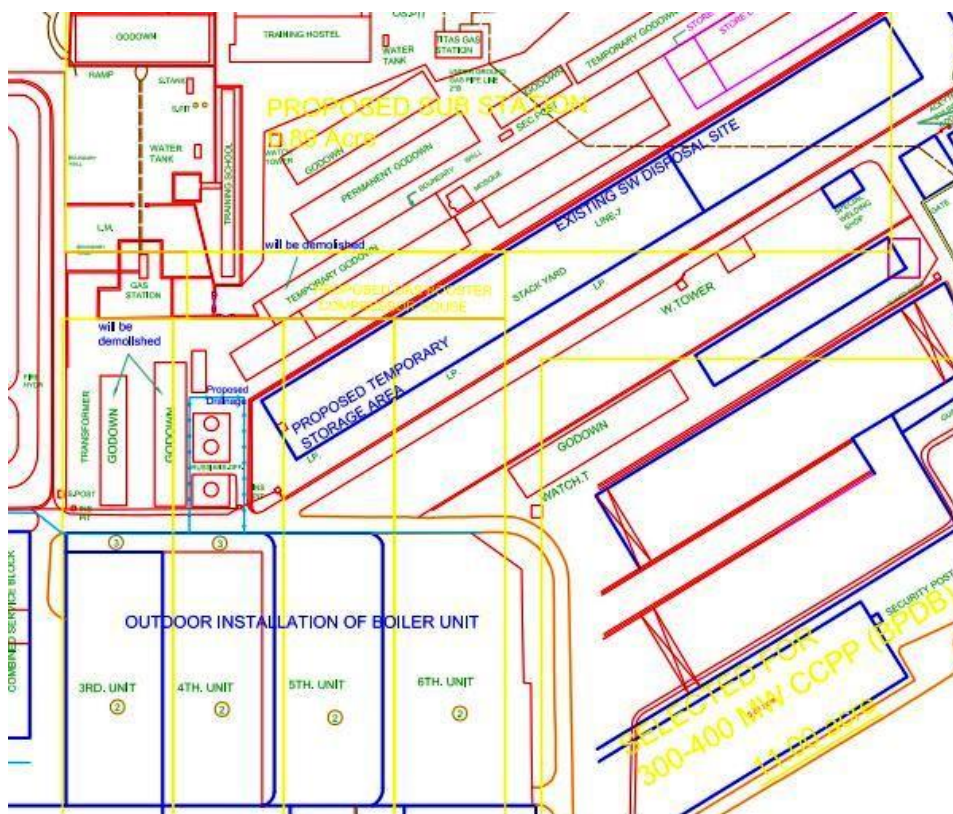
Figure 3: Single Composite Wall Liner Land Fill

Department of Environment Bangladesh Government has no Asbestos handling Standards especially for secured asbestos disposal and secure land fill. As Bangladesh has rivers spanning across the country, specifically the Shitalakhya River being so close to the Ghorasal plant, the water table is quite high. Similar situation is observed in countries like the Netherlands as it is situated at sub sea level. Hence, it is advisable to follow Standards of Asbestos Waste Disposal of the Netherlands.

SCRAP DISPOSAL LOCATION AND ARRANGEMENT DURING DECOMMISSIONING OF BOILER

During construction, old existing stores and temporary sheds are easy to demolish to make room for storing removed scrap while decommissioning the boiler, not including asbestos. Figure 1 shows the temporary storage sites for scrap materials. The area will be divided into different compartments to segregate and accommodate different types of scrap material. For example,

- Carbon steel scrap.
- Alloy steel piping
- Ducting sheets
- Gun metal valves
- Carbon steel valve
- Alloy steel valves
- Assembly of auxiliary equipment (these may be shifted to main stores as it will be used as spares to other running unit during maintenance)
- Hangers, springs, etc.
- Fans bearings (having white metal lining)



Enlarged view of Boiler Scrap Disposal Area

15. EMPLOYEES OCCUPATIONAL HEALTH

RESPIRATOR'S USE

- All employees must wear respiratory protection on-site during the preparation of work areas for asbestos removal.
- The respiratory protection must have a minimum protection factor of 50, and be approved by NIOSH for protection against asbestos.
- When using respirators, follow the procedures of the equipment manufacturer
- Employees shall be properly trained about using and fitting of respirator.
- The respirator must be fitted so that there is an effective seal between the respirator and the employee's face.
- Where practicable, assign a respirator to an employee for the employee's exclusive use.
- Reusable respirators must be cleaned, disinfected and inspected: after use; at least once each shift.
- When not in use, maintain and store reusable respirators in a clean and sanitary location.
- Respirator shall be provided by the employer.
- Every employee who enters the work site; consists of full body covering, including head covering, with snug fitting cuffs at the wrists, ankles and neck, (disposable coveralls are strongly recommended).

SPECIAL PRECAUTIONS ARE TAKEN FOR EMPLOYEES INSIDE THE REMOVAL AREA:

- Eating, drinking, chewing or smoking inside the change room, shower room, hallways, storage room(s) or removal area are strictly prohibited.
- Complete decontamination is required prior to eating, drinking, chewing or smoking when come out of working area.
- Respiratory protective equipment is not removed inside the asbestos work area.
- Employees take coffee breaks and have lunch in an area completely separate from the asbestos removal area.

MEDICAL CHECK-UP OF EMPLOYEES

- Employees shall be periodically checked for asbestos effect.
- If an employee found affected by asbestos he shall immediately stop working in asbestos removal area and necessary treatment shall be administered to him.
- Employee's family shall be periodically checked for asbestos effect.

- Provide proper medication to every employee such as tonic tablets, etc. during execution of work.

ENVIRONMENTAL DATA COLLECTION

After completion of clean-up process of boiler area, collection and analysis of samples must be conducted. The analysis shall include presence of Asbestos in all these samples. Record all data and compare with the base line data collected before the start of asbestos removal activity:

- Air pollution data at different locations in the plant.
- Air pollution data in the surrounding area at different locations in periphery of one kilometer.
- Collect river water sample and carry out detailed analysis.
- Collect operating plant Effluents sample at discharge points from plant and carry out detailed analysis.
- Collect storm water sample at discharge point from plant and carry out detailed analysis.
- Analyze soil sample around Unit # 4 boiler at different location.

APPENDIX A2: SITE VISIT IMAGES



Image 1: Consultants are discussing with GPS Executives



Image 2: Consultants at Ghorashal Power Station



Image 3: Control Room of GPS Unit #4



Image 4: Ghorashal Power Station Unit #4



Image 5: GPS Unit #4 Library



Image 6: Consultants are checking documents for useful data



Image 7: Consultants are checking documents for useful data