FINAL ENVIRONMENTAL MANAGEMENT PLAN FOR THE OPEN CYCLE GAS TURBINE POWER STATION AT ATLANTIS, WESTERN CAPE PROVINCE

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CONTACT DETAILS OF RESPONSIBLE PERSONS

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GLOSSARY OF TERMS AND ABBREVIATIONS

EMP:

Environmental Management Plan. A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive environmental impacts and limiting or preventing negative environmental impacts are implemented during the life-cycle of a project. This EMP focuses primarily on the construction phase and operational phase of the proposed project. This Environmental Management Plan is not part of an Environmental Management System and has not been compiled in terms of the ISO 14001 standard.

ENVIRONMENT:

In terms of the National Environmental Management Act (NEMA) (No 107 of 1998), "environment" means the surroundings within which humans exist and that are made up of:

(i) the land, water and atmosphere of the earth;
(ii) micro-organisms, plant and animal life;
(iii) any part or combination of (i) of (ii) and the interrelationships among and between them; and
(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

ESKOM'S PROJECT MANAGER:

The person appointed by Eskom from time to time to act in the capacity and notified, by name and in writing by Eskom to the Contractor, to act as required in the contract.

SITE MANAGER:

The person appointed by Eskom from time to time to act in the capacity of site manager, and whose authority will be notified in writing to the Contractor by Eskom's Project Manager, and is responsible for managing the construction process on site.

ENVIRONMENTAL CONTROL OFFICER:

An individual nominated through the Project Manager to be present on site to act on behalf of the Project Manager in matters concerning the implementation and day to day monitoring of the EMP. The Environmental Control Officer is assumed to be the Environmental Practitioner appointed by Eskom to the project.

CONTRACTOR:

A person or company appointed by Eskom/Generation Division to carry out stipulated activities

ENVIRONMENTAL IMPACT

A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.

INCIDENT

An undesired event which may result in a significant environmental Impact but can be managed through internal response.

EMERGENCY

An undesired event that does result in a significant environmental impact and requires the notification of the relevant statutory body such as a local authority.

1. INTRODUCTION

In order to supplement the need for new peaking electricity generation capacity, with a short lead-time to commercial operation, Eskom Holdings Limited (Eskom) propose to construct an Open Cycle Gas Turbine (OCGT) Power Station at two sites within the Western Cape Province, i.e. Atlantis Industria and Mossel Bay. This Environmental Management Plan (EMP) outlines mitigation and management measures to be implemented during the construction and operational phases of the proposed facility within Atlantis Industria. This facility can utilise liquid distillate fuel or natural gas as a fuel source. In order to integrate this proposed power station into the existing National Transmission Network, Eskom further proposes the construction of a new substation and four 400 kV Transmission lines in parallel between the existing Koeberg-Aurora Transmission lines and the proposed Atlantis Substation.

1.1. Overview of the Proposed Project

The proposed project includes the construction of a new OCGT Power Station, a new substation and four 400 kV Transmission lines in parallel between the new substation and the existing Koeberg-Aurora 400 kV Transmission lines, within Atlantis Industria in the Western Cape Province.

1.1.1. OCGT Power Station

An Open Cycle Gas Turbine (OCGT) Power Station consists of a combustion chamber, a compressor, a gas turbine and a generator. The compressor and the gas turbine are mounted on the same shaft. The compressor draws fresh air from the atmosphere and increases the air pressure, by compressing it, before sending this air to the combustion chamber. At the combustion chamber fuel is added to the compressed air and the total mixture is combusted, resulting in hot gas entering the turbine at a temperature greater than 1300ºC. This hot gas imparts the majority of its energy via a turbine to both the compressor and a generator. The open cycle gas turbine discharges exhaust gases and heat to the atmosphere. Figure 1.1 below provides a representation of the power generation process using a gas turbine.

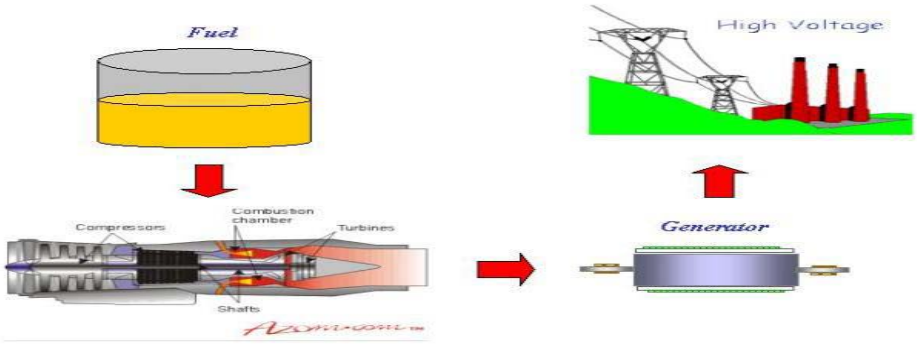

Figure 1.1: A graphical representation of the power generation process using a gas turbine

The OCGT Power Station is required to be sited on a technically feasible site. A technical pre-feasibility study undertaken by Eskom (and independently reviewed by Mark Wood through Ninham Shand), therefore considered land availability and land-use compatibility, load variances in the area, fuel availability and costs, ease of integration with, and impacts on the existing National Transmission Network, impacts on the Transmission network, and benefits to transmission load variances (Refer to Appendix A) in order to determine feasible sites. Eskom has identified two areas where such technology would be feasible, namely Mossel Bay and Atlantis. Eskom plans to construct OCGTs in both of these areas. This EIA process considers the construction of an OCGT within the Atlantis area only. The Mossel Bay OCGT project is the subject of a separate EIA (Ninham Shand, 2005). Through this study, the Farm 1183 and a portion of the Farm Witzand 2 within the Atlantis Industria area was identified as a feasible site for the establishment of the OCGT power station (Refer to Figure 1.2). Through the public participation process undertaken during the scoping phase of this study, an alternative site for establishment of the OCGT Power Station was identified. This site is located in the south western corner of the Atlantis Industria area.

The proposed OCGT Power Station at Atlantis is proposed to consist of 3-5 units, each with a nominal capacity of between approximately 120 MW – 250 MW each. The total nominal capacity of the power plant is proposed to be a maximum of 1 000 MW. The number of units required and exact output will depend on the specification of the equipment from the supplier selected for the project and the ambient operating conditions. Each unit will consist of one gas turbine driving an electric generator. A total area of approximately 20 ha is required for the OCGT Power Station and associated infrastructure. An area of approximately 250 m x 350 m (i.e. 9 ha) is required for the construction of the OCGT Power Station itself. The footprint of each unit is approximately 25 m x 75 m. Being a peak

capacity plant, the OCGT will only be required to operate during those times when electricity is in its highest demand, i.e. for approximately 2 hours in the morning (07h00 to 09h00) and 2 hours in the evening (18h00 to 20h00). If necessary the plant can operate for up to 8-hour shifts. In emergency situations, the power station can operate for a 24-hour period.

The economics in terms of the operations of a plant of this nature are based on cost of primary energy and cost of operations and maintenance (opex). This assumes that key emission levels need to be met. The most cost effective fuel in terms of primary energy and opex that can be used for the proposed plant is natural gas. To date no sources of natural gas have been identified to fuel the plant within the given timeframes. The next most cost-effective primary energy option is kerosene followed by low sulphur diesel. Other fuel types have been investigated but were found not to be feasible in light of emissions, water usage and impact on opex. Being the worst-case scenario in this case, the effects of operating such a plant on low sulphur diesel were investigated within this EIA. An estimated 1,9 million litres of fuel is required per week in order to supply the power station for peaking capacity requirements. In order to accommodate an emergency supply of fuel at the power station site, 2 - 4 fuel storage tanks, storing up to a total of 5 million litres, are proposed to form a fuel storage buffer between actual fuel usage and fuel delivery. These fuel storage tanks will be located within the broader 20 ha area required for the plant.

In designing this plant, Eskom has endeavoured to minimise the impact on natural resources such as water. To this extent the technology that has been selected will not require large quantities of water (as originally anticipated) should the plant be fuelled by natural gas, kerosene or diesel fuel. Small quantities of water will be required for turbine blade washing. This is estimated at 1 cubic meter every 2 to 3 months.

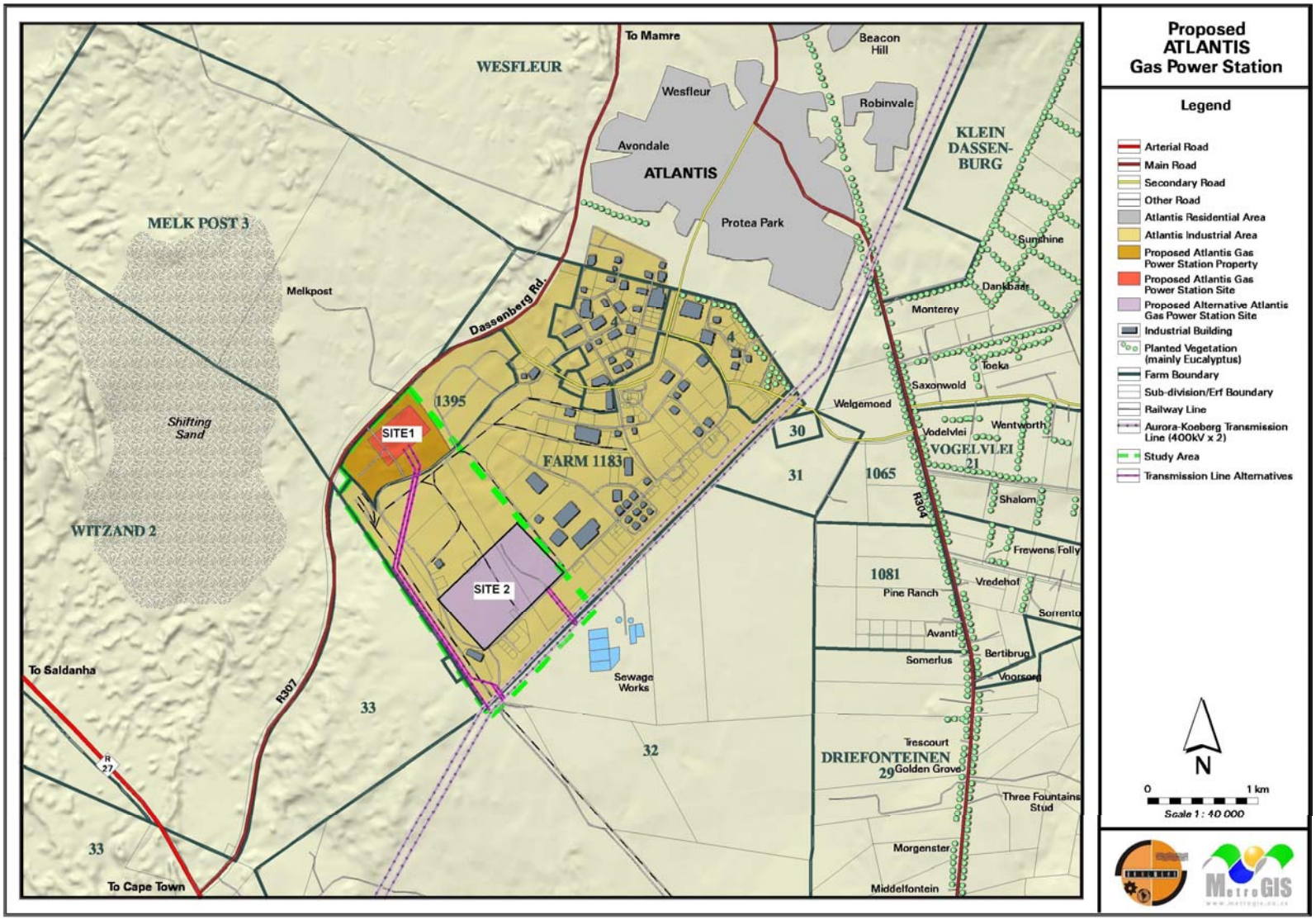

Figure 1.2: Map showing the location of the proposed OCGT Power Station, substation and 400 kV Transmission lines

1.1.2. Integration into National Transmission Network

In order to integrate this new plant into the existing National Transmission Network, the establishment of the OCGT Power Station will be associated with a new transmission substation and Transmission lines. The integration of this power station into the National Transmission Network must be undertaken with the least risk to the existing network in terms of network losses and fault levels. A preferred option for this integration has been identified through a pre-engineering study undertaken by Eskom (Eskom Transmission, 2004), which involves the turn-in and out of both existing Koeberg-Aurora 400 kV Transmission lines to the proposed Atlantis Transmission substation. The following infrastructure is required:

- The construction of a new substation at the Atlantis OCGT site. The substation will be accommodated within the 20 ha area which is required for the OCGT Power Station and associated infrastructure. An area of 9 ha is required for the substation high voltage yard. The substation infrastructure will be approximately 45 m in height.
- The establishment of four 400 kV Transmission lines between the new substation and the existing Koeberg-Aurora 400 kV Transmission lines. It is proposed that the two Koeberg-Aurora 400 kV Transmission lines will be turned in and out of the Atlantis site. Each Transmission corridor requires a servitude width of 55 m. A feasible Transmission line corridor has been identified through the scoping phase and applies for both sites (refer figure 1.2).

1.2. Applicable Documentation

The following environmental documentation is applicable for the project, and will be read in conjunction with this EMP:

- Environmental Scoping Report for the proposed new OCGT Plant and Associated Transmission lines and substation at Atlantis, Western Cape Province.
- Environmental Impact Assessment Report for the proposed new OCGT Plant and Associated Transmission lines and substation at Atlantis, Western Cape Province.
    - Record of Decision issued by the Western Cape Department of Environmental Affairs and Development Planning (WC DEADP) (once issued).

Cognisance of the Record of Decision (RoD) must be taken once it has been issued. Where necessary, this EMP must be amended to comply with the conditions as stipulated in the RoD.

1.3. Structure of the Environmental Management Plan

The EMP provides mitigation and management measures for the following phases of the project:

- *Construction Phase*
  This section of the EMP provides management principles for the construction phase of the project. Environmental actions, procedures and responsibilities as required within the construction phase are specified. These specifications will form part of the contract documentation and, therefore, the Contractor will be required to comply with the specifications to the satisfaction of the Project Manager and Environmental Control Officer, in terms of the construction contract.

- *Operation and Maintenance Phase*
  This section of the EMP provides management principles for the operation and maintenance phase of the project. Environmental actions, procedures and responsibilities as required from Eskom within the operation and maintenance phase are specified.

- *Decommissioning Phase*
  This section includes principles for the decommissioning phase of the project. This section of the EMP will be required to be revisited and updated at the time of decommissioning.

All relevant environmental legislation pertaining to the project is listed within Appendix A. The Contractor is required to comply with this legislation for all phases of the project. This list is intended to serve as a guideline only for the Contractor and is not exhaustive.

This EMP has been prepared for the construction and operational phases of the OCGT Plant only. Separate EMP's for the transmission line construction and the substation will be compiled and submitted to the DEA&DP.

This EMP is a dynamic document which will be updated as required on a continuous basis. Any amendments made, must be submitted to both the Environmental Officer and Project Manager for approval prior to implementation.

1.4. Objectives of the EMP

The EMP has the following objectives:

- To outline functions and responsibilities of responsible persons.
- To state standards and guidelines, which are required to be achieved in terms of environmental legislation.
- To outline mitigation measures and environmental specifications which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the OCGT Facility.
- To prevent long-term or permanent environmental degradation.

2. MANAGEMENT PROCEDURES

2.1. Organisational Structure and Responsibility

2.1.1. Functions and Responsibilities for the Construction Phase

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager, Site Manager and Environmental Officer for the construction phase of this project are as detailed below.

The Project Manager will:

- Ensure that Eskom and the Contractor are aware of all specifications, legal constraints and Eskom standards and procedures pertaining to the project specifically with regards to the environment.
- Ensure that all stipulations within the EMP are communicated and adhered to by Eskom and its Contractor(s).
- Monitor the implementation of the EMP throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
- Be fully conversant with the Environmental Impact Assessment for the project, the conditions of the RoD (once issued), and all relevant environmental legislation.

The Site Manager (Eskom's Representative) will:

- Be fully conversant with the Environmental Impact Assessment.
- Be fully conversant with the conditions of the RoD.
- Be fully conversant with the Environmental Management Plan.
- Be fully conversant with all relevant environmental legislation and Eskom environmental policies and procedures, and ensure compliance with these.
- Have overall responsibility for the implementation of the EMP.
- Conduct audits to ensure compliance to the EMP.
- Liaise with the Project Manager or his delegate, the Environmental Officer and relevant discipline Engineers on matters concerning the environment.

- Prevent actions that will harm or may cause harm to the environment, and take steps to prevent pollution on the site.
- Confine activities to the demarcated construction site.

The Environmental Officer will:

- Be fully conversant with the Environmental Impact Assessment.
- Be fully conversant with the conditions of the RoD.
- Be fully conversant with the Environmental Management Plan.
- Be fully conversant with all relevant environmental legislation and Eskom environmental policies and procedures, and ensure compliance with them.
- Convey the contents of this document to the Contractor site staff and discuss the contents in detail with the Project Manager and Contractor.
- Undertake regular and comprehensive inspection of the site and surrounding areas in order to monitor compliance with the EMP.
- Take appropriate action if the specifications contained in the EMP are not followed.
- Monitor and verify that environmental impacts are kept to a minimum, as far as possible.
- Review and approve construction methods, with input from the Site Manager, where necessary.
- Ensure that activities on site comply with all relevant environmental legislation.
- Order the removal of person(s) and/or equipment in contravention of the specifications of the EMP.
- Compile progress reports on a regular basis, with input from the Site Manager, for submission to the Project Manager, including a final post-construction audit.
- Liaise with the Site Manager regarding the monitoring of the site.
- Report any non-compliance or remedial measures that need to be applied.

Contractors and Service Providers:

All contractors (including subcontractors and staff) and service providers are ultimately responsible for:

- complying with the environmental management specifications;
- submitting an obligatory Methods Statement for approval by the EO before any work is undertaken;
- adhering to any instructions issued by the Engineer/Project Manager on the advice of the EO;
- submitting a report at each site meeting which will document all incidents that have occurred during the period before the site meeting
- displaying the list of transgressions issued by the EO in the site office

- maintaining a public complaints register.
- arrange that all his employees and those of his subcontractors receive training before the commencement of construction in order that they:

2.1.2. Functions and Responsibilities for the Operational Phase

The Generation Environmental Manager will:

- Provide overall assurance to the MD: Generation Division (and hence ultimately the CEO) that environmental issues are appropriately addressed and managed at the various business units (= power stations)
- Develop and implement strategies on various issues such as Environmental management systems, air quality, waste, etc., etc
- Be responsible for overall consolidation and reporting of environmental performance within the Generation Division
- Liaise on a strategic level with Government and other stakeholders on a range of issues

The Station Manager will:

- Identify and appoint representatives from different departments of the power station. These employees shall be assigned the role of EMP drivers and shall collectively form the EMS management team with the environmental practitioner
- Ensure that adequate resources (human, financial, technology) are made available for the successful implementation and operation of the EMS
- Conduct annual basis reviews of the EMS to evaluate its effectiveness
- Take appropriate action as a result of findings and recommendations in Management reviews and audits

The Safety, Health and Environment (SHE) Representative will:

- Implement an Environmental Management System (EMS) for the power station
- Manage and report on station's environmental performance
- Conduct internal environmental audits and co-ordinate external environmental audits
- Liaise with statutory bodies such as CAPCO, DWAF and DEAT on environmental performance and other issues
- Conduct environmental training and awareness of the Atlantis OCGT Power Station employees

- Compile environmental policies and procedures
- Advise the Atlantis OCGT top management on environmental issues
- Liaise with interested and affected parties on environmental issues of common concern

2.2. Awareness and Competence

It is important to ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and ongoing minimisation of environmental harm.

To achieve effective environmental management, it is important that employees, Contractors and Subcontractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMP. Environmental training must include the following:

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment;
- Employees will be thoroughly familiar with the requirements of the EMP and the environmental specifications as they apply to the construction of the power station.
- Employees must undergo training for the operation and maintenance activities associated with the OCGT Plant and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- Basic training in the identification of archaeological artefacts, and rare and endangered flora and fauna that may be encountered on the site.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
- The training must include a system of certification and/or accreditation related to training, to ensure all the workers have proof of work performed for future job applications.
- Records must be kept of those that have completed the relevant training.
- Training must include the environment, health and safety as well as basic HIV/AIDS education.

Training can be done either in a written or verbal format but will be in an appropriate format for the receiving audience. Where training has been done verbally, persons having received training must indicate in writing that they have indeed attended a training session and have been notified in detail of the contents and requirements of the EMP.

2.3. Monitoring

A monitoring programme will be in place not only to ensure conformance with the EMP through the contract/work instruction specifications, but also to monitor any environmental issues and impacts which have not been accounted for in the EMP that are, or could result in significant environmental impacts for which corrective action is required. As part of the contract or work instruction, Eskom will stipulate the period and frequency of monitoring required. This will be determined in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is carried out.

An Environmental Officer must be appointed to ensure compliance with the EMP, and to carry out monitoring activities. The Environmental Officer must have the appropriate experience and qualifications to undertake the necessary tasks. The Environmental Officer will report to the Site Manager should any non-compliance be evident or corrective action necessary. Only in severe cases of non-compliance, or repeated offences, will the Environmental Officer be required to report to the Project Manager.

All instruments and devices used for the measurement or monitoring of any aspect of this EMP must be calibrated and appropriately operated and maintained.

2.4. Non-Conformance and Corrective Action

The monitoring of the construction or operation of the power station may identify non-conformances of the EMP. Non-conformances may also be identified though incidents, emergencies or complaints. In order to correct these non-conformances, the source must be determined and corrective actions must be identified.

2.4.1. Compliance with the Environmental Management Plan Specifications and/or Record of Decision conditions

- The EMP will be available on-site at all times.
- All persons employed by the Contractor or his sub-contractors will abide by the requirements of the EMP.
- Any members of the construction workforce found to be in breach of any of the specifications contained within the EMP may be ordered by the Project Co-ordinator to leave the site. The order may be given orally or in writing. Confirmation of an oral order will be provided as soon as practically possible, but the absence of a written order will not be cause for an offender to remain on site. No extension of time will be granted for any delay or disadvantage to the Contractor brought about by an offender ordered to leave the site.

- The Contractor will not direct a person to undertake any activity which would place them in contravention of the specifications contained within the EMP.
- Should the Contractor be in breach of any of the specifications contained in the EMP, the Project Manager will, in writing, instruct the Contractor responsible for the incident of non-compliance regarding corrective and/or remedial action required, specify a timeframe for implementation of these actions, implement a penalty and/or indicate that work will be suspended should non-compliance continue.
- Should non-compliance continue, further written notification will be forwarded to the Contractor responsible for the incident of non-compliance outlining the required corrective and/or remedial action, the timeframe for implementation, penalties and/or work will be suspended as specified previously.
- The Contractor will be responsible and will bear the cost of any delays, corrective or remedial actions required as a result of non-compliance with the specifications and clauses of the EMP.
- An appropriate reporting schedule for frequent reporting (of compliance with the ROD/EMP) to the DEA&DP and interested and affected parties will be developed. The process to be followed for the auditing of the ROD conditions/EMP, as well as the reporting procedure to be followed, will be outlined in this document.
- The owner and/or developer must notify the Directorate: Integrated Environmental Management (Region B): DEA&DP and any other relevant authority, in writing, **within 24 hours** thereof if any condition of the ROD authorisation is not adhered to.
- Departmental officials will be given access to the property referred to in the ROD authorisation for the purpose of assessing and/or monitoring compliance with the conditions contained in the ROD, at all reasonable times.

2.5. Documentation and Reporting

The following documentation must be kept on site in order to record compliance with the EMP:

- Record of Complaints
- Monitoring Results
- Notification of Emergencies and Incidents.

2.5.1. Environmental Register

The Contractor will report incidents involving Contractor employees and/or the public that could potentially cause negative sentiment and perception towards the project:

- Report incidents involving Contractor employees and/or the public that could potentially cause negative sentiment and perception towards the project and/or Eskom.
- Report environmental complaints and correspondence received from the public to the Project Manager or the Environmental Control Officer.
- Record and report incidents that cause harm or may cause harm to the environment to the Environmental Control Officer.
- Record all hazardous materials used on site.
- Maintain a record of all Hazardous Waste Disposal Manifests detailing the nature of the hazardous waste disposed of, the hazardous waste classification and the location of the site to which such waste was sent.

The above records will form an integral part of the Contractors' Records. These records will be kept with the EMP, and will be made available for scrutiny if so requested by the Project Manager or his delegate and the Environmental Officer.

The Environmental Officer will put in place an Environmental Register to document:

- All environmental complaints and correspondence received from the public, Eskom or the construction workforce.
- Incidents of non-compliance with the EMP (refer to Section 4.15).
- Any other environmental incidents related to the construction phase of the project.

The Environmental Officer will ensure that the following information is recorded for all complaints/incidents:

- Nature of complaint/incident.
- Causes of complaint/incident.
- Party/parties responsible for causing complaint/incident.
- Immediate actions undertaken to stop/reduce/contain the causes of the complaint/incident.
- Additional corrective or remedial action taken and/or to be taken to address and to prevent reoccurrence of the complaint/incident.
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions.
- Procedures to be undertaken and/or penalties to be applied if corrective or remedial actions are not implemented.
- Copies of all correspondence received regarding complaints/incidents.

2.6. Public Communication and Liaison with I&APs

Eskom must ensure that the public and surrounding communities are informed and updated throughout the construction and operational phases.

A signboard must be erected at the entrance to the construction site, informing the public of the construction activities taking place. The signboard must include the following information:

- The name of the contractor
- The name and contact details of the site representative to be contact in the event of emergencies or complaint registration.

2.7. Atlantis Community Liaison Committee

A Liaison Committee, to be known as the Atlantis Community Liaison Community, must be established to ensure that relevant information can be reported to Western Cape Department of Environmental Affairs and Development Planning (WC D:EA&DP), as well as interested and affected parties.

The objective of this committee will be the following:

- To facilitate proper communication and co-operation between the developer (Eskom Holdings Limited), the community of Atlantis, and other interested & affected parties
- To facilitate discussion on various issues pertaining to labour, safety, health environmental, social and other community related issues and concerns
- To serve as an advisory forum to the proponent during the construction and operational phases of the new development;
- To provide a platform where day-to-day community concerns around the project can be raised and addressed;
- To ensure that the community and other stakeholders understand the various legal obligations imposed on the project, and the developer's strategy to meet these obligations
- To provide a platform where the developer's performance on issues relating to safety, health, environmental, and social can be discussed

The composition of the Liaison Committee shall be as follows:

- Two representatives from Eskom Holdings Limited ("the developer")
- A maximum of three representatives from community-based organisations in Atlantis, to effectively represent the interests of the broader Atlantis community

- One official from the Department of Environmental Affairs & Developmental Planning, Western Cape (DEA&DP)
- One official from the City of Cape Town Metropolitan Municipality or the Blaauwberg Local Municipality

The committee can call for specialist input or advice when necessary

2.7.1. Functional Aspects

- The Community Liaison Committee shall be chaired by the developer;
- The secretariat of the Committee shall be elected by the Committee;
- The Committee shall meet monthly, and emergency/ad hoc meetings shall be arranged as and when required or as decided upon in the Committee meetings;
- Other stakeholders or government departments will be co-opted onto the Committee as and when the need arises

2.7.2. Limitations of the Committee

The Committee:

- Has no legal standing;
- Does not take away any authority that any government or provincial department has in terms of the SA statutory framework;
- Is not a decision making body, but a co-ordination and advisory body

2.7.3. Duties of the Committee

- Advisory role to the project developer on various community-related issues;
- Serves generally as a communication channel between the developer and the Atlantis community
- Advisory role to the government departments with regulatory responsibilities at the Atlantis Open Cycle Gas Turbine site

3. ENVIRONMENTAL GUIDELINES, STANDARDS AND PERMITS

3.1. Legal Summary

The following is a summary of the applicable environmental legislation for the establishment of the OCGT Power Station and associated infrastructure. The detailed summary has been included in Appendix A.

APPLICABLE LEGISLATION ALREADY IN EFFECT AT DATE OF THIS EMP
National Legislation
Constitution of South Africa (Act No. 108 of 1996)
Environment Conservation Act (Act No. 73 of 1989)
National Environmental Management Act (Act No. 107 of 1998)
National Heritage Resources Act (Act No. 25 of 1999)
Hazardous Substances Act (Act No. 15 of 1973)
Occupational Health and Safety Act (Act No. 85 of 1993)
National Road Traffic Act (Act No. 93 of 1996)
Atmospheric Pollution Prevention Act (Act No. 45 of 1965)
National Water Act (Act No. 36 of 1998)
Conservation of Agricultural Resources Act (act No. 43 of 1983)
National Veld and Forest Fire Act (Act No. 101 1998)
Health Act (Act No. 63 of 1977)
National Environmental Management: Air Quality act (Act No. 39 of 2004)
National Forest Act (act No. 84 of 1998)
Provincial Legislation
Nature Conservation Ordinance (Act No. 19 of 1974)
Local Legislation
City of Cape Town Air Pollution Control By-Law 12649 - 4 February 2004 – Provincial Gazette Extraordinary 5979
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832
APPLICABLE NATIONAL LEGISLATION NOT YET IN EFFECT AT DATE OF THIS EMP
Petroleum Pipelines Act (Act No. 60 of 2003)
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

3.2. Environmental Guidelines and Standards

All applicable environmental standards contained within the environmental legislation will be adhered to. At the time of compiling this draft EMP, the following environmental guidelines and standards were identified as being applicable.

3.2.1. Air Quality Guidelines

Currently air pollution in South Africa is regulated under the Atmospheric Pollution Prevention At 45 of 1965 (APPA). The APPA is scheduled to be replaced by the National Environmental Management: Air Quality Act 39 of 2004. The new Act was signed by the President and gazetted in February 2005 and certain sections of the act came into force on 11 September 2005. In terms of this Act power generation processes will be classified as a 'listed activity' and as such will require an 'atmospheric emissions license' in order to operate. During the transitional phase an application for a registration certificate under the APPA will be taken as an application for an atmospheric emission license under the Air Quality Act. Holders of registration certificates will be responsible for proving compliance with the requirements of such permits and for applying for atmospheric emissions licenses.

3.2.2. Blasting Regulations and Standards

Wherever blasting activity is required on the site, the Contractor will rigorously adhere to the relevant statutes and regulations that control the use of explosives. It is, however, unlikely that blasting will be required for this project.

3.2.3. Control of Alien Vegetation

In terms of Government Notice R1048, the following regulations are applicable with regards to the control of invasive alien vegetation and declared weeds:

- It is illegal to have declared weed species or invasive alien vegetation on one's property.
- The landowner must immediately take steps to eradicate them by using the methods prescribed in the regulations, namely:
  - uprooting and burning, or
  - the application of a suitable chemical weed-killer (herbicide), or
  - any other method of permanent eradication.
- One may not uproot or remove such plants and dump or discard them elsewhere to re-grow or allow their seeds to be spread or blown onto other properties.
- If the landowner does not comply with requirements above, a person may be found guilty of a criminal offence.

For further detail about the management of the alien vegetation on site refer to section 4.12.4.

3.2.4. Waste Disposal

All waste (general and hazardous) generated during the construction of the powerline and substation may only be disposed of at appropriately licensed waste disposal sites (in terms of Section 20 of the Environment Conservation Act, No 73 of 1989). Cognisance must also be taken of the relevant provincial legislation in this regard. It will be noted that all controlling authority regulations pertaining to litter in terms of the Environment Conservation Act (sections 19, 19A and 24A) have been delegated to the provinces. For further detail regarding the management of waste on site refer to section 4.10.

3.3. Environmental Permitting Requirements

Environmental permits, which will be required to be obtained for construction and operation, are discussed briefly below. These will be required to be obtained before construction commences.

3.3.1. Protected Plants

In terms of the National Forest Act (No 84 of 1998) and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act (No 122 of 1984) for protected tree species), the removal, relocation or pruning of any protected plants will require a permit.

Protected indigenous plants in general are controlled under the relevant Provincial Ordinances or Acts dealing with nature conservation, i.e. Transvaal Nature Conservation Ordinance (No 12 of 1983). Included within the provincial Ordinance is the legislation regarding the plant species on the Red Data list.

Due to the fact that no protected plants were identified on site during the impact assessment, the above regulation will only be applicable in the event that a protected plant is identified during the final survey.

3.3.2. Abstraction of Water

If water is to be abstracted from a public stream during construction (for construction activities), a permit is required from the Minister of Water Affairs and Forestry. If water is to be abstracted from water of which the rights of use belong to private landowners, it will be necessary to establish whether their water use rights are still valid in terms of the provisions of the National Water Act, negotiate with the relevant landowners and then to obtain a water use permit from DWAF in terms of Section 21, 40 and 41 of the National Water Act (No 36 of 1998).

3.3.3. Heritage Sites

In terms of the National Heritage Resources Act (No 25 of 1999), a permit is required to be obtained for the disturbance, removal or destruction of any national and provincial heritage sites, archaeological and palaeontological sites, burial grounds and graves and public monuments and memorials.

3.3.4. Public Health

Ablution facilities must be approved by the nearest local authority in terms of their by-laws and relevant provincial standard by-laws. These facilities do not fall under provisions of the National Water Act (No 25 of 1999). Chemical toilets must be provided on site and must be emptied at regular intervals. No other types of ablution facilities are permitted on site.

3.3.5. Air Quality

In terms of APPA, the whole of South Africa has been declared a control area for noxious and offensive gases. Section 9 of the APPA states that no scheduled process may be undertaken without a registration certificate having been granted by the relevant Provincial Air Pollution Control Officer (APCO), that has been applied for in terms of Section 10. The process for obtaining a registration certificate is to indicate clearly to APCO that the best practicable means are being adopted for preventing or reducing to a minimum emission to the atmosphere of noxious or offensive gasses.

The Atlantis OCGT Power Station will be classified as a scheduled process. In terms of the Scheduled processes listed in Appendix 8 of the Guideline Document for the EIA Regulations, the scheduled process applicable to the Atlantis OCGT Power Station is:

(29) Power generation processes,

That is to say, processes in which:

(a) fuel is burned for the generation of electricity for distribution to the public

It is therefore required that Eskom apply to register this process with the responsible provincial APCO.

Section 16 of the APPA requires that all chimneys and openings for carrying smoke, gases, vapours, fumes, grit or dust form a fuel burning appliance must be approved by the local authority. The Atlantis OCGT Power Station has 3-5 stacks that emit gases and particulates to the atmosphere. It is necessary that Eskom register the stacks with the responsible authority.

Cape Town, including the Atlantis Industria Area, is a dust control area and the dust control measures of the APPA apply. Section 28 of the APPA states that persons who generate dust must apply best practicable means to contain dust if it is a nuisance to neighbours. The power generation process is relatively dust-free and Section 28 is unlikely to apply to the OCGT Power Station under normal operating conditions. However, dust will be generated during the construction phases of the project. In terms of Section 28 of the APPA suitable dust control measures will need to be implemented.

3.3.6. Traffic and Transport

- *Abnormal Load Permit Application*

Eskom will be required to apply for a permit to transport very large, bulky turbine plant from either Cape Town Harbour or Saldanha Bay in terms of the National Road Traffic Act, 1996 (Act No. 93 of 1996).

The critical part of the Abnormal Load Route Permit application is the survey of the prospective route by a qualified structural engineer who needs to examine all the bridges/overpasses/underpasses and issue a certificate of compliance for the particular vehicle type/width/length and height.

It is estimated that the whole survey and application procedure may take two to three months to complete.

- *Transport of Fuel*

Due to the fact that Kerosene is a hazardous material, road-based fuel tankers require a permit to transport fuel along a particular route in terms of the National Road Traffic Act, 1996 (Act No. 93 of 1996). The appointed fuel supplier needs to have a permit for this. Although the delivery demand will increase for the Atlantis Power Station it is unlikely that another route permit will be required.

4. CONSTRUCTION ACTIVITIES

4.1. Contractor Selection and Performance

- Eskom must ensure that this EMP forms part of any contractual agreements with sub-contractors for the execution of the proposed project
- The contractor must monitor the performance of the construction team from time to time to ensure compliance with the requirements of this EMP

4.2. Legal and Other Requirements

- Eskom and the Contractor must commit themselves to comply with the relevant provisions of the applicable environmental legislation and associated regulations promulgated in terms of these laws.
- The client must enter into agreement with the local authority concerning any requirements directed towards protecting the environment. Contractors will be required to respect and comply with such agreements.

4.3. Social Interaction

- All neighbours must be notified and advised of the timing of the intended construction activities.
- A community liaison officer/Communications Practitioner from Eskom will deal with community needs and complaints.
- Open liaison channels with nearby residents and Interested and Affected Parties (I&APs) must be developed in order to facilitate communication and field concerns or complaints about construction activities, working hour's etc.
- The construction camp must be planned in detail, such that affected parties do not feel threatened by the presence of construction workers.
- Contractors must prevent and prohibit their employees from entering neighbouring land and homes.
- The Contractor must construct and maintain adequate fencing around the camp and ensure that materials used for construction on the site do not blow on or move outside the site and environs.
- All construction activities must take place within the demarcated footprint. If it is necessary for activities to take place outside of this area, permission must be obtained from the ECO.
- Ensure that the entire camp site(s) is fenced, that access into and out of the camp is controlled and that gates are locked after hours and over weekends.
- Movement of construction personnel on site, outside of the demarcated development areas, must be strictly prohibited.

4.4 Labour

- Normal working hours must be maintained. Proposed normal working hours are between 06h00 and 18h00 Monday to Friday.
- The contractor must employ labour with appropriate qualifications and experience from the surrounding areas, as far as possible.
- Night-time activities must be limited as far as possible, and construction activities must be contained to reasonable hours during the day and early evening.
- Construction time limits must be implemented for noisy construction activities. Surrounding communities must be informed of the timing of such noisy activities.
- Construction outside working hours must be approved by the Community Liaison Officer/SHE Officer and the affected community must be informed accordingly
- The Contractor must inform all adjacent landowners of any after-hour construction activities and any other activity that could cause a nuisance e.g. the application of chemicals to the work surface. Arrangements are to be made with the Client and Local Authorities/community leaders for after-hours work.
- The Contractor will maintain records of time worked, wages paid and training to show compliance.

4.5. Employment

4.5.1. Local Preference

- The Contractor will give employment preference to residents of the Project Area in accordance with approved agreements and procedures.
- Where skilled workmen, artisans and operators are not available locally, they will be employed from non-local sources.
- The Contractor will make available to the Community Liaison Officer specific and relevant information on the available employment; this will include number and type of jobs, skill requirements for the jobs, duration of the jobs, remuneration scales, hours of work, conditions of work, procedures for the application of jobs, procedures for selecting job applicants, and training and certification available on the job.
- The Contractor will consider personnel from the applicants put forward by the Community Liaison Officer and will consider aptitude, health, previous training and expertise.
- No casual job seekers outside the construction site will be selected.
- The Contractor will maintain and submit records of all hirings, including dates of hiring and work commencement, the names and details of the applicants hired.

- The Contractor will maintain written records of all discussions with the Community Liaison Officer.

4.6. Safety and Security

4.6.1. General Procedures

The Contractor will ensure the implementation of the following safety and security measures:

- Clearly mark dangerous areas and restrict access to these areas.
- Ensure compliance with the Occupational Health and Safety Act (No 85 of 1993).
- Ensure that no person under the influence of alcohol or narcotic substances is permitted to work on the site.
- Ensure adequate signage is provided along the major roads and at the entrance of the construction site.
- In terms of construction worker safety, safety management plans must be implemented.
- Community safety & community safety concerns are to be addressed by the Contractor.

4.6.2. Health and Safety

Element	Management Plan
Controls	• A Health and Safety Plan will be developed in respect of construction worker safety. This plan must be in line with Eskom's SHE Policy and relevant legislation. • A health and safety officer/SHE Officer must be employed to monitor project activities for any potential problems. • Contractors must adhere to the prescriptions of the relevant health and safety legislation and standards. The Contractor must familiarise himself and his employees with the contents of the aforementioned Legislation. • First Aid facilities must be on hand at all times in accordance with international practice. • The Contractor must implement adequate and mandatory safety precautions relating to all aspects of the operation. Such safety measures and work procedures/instructions must be communicated to construction workers. • The wearing of safety equipment on site is mandatory for all personnel and construction team members. Minimum requirements must include the wearing of an approved safety helmet and safety boots. Ensure that all labourers are supplied with the appropriate safety equipment. • No one must be allowed on site unless wearing approved safety equipment.

Element	Management Plan
	• The Contractor's name or logo must be clearly visible on the helmet along with the name of the person and their designation. • Identity tags complete with a photograph must be issued to all individuals that are to be present on site for more than 3 consecutive calendar days. • Casual visitors must be required to sign a register at the security checkpoint and must be issued with a visitor's permit. A responsible person must endorse this permit before leaving the security area. • Existing fences must be maintained throughout the construction period. • All temporary fencing must be removed on completion of the contract. • Spillages of chemicals or fluids must be cleaned up immediately using the appropriate procedures. • No open trenches must be permitted without the use of demarcation tape. • Speed limits must be enforced in all areas, including public roads and private property to avoid potential accidents. • Erection of scaffolding must be undertaken by a certified practitioner. • Workers' right to refuse work in unsafe conditions must be respected. • Personnel must be trained in basic site safety procedures. • The Contractor must design, test/exercise appropriate emergency preparedness programmes (plans, schedules, procedures and methods) for addressing environmental accidents, incidents and events such as spills of fuel, oil or lubricants; veld fires and heavy rainfall causing exceptional runoff, leading to soil erosion and silt laden runoff etc. • The contractor must be obliged to ensure that workers are educated about HIV/AIDS and that condoms are readily distributed. The local health services are to participate in order to ensure the implementation of education/condom distribution programmes.
Maintenance	• Ensure that experienced and skilled personnel are designated and authorised to take remedial and corrective action in the case of an accident or incident, e.g. fire officer, first aid officer and for spills. • Ensure that the emergency numbers for the area are clearly displayed and available at all times. • Ensure that basic fire-fighting equipment is available, i.e. fire extinguishers, rubber beaters and a water tank equipped with a pump and a hose.
Monitoring	• Regular auditing of safety requirements must be undertaken in order to monitor and control problems before they become

Element	Management Plan
	unmanageable. • A record must be kept of all incidents on site.

4.7. Hazard Risk and Emergency Response

Element	Management Plan
Potential Impacts	• Fire • Transport spillage of fuel
Sources	Sources identified in the risk assessment include both construction and operational hazards
Controls	• Development of construction specific response procedures for: ∗ Safety training ∗ On-site and off-site emergency plans for fire and spill response ∗ Monitoring ∗ Incident reporting ∗ Community consultation and information ∗ Cleaning-up and remediation procedures • Develop construction work instructions for all high-risk activities. e.g. welding • Regular checks and drills must be conducted to ensure that the risk and hazard control strategies are maintained and up to date.
Monitoring	• All monitoring will occur according to appropriate plans and guidelines • The complaints register must be maintained. All complaints must be investigated and, if appropriate acted upon.
Corrective Action	• If reports or drills indicate an error / omission in risk and hazard management procedures, then procedures must be altered or updated to ensure effective management. • If an incident occurs, the emergency procedures must be enacted to ensure all impacts are minimised.

4.8. Fire Control

Element	Management Plan
Sources	Open fires / flames on site
Controls	• A Fire Management Strategy must be compiled and implemented. • All construction personnel will receive training on fire hazards and techniques to extinguish any fire that may be initiated on the site. • They must also be made aware of the added risks during the dry summer months, as well as, of the Fire Management Strategy to be implemented during construction. • The equipment required to extinguish any fires that may be

Element	Management Plan
	initiated by construction activities must be installed on the site. • Flammable materials will be stored under conditions that will limit the potential for ignition and the spread of fires. • Staff will not be permitted to light fires on the site or on surrounding land, in areas other than those designated as safe by the Site Manager. • There will be a (recommended 5 m) firebreak around the construction site. This area will be kept clear of vegetation and refuse. • Burning of vegetation cut during site clearing and establishment will not be permitted unless authorised by the Site Manager. All cleared vegetation will be removed to a landfill site designated by the SHE Officer/ECO. • The Contractor will supply fire-fighting equipment in proportion to the fire risk presented by the type of construction and other on-site activities and materials used on site. This equipment will be kept in good operating order. • No fires must be allowed adjacent to the boundary fence, either inside or outside the construction site. • Any welding or other sources of heating of materials must be done in a controlled environment, wherever possible and under appropriate supervision, in such a manner as to minimise the risk of veld fires and/or injury to staff. • The Contractor will take reasonable and active steps to avoid increasing the risk of fire through his activities on site. Accidental fires must be prevented through proper sensitisation of employees towards the associated risks, dangers and damage of property. • The use of open fires for cooking of food, etc. by construction personnel must be restricted to designated cooking areas. • Restrict smoking activities to demarcated smoking areas. • Ensure that an emergency preparedness plan is in place in order to fight accidental veld fires should they occur. The adjacent land owners/users/ managers must also be informed and/or involved. • The use of branches of trees and shrubs for fire-making purposes must be strictly prohibited.
Corrective Action	• Report any fires which occur to the ECO as soon as possible

4.9. Site Establishment and Management

4.9.1. Construction Site Layout Plan

Once the design and positioning of the power station has been finalised, the Contractor will develop a construction layout plan, indicating the intended use of the site, including the following to be supplied by Eskom:

- The extent of the power station construction area.
- Site access during construction (including all entry and exit points).
- Two metre interval contour lines.

In addition, the following will be indicated by the Contractor:

- All material and equipment storage areas (including storage areas for hazardous substances such as fuel, cement and herbicides).
- Construction offices and other structures.
- Security requirements (including temporary and permanent fencing and lighting) and accommodation for security staff.
- Areas where vegetation is required to be cleared.
- Areas where material is to be stockpiled (including construction materials and topsoil).
- Solid waste collection facilities.
- Temporary construction phase stormwater control measures.
- Areas which require slope stabilisation during construction.
- Provision and management of potable water and temporary ablution facilities for construction personnel.

The construction area must be clearly demarcated on the site plan, and all other areas must be considered no-go areas for the construction personnel.

Only designated areas may be used for the storage of construction material, topsoil, machinery, equipment and establishment of site offices.

The construction layout plan will be made available to the Site Manager (Eskom's representative) for written approval. Throughout the period of construction, the Contractor will restrict all activities to within the approved areas on the construction layout plan.

4.9.2. Construction Camp and Construction Staff

The Contractor will be responsible for negotiating the site camps(s) and conditions under which the site may be established with the relevant landowner(s) (if required). Prior to the establishment of the site camp(s), the Contractor will produce a layout plan showing the positions of all buildings, vehicle wash areas, fuel and cement storage areas and other infrastructure for approval of the Site Manager. If possible, it is considered preferable to locate the site camp as close as possible to the construction site.

A signboard must be placed in the area of construction informing the public of the construction activities taking place.

Construction staff must be adequately educated by the Environmental Control Officer or the Site Manager as to the provisions included in the EMP and general environmentally friendly practice.

The conduct of on-site workers must be specified to the Contractor by Eskom. Specifications are to include sanitation, water and waste (litter), as well as informal trading and interfering in local community/cultural affairs. The following activities must be prohibited at site camp(s), and by the construction staff in general:

- The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames which could result in veld fires or constitute a hazard.
- Indiscriminate disposal of rubbish or rubble.
- Littering of the site.
- Spillage of potential pollutants, such as petroleum products.
- Collection of firewood.
- Lighting of fires for cooking, heating or other purposes outside designated areas, and failure to exterminate any fires.
- Burning of any type of waste material.
- Interference with any wildlife, fauna or flora.
- Poaching of any description.
- Use of any ablution facility other than those provided.
- Burning of wastes and cleared vegetation under any circumstances.
- The use of rivers, streams, dams or any watercourses/surface water for washing purposes.
- Entering areas outside of the demarcated construction area without relevant permissions.
- The presence of construction staff at the construction site outside of the designated construction times (6:00 to 18:00), i.e. no construction staff are allowed to overnight on site, outside of the demarcated construction camp.

4.9.3. Sanitation

Element	Management Plan
Controls	• A minimum of one chemical toilet must be provided per 15 persons per shift. • Toilets must be strategically placed (easily accessible to workers) and will not be situated within 150m of any borehole or drainage line. • They must be secure, clean and functional throughout the construction period. • All ablution activities must take place in these facilities, and the waste material must be stored and disposed of at the

Element	Management Plan
	registered waste disposal site or collected by a suitable waste contractor on a regular basis. • The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied. • The exact location of the toilets must be approved by the SHE Officer/ECO prior to establishment. • All temporary/portable toilets must be secured to the ground to prevent them from toppling due to wind or any other cause. • The Contractor will ensure that the entrances to toilets are adequately screened from public view. • Discharge of waste from toilets into the environment and burying of waste is strictly prohibited. • Suitable toilets will be provided for the staff at all points at which workmen are carrying out duties under the contract.
Monitoring	• The Contractor will monitor that toilet facilities are used by personnel and that use of non-designated areas is actively discouraged.

4.9.4. Site Management

Element	Management Plan
Controls	• The Contractor must take responsibility for the camp to conform to all contractual aspects and environmental standards applicable. This includes aspects related to stormwater management and waste management. • The Contractor must provide adequate refuse bins that must be cleaned/emptied and the waste removed from site on a regular basis. • The construction camp must be kept neat and tidy at all times. • Water sources/taps available for drinking water etc. must be pointed out by the EO. It is not advisable that a contractor makes use of or collects water from any other source other than those pointed out to them as being suitable for use. • Food preparation must only be done in areas designated by the EO.

4.9.5. Site Access

Element	Management Plan
Controls	• Access in and out of the site must be allowed only at one point to minimise impacts during construction. • All areas of construction activity will be fenced by the Contractor prior to construction, unless authorisation to the contrary is given by the Site Manager. Fencing will be done at individual areas of construction and around the full perimeter of the site. • Construction activities must be limited to areas which are deemed to be safe, and deemed as the minimum area needed for the construction activity. All sites that are identified by the Site Manager as being unsafe will be indicated as such with warning signs in all relevant languages. • Livestock/domestic animals will be not be permitted access to construction sites.

4.9.6. Site Clearing

Element	Management Plan
Controls	• The size of areas subjected to land clearance will be kept to a minimum. • Only areas as instructed by the Site Manager must be cleared and grubbed. • Cleared vegetation debris which has not been utilised or collected by local communities will be collected and disposed of to a suitable waste disposal site. It will not be burned on site. • No vegetation will be cut or collected off construction sites for burning or for any other purpose without the prior permission of the Site Manager. • All vegetation not required to be removed will be protected against damage.

4.9.7. Plant Repair, Maintenance & Cleaning

Element	Management Plan
Controls	• No vehicle maintenance and repairs will be undertaken within a 30m radius of any water courses and drainage lines. Any facilities susceptible to oil, petrol and diesel spillage will be located a minimum of 30m and preferably 50m from all water course. • Repair yards, batching plants and stationary machines will be provided with sumps, and spilled fluids and runoff will be kept in a conservancy tank until removed from the site in terms of

	the relevant legislative requirements. • Adequate collection facilities such as diversion mounds, ditches, drains, oil separation sumps and sedimentation ponds will be constructed at each location with a pollution potential. • All repair work away from bunded areas will make use of drip trays. • Regular inspections will be carried out to detect leaks and spillages. These facilities will be maintained as regularly as is necessary to ensure they meet the original specification.

4.10. Noise

Element	Management Plan
Potential Impact	Nuisance noise from construction activities affecting the surrounding areas
Sources	• Site preparation and earthworks • Construction related transport • Foundations and plant equipment installation • Building activities
Controls	• Noise control measures must be implemented. All noise levels must be controlled at the source. • All employees must be given the necessary ear protection gear, if necessary. • Affected parties must be informed of any excessive noise factors. • No loud music is allowed on site and in construction camps. • Impose prescribed working hours of between 06:00 and 18:00, with preferably no work permitted on Sundays and public holidays. • A speed restriction of 40km/h will be imposed on all construction vehicles on site, in order to limit additional noise generated by these vehicles. • Construction-site generated noise will not be above background levels inside any homestead adjacent to the construction areas between 10 pm and 7 am. • The Community Liaison Officer/SHE Officer will be advised in advance when unavoidable out-of-hours work will occur. • Appropriate and effective mufflers must be fitted to earth-moving and other vehicles on the site. • Noise from vehicles and on-site powered machinery and equipment will not exceed the manufacturer's specifications, based on the installation of noise attenuation measures.
Maintenance	• All construction equipment must be maintained in good working order. • Silencers on construction equipment will be maintained to ensure no deterioration in noise-dampening capacity.
Corrective Actions	• The Contractor will respond timeously in the event of any complaints by local residents or others about disturbing noise.

Element	Management Plan
	The noise source will be identified and appropriate noise mitigatory measures instituted in consultation with the affected party(ies). • In the case of legitimate complaints the noise level must be tested by a specialist

4.11. Aesthetics

Due to the height of the facility, it is not considered a viable option to shield the plant from the observer but to rather implement measures to shield the observer from the plant. The strategic placement of the OCGT plant is the first level of visual impact mitigation. The placement must occur with utmost care and sensitivity towards potential observers and must address both primary and secondary associated impacts.

Element	Management Plan
Potential Impacts	The negative visual impact of the construction of the power station on surrounding communities.
Sources	• Power station construction site • Roadways • Associated construction equipment and vehicle movement
Controls	• The strategic placement of the OCGT Plant. • Careful planning and sensitive placement of light fixtures and the fitment of covers and shields designed to contain rather than spread light. • The use of vegetation in order to soften the stark lines and sharp edges of the OCGT units. • Damage to the natural environment must be minimised. • Trees and tall woody shrubs must be planted to provide a natural visual shield. Excavated material must not be placed on such plants and movement across them must not be allowed, as far as practical. • No painting or marking of natural features must be allowed. Marking for surveying and other purposes must only be done with pegs and beacons. • Avoid the use of overtly contrasting and bright colours when painting the OCGT units. Natural hues that complements the natural environment can soften the general appearance of the power plant (e.g. light sky blue could be used where the facility is seen against the skyline, pale green can be used where it is seen against the vegetation. • All lighting where practical, must be "down" to minimise the visual impact of the facility at night. Lighting must be directed towards the areas they are suppose to illuminate. • The minimum amount of lighting must be used. • The Architectural and Cultural heritage of the area must be

Element	Management Plan
	included in the design guidelines for development.
Maintenance	Timely maintenance of the OCGT units, ancillary infrastructure and general surrounds of the property (i.e. gardens, access roads etc.).
Corrective Actions	If a visually intrusive component of the site is identified, procedures must be altered or updated to ensure effective management.

4.12. Vegetation

4.12.1. Vegetation Clearing

All vegetative matter will be physically removed from all areas where construction is to take place. Prior to site clearance, a detailed survey of the vegetation in the area must be undertaken by a qualified vegetation specialist and any protected plant species recorded must be appropriately marked. The appropriate permit/s must be obtained from the Provincial Department of Conservation in the event that protected plants need to be relocated. All cleared areas will be stabilised as soon as possible in order to minimise the risk of erosion.

In terms of the Environment Conservation Act (No 73 of 1989), the disposal of vegetation by burying or burning is prohibited. No vegetative matter will be burnt or removed for firewood by any Eskom employee or contractor prior to the necessary permission from the relevant authorities. The use of herbicides will only be allowed after a proper investigation into the necessity, the type to be used, the long term effects and the effectiveness of the agent.

The Contractor will ensure:

- The areas needing to be cleared and the degree of clearing required must be determined and demarcated in consultation with the ECO before clearing begins.
- The Contractor may not deface, paint or otherwise mark and or damage natural features / vegetation on the site, unless agreed beforehand with the EO. Any features / vegetation defaced by the Contractor must be restored to the satisfaction of the EO.
- The EO must be present during vegetation clearing.

Plant search and Rescue:

- Plant search and rescue (i.e. the location and removal of specified plant species, without unnecessary damage, and their transfer to a specified location) and the collection of seed, will be conducted by the ECO prior to the onset of any site clearing operations, should the detailed survey indicate this to be necessary.

- Sensitive areas and/or species that have been selected for conservation by the ecologist or ECO, will be demarcated with danger tape/hazard tape. No activity will take place at these areas.

4.12.2. Protection of Vegetation

The Contractor will ensure that all works are undertaken in a manner, which minimises the impact on vegetation outside of the site area as designated in the construction site layout. However, it may be necessary in certain instances to remove or prune vegetation outside of the development in order to prevent possible damage to the facilities. This must be undertaken in consultation with the Site Manager.

4.12.3. Threatened and/or Protected Plant Species

A protocol describing the actions to be followed if a threatened species is found must be in place. Prior to vegetation clearance, any threatened and/or protected plant species which have been identified by the vegetation specialist and/or Environmental Control Officer must be removed and transplanted, wherever possible. These plant species must be planted in similar soil conditions and to the same depth as they were before removal. Care must be taken during the removal of plants to ensure that they are not damaged. The plants must be watered directly after transplanting to settle the soil. The Contractor must be assisted by an experienced individual or organisation.

The purpose of the vegetation survey is to:

- determine the actual occurrence of threatened and or protected plant species; and
- ensure that appropriate mitigation measures are taken, i.e. removal for plants for genetic propagation, relocation of plants (the relocation of sensitive species is not considered a favourable option due to the unknown secondary impacts of the relocated plants on the receiving environment and the low probability of long-term survival of the relocated specimens due to high habitat specificity).

Where it is absolutely essential to cut protected indigenous plants, Provincial Ordinances will be adhered to. The necessary permits will be obtained prior to commencement of any work.

4.12.4. Alien Vegetation

Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and protecting the agricultural resources and soil

conservation works are regulated by the Conservation of Agricultural Resources Act (No 43 of 1983) and must be addressed on a continual basis, through an alien vegetation control and monitoring programme.

In view of the fact that the presence of declared weeds is illegal, it is recommended that the landowner/manager comply with the following legally prescribed requirements (refer to Sections 1, 2, 5 and 6 of the Conservation of Agricultural Resources Act (No 43 of 1983), as well as government notice GN R1048):

a) The landowner/manager must take steps to eradicate the declared weeds by using the methods prescribed in the regulations, namely
   - uprooting and burning, or
   - the application of a suitable chemical weed-killer (herbicide), or
   - any other method which will ensure their permanent eradication.

b) One may not uproot or remove such plants and dump or discard them elsewhere to re-grow or to allow their seeds to be spread or blown onto other properties.

c) If the landowner/manager does not comply with the requirements under a) and b) above, he/she is guilty of a criminal offence.

The Contractor will remove all alien vegetation on the OCGT Site as listed in the Conservation of Agricultural Resources Act (No 43 of 1983), or as directed by the Environmental Officer during the construction period. Table 4.1 lists the alien species found on the OCGT Plant Site.

Table 4.1. Alien plant species recorded at the OCGT Plant site. All the exotic species are indicated by **(e)** the declared weeds by **(w)** species with invasive qualities by **(i)**.

Species	Common Name	Ecological Status
Woody Species		
Acacia saligna	Port Jackson	w2
Acacia Cyclops	Rooikrans	w2
Grass Species		
Lolium perenne	Perennial Ryegrass	i
Hordeum murinum	Mouse Barley	i

An alien control and monitoring programme must be developed before the construction phase and to be carried over into the operational phase. The alien control and monitoring programme is included in Appendix B. The following elements are included in such a programme:

- The active control of all alien invasive species by means of manual removal, ring-barking, chemical control or a combination of these methods.

- The bigger trunks and branches must be removed while the smaller branches can be used as a soil stabiliser against wind erosion in exposed areas, while providing micro-habitat for seedling establishment.
- Rehabilitation of the cleared areas, starting with the establishment of a grass cover and phasing in the re-establishment of fynbos species by sowing in of smoked treated seed or pre-emerged seed.
- All emergent seedlings must be removed by hand and re-sprouting from existing rootstock must be chemically treated in a continual monitoring and follow-up programme.
- Ideally the clearance and rehabilitation efforts must not be limited to the Atlantis power station site and alignment corridors alone, but must include the larger Atlantis industrial site in a phased approach, starting at the northwestern corner. The Control of Alien invasive species will be an ongoing process, especially if the source of invasion is not removed (i.e. the surrounding invasion of the greater Atlantis industrial area).

A detailed Rehabilitation Programme detailing all rehabilitation to be undertaken is included in Appendix C.

If properly planned and motivated this could serve as a trade-off programme with the potential of attracting external funding (e.g. Working for Water and/or Extended Works Programme). The method used for clearing of alien plants must include a full long-term alien eradication programme. The mature woody plants can be cut down to knee height and herbicide must be applied to all exposed surfaces (a dye must be mixed with the herbicide to assist with identifying plants where it has been applied). All alien plant material must then be removed from site to reduce seeds from spreading. All seedlings, young plants and forbes can be removed by hand, ensuring that roots are removed with the plant. Follow-up clearing must be implemented following the initial alien removal (after approximately two months), to eradicate all the seedlings that will germinate following the removal of the mature specimens. Follow-up clearing must be required on an annual basis to prevent the aliens from re-establishing (Bromilow, 2001).

Not all species listed in Table 4.1 are listed as declared weeds according to the legislation. It is, however, recommended that all these species be removed where possible. The herbaceous, willow rooted species are easily removed by hand.

4.12.5. Herbicide Use

The use of herbicides will be in compliance with the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No 36 of 1947). In terms of this Act, a registered pest control operator will apply herbicides, or will supervise the

application of herbicides. Herbicide use will only be allowed with the approval of Eskom. The application will be according to set specifications and under supervision of a qualified technician.

Therefore, the Contractor will:

- Ensure that a registered pest control operator applies or supervises the application of all herbicides.
- Ensure that all Eskom policies on the use and application of herbicides will be adhered to.
- Ensure that all herbicides are stored in a well-ventilated demarcated storage area.
- Ensure that a register of all contents of the storage area is kept and updated on a regular basis.
- Ensure that a daily register of all relevant details of herbicide usage is kept, and that such a register is maintained by the relevant Eskom custodian.

The Eskom policy for herbicide use is included in Appendix D.

4.13. Fauna

Element	Management Plan
Potential Impacts	Impact on both terrestrial fauna and avifauna as a result habitat destruction due to construction activities.
Sources	• Construction camp and labour • Mobile construction equipment • Traffic to and from site
Controls	• No disturbing, injuring or killing of any fauna (including snakes specifically the Cape Cobra) for any purposes. • No feeding of wildlife. • No domestic animals are to brought onto the site. • The construction site will be kept clean and tidy and free from rubbish which would attract animal pest species. • Eskom will advise all employees, contractors and subcontractors of the penalties associated with the needless destruction of wildlife, as set out in the Animals Protection Act (Act 71 of 1962) sec. 2 (fine R2 000 and/or 12 months imprisonment).
Corrective actions	• The Contractor will, as soon as reasonably possible, but within 24 hours of becoming aware of a complaint relating to wildlife interaction, respond to the complaint and register the complaint in the Environmental Register (refer to Section 4.16). In addition, the complaint must be reported to the Environmental Practitioner as soon as possible such that the incident can be investigated by the Environmental Practitioner or Contractor • In the event that a snake (such as Cape Cobra) or any other problem animal is encountered, a professional must be called in

Element	Management Plan
	to remove the problem animal (i.e. the local Nature Conservation Officer).

4.14. Heritage

Element	Management Plan
Potential Impacts	Heritage objects or artefacts found on site and inappropriately managed.
Controls	• All relevant legislation regarding the conservation of national heritage sites must be adhered to. • The co-ordinates of the site must be plotted on a site plan to establish if any heritage sites lie within the final footprint of the OCGT. • An archaeologist/palaeontologist must be appointed to inspect any preliminary geotechnical excavations that are carried out. • An archaeologist/palaeontologist be appointed to monitor any bulk excavations that take place on site during the construction process. • Bulk excavation for laying of pipelines on site (kerosene, gas or water) are subject to field proofing by an archaeologist. • Under no circumstances must the contractor, his employees, his sub-contractor's employees remove, destroy or interfere with archaeological artefacts.
Maintenance	Awareness of procedures for dealing with heritage objects must be updated where necessary.
Corrective Action	• In the event that any heritage sites are found within the footprint of the OCGT plant all work will cease immediately, and the event reported to Heritage: Western Cape immediately. • The excavation must be examined by an archaeologist as soon as possible. The ECO will advise the Contractor of necessary actions to be taken after receiving advice from the archaeologist. All necessary actions to ensure that delays to construction are minimised must be taken. • If any human remains are discovered they must be treated with respect and SAHRA notified immediately. An archaeologist/palaeontologist must be contracted to remove the remains at the expense of the developer. • Eskom may need to apply for a permit from Heritage Western Cape to destroy the occurrences if they are to be affected by the proposed activities. The province archaeologist may at her discretion ask that mitigatory work in form of archaeological trial excavations and rescue of archaeological material be conducted by an accredited archaeologist as a condition of such a permit being issued.

4.15. Air Pollution Management

4.15.1. Air Quality

Element	Management Plan
Sources	• Fuel burning engines • Emissions from Concrete and asphalt batch plants • Fire
Controls	• All activities on-site must comply with the requirements of the Atmospheric Pollution Prevention Act (Act No. 45 of 1965). • Burning of materials including wood, grass and refuse which emit visible smoke will not be permitted on construction sites. • Waste must be disposed, as soon as possible at a municipal transfer station, skip or on a permitted landfill site. Waste must not be allowed to stand on site to decay, resulting in malodours and attracting vermin. • No open fires are to be allowed on site. • Ensure that batching plants are fitted with the appropriate filters.
Maintenance	• The Contractor will ensure that all vehicles and machinery are fitted with appropriate emission control equipment, are maintained frequently and serviced to the manufacturers' specifications.
Corrective Actions	• If monitoring results or complaints indicate inadequate compliance with the EMP, the source of the problem must be identified and existing procedures or equipment modified to ensure that the problem is rectified. • Non-compliance with the EMP must be reported to the department, in writing, within 24 hours of an incident.

4.15.2. Dust Control

Element	Management Plan
Potential Impacts	Dust and particulates from vehicle usage, excavation, temporary stockpiles and land clearing affecting the surrounding community and site visibility
Sources	• Clearing of vegetation and topsoil • Excavation, grading / scraping and transport of material • Loading and unloading of trucks • Re-entrainment of deposited dust by vehicle movement • Wind Erosion from stockpiles and unsealed roads and surfaces
Controls	• Speed limits must be enforced in all areas, including public roads and private property to limit the levels of dust pollution • Dust must be suppressed on access roads and construction sites during dry periods by the regular application of water or a biodegradable soil stabilisation agent. Water used for this purpose must be used in quantities that will not result in the

Element	Management Plan
	generation of run-off. • Dust dispersion from construction activities, unsurfaced roads, spoil dumps and other construction locations will be limited and suppressed to the maximum extent practical. • Spoil dumps will be positioned such that they are not vulnerable to wind erosion. • Spoil and other dust-generating dumps which are left unused for 28 days or longer will be sprayed with water or chemically inert stabilisers to control dust, and treated with mulch and seeded. • Untarred roads will be sprayed with water from a water cart to limit dust generation by construction vehicles. Where spraying of water on roads is not adequate for dust control, environmentally benign binding agents will be used to limit dust generation by construction vehicles. • An appropriate freeboard will be maintained in trucks hauling dirt, sand, soil and other loose material when leaving the road reserve.
Maintenance	• Roads must be sealed as soon as possible and maintained to ensure that dust from road or vehicle sources will not exceed prescribed levels • Any cleared areas must be watered to ensure that dust levels are minimised prior to sealing or revegetation
Corrective Actions	• In the event of serious levels of dust pollution, the implementation of constant dust monitoring by qualified consultants must be undertaken • If monitoring results or complaints indicate inadequate compliance with the EMP, the source of the problem must be identified and existing procedures modified to ensure that the problem is rectified

4.16. Water Management

4.16.1. Water for Domestic Use

The Contractor will implement measures to ensure that the construction workforce present on the site has access to sufficient potable water.

Element	Management Plan
Controls	• The provision of potable water and safe drinking utensils at various points on the site. • Provision of facilities for hand washing at all ablution facilities and near all toilet facilities. • Contractors must ensure construction crews are provided with an appropriate portable water supply, safe and healthy sanitary facilities and protection against exposure to

	environmentally dangerous or unhealthy situations or conditions. • All runoff water from fuel deposits, workshops, vehicles washing areas and other equipment must be collected and directed through oil traps to settlement ponds. These ponds must be suitably lined. • All runoff washing water and changing facilities must not be disposed of directly into drainage lines, streams or rivers, but in an environmentally acceptable manner.

4.16.2. Water Consumption

Element	Management Plan
Controls	• Create awareness and encourage the construction workforce to use water sparingly such that there is no water wastage. • Ensure that no natural water sources (i.e. streams, rivers) are used for construction activities or for domestic purposes by the construction workforce. • Negotiate the use of water for any purpose with the appropriate authorities and obtain written approval. • The contractor will not make use of/collect water from any other source than those pointed out to them as suitable for use.

4.16.3. Water Pollution Management

Element	Management Plan
Controls	• Ensure that working areas where hazardous substances (such as cement and vehicle fuels) are handled or stored are designed to collect and contain these hazardous substances. • Ensure that no pollution enters surface water or has the potential to pollute groundwater by ensuring that there is containment of spillages (e.g. diesel, oils, etc) and that there is an emergency plan in place to deal with accidental spillage (Refer to Appendix E). • Ensure that washing of containers, equipment, vehicles and other surfaces only occurs at designated washing areas. • Ensure that sufficient ablution facilities are provided (at least one toilet for every 15 members of the construction workforce per shift). Adequate numbers and placement of portable chemical toilet facilities at construction sites is crucial to prevent unnecessary pollution of the surrounding environment. • All fuel, chemical, oil, etc spills must be confined to areas where the drainage of water can be controlled and managed to confine spillages such that they do not interfere with stormwater and groundwater (referred to as 'clean water').

	This can be achieved through the use of appropriate structures and methods such as the construction of bunded areas, berms and pans, or through the application of surface treatments that neutralise toxic effects.

4.16.4. Water Flows Across Construction Sites

Element	Management Plan
Controls	• Adequate measures will be put into place to control surface water flows across and around all construction sites. • The quantity of uncontaminated stormwater entering cleared areas will be minimised by appropriate site design and by installation of control structures and drains which direct such flows away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations. • Site drainage lines will be identified and control measures installed to handle predicted stormwater and sediment loads generated in the mini catchment. • The extent of continuous slopes in zones where flowing water is anticipated will be minimised by appropriate design and the installation of control structures. • The velocity of stormwater flows and associated scouring across construction sites will be controlled though the installation of geotextiles, rock- or other structures. • All drains constructed on site must discharge into natural drainage lines. • A ground water monitoring programme must be established on the site. This monitoring programme must commence within one week of construction activities beginning. • Details pertaining to all effluent control measures are included in Appendix F.

4.16.5. Waste Water

Element	Management Plan
Controls	• The Contractor will submit a site design of waste/foul water management systems as part of the environmental management plan for prior approval by Site Manager (Refer to Appendix G). • All water discharged from the works including effluent from sewage treatment, wash water and stormwater from workshops and refuelling areas, as well as all runoff from areas with pollution potential will comply with national effluent standards. • Plan the layout of wash areas, batching areas and workshops with the following guidelines in mind: • Optimise the layout to minimise disturbance to the

	environment and to neighbours • Concrete slabs must slope towards a conservancy tank so that run-off water can be collected. These tanks must be emptied, at least once a week or when they are 60% full

4.17. Soil Management

4.17.1. Topsoil

Element	Management Plan
Controls	• Topsoil[1] will be sourced from areas which are cleared for construction and spoil dumps, conserved and used judiciously in the rehabilitation of disturbed land. • The Contractor is required to strip topsoil together with grass from all areas where permanent or temporary structures are located, construction related activities occur, and access roads are to be constructed. Topsoil must be stockpiled for later use. • Topsoil stripping will be scheduled for the dry season, as far as possible. • Topsoil is to be handled twice only - once to strip and stockpile, and secondly to replace, level, shape and scarify. • Topsoil must not be compacted in any way, nor should any object be placed or stockpiled upon it. No vehicles may be allowed access onto the stockpiles after they have been placed • Topsoil is to be replaced along the contour. • Topsoil stripped from different sites must be stockpiled separately and clearly identified as such. • Land to which topsoil has been applied will be vegetated as soon as possible after application. • The disposal of unused topsoil (i.e. topsoil leftover after site rehabilitation and landscaping is complete) must be undertaken in consultation with the surrounding landowners and relevant authorities.
Maintenance	• Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds which would adversely affect its suitability for planting. • Topsoil stockpiles are not to exceed 1,5 m in height. Topsoil, which is to be stockpiled for periods exceeding 28 days, must be treated with mulch, roughened and seeded with an approved grass mixture or ground cover specified by the SHE Officer/ECO. The mulch cover must kept free of alien vegetation/seeds

[1] Topsoil is defined as the top layer of soil that can be mechanically removed to a depth of about 100mm without ripping or blasting.

4.17.2. Spoil Material

Element	Management Plan
Controls	• The location of spoil stockpile sites will be agreed by the ECO prior to the onset of any operations that will generate spoil materials. No spoil material will be dumped outside the defined site. The Contractor will ensure that the material does not blow or wash away. If the spoil material is in danger of being washed or blown away, the contractor will cover it with a suitable material such as hessian or plastic. • All cut material will be tested against quality requirements for other works. • If material meets quality requirements for other works it must be taken to the relevant area on instruction of the Site Manager • If material does not meet the quality requirements for other works the material must be disposed of at a relevant waste disposal site. • Spoil dumps will be located at least 10 m away from natural drainage lines. • Spoil dumps will be placed wherever practical in topographically sheltered locations to obtain maximum protection from wind exposure. • All spoil dumps assessed as being unstable will be encircled with silt fences or drainage systems that will collect and dispose of contaminated water. • Spoil dumps will have slopes not greater than 1:2 (vertical to horizontal). Less steep slopes will be applied in conditions where erosion risks are indicated to be high. • Spoil dumps will be smoothed and contoured and compacted to prevent ponding.

4.17.3. Excavation, Backfilling and Trenching

Element	Management Plan
Controls	• Excavations should preferably not be undertaken until such time that all required materials/services etc. are available on-site, to facilitate immediate laying of such services or the construction of subsurface infrastructure. • Any such excavations must be undertaken within the confines of an established construction site - i.e. a site that is either protected with a peripheral fence, or a site that has a regular/continual human presence. Failing this, regular daily inspections are essential. All excavations, regardless of depth, must be provided with escape ramps, suitably constructed with a stable gravel or similar material, at a minimum

Element	Management Plan
	gradient of 1:2. • Consider using any excess rocks and boulders that were excavated from the construction site for any erosion protection work which is required on site. • Excess material as a result of excavation activities is not to be dumped along the roadsides, but must, together with construction rubble be removed, once construction is completed, and appropriately disposed of. • Suitable excavated material is to be stockpiled next to excavations for use as backfill and all unsuitable or excess material must be loaded onto trucks and hauled to designated spoil areas. • Backfill material must be from excavated material or imported from a suitable source if the excavated material does not conform to the required specifications • Areas to be backfilled must be cleared of all unsuitable material and debris

4.17.4. Erosion Control

Element	Management Plan
Controls	• Areas susceptible to erosion must be protected by installing the necessary temporary and/or permanent drainage works as soon as possible and by taking other measures necessary to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas. • Any runnels or erosion channels developed during the construction period of during the vegetation establishment period shall be backfilled and compacted, and the areas restored to a proper condition. • Anti-erosion compounds shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be of such quality that grass seeds may germinate and not prohibit growth. • The following erosion control methods can be considered where required: ❖ Brushcut packing ❖ Mulch or chip cover ❖ Straw Stabilisation ❖ Watering ❖ Planting/sodding ❖ Hand seeding/sowing ❖ Hydroseeding ❖ Retating walls ❖ Soil binders and anti-erosion compounds

Element	Management Plan
	❖ Log/pole fencing • These erosion control measures, including stormwater drainage systems, will be installed before construction commences. • Installed erosion control measures will be appropriate to site conditions to handle a one-in-two-year storm event for temporary structures, and a one-in-fifty year storm event for permanent structures which provide ongoing sediment control after a site has been rehabilitated. • Contingency plans will be in place for extreme storm events. • Blocking of stormwater drainage systems must be prevented and storm water must be managed to prevent soil erosion. • Natural stormwater run-off, which is not polluted by the site operations, must be diverted around spoil dumps and soil stockpiles. • Where stormwater has accumulated in the working area and needs to be pumped out, it must be disposed of into the nearest stream or river in such a way that erosion does not occur along the course of its passage. • No stormwater must be allowed to enter drainage installations (i.e. installations for the reception, conveyance, storage or treatment of sewage. • Maintain soil erosion structures such as stone pitching, gabions, etc to enable effectiveness. • Site activities will take overall recognition of the importance of measures to avoid and reduce erosion by phasing the work program to minimise land disturbance in the planning and design stage, by keeping the areas of land cleared to a minimum, and by ensuring that the period of time for which areas remain cleared are kept to a minimum. • All cleared areas will be promptly rehabilitated and in accordance with specific instructions from the Site Manager. • Soil must be exposed for the minimum time possible once cleared of invasive vegetation. The timing of clearing and grubbing must be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. • Stockpiled topsoil must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds. • Only light equipment may be used for transport and delivery of construction material in areas of unstable soils, in areas where no erosion is evident.

4.18. Waste Management

Element	Management Plan
Potential Impacts	Inefficient use of resources resulting in excessive waste generation

Element	Management Plan
	Litter or contamination of the site or water through poor waste management practices.
Sources	• Packaging • Construction wastes • Waste dirt or rock from excavation • Storage of oils and fuels • Domestic waste form site offices and construction camp
Controls	• Adhere to waste management guidelines and any relevant license conditions imposed • Where possible, construction wastes on site must be reused or recycled • Disposal of waste must be in accordance with relevant legislative requirements. • The Contractor must familiarise themselves with the definitions of waste and the handling, storage and transport of it as prescribed in the applicable environmental legislation (refer to Appendix A). • The contractor will appoint a person to manage and control waste. • Integrated waste management on site will be carried out by applying, in order of preference, waste avoidance, reuse, recycling and disposal. These waste management guidelines are included within Appendix H. • Burning of waste material will not be permitted except under special circumstances and with prior approval of the Site Manager. • The Contractor will provide and maintain adequate facilities for litter collection (e.g. bins) at strategic locations around the site camp such as the office, garage, parking, housing facilities and locations where food is consumed. • Waste will be sorted at source (i.e. the separation of tins, glass, paper etc). Recycled waste of this sort will be collected by a local contractor. • A high quality of housekeeping will be maintained on all construction sites to ensure that materials are not left where they can be washed or blown away to become litter. • Littering must be prohibited. • Stockpiled waste must not remain on site for longer than 30 days. • The contractor must supply waste bins/skips throughout the site at locations where construction personnel or labourers are working. The bins must be provided with lids and an external closing mechanism to prevent contents from blowing out, and must be scavenger proof to prevent animals attracted to waste. Bins must be emptied on a regular basis and the waste removed to the construction camp where it must be contained in scavenger, water and windproof containers until disposed

Element	Management Plan
	of. • All waste (general and hazardous) generated during the construction phase may only be disposed of at appropriately licensed sites in terms of applicable Environmental legislation • The collection, storage and disposal of waste may not cause any nuisance (odours, fumes, aesthetic impacts, etc.). • No waste may be disposed of on neighbouring land. • Anything recyclable must be recycled. • Illegal dumping must be prohibited.
Maintenance	• Litter collection at all construction sites will be undertaken at least once per working day. Work teams will be supplied with refuse bags which can be disposed of daily in skips at centralised locations. • All waste containers will be emptied at least once a week. • Waste documentation must be completed and kept onsite.
Corrective actions	• A complaints register must be maintained, in which any complaints from the community must be logged. All complaints must be investigated and, if appropriate, acted upon • Corrective actions are required to be undertaken immediately after a complaint is made or a non-conformance is identified.

4.19. Storage and Handling of Hazardous Substances

Element	Management Plan
Potential Impacts	Release of contaminated water from contact with spilt chemicals Fuel source for on-site fires Generation of contaminated wastes from used chemical containers.
Controls	• The storage of flammable and combustible liquids such as oils will comply with all relevant legislation and regulations. • Any spills will be rendered harmless and arrangements made for appropriate collection and disposal including cleaning materials, absorbents and contaminated soils. • Ensure that spill kits are available on site to clean up spills and leaks. • Obtain any storage and disposal permits / approvals necessary and comply with the conditions attached to such permits and approvals • Ensure that any delivery drivers are appropriately supervised by an individual familiar with all procedures and restrictions on site. This is of particular importance during off and on-loading of materials. • Ensure that only designated areas are used for the handling or storage of construction materials. • All materials must be stored at one location, to be approved

Element	Management Plan
	by the EO. • The Contractor must comply with all national, regional and local legislation with regard to the storage, transport, use and disposal of chemicals, harmful and hazardous substances and materials. • The Contractor will furthermore be responsible for the training and education of all personnel on site who must be handling the material about its proper use, handling and disposal as well as spill response. • The Contractor must be responsible for establishing an emergency procedure for dealing with spills. • Storage of all hazardous materials is to be safe, tamper proof and under strict control. • Fuels, solvent and other wastes must be stored in vessels equipped with secondary containment structures and must be moved from construction area being disposed of in compliance with the relevant legislation and regulations. • The containers in which the products are kept must, in compliance with hazardous material management procedures, be removed from the site once empty. Hazardous products must otherwise be stored on adequately bunded surfaces in the designated hazardous material storage areas. • All manufactured and/or imported material must be stored in an appropriate manner in the Construction camp. Depending of the type of material, storage areas will be roofed with impervious material (e.g. cement and chemicals). • Fluids must not be stored together with solids; instead fuels, lubricants, transmission and hydraulic fluids must be stored in a designated area for fluids. • Cement, building sand, topsoil and subsoil must also be stockpiled separately in their designated areas. • Separate material delivery and storage, and lay-down areas must be demarcated as needed • All material storage areas must be sited away from ecologically sensitive areas. • Hazardous chemicals used during construction must be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) must be available on site. • The Contractor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and situated with the intention of preventing pollution of the surrounding area and environment. • Identify and maintain a register of all activities that involve the handling of potentially hazardous substances, as well as devise and supervise the implementation of protocols for the handling of these substances. This will include all fuels, oils,

Element	Management Plan
	lubricants and grease. • Ensure that all hazardous substances are handled in accordance with the manufacturer's specifications and legal requirements. • Store all hazardous substances (including oils, fuels, chemicals, etc.) in a manner prescribed in the relevant Acts and Regulations.
Maintenance	• Any accidental chemical/fuel spills to be corrected immediately. • Keep MSDS records of chemicals in use up to date. • Waste records must be kept available for review • Implement appropriate actions and measures to reduce, stop or contain a spill of potentially hazardous substances (e.g. fuel or lubricating oil). • Implement appropriate actions and measures to reduce or prevent contamination of the ground and surface water as a result of a spill of potentially hazardous substances
Corrective Actions	• Observation and supervision of chemical storage and handling practises and vehicle maintenance throughout the construction phase. • Arrange and supervise the implementation of clean-up operations and appropriate disposal of contaminated materials at the hazardous waste disposal site. • A complaints register must be maintained, in which any complaints from the community must be logged. All complaints must be investigated and, if appropriate, acted upon • Keep written records detailing the type of spill, the corrective and remedial measures implemented in the stopping or reduction of the spill, and the clean up of the spill. Such progress reporting is important for monitoring and auditing purposes and the written reports may afterwards be used for training purposes in an effort to prevent similar future occurrences. • Report the nature and extent of the spill to the EMO, EM and RE as soon as reasonably possible, but within 24 hours. • The EMO will prescribe measures to be implemented in order to prevent spills of potentially hazardous substances. • Preventative measures to reduce the possibility of spillage of hazardous substances are included in Appendices E.

4.19.1. Cement and Concrete

Element	Management Plan
Controls	• Concrete must be mixed only in an area demarcated for this purpose. All concrete spilled outside this area, must be promptly removed by the Contractor and taken to a permitted

Element	Management Plan
	waste disposal site. After all concrete mixing is complete all waste concrete must be removed from the batching area and disposed of at an approved waste disposal site. • The batching plant will be enclosed by a bunded wall with divisions and dedicated compartments for the various types of materials. Air filters will be monitored and cleaned and replaced as per the supplier's guidelines. • Operators must wear suitable safety clothing. • All runoff from batching areas must be strictly controlled. Cement contaminated water must be collected, stored and disposed of at a site approved by the Site Manager. • Appropriate measures for overflow from batching plant, e.g. during heavy rains, must be put in place. • Waste concrete and cement sludge must be scraped off the site of the batching plant daily and removed to an approved landfill site. (To prevent pollution during the rain). • Solidified concrete can be disposed of at a registered general waste landfill site. • Concrete must not be mixed directly on the ground. Plastic liners or mixing trays are to be used.

4.19.2. Fuel storage

Element	Management Plan
Controls	• All legal compliance requirements with respect to Fuel storage and dispensing must be met. • All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, SANS codes and other relevant requirements. • The Contractor must ensure that all liquid fuels and oils are stored in tanks with lids, which are kept firmly shut and under lock and key at all times. • Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations and may require the approval of the Municipal Fire Prevention Officer. • Flammable fuel and gas must be well separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire. • The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials. • Symbolic safety signs depicting "No Smoking", "No Naked Flames" and "Danger" are to be prominently displayed in and around the fuel storage area. • The capacity of the tank must be clearly displayed and the

Element	Management Plan
	product contained within the tank clearly identified. • There must be adequate fire- fighting equipment at the fuel storage and dispensing area or areas. • The storage tank must be removed on completion of the construction phase of the project. • All such tanks to be designed and constructed in accordance with a recognised code (international standard). • The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage. • Tanks must be situated in a bunded area, the volume of which must be at least 110% of the proposed volume of the tank. • The floor of the bunded area must be smooth and impermeable, constructed of concrete or plastic sheeting with impermeable joints with a layer of sand over to prevent perishing. The floor of the bunded area will be sloped towards an oil trap or sump to enable any spilled fuel and/or fuel – soaked water to be removed. • Any water that collects in the bund must not be allowed to stand and must be removed and the hydrocarbon digestion agent within must be replenished. • Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored on an area where the ground has been protected. • Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition of the product. • If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used. • The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use. • All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site. • The amounts of fuel and chemicals stored on site will be minimised. • Storage sites will be provided with bunds to contain any spilled liquids and materials..
Maintenance	• Regular inspections will be carried out to detect leaks and spillages. All storage facilities will be maintained as regularly as is necessary to ensure they meet the original specification. Inspections will be carried out on a daily, weekly and monthly basis by the EMO. Quarterly audits will also be undertaken. The contractors will be audited by Eskom Generation, and the SHE department will be audited by independent auditors.

Element	Management Plan
	• All equipment that leak oil or fuel must be repaired immediately or removed from the construction site
Corrective Actions	• Absorbent material must be available at tanks to absorb any spills

4.20. Traffic and Transport

Element	Management Plan
Potential Impacts	• Traffic, and thus accident potential, increase at the proposed access point • Traffic, and thus accident potential, increase on neighbouring roads • Accident potential from heavy and wide loads.
Sources	• Transport of very large bulky turbine plant, which needs to be transported from either Cape Town harbour or Saldana Bay. • Construction traffic specifically related to the physical construction of the Power Station over a period of approximately 18 months.
Controls	• The transport contractor must obtain the relevant permits and obtain approval for transport routes to be used. • Optimal use must be made of existing access roads. The construction of new access roads must be minimised. • Routes to be used must be communicated to the local community. • Appropriate road management strategies implemented on external and internal roads with all employees and contractors required to abide by standard roads and safety procedures. • All road management strategies and traffic accommodation must be in compliance with the COLTO (Committee of Land Transport Officials) Standard Specifications for Road Building • A responsible person must be given the duty of monitoring the traffic and to see that the correct and sufficient warning signs are in place. • Creation of designated access to the proposed site to ensure safe entry and exit. • Transport of all hazardous substances must be in accordance with the relevant legislation and regulations. • All drivers will be in possession of an appropriate valid driver's license. • All maintenance vehicles travelling on public roads will adhere to the specified speed limits. • Moderate speeds (i.e. 20 km per hour) will be employed and adhered to on all access/service roads. • The movement of all vehicles will be controlled such that they remain on designated routes. • No member of the workforce will be permitted to drive a

Element	Management Plan
	vehicle under the influence of alcohol or narcotic substances. • No deviation from approved access roads will be allowed. If necessary, new access routes can be designed, but must initially be approved by the EO. • Traffic control mechanisms must be implemented to limit vehicle entrained dust from unpaved roads. • Obtain the appropriate abnormal load permits. • Ensure the use of approved routes for the transportation of heavy loads.
Maintenance	• Appropriate maintenance of all vehicles • Appropriate maintenance of access roads
Corrective Actions	• Visual monitoring of dust produced by traffic in order to minimise dust emissions • Visual monitoring of traffic control measures to ensure they are effective • A complaints register must be maintained, in which any complaints from the community must be logged. All complaints must be investigated and, if appropriate, acted upon.

4.21. Site Clean -up

Element	Management Plan
Controls	• The contractor must ensure that all temporary structures, materials, waste and facilities used for construction activities are removed upon completion of the project. • Fully rehabilitate (e.g. clear and clean area, rake, pack branches etc) all disturbed areas and protect them from erosion. • Only indigenous plants that are able to establish easily and will need less maintenance because they have already adapted to the local conditions must be considered for rehabilitation purposes. • Before final decisions about the choice of plant species are taken the ECO must be approached for their advice

5. OPERATION AND MAINTENANCE

5.1. Labour

5.1.1. Conduct of Employees

The following restrictions or constraints will be placed on the operation and maintenance staff in general:

- No indiscriminate disposal of rubbish or rubble.
- No littering of the servitude and substation areas and the surrounding areas.
- No collection of firewood.
- No interference with any wildlife, fauna or flora.
- No poaching of any description.
- No use of facilities other than the chemical toilets provided.

5.2. Hazard and Risk

Element	Management Plan
Potential Impacts	• Fire from flammable liquid • Transport spillage of fuel • Storage of fuel
Sources	Fuel
Actions/Controls	When design is completed, a detailed Risk Management and Emergency Response Plan must be developed prior to commissioning for review by appropriate stakeholders. The plan will cover: • Design specifications for layout, selection of materials, construction and operation of the facility; • Preventative measures • Control measures • Non-technical measures including organizational and systems measures. • Appropriate warning sign boards, clearly denoting warning procedures and emergency exit routes, must be posted at relevant locations in the facility. • Setting up of emergency teams with team leaders • Formulation of detailed emergency procedures such as: ∗ Emergency notification / alarm procedures including names and telephone numbers of internal and external emergency service ∗ Evacuation routes, maps, route signs etc. ∗ Directions to showers, wash stations, fire extinguishers etc. ∗ Location • Safety training.

Element	Management Plan
	• On-site and off-site emergency plans (for fire and spill response) • Monitoring • Incident and safety reporting • Community consultation and information
Maintenance	Regular checks and drills must be conducted to ensure that the risk and hazard control strategies are maintained up to date.
Monitoring	• All monitoring will occur according to the risk management and emergency response plan, guidelines and license conditions. • A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon.
Corrective Actions/Reporting	• If a report or drill indicates an error/omission in risk and hazard management procedures, then procedures must be altered or updated to ensure effective management. • If an incident occurs, then emergency procedures must be enacted to ensure all impacts are minimized.

5.3. Noise

Element	Management Plan
Potential Impacts	• Nuisance noise from the commissioning and operations activities
Sources	• Staff transport and equipment transport • Turbines • Commissioning activities • Maintenance activities • Pump house
Actions/Controls	• In order to reduce the overall noise emission to acceptable levels, final design of equipment will ensure the level of noise emission from the plant must be limited to levels guaranteed by the contractor. • All noise from activities at the OCGT Plant during the operation and maintenance of the OCGT Plant must be within acceptable limits (according to the Environment Conservation Act and the National Environmental Management Act), taking into consideration that maintenance activities may be required at the OCGT Plant outside of working hours, for example, in the case of emergencies. • Noise insulation must be implemented surrounding turbine casing. • Communication with neighbours during commissioning must there be potential for extraordinary noise emissions. • Eskom will provide all equipment with standard silencers and maintain silencer units on vehicles and equipment in good

Element	Management Plan
	working order, for those vehicles where it is necessary. • Noise mitigation strategies that are in compliance with SANS code 10103 must be implemented. The use of berms and vegetation for screening purposes must be further investigated and implemented prior to the facility becoming operational. • Pure tones and impulsive sounds must be monitored. Corrective measures must be taken immediately should it become necessary. • All other noise mitigation measures required to make the facility compliant with the relevant SANS standards, must be implemented to minimise the noise impacts associated with the development
Maintenance	All plant and equipment, including vehicles, must be properly maintained in order to minimise noise generation.
Monitoring	• Observation of on-site noise levels by SHE Officer • A complaints register must be held, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon. • Noise monitoring conducted following commissioning to ensure noise levels meet specified levels. Pure and Impulsive tones must be monitored.
Corrective Actions/Reporting	• Corrective action is required to be undertaken immediately after a complaint is made or non-conformance is identified. • Any complaints regarding noise must be investigated, sources identified and mitigation measures implemented. Feedback on resolution of the issue must be provided to the complainant. • The SHE Officer/Station manager will maintain an incident reporting system to record non-conformances. • The Generation Environmental Manager will report on compliance with this EMP if required by the administering authority.

5.4. Visual Impact

Element	Management Plan
Potential Impacts	Negative impact on amenity for the surrounding community
Sources	• Power station plant • Roadways • Associated buildings
Actions/Controls	• As far as possible, the architectural and cultural heritage of the area must be included in the design guidelines for the development. • Use of low reflective materials on buildings • Use of colours on buildings and plant that are neutrally toned

Element	Management Plan
	and suit the surrounding landscape • Retention of as much existing vegetation as possible • Implementation of tree/shrub planting to assist screening the observer from the power station • Use of light fixtures and the fitment of covers and shields designed to contain rather than spread light
Maintenance	• Vegetation barriers must be regularly maintained so as to ensure minimal visual intrusion. • Timely maintenance of the OCGT units, ancillary infrastructure and general surrounds of the property (i.e. gardens, access roads etc.).
Monitoring	• Observation of site appearance by the Station manager • A complaints register must be maintained in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon.
Corrective Actions/Reporting	• If a visually intrusive component of the site is identified, the procedures must be altered or updated to ensure effective management. • An incident reporting system will record and manage follow up of resolution of non-conformances • The Generation Environmental Manager will report on compliance with the EMP is required by the administering authority.

5.5. Fauna and Flora

Element	Management Plan
Potential Impacts	• Impact of operational activities on flora and fauna in the surrounding areas.
Sources	• Movement of employee and visitor vehicles within and around the site
Actions/Controls	• Implementation of a site rehabilitation and landscaping program • Use of indigenous plants in landscaping and rehabilitation activities • Program regular alien plant identification and eradication activities. • The maintenance staff may not harm or kill any fauna during the activities of maintaining the OCGT Plant. • Wildlife interaction will be investigated by the Environmental Officer. • The active control of all alien invasive species by means of manual removal, ring-barking, chemical control or a combination of these methods. • The bigger trunks and branches must be removed while the smaller branches can be used as a soil stabiliser against wind

Element	Management Plan
	erosion in exposed areas, while providing micro-habitat for seedling establishment. • Rehabilitation of the cleared areas, starting with the establishment of a grass cover and phasing in the re-establishment of fynbos species by sowing in of smoked treated seed or pre-emerged seed. • All emergent seedlings must be removed by hand and re-sprouting from existing rootstock must be chemically treated in a continual monitoring and follow-up programme. • Ideally the clearance and rehabilitation efforts is must not be limited to the Atlantis power station site and alignment corridors alone, but must include the larger Atlantis industrial site in a phased approach, starting at the northwestern corner. The Control of Alien invasive species will be an ongoing process, especially if the source of invasion is not removed (i.e. the surrounding invasion of the greater Atlantis industrial area).
Maintenance	• Vegetative barriers must be regularly maintained so as to ensure minimal visual intrusion • Maintenance of plants on site to ensure continued viability of vegetative barriers • Maintenance of rehabilitated areas to ensure sustainability.
Monitoring	• Observation of site appearance by Station manager • A complaint register, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon. • Regular alien plant inspections (6 – 12 monthly)
Corrective Actions/Reporting	• An incident reporting system will record and mange follow up of resolution of non-conformances. • In the event of an incident, the Environmental Officer will write a report regarding the incident, and make recommendations. A follow up site inspection will be conducted by the Environmental Officer in order to assess the effectiveness of the recommendations. • The Power Station Manager will report on compliance with this EMP if required by the administering authority.

5.5.1. Use of herbicides in the Alien Control Programme

The use of herbicides will be in compliance with the terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No 36 of 1947). In terms of this Act, a registered pest control operator will apply herbicides, or will supervise the application of herbicides.

Therefore, Eskom will:

- Ensure that a registered pest control operator applies or supervises the application of all herbicides.
- Ensure that all herbicides are stored in a well-ventilated demarcated storage area.
- Ensure that a register of all contents of the storage area is kept and updated on a regular basis.
- Ensure that a daily register of all relevant details of herbicide usage is kept, and that such a register is maintained by the relevant Eskom custodian.

5.6. Air Pollution Management

Element	Management Plan
Potential Impacts	• Release of above guideline levels of air pollutants, i.e. exceeding the limits as set-out in the CAPCO licence • Release of greenhouse gases • Dust and particulates from stacks and establishment of vegetation
Sources	• Power station stacks • Rehabilitated land
Actions/Controls	• The power station must be modelled and designed so as to ensure greenhouse gas emissions and air quality will fall within the guideline levels. • Dust control mechanisms must be utilised including the following: turbines and diesel generator fitted with filters to reduce the amount of dust being released, filters maintained on a regular basis, any open areas must be vegetated and watered and if necessary mulched to protect surfaces from drying out, and all roads on-site must be sealed for vehicle access. • The OCGT power plant must be fitted with the appropriate NO_x mitigation control equipment to minimise the production of NO_x. • Release of emissions from the turbine stacks must only be released to the atmosphere: * From those release points and to the corresponding heights, velocities and concentrations specified in the license, and * Directed vertically upwards without any impedance or hindrance.
Maintenance	• Power Station equipment must be performance tested during the commissioning phase to ensure that the manufacturer's standard has been delivered. • All power station equipment must be maintained according to industry standards. This will ensure that emissions, odours and dust from power station stacks continue to fall within guideline levels. • Roads must be sealed and maintained to ensure that dust from road or vehicle sources will not exceed prescribed levels.

Element	Management Plan
	• During establishment of vegetation from rehabilitation/landscaping affected areas must be watered to ensure dust level are minimized • Ensure incident and complaint registers are established and maintained.
Monitoring	• Due to the fact the no ambient air quality monitoring is undertaken in the vicinity of the development, it is recommended that a survey of the ambient air quality is undertaken prior to (in order to establish a baseline) and following the commissioning of the plant. This programme must include appropriate NOx monitoring on the site and in the vicinity of Klein Dassenberg, as well as CO2 and other emissions from the stacks. • Monitoring must be undertaken to ensure emissions are not exceeding the legal limits. • A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, of appropriate acted upon.
Corrective Actions/Reporting	• Initial monitoring undertaken following commissioning to ensure emissions are meeting specified levels. • If monitoring results or complaints indicate inadequate performance, then the source of the problem must be identified, and existing procedures or equipment modified to ensure the problem is rectified. • The station manager is to keep an environmental incident reporting system to record non-conformances. • The Power Station Manager will report on compliance with the EMP if required by the administering authority. • A validation of the modeled results represented in the air emissions Specialist Study done by CSIR Environmentek must be undertaken within 6 months of the facility becoming operational.

5.7. Water Management

Element	Management Plan
Potential Impacts	Wastewater entering the surrounding areas / system
Sources	• Stormwater • Firefighting water • Potentially contaminated bund water • Effluent from turbine blade washing • Storage of kerosene for turbine operation • Management of potentially contaminated stormwater run-off • Landscaping and gardening
Controls/actions	• All chemical/hydrocarbon storage areas must be bunded. This bund water must be removed from site by a licensed

Element	Management Plan
	contractor. • All plant and chemical usage areas must be paved. • Potentially contaminated water must be directed to an oil/water separator. Oily water must be removed from the site by a licensed contractor. • Any run-off that is discharged from the site must be uncontaminated. • All vehicle transfers of materials must be conducted within a bunded area to minimise the potential for spills to enter the stormwater. • Spills of potential contaminants must be immediately cleaned up and neutralised. Such spills must be handled with consideration to health and safety considerations. • The use of water to clean up spills must be avoided except where absolutely necessary. • Movement of vehicles on and off site is to be through approved access points only. • Spill kits must be made available on site for the clean up of spills and leaks of contaminants. • Spill response procedures to include removal/disposal of potentially contaminated water and any used absorbent materials.
Maintenance	• The water quality control structures used on site must be monitored and maintained in a fully operational state at all times. • Ensure incident/complaint registers are established and maintained.
Monitoring Parameters	The following parameters must be monitored in order to determine the hydrochemical character of the groundwater: • Major ions (Ca, Mg, Na, K, HCO_3, SO_4 and Cl) • Electrical conductivity (EC) • Total dissolved salts (TDS) • pH The following parameters must be monitored as indicators of potential organic contamination: • Dissolved organic carbon (DOC) • PO_4 • NO_3 • Total petroleum hydrocarbon (TPH) levels
Monitoring	• Monitoring program to be developed in consultation with relevant authorities and Stakeholders.
Corrective Actions/reporting	• Corrective action is required to be undertaken immediately of a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the effected environment as much as practically possible and taking

Element	Management Plan
	preventative measures. • An incident reporting system will record significant events and issues with the sediment and water quality controls. • In the event of a major spill or leak of contaminants, the administering authority must be contacted immediately as per incident reporting procedures. • The Power Station Manager will report on the performance of the sediment and water quality control measures when required by the administering authority. • In the event that water quality at the monitoring locations in found to fall outside of the prescribed guideline levels, the source of the deviation must be investigate and measures taken to correct the problem. • No ground water or surface water must be polluted by any activities on site. • Should any negative effects (on the supply of groundwater to neighbouring users in the area) become apparent these must immediately be reported to DWAF, the City of Cape Town and DEA&DP.

5.8. Maintenance of Rehabilitated areas

Element	Management Plan
Controls	• Monitoring of plant growth in rehabilitated areas will be conducted on a weekly basis during initial phases and on a monthly basis when plants have become firmly established. • Vegetation must be replanted in areas where vegetation cover has decreased due to dieback, or has failed otherwise to successfully establish. • Noxious weeds, invasive and alien species will be controlled by pulling, cutting or any other means approved by the Site Manager. The use of herbicides will not be allowed unless specified by the Site Manager. Bare patches will be replanted. • Acceptable cover will be construed as not less than 75% of the area being covered in the case of hydro seeding and sowing and 50% in the case of hand planted runners. There will be no bare patches greater than 750mm in diameter.

5.9. Waste management

Element	Management Plan
Potential Impacts	• Ineffective use of resources resulting in excessive waste generation • Litter or contamination of the site or water through poor waste management practices
Sources	• Office and workshop facilities

Element	Management Plan
	• Transformers and switchgear • Fire services and fire water storage • Water storage tank • Fuel and oil storage
Actions/Controls	• All structures and/or components replaced during maintenance activities are appropriately disposed of at an appropriate DWAF licensed waste disposal site or sold to a recycling merchant for recycling. • Ensure that care is taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Should any accidental spillage take place, it must be cleaned up according to specified standards regarding bioremediation. • Waste handling, collection and disposal operations are managed and controlled by a waste management contractor • Wastewater ∗ Water from bunds and oily water from oil/water separator must be removed by a licensed contractor. • Waste – Leaked oil and chemicals ∗ Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority ∗ Waste must be stored and handled according to the relevant legislation and regulations. • General Waste ∗ Recycled where possible or disposed of properly to landfill as designated by the administering authority • Hazardous Waste ∗ Separate hazardous and general waste and dispose hazardous waste to an appropriate hazardous waste disposal site. • Sewage ∗ Disposal to municipal sewer.
Maintenance	• Uncontaminated waste must be removed at least weekly for disposal • Contaminated or regular wastes must be disposed of as necessary ad in accordance with legislation • An incident/complaint register must be established and maintained
Monitoring	• Wastewater pumped to evaporation ponds, if any, to be tested periodically • Visual inspection of the site must be carried out daily for evidence of litter or waste material that has been inappropriately disposed of by site personnel • Waste collection must be monitored on a regular basis • Waste documentation must be completed and available for inspection on request • A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon.

Element	Management Plan
	• Weekly and monthly reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the SHE management representative. All appropriate waste disposal certificates accompany the monthly reports.
Corrective Actions/Reporting	• Corrective action is required to be undertaken immediately after a complaint is made or non-conformance is identified. • Upon the identification of any non-conformance, appropriately feasible remediation measures must be determined and implemented. • An incident reporting system will record and manage follow up of resolution of non-conformances • The Power Station Manager will report on compliance with the EMP if required by the administering authority.

5.10. Storage, Handling and Management of Hazardous Substances

Element	Management Plan
Potential Impacts	• Release of contaminated water from contact with spilled chemicals • Fuel source for on site fires • Generation of contaminated wastes from used chemical containers and spill clean up • Storage of Fuel
Actions/Controls	• Management strategies/operational procedures for the routine monitoring and inspection of fuel tanks, pipelines and other fuel related equipment will be compiled and implemented. • The storage of flammable and combustible liquids such as oils will comply with the relevant legislation. • The storage and handling of corrosive substances must be in accordance with the relevant legislation • The minimum amount of fuel required for efficient operation of the facility must be stored on site. • Any spills will be rendered harmless and arrangements made for appropriate collection and disposal, including cleaning materials, absorbents and contaminated solid in accordance with this EMP • Ensure that spill kits are available on site to clean up spills and leaks. • Obtain any permits and approvals necessary and comply with the conditions attached to such permits ad approvals • Transport of all hazardous substances must be in accordance with the relevant legislation. • Identify and maintain a register of all activities that involve the handling of potentially hazardous substances, as well as devise and supervise the implementation of protocols for the handling of these substances. This will include all fuels, oils,

Element	Management Plan
	lubricants and grease. • Ensure that all hazardous substances are handled in accordance with the manufacturer's specifications, legal requirements and Eskom's procedures. • Store all hazardous substances in a manner prescribed in the relevant Acts and Regulations (e.g. in a well-ventilated area). • Implement appropriate actions and measures to reduce, stop or contain a spill of potentially hazardous substances (e.g. fuel or lubricating oil). • Implement appropriate actions and measures to reduce or prevent contamination of the ground and surface water as a result of a spill of potentially hazardous substances. • Arrange and supervise the implementation of clean up operations and proper disposal of contaminated materials at a licensed hazardous waste disposal site. • Keep written records detailing the type of spill, the corrective and remedial measures implemented in the stopping or reduction of the spill, and the clean up of the spill. Such progress reporting is important for monitoring and auditing purposes and the written reports may afterwards be used for training purposes in an effort to prevent similar future occurrences. • All such tanks to be designed and constructed in accordance with a recognised code (international standard). • The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage. • Tanks must be situated in a bunded area the volume of which must be at least 110% of the proposed volume of the tank. • The floor of the bunded area must be smooth and impermeable, constructed of concrete or plastic sheeting with impermeable joints with a layer of sand over to prevent perishing. The floor of the bunded area will be sloped towards an oil trap or sump to enable any spilled fuel and/or fuel – soaked water to be removed. • The fuel delivery area must be bunded and an interceptor system must be installed, with all drainage directed to an oil water separator. This will allow for the removal of free product from any surface run-off or spillages. The interceptor system must contain a holding tank that is used to contain any free product recovered. Free product must be removed from this separator, stored in a holding tank, and recycled or disposed of in an appropriate manner. The water may be discharged in the municipal sewer in accordance with the municipalities effluent standards. • Internationally approved non-corrosive pipework systems must be installed (approved codes). • Antiflash nozzles must be installed at the end of the vent pipes and provisions must be made for overfill protection

Element	Management Plan
	devices in the tank filling pipes to prevent tank overfills during filling operations. • Fuel must be dispensed via a system that has mechanical leak detectors linked to the fuel lines. These link detectors must form an integral part of the pumping system and allow for automatic cut-off of the fuel supply must a leak be detected. • Any water that collects in the bund must not be allowed to stand and must be removed and the hydrocarbon digestion agent within must be replenished.
Maintenance	• Spill and emergency response equipment must be accessible at chemical transfer/unloading points and refueling locations. • Bunds and storage facilities must be maintained to ensure design capacity is available. • Water which ponds within the bunded areas must be pumped to the oil/water separator as soon as possible after rain events cease.
Monitoring	• Observation and supervision of chemical storage and handling practices and vehicle maintenance by Station manager throughout the power station's operational phase • Inspection of demineralization plant chemicals storage for corrosion • Inspection of bunding integrity, stability and function • A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon.
Corrective Actions/Reporting	• Corrective action is required to be undertaken immediately after a complaint is made or non-conformance is identified • An incident reporting system will record and manage follow up of non-conformances • The Power Station Manager will report on compliance with the EMP if required by the administering authority.

5.11. Traffic and transport

Element	Management Plan
Controls	• Transport of Fuels * The fuel supplier must obtain relevant permits and obtain approval for the transport routes to be used. * The routes to be used must be communicated to the local community. * A management Strategy must be implemented for the delivery of fuels. * Fuel delivery must be done during times that will have minimum impact on traffic along the routes taken • Access and Traffic control * All drivers will be in possession of an appropriate valid driver's license.

Element	Management Plan
	* All maintenance vehicles travelling on public roads will adhere to the specified speed limits. * Moderate speeds (to be agreed to by Eskom) will be employed and adhered to on all roads within the OCGT Plant area. * The movement of all vehicles will be controlled such that they remain on designated routes. * No member of the workforce will be permitted to drive a vehicle under the influence of alcohol or narcotic substances. * No deviation from approved access roads or transportation routes will be allowed. * Appropriate security measures must be established with regards to access into the OCGT Plant. * During fuel tanker delivery, the tanker driver and adequately qualified staff must be present at all times during product offloading. * An emergency cut-off switch must be installed to immediately stop fuel delivery must an accident occur. * Fuel tankers must not travel in convoy when delivering fuel. * Tank filler points must be located away from the tank farm to prevent congestion of the site during road tanker refuelling

6. DE-COMMISSIONING

6.1 General Principles for Environmental Management during Decommissioning

At this point of the project planning process, the necessity for and timing of the decommissioning of the OCGT Power Station is not known. In addition, approval of this EMP by WP D:EA&DP is limited by a specified timeframe, where-after revision and re-submission is required. Therefore, only general principles for decommissioning are detailed below. These principles must be required to be re-visited and supplemented in the event of the decommissioning of the OCGT Power Station.

In order to minimise the extent of rehabilitation activities required during the decommissioning phase, Eskom will ensure that constant effort is applied to rehabilitation activities throughout the construction, operation and maintenance phases of the project.

On decommissioning of the OCGT Power Station, Eskom will:

- Ensure that all sites not already vegetated are vegetated as soon as possible after operation ceases with species appropriate to the area.
- All structures, foundations and concrete and tarred areas are demolished, removed and waste material disposed of at an appropriately licensed waste disposal site.
- All access/service roads not required to be retained by landowners are closed and fully rehabilitated.
- All disturbed areas are compacted, sloped and contoured to ensure drainage and runoff and to minimise the risk of erosion.
- All rehabilitated areas are monitored for erosion.

APPENDIX A

SUMMARY OF RELEVANT ENVIRONMENTAL LEGISLATION

LIST OF APPLICABLE LEGISLATION AND AUTHORISATIONS REQUIRED FOR THE ESTABLISHMENT OF THE OCGT POWER STATION AND ASSOCIATED INFRASTRUCTURE AT A SITE IN ATLANTIS INDUSTRIA, WESTERN CAPE PROVINCE

Applicable Environmental Law	Aspect Component	Compliance Requirement
National Legislation		
Constitution of South Africa (No 108 of 1996)	"Environmental rights" are created by Section 24(a) of the Constitution of the Republic of South Africa Act (No 108 of 1996). The rights include the right "to an environment that is not harmful to their health or well-being".	Ensure that best practice technology is used to minimise impacts on the environment. Respect and protect the public and employees' rights to an environment which is not detrimental to their health and well being.
Environment Conservation Act, No 73 of 1989 and Regulations 1182 and 1183 published there under.	Commencement of any activity that is considered to be detrimental to the environment must be preceded by written authorisation obtained from the relevant authority.	An Environmental Impact Assessment must be submitted to the competent authority (i.e. WC DEA&DP).
Environment Conservation Act (No 73 of 1989), Section 19	Section 19 prohibits discarding, dumping or leaving of any litter on any land or water surface, street, road or site in or on any place to which the pubic has access, except in a container or at a place which has been specifically indicated, provided or set apart for such purposes.	Adequate numbers of containers must be placed in strategic positions for the collection of litter.
Environment Conservation Act (No 73 of 1989), Section 20 (1)	Section 20 (1) provides that where an operation accumulates, treats, stores or disposes of waste on site for a continuous period, it must apply for a permit to be classified as a suitable waste disposal facility, from DWAF.	If applicable a permit application will be submitted to DWAF. On receipt of a permit, the conditions of the permit must be complied with at all times.

Applicable Environmental Law	Aspect Component	Compliance Requirement

National Environmental Management Act (No 107 of 1998)	The Act:
	• establishes principles to guide the decisions and actions of all organs of State.
	• establishes institutions to:
	  * co-ordinate and harmonise the environmental functions of organs of State; and
	  * promote the participation of stakeholders in environmental governance.
	• establishes procedures for co-operative governance.
	• establishes procedures for conflict management.
	• defines the environmental rights of employees (s.2) and the restraints on management when employees exercise these rights (s.29).
	• establishes a general "duty of care" towards the environment on developers and prescribes the "measures" demanded from them to demonstrate such duty of care (see s.28).
	• defines who has a legal standing to institute litigation against transgressors of environmental legal provisions (s.32). These provisions are in line with those contained in Section 38 of the Constitution.
	• provides also for a policy of co-regulation and Environmental Management Co-operation Agreements (s.35). This section will be read in conjunction with the document entitled: "Environmental Management Co-operation Agreements: A Guide for their Design and Use," published by the Department of Environmental Affairs and Tourism, June 2000
		In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.

Applicable Environmental Law	Aspect Component	Compliance Requirement
National Environmental Management Act (No 107 of 1998), Section 24 (1)	Requires the consideration, investigation and assessment of the potential impact on the environment, socio-economic conditions and cultural heritage as a result of activities that require authorisation by law (i.e. in terms of the ECA), and that may significantly affect the environment.	An Environmental Impact Assessment must be submitted to the competent authority (i.e. WC DEA&DP).
National Heritage Resources Act (No 25 of 1999)	Provides general principles for governing heritage resources management throughout South Africa including national and provincial heritage sites, archaeological and palaeontological sites, burial grounds and graves and public monuments and memorials. The demolition or dismantling of all man-made structures and buildings older than 60 years is subject to the approval of the relevant provincial heritage council under the *National Heritage Council Act , 11 of 1999*.	If applicable, a permit must be obtained from the relevant provincial heritage council.
Hazardous Substances Act, No 15 of 1973	This act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. • Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be:	It is important to identify and list all the Group I,II,III and IV hazardous substances that may be on the premises and in what operational context they are used, stored or handled. If applicable, a license application will be submitted to the Department of Health.

Applicable Environmental Law	Aspect Component	Compliance Requirement
	• Group I or Group II hazardous substance; • Group IV: any electronic product; • Group V: any radioactive material The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.	
Occupational Health and Safety Act, No 85 of 1993 – Major Hazard Installation Regulations – GN R692 of 30 July 2001	In terms of the regulations, the Chief Inspector, Provincial Director of the Department of Labour and the relevant local government need to be notified of either a temporary or permanent erection, installation, conversion or modifying of a major hazard production installation or any quantity of a substance that can pose a significant risk of resulting in a major incident that could affect the health and safety of persons outside the premises.	Written application is to be lodged with the relevant authorities to erect any installation that will be classified as a major hazard installation or any conversion of an existing installation to a hazard installation. The proposed installation has to be advertised in at least one newspaper serving the surrounding communities and notices advertising the installation are to be posted within those communities.
Occupational Health and Safety Act, No 85 of 1993 – Major Hazard Installation Regulations – GN R692 of 30 July 2001	An employer must undertake a risk assessment of existing major hazard installations or substances which will be updated every three (3) years and submitted to the local emergency services, the employer must further in consultation with the local emergency services, establish an on-site emergency plan to be followed inside the premises of the installation classified as a major hazard installations. This plan must be updated at least every three (3) years.	Ensure that procedures and an on-site emergency plan are in place and updated at least once every three (3) years.

Applicable Environmental Law	Aspect Component	Compliance Requirement
Occupational Health and Safety Act, No 85 of 1993 – GNR 1179 of 25 August 1995	An employer will, in order to avoid contamination with hazardous chemical substances, take all steps to ensure that hazardous chemical substances are stored or distributed and are properly identified and handled in accordance the SABS 0228 Code	Ensure that all hazardous substances are stored, handled and identified in terms of the relevant SABS codes of practice.
Occupational Health and Safety Act, No 85 of 1993 – GNR 1179 of 25 August 1995	All drivers transporting hazardous material must be in possession of a valid, appropriate driver's licence, a medical certificate and a HazChem training certificate. In addition they must comply with the Road Transport Quality System, have full knowledge of emergency response procedures, and be equipped with and trained in the use of protective clothing.	Ensure that the relevant drivers have the correct licences and that awareness training programs, highlighting all transportation of dangerous goods risks are developed and implemented on all relevant driver levels.
Occupational Health and Safety Act, No 85 of 1993 – GNR 1179 of 25 August 1995	Before any employee is exposed or may be exposed to any hazardous chemical substance, it must be ensured that he/she is adequately and comprehensively informed and trained.	Develop and implement awareness-training programs highlighting the risks involved in respect of exposure to hazardous substances.
Occupational Health and Safety Act, No 85 of 1993 – GNR 60 of 16 January 1998	If a substance is supplied to your operation which results ion an installation being classified as a major hazard installation, then the supplier f such a substance must provide you with a material safety data sheet.	Ensure that procedures are in place to notify all suppliers of this regulation and that you have been supplied with a material safety data sheet at all relevant times.
Occupational Health and Safety Act, No 85 of 1993 – GNR 7458 of 17 January 2003	Ensure that an emergency plan is established and implemented; the emergency plan is tested in practice at least once every twelve (12) months.	Implement an emergency plan that includes detailed evacuation procedures and test the plan every twelve (12) months.

Applicable Environmental Law	Aspect Component	Compliance Requirement
National Road Traffic Act 93 of 1996 – GNR 225 of 17 May 2000	Regulation 274 (read with SABS Code 0232 which deals with transportation of dangerous goods and emergency information systems) states that the regulations are applicable where dangerous goods are transported in quantities, which exceed the exempt quantities (listed in Annex E of SABS Code 0232). Dangerous goods may only be transported in accordance with the provisions in the Regulations, unless the Minister of Transport has granted an exemption.	Ensure that procedures are in place to prevent that the quantities of dangerous goods transported exceed the prescribed quantity (listed in Annex E of SABS Code 0232). Apply for an exemption, if applicable.
Atmospheric Pollution Prevention Act, No 45 of 1965 (APPA) - Section 9	*Scheduled Processes* A specifications standard applies to the production of noxious or offensive gases. This means that pollution control equipment used in operating the process must conform to certain design criteria. Currently sixty nine (69) scheduled processes are listed in the Second Schedule to the Act No person may carry on a Scheduled Process in or on any premises unless he is the holder of a current registration certificate. The granting of a permit is subject to compliance with certain minimum standard specifications.	Obtain a registration certificate from the Chief Air Pollution Control Officer (CAPCO) at DEA&DP. In respect of each an every scheduled process, and ensure that the conditions in the certificate are complied with at all times.
Atmospheric Pollution Prevention Act, No 45 of 1965 (APPA) - Section 15	*Smoke emissions* The operation will not install in or on any premises any fuel-burning appliance, unless such an appliance is provided with effective appliances to limit the emission of grit and dust to the satisfaction of the local authority. A local authority may require any person to furnish information as to the fuel or refuse used in fuel burning appliances.	Ensure that best practice technology is used to prevent the escape into the atmosphere of noxious or offensive gases.
Atmospheric Pollution Prevention Act, No 45 of 1965 (APPA) – Section 16	No local authority will approve of any plan that provides for the installation of any fuel burning appliance, unless it is satisfied that a fuel burning appliance is suitably sited.	Ensure that best practice technology is used to prevent the escape into the atmosphere of noxious or offensive gases.

Applicable Environmental Law	Aspect Component	Compliance Requirement
Atmospheric Pollution Prevention Act, No 45 of 1965 (APPA) – Part IV	*Dust* Part IV of the Act pertains to dust control and includes dust arising from industrial processes. In terms of section 27 the Minister may declare any area to be a dust control area for the purposes of the Act. If in terms of section 28 if the CAPCO is of the opinion that dust originating on any land in a dust controlled area is causing a nuisance to persons residing or present in the vicinity of that land, he may by notice in writing require such owner or occupier to take the prescribed steps or adopt the "best practicable means" for the abatement of such nuisance.	Ensure that the operation adopt "best practicable means" in order to comply with the requirements of the relevant CAPCO.
Atmospheric Pollution Prevention Act, No 45 of 1965 (APPA) – Part V	*Vehicle emissions* Part V of the Act deals with pollution emanating from vehicles and is applicable to areas specifically designated by ministerial order. The Minister may regulate the use on a public road of vehicles emitting specific noxious or offensive gases, or gases which are of a darker colour or greater density or specific content and he may prescribe the steps to be taken to prevent the emission of noxious or offensive gases and the methods to be applied to determine whether noxious or offensive gases are being emitted.	Ensure that all vehicles travelling to and from the operation are compliant with the provisions contained in the regulations regulating vehicle emissions.
National Water Act (No 36 of 1998)	Regulates the protection, use, development, conservation, management and control of water resources in South Africa. Provides for the Constitutional demands for pollution prevention, ecological and resource conservation, sustainable utilisation, the precautionary principle, social upliftment, participatory decision-making, transparency and just	Appropriate water use permits must be applied for from the Department of Water Affairs and Forestry (DWAF), if required.

Applicable Environmental Law	Aspect Component	Compliance Requirement
	administrative action. In terms of this Act, water resource reserves for human use and maintaining sound ecosystems (the reserve) take precedence over agricultural and industrial demands. Water use permits are required to be obtained for water abstraction, water storage and water discharge in terms of Sections 27 – 29.	
Conservation of Agricultural Resources Act (No 43 of 1983)	Regulates agricultural natural resources and the conservation, management and use thereof. The most important features of this legislation are the measures provided for the prevention of soil erosion, the development of soil conservation schemes, the protection of wetlands and associated vegetation, the utilisation and protection of veld, the prevention of the spread of declared weeds and invader plants, and grazing management	Soil erosion prevention and soil conservation strategies must be developed and implemented. A weed control and management plan must be developed and implemented.
National Veld and Forest Fire Act (No 101 of 1998)	Purpose of this Act is to prevent and combat veld, forest and mountain fires throughout South Africa. The Act provides for a variety of institutions, methods and practices for achieving this purpose. Every landowner on whose land a fire may start or burn or from where a fire may spread must prepare and maintain a firebreak on his/her side of the border between his/her land and all the neighbours	Appropriate emergency response plans must be in place to respond to and combat fires associated with the proposed project. Appropriate fire breaks must be in place and be maintained.
Health Act (No 63 of 1977)	Temporary ablution facilities at construction camps are required to be approved in terms of this Act by the nearest local authority.	If applicable, approval must be obtained from the local authority for temporary ablution facilities during construction.
National Forest Act 84 of 1998	No one may cut, disturb, damage or destroy any indigenous tree in…a natural forest or a protected tree declared as such under section 12(1) or 14 (2) of the Act.	If applicable the necessary permit will be obtained from DWAF.

Applicable Environmental Law	Aspect Component	Compliance Requirement
Provincial Legislation		
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking (defined in terms of article 2 to include, cut, chop off, take, gather, pluck, uproot, break, damage or destroying of certain flora. Schedule 3 lists endangered flora and Schedule 4 lists protected flora. Articles 26 to 47 regulates the use of wild animals	Establish whether any of the species are listed in terms of Schedule 3 and 4, if so obtain a permit from Cape Nature. Consult Cape Nature before removal or donation of a wild animal is made or permitted.
Local Legislation		
City of Cape Town Air Pollution Control By-Law 12649- 4 February 2004- Provincial Gazette Extraordinary 5979 Section 7	No person will install, alter extend or replace any fuel-burning equipment on any premises without the prior written authorisation of the Council, which may only be given after consideration of the relevant plans and specifications.	If applicable obtain written authorisation from the local council.
City of Cape Town Air Pollution Control By-Law 12649- 4 February 2004- Provincial Gazette Extraordinary 5979 Section 14	Section 14 prohibits the open burning of any material unless prior written authorization is obtained from the council.	
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832 Section 37(1)	Prior to the construction of a new installation or the alteration of an existing installation, whether temporary or permanent, for the storage of a flammable substance, the owner or person in charge of the installation must submit a building plan to the Municipality, in accordance with the National Building Regulations. And a copy of the approved plan must be available at the site where the installation is being constructed.	Submit building plans and obtain approval prior to construction from the Municipality.

Applicable Environmental Law	Aspect Component	Compliance Requirement
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832 Section 37(2)	Prior to the commissioning of an aboveground or underground storage tank installation, liquid petroleum gas installation or associated pipework, the owner or person in charge of the installation must ensure that it is pressure-tested in accordance with the provisions of the National Building regulations (T1), SABS 0131: Parts1 and 2, SABS 089:Part 3 and SABS 087: Parts 1,3 and 7 in the presence of the controlling authority.	Notify the authorities 48 hours prior to the pressure test.
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832 Section 37(6)	The owner or person in charge of the premises, who requires to store a flammable gas in excess of 19 kilogram, or a flammable liquid of a danger group (i),(ii),(iii),or (iv) in excess of 200 litres must obtain a flammable substance certificate from the controlling authority.	If applicable submit an application to the controlling authority as prescribed in Schedule 2 of this By-law.
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832 Section 41	The handling, storage and distribution of flammable substances at bulk depots must be in accordance with the National Building regulations (T1), read in conjunction with SABS 089: Part 1.	If applicable ensure that handling, storage and distribution is in accordance with National building regulations.
By-law relating to Community Fire Safety 11257 – 28 February 2002 – Provincial Gazette Extraordinary 5832 Section 53	The operator of a vehicle designed for the transportation of dangerous goods may not operate such a vehicle in the jurisdiction of the controlling authority, unless he has obtained a dangerous goods certificate issued by a fire brigade service in terms of the National Road Traffic Act	Obtain the dangerous goods certificates in respect of all vehicles transporting dangerous goods and keep the certificate available in the relevant vehicle.

LIST OF APPLICABLE NATIONAL LEGISLATION NOT YET TAKEN EFFECT AT DATE OF THIS DOCUMENT

Applicable Environmental Law	Aspect component	Compliance Requirement
National Environmental Management: Air Quality Act 39 of 2004 – Section 21 (Expected to take effect on 1 September 2005)	The Minister, or the MEC may by notice in the Gazette publish a list of activities which result in atmospheric emissions and which the Minister or MEC reasonable believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage.	Determine whether any of the activities undertaken by the applicant is a listed activity.
National Environmental Management: Air Quality Act 39 of 2004 – Section 22	No person may without a provisional atmospheric emission license or an atmospheric emission license conduct an activity listed on the national list anywhere in the Republic or listed on the list applicable in a province anywhere in that province.	Apply for an atmospheric emission license from the Metropolitan or District municipality (charged with implementing the atmospheric emission licensing system in terms of section 36)
National Environmental Management: Air Quality Act 39 of 2004 – Section 26	The Minister or MEC may by notice in the Gazette, declare a substance or mixture of substances which, when used as a fuel in a combustion process, result in atmospheric emissions which through ambient concentrations, bioaccumulation, deposition or in any other way, present a threat to health or the environment or which the Minister or MEC reasonable believes present such a threat, as a controlled fuel	Establish whether any of the substances or mixture of substances used as a fuel in a combustion process by the applicant is a controlled fuel.
National Environmental Management: Air Quality Act 39 of 2004 – Section 28	No person may manufacture, sell or use a controlled fuel unless that manufacture, sale or use complies with the standards established in terms of section 27.	Ensure that the standards as established in terms of section 27 are adhered to.
National Environmental Management: Air Quality Act 39 of 2004 – Section 61	Despite the repeal of the Atmospheric Pollution Prevention Act by section 60 of this Act, a provisional registration certificate issued in terms of that Act and which was a valid certificate immediately before the date on which section 60 took effect, continues to be valid for a period of two (2) years from that date in respect of a	If the applicant is the holder of a registration certificate apply for a renewal in terms of section 47 within the first three year period.

Applicable Environmental Law	Aspect component	Compliance Requirement
	registration certificate it is valid for a period of four (4) years from that date. The holder of the registration certificate must within the first three (3) years of the four year period lodge a renewal application in terms of section 47 of this Act. If the holder fails to lodge a renewal application within the first three years the certificate expires at the end of the three years.	
National Environmental Management: Air Quality Act 39 of 2004 – Section 34	The Minister may prescribe essential national standards for the control of noise, either in general or specified machinery or activities or in specified places or areas; or for determining a definition of noise; and the maximum levels of noise	Ensure that the applicant is familiar with the contents of this section to ensure that it adheres to the standards prescribed by the Minister.
National Environmental Management: Air Quality Act 39 of 2004 – Section 35	The Minister or MEC may prescribe measures for the control of offensive odours emanating from specified activities. The occupier of any premises must take al reasonable steps to prevent the emission of any offensive odour caused by any activity on such premises.	Ensure that the applicant is familiar with the contents of this section to ensure that it adheres to the measures prescribed by the Minister for the control of offensive odours. Take all reasonable steps to prevent the emission of any offensive odour.
Petroleum Pipelines Act 60 of 2003 – Section 4 (Expected to take effect during October 2005)	The Petroleum Pipelined Regulatory Authority must as appropriate, in accordance with this Act issue licenses for the construction and conversion of petroleum pipelines, loading facilities and storage facilities and the operation of petroleum pipelines, loading facilities and storage facilities. • "petroleum" means crude oil and petroleum products; "petroleum products" means any liquid petroleum fuel and any lubricant, whether used or unused, and includes any other substance which will be used for a purpose for which petroleum fuel or any lubricant may be used; • "petroleum pipeline" means a pipeline used to transport petroleum excluding those located on the premises of a manufacturer of petroleum products or a storage facility;	

Applicable Environmental Law	Aspect component	Compliance Requirement
	• "storage facility" means any bulk storage facility and its auxiliary equipment that is or is intended to be used for the storage of petroleum and excludes storage facilities – ((b) for own final use	
Petroleum Pipeline Levies Act 28 of 2004 – Section 2	The Minister may by notice in the Government Gazette impose levies payable to the Petroleum Pipelined Regulatory Authority. The levy is payable by the person holding title to the petroleum immediately after it has entered the inlet flange. "Petroleum" and "petroleum pipeline" means the same as in the Petroleum Pipelines Act 60 of 2003	Establish whether a levy has been determined by the Minister and when it is payable. If applicable pay in time to avoid penalties and interest.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 40	The Minister of MEC for environmental affairs in a province may by notice in the Gazette determine a geographic region as a bioregion for purposes of this Act if that region contains whole or several nested ecosystems and is characterized by its landforms, vegetation cover, human culture and history and publish a plan for the management of biodiversity and the components of biodiversity in such region.	Establish whether the development site falls within such a bioregion and ensure that you familiarize yourself with the measures for the effective management of biodiversity as contained in the bioregional plan.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 43	The Minister may publish by notice in the Gazette a biodiversity management plan approved for (a) an ecosystem listed in terms of section 54 or an ecosystem that warrant special conservation attention (b) an indigenous species listed in terms of section 56 or a species which warrants special conservation attention.	Establish whether biodiversity management plans are in existence in respect of any ecosystem or species on the development site and if so familiarize yourself with the contents of the biodiversity management plan.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 52	The Minister may by notice in the Gazette may publish a list of national ecosystems that are threatened and in need of protection; an MEC for environmental affairs in a province may publish a provincial list of ecosystems in the province that are threatened and in need of protection.	Establish whether any listed ecosystem occurs on the development site.

Applicable Environmental Law	Aspect component	Compliance Requirement
National Environmental Management : Biodiversity Act 10 of 2004 – Section 53	The Minister may by notice in the Gazette identify any process or activity in a listed ecosystem as a threatening process. A threatening process must be regarded as a specified activity contemplated in section 24 (2)(b) of the National Environmental Management Act and a listed ecosystem must be regarded as an area identified for the purpose of that section.	Establish whether the proposed activity constitutes a threatening process, if so ☐authorization must be obtained from DEA&DP.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 56	The Minister may by notice in the Gazette publish a list of critically endangered species, endangered species, vulnerable species and protected species	Establish whether any of the species found on the development site is a listed species.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 57 (1)	A person may not carry out a restricted activity (as defined in section 1 of the Act) involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.	Establish whether the proposed development of the site constitutes a restricted activity, if so obtain a permit from the issuing authority (In terms of section 97 the Minister may make regulations relating to the designation of organs of state which may be issuing authorities – no regulations published to date)
National Environmental Management : Biodiversity Act 10 of 2004 – Section 57 (2)	The Minister may, by notice in the Gazette prohibit the carrying out of any activity which is of a nature that may negatively impact on the survival of a listed threatened or protected species and which is specified in the notice or prohibit the carrying out of such activity without a permit issued in terms of chapter 7.	If applicable obtain a permit from the issuing authority.
National Environmental Management : Biodiversity Act 10 of 2004 – Section 65	A person may not carry out a restricted activity (as defined in section 1 of the Act) involving a specimen of an alien species (as defined in section 1 of the Act) without a permit issued in terms of chapter 7.	If applicable obtain a permit from the issuing authority.

Applicable Environmental Law	Aspect component	Compliance Requirement
National Environmental Management : Biodiversity Act 10 of 2004 – Section 70,71	The Minister may by notice in the Gazette publish a list of invasive species; an MEC for environmental affairs in a province may publish a provincial list of invasive species. A person may not carryout a restricted activity (as defined in section 1 of the Act) involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.	If applicable obtain a permit from the issuing authority.

APPENDIX B

DETAILED ALIEN CONTROL AND MONITORING PROGRAMME

ALIEN CLEARING AND CONTROL GUIDELINES FOR THE ATLANTIS GAS TURBINE PLANT SITE

COMPILED BY: H.G WESTMAN
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ESKOM KOEBERG NATURE RESERVE

INTRODUCTION

Invasive alien species have significant negative impact on the environment. Next to direct habitat destruction, invading alien organisms are regarded as the biggest threat to biodiversity, and southern Africa could lose almost a quarter of it plant species from the fynbos region alone, due to invading alien plants. Other impacts include:

- Reducing stream flow (particularly when replacing fynbos with tree species that use more water)
- Reducing the ability of water supply schemes to deliver water to meet demands, especially in the dry periods.
- Increasing the fuel load that can burn leading to higher intensity and more regular fires.
- This in turn leads to physical damage of the soil and erosion after fire, and reduction in the viability of indigenous seeds thereby favouring recruitment of more invasive alien plants
- Densely invaded are impenetrable, restricting access and making fires even more difficult to control.

Land owners need a management tool to enable them to control alien plants and manage their environment in a responsible and cost effective manner.

Alien control are long term management projects and require careful and well considered planning and execution. This working guideline will attempt to provide insights into planning, methodology, bio –control and restorations.

LEGISLATION

Landowners are under a legal obligation to control invading alien plants occurring on their properties. This obligation exists as a result of the various laws. The current relevant laws identified at this stage are the following:

1. The common law relating to neighbours and nuisance;
2. Section 151(1) of the National Water act 36 of 1998
3. Section 28 of the National Environmental Management Act, 107 of 1998;
4. Section 31A of the Environment Conservation Act, 73 of 1989
5. Municipal by-laws and the National Veld and Forest Fire Act 101 of 1989
6. Regulations in terms of the Conservation of Agricultural Resources Act, 43 of 1983.

The Conservation of Agricultural Resources Act, No 43 of 10983
Deals directly with the combating of invasive alien plants. Refer categories for identification, on the DEAT website.

“ Invader plants” is defined in the Act as “a kind of plant which has under section 2(3) been declared an invader plant, and includes the seed of such plant and any vegetative part of such a plant which reproduces itself sexually”.

PLANNING CONTROL OPERATIONS

General Principles

Prioritize areas to be controlled:

- Areas requiring follow up treatment take precedence over areas, which still require initial clearing. Follow up treatment is essential to curb the further growth and spread of the alien vegetation, which has already had time and money spend on it.

- Start with young less dense trees to arrest the invasion and prevent the build up of seed banks. Starting with less dense areas also requires less resources and these areas will also be easier to carry out follow up treatment in.
- Dense mature stands should ideally be left for last, as they most probably won't increase in density or pose a greater threat than they are at the moment. Starting to clear dense areas also means that you have to be dedicated to expensive follow up treatments thereafter.
- One should always consider the natural gradient of the area being cleared, all operations should follow the gradient of the e.g. the slope or drainage lines.
- The role of fire should be considered in alien clearing operations.

ADDITIONAL FACTORS INFLUENCING PLANNING

Factors influencing methods, extent and location of initial clearing operations include:
- Rehabilitation and restoration potential
- Accessibility for machinery
- Management history
- Level of labour skills.

Other species may invade after initial clearing and clearing methods should be adjusted accordingly.

Continually evaluate success rate of clearing operations and methods.

THE ROLE OF FIRE

Fire management is necessary to reduce fire hazards to control alien invasive plants and to improve the water yield in catchments. Fire protection is also essential to control unscheduled fires to protect property, infrastructure and alien clearing investments already made.

Untimely and uncontrolled fires easily and often defeat the purpose of mechanical and bio – control clearing.

Fire, with appropriate management, is a cost-effective alien vegetation control method.

ASPECTS OF ALIEN CONTROL FOR BUDGETING PURPOSES

Vegetation:	Species
	Density – coverage / stems per ha (for woody species)
	Area (ha)
	Height (m)
	Growth stage – vegetative, flowering, fruiting
	Location
Terrain	Slope / Access
	Transport (c/km)
	Equipment
	Method
Labour	Type – skilled / unskilled
	Number (x)
	Task rate (persondays / ha)
	Availability

Technique

Chemical	Mechanical	Biological
Foliar	Felling	
Stem treatment	Ring barking	
Stump treatment	Hand pulling	

Equipment
Knapsacks
Foam sprayer
Manual / Mechanical (Slashers /Loppers /Bow saws/Brush cutters)
Maintenance(cost)

Herbicide
Type
Environment
Cost

Program
Duration
Number of treatments
Total cost for programme

METHODS OF ALIEN CLEARING

PORT JACKSON (*Acacia saligna*)

	Method	Mechanical	Chemical	Biological
Age	**Seedlings**	Hand pulled or hoed depending on site sensitivity	Foliar spray of either mamba, touchdown or Garlon.	
	Saplings	Hand pulled or hoed depending on site sensitivity	Foliar spray using Touchdown or Garlon	
	Large Trees	Must be felled as low as possible with a stump treatment of Timbrel.	Timbrel is used as stump treatment	The gall fungus has spread into most of Port Jackson and causes substantial mortality. The seed feeding weevil has been introduced with limited impact.

ROOIKRANS (*Acacia cyclops*)

	Method	**Mechanical**	**Chemical**	**Biological**
Age	**Mature trees**	Felling low to the ground		A seed feeding weevil has been released which can cause 95% destruction of seed. A galling midge has also been released.
	Young trees	Cutting or slashing low to the ground		
	Seedlings	If there is enough dry material fire can be used to kill medium to scattered seedlings. Frequent burning is ecologically unacceptable	Foliar spray with Garlon	

BIOLOGICAL CONTROL

INVASIVE TREE	BIOCONTROL AGENTS (Year 1st Est.)	DAMAGE TO PLANT	COMMENTS ON CONTROL
Port Jackson Willow (*Acacia saligna*)	1. Euromycladium tepperianum – gall fungus (1987) 2. Melanterius compactus – seed feeding weevil (2001)	Extensive (too early)	Control almost complete . Caused 85% of adult plants killed. Seedling re – growth problems.

INVASIVE TREE	BIOCONTROL AGENTS	(Year 1st Est.)	DAMAGE TO PLANT	COMMENTS ON CONTROL
Rooikrans (*Acacia cyclops)*	1.Melanterius servulus seed feeding weevil 2. Dasineura dielsi	(1994) (2001)	Extensive (release permission awaited from DEAT)	High proportion of seeds destroyed(96% or more at many sites)

How long does biological control take before you can see the results

Biological control is a long – term strategy. It is usual for biological control agents to take 10 or 20 years, or more, to build up in numbers and to effect satisfactory control of the target weed.

HERBICIDE REGIME

HERBICIDE USAGE GUIDE

SPECIES	SIZE CLASS	TREATMENT	HERBICIDE	DOSAGE PER ONE – LITRE MIX	DOSAGE	ESTIMATED PRODUCT / HECTARE
Port Jackson Acacia saligna	Seedlings	Hand pull	None			
Port Jackson Acacia saligna	Seedlings	Foliar spray	Garlon	7.5 ml/ 1*l* water + 5ml Actipron	0.75% **1-2% RECOM**	2 *l* / ha
Port Jackson Acacia saligna	Mature /Adult	Frill / Cut Stump	Timbrel	30ml / 1*l* water + 5ml Actipron + Dye	3%	2.25 *l* / ha
Rooikrans Acacia Cyclops	Seedlings	Hand pull	None			
Rooikrans Acacia Cyclops	Seedlings	Foliar spray	Garlon	5ml / 1*l* / water + 5ml Actipron+Dye	2%	2*l* / ha
Rooikrans Acacia Cyclops	Mature /Adult	Fell	None			

Handling

The handling of herbicide concentrates requires strict precautions and personnel handling product concentrates must be fully aware of precautions to be observed.

Suitable protective clothing must be available and use thereof is compulsory.
Chemical resistant plastic aprons gloves and eye protection must be worn when handling concentrates.

Adequate hygiene aids such as plentiful water, soap, towels and eyewash must be readily available.

Suitable absorbent material such as fine dry soil and cleaning equipment must be available to handle accidental spillage.

In the case of spillage, the spill must be contained immediately and cleaned up with absorbent material such as fine dry soil. The contaminated material should then be disposed of by burying in a safe place.

Concentrates should if possible be decanted in a safe suitable place and not in the field. Such a handling and mixing area should have a hard impermeable floor, be bunded and have an adequate sump to accommodate run – off from washing, flooding or fire containment.

Concentrates and mixtures should never be decanted into or be mixed in drinking bottles or other food containers.

All containers into which herbicides or adjuvants are decanted must be clearly marked and a copy of the original label secured to the container. Suitable equipment must be available to prepare spray mixtures. These include plastic measuring cylinders and breakers, mixing containers (bucket) and funnels.

In the field the following must be observed:

Spray mixtures must be kept in leak – proof, non – spill containers. The containers should be kept away from personal belongings, foodstuff, drinking water and eating and living areas.

Containers should stand on suitable absorbent material, eg a large piece of thick hesian sack that will absorb minor drips, out of direct sunlight in a cool place.

Containers must be kept at least 20m away from water bodies.

The area where the containers are kept in the field must be demarcated with danger tape.

Filling sites should be selected to prevent damage to desirable vegetation and to enable spillage to be cleaned up and disposed of.

Spray mixture containers must be clearly labeled and only reused for the specific herbicide.

Application equipment and containers should not be cleaned on site but at a suitable designated area at the store.

Suitable protective clothing, overalls, rubber boots, operators must wear gloves and if necessary eye protection when handling and applying herbicides.

Transportation

Herbicides and application equipment must be carried on a separate vehicle or in a part of the vehicle isolated from people, food and clothing.

Vehicles should carry absorbent material to absorb any spillage.

Herbicides and equipment must be secured to prevent spillage and damage.

Product, spray mixtures and equipment must not be left unattended where there is a danger of theft or abuse.

Disposal of Containers

A designated officer should be responsible to ensure that herbicide containers are correctly and safely disposed of, according to AVCASA guidelines.

Empty containers must be destroyed after use and not be used for any other purpose. Under no circumstances may containers be taken home for personal use.

Empty containers should be returned to the store for safe keeping and disposal.

Where arrangements have been made containers should be returned to the supplier.

Containers that have to be destroyed should be triple rinsed, punctured, flattened and, if suitable, burned.

Only sufficient spray mixture that can be used is a day should be prepared. Left – over material should be returned to the depot for storage and re – use. Spray mixture should only be disposed of in a suitable site.

Certain spray mixtures should not be left standing overnight and should be safely disposed of. Consult the product label. If mixtures can be left overnight with no adverse effects, they should be kept to reduce costs and pollution from herbicide and wash water.

Public Safety

Due regard must be paid at all times to the health and safety of the public.

Public should be kept out of operational areas where any hazard's exist. Warning notices should be displayed to this effect where necessary.

Herbicides must only be applied strictly according to label recommendations.

Products and spray mixtures should be stored so that they are inaccessible to the public.

Treatment of areas within 50m of habitat and public areas (e.g. parks) should be avoided or only carried out in consultation with the parties effected.

Public should be informed of control operations in their area by means of verbal communication, notices, pamphlets, the press etc.

Environmental Safety

Most alien vegetation control operations are carried out in riparian situations which are regarded as environmentally sensitive.

All care must be taken to prevent contamination of any water bodies.

Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.

To avoid damage to indigenous or other desirable vegetation product should be selected that will have the least effect on non – target vegetation.

Application

Equipment should be inspected regularly between and during applications and necessary repairs carried out.

Leaking sprayers or sprayer not applying correctly should be withdrawn until repairs have been carried out. Spare applicators and parts should always be available so as not to impede operations.

Ensure that correct nozzles are fitted and pressure settings are checked regularly.

Where possible use low water volumes to keep turn around (refilling) time down to a minimum. Caution must be observed to limit drift when using minimum output nozzles.

Spray mixture must not be left in the apparatus overnight.

Apparatus should be stored under lock and key when not in use.

Rates of Application – General Rules

Products shall be mixed and applied at rates recommended on the label.

Applications should be checked regularly to ensure that they comply with recommendations.

Precautions
Appropriate protective clothing must be changed and washed regularly and should be removed immediately if grossly contaminated.

Spillage must be attended to immediately and appropriately disposed of.

Application teams must be trained to avoid damage to non – target species.

Contamination of all water bodies must be strictly avoided.

Hygiene aids – clean water, soap, towels and eyewash must always be available to spray operators.

Adjuvants

Where recommended wetting and spreading agents should be added to spray mixtures. Wetters should always be mixed in accordance with label recommendations.

Dye must be added to all applications where the product has no built in dye to ensure that no target species are missed and plants are correctly treated.

Water sources

Only clean water may be used for spray mixtures

Weather Conditions

Applications should not be carried out under unfavourably weather conditions that could affect the control obtained or endanger nearby desirable vegetation, water bodies or personnel.

- Threatening rain
- Wind conditions
- Hot, dry conditions

Mixing Herbicides
Mixing must take place according to label instructions.

Suitable protective clothing must be worn when handling concentrates.

Liquid concentrates should be added to the half full tank which is then topped up.

Adjuvants should be added to the tank as per the label instruction prior to the addition of the herbicide when buffering and afterwards for wetters and dyes.

Do not mix concentrates together before adding them to the tank. Consult product labels.

Proper mixing in knapsacks and hand held applicators is difficult and spray mixtures should be mixed in bulk containers or if necessary (e.g wettable powders) buckets before pouring into the knapsacks or hand held applicators.

Spray mixtures should be agitated continuously if recommended. This is essential after they have been standing for a while.

Calibration

Application equipment must be correctly calibrated to obtain optimum results and prevent wastage through over - application.

Calibration should be carried out in the area to be treated.

Calibration should be checked frequently during application.

Restoration

The primary goal of restoration following alien plant invasion is to re – establish a structurally representative stand of indigenous vegetation that fulfills the major ecosystem functions. Alien plant eradication projects are an integral part of restoration and vice versa.

Provided that no other disturbance has affected the area, light to moderate alien plant stands can be cleared without negatively affecting indigenous vegetation recovery. However when clearing operations result in large exposed areas, restoration should be considered.

Coastal and Sand Plain

- Sand Plain Fynbos is mainly comprised of predominantly short – lived species and after a dense invasion few long – lived species reign. Most of these long – lived species have short distance dispersal and will not readily re – colonise the site.
- Without restoration densely invaded Sand Plain areas are prone to invasion by alien annuals.
- Wind – blown sand damages vegetation and needs to be controlled, cut plant material can be placed on the sand to reduce the wind speed at the surface.
- Collect a local seed mix containing a range of growth forms and species and sow in the autumn after a fire.
- Rake seed lightly into soil or apply a thin layer of wood chips or fynbos mulch to improve contact between seed and soil.
- Bird perches can be erected to facilitate the re- colonisation by indigenious bird – dispersed species.

Herbicide recommendations for the control of alien species

species		Treatment	Herbicide	Dosage %	Mixture in 10L water
Botanical name	Common name				
Acacia cyclops	Rooikrans	Cut stump	Timbrel	3.0%	300ml
		Foliar spray	Garlon	0.5% **RECOM. 1-2%**	50ml
Acacia Saligna	Port Jackson	Cut stump	Timbrel	3.0%	300ml
		Basal stem	Garlon	2.0%	200ml
		Foliar spray	Garlon	0.75%**RECOM 1%**	75ml

Herbicide Guidelines – KOEBERG NATURE RESERVE

Product / Use	**Concentration Percentage**	**Pressure spray can**	**Spray can**	**CP3 Knapsack**	**CP3 Knapsack**	**Tank**	**Tank**	**Quad Bike Trailer – spray tank**	**Rear tank unit – 4x4 tractor**	**Rinkhals**
		1L	5L	15L	20L	100L	200L	280L	400	500L
Garlon 4 Foliar application Rooikrans Port Jackson	Garlon 1% Actipron 1% water	20ml	100ml	300ml	400ml	2L	4L	5.6L	8L	10L
Timbrel Stump treatment	Timbrel 3% Actipron 0.5%	30ml 0.5ml	150ml 25ml	450ml 75ml	600ml 100ml	- -	- -	- -	- -	- -
Touch down plus & Simazine Effective weed control and grasses	Touch Down 2% Simazine 3%	- -	- -	300ml 450ml	400ml 600ml	- -	4L 6L	5.6L 8.4L	8L 12L	10L 15L
Touch Down & Water Chemical mowing Used for weeds and grasses in fynbos and sensitive areas.	Touch Down 2% Water	- -	- -	- -	400ml 20L	2L 100L	4L 200L	- -	- -	10L 500L

Management of the plant invader species (Alien Eradication)

a) Alien vegetation is an ecological threat to the area.
Approximately 25% of the property has been invaded by alien acacia, pine or poplar species. Alien plants(plants that are not indigenous to the area) can cause severe damage to ecosystem by physical crowding, the use of available nutrients and water, and by reducing available light.

b) The Management towards the eradication of populations of alien plant species.
Principles:

- Acacia cyclops (rooikrans) should be given the highest priority for eradication
- Priority should be given to clearing aliens from communities with a high conservation status(neutral sand proteoid fynbos, limestone proteoid fynbos and forest thicket and then the remaining communities.
- The procedure for alien clearing, in order of priority, are;
    - Control young alien regeneration following initial treatments or wilderness before new seeds can be produced i.e before the plant reach an age of 2 –3 years.
    - Control individual plants and sparse to open stands
    - Control first – generation dense and closed stands (i.e stands that were sparse or open before the last control operation or fire)
    - Systematically carry out control operations on older dense and close stands.
- All alien clearing operations that are initiated must be followed up and completed before new operations are begun.
- To prevent the development of dense stands of alien plants by effectively controlling regeneration of young plants.
- Only use herbicide to control alien plant growth where there is no practical alternative.
- To use fire as part of the alien control operations, especially as regards the stimulation of the indigenous seedbank to germinate.
- Where possible, use biocontrol methods to control alien species.

METHODS

Manual – semi or unskilled labour can be utilized, however training must be given.

Lopper & bow – saw : are the two most important effective land tools. Preferably literate to read herbicide labels, measurements etc.
Lopper : 50 - 80 cm invader plant diameter
Bow saw 80 – 120cm invader plant diameter
Chainsaw >120cm

Mechanical – Chainsaw: For larger alien trees- Acacia cyclops & Acacia saligna
Costly to operate, however very effective for large areas of dense infestations to be cleared.
Noise aspects must be considered

NB

A SITE VISIT TO THE KOEBERG NATURE RESERVE IS WELCOMED FOR OBSERVATIONS AND PRACTICAL EXPOSURE TO SEE HOW WE ACHIEVE THE WAR AGAINST PLANT INVADERS.

PLEASE CONTACT HILTON WESTMAN,ESKOM KOEBERG CONSERVATION OFFICER FOR A SITE VISIT OR ADVICE.

TEL 021-5532466

082737991

hilton.westman@eskom.co.za

APPENDIX C

DETAILED REHABILITATION PROGRAMME

PSER REVEGETATION. (SPEC ER)

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PSER1 SCOPE

PSER2 INTERPRETATIONS
PSER2.01 Definitions

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PSER6 TOLERANCES

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PSER8 MEASUREMENT AND PAYMENT
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PSER8.16	Slope stabiliser
PSER8.17	Mowing of grass
PSER8.18	All other requirements of the revegetation specification

PSER REVEGETATION. (SPECER)

PSER1 SCOPE

This Specification covers the requirements for the planting and establishment of vegetation on Site following construction activities.

PSER2 INTERPRETATIONS

PSER2.01 Definitions

For the purposes of this Specification the following definitions shall apply: {*include any relevant definitions*}

PSER3 MATERIALS

PSER3.01

Plant material shall be {*give details of required materials*}

Plant species list

Species	Habitat and vegetation type	Flowering time
	Ground covers	
Arctotheca calendula	Widespread on lowlands and lower slopes; renosterveld and sand plain fynbos	Winter-Spring
Arctotis acaulis	Clay soils on lower slopes; renosterveld	Late Winter-Summer
Arctotis hirsute	Sandy soils on lowlands; sand plain fynbos	Spring-early Summer
Cliffortia ferruginea	Wet soils near water; mountain fynbos	
Cenia turbinate	Sandy soils on lowlands; sand plain fynbos	Autumn-early Summer
Chrysocoma ciliata	Clay soils; renosterveld	Winter-early Summer
Chrysocoma coma-aurea	Renosterveld	Spring
Dimorphotheca pluvialis	Sandy soils on lowlands; sand plain fynbos	Winter-Spring
Dorotheanthus bellidiformis	Sandy soils on lowlands; sand plain fynbos	Winter-early Spring
Falkia repens	Sandy soils on lowlands; sand plain fynbos	Late Winter-Summer
Felicia aethiopica	Sandy soils on lower slopes; mountain fynbos	All year
Felicia bergeriana	Sandy soils on lowlands; sand plain fynbos	All year
Felicia filifolia subsp. filifolia	Rocky soils on upper slopes of Hottentots-Holland; mountain fynbos	Late Autumn-Spring
Felicia longifolium	Sandy soils on lowlands, sand plain fynbos	All year
Gazania krebsiana	Widespread; renosterveld and sand plain fynbos	Late Winter-Summer
Geranium incanum	Sandy soils on lowlands; sand plain fynbos	Late Winter-Summer
Helichrysum crispum	Sandy soils on lowlands; renosterveld and sand plain fynbos	Spring-Summer
Helichrysum cymosum	Sandy soils on lowlands; renosterveld and sand plain fynbos	Spring-Summer
Helichrysum odoratissimum	Slopes; mountain fynbos	
Helichrysum teretifolium	Sandy soils on lowlands; sand plain fynbos	Spring-early Autumn
Heliophila coronopifolia	Loamy soils on lowlands; sand plain fynbos and renosterveld	Late Winter-Spring
Hermannia pinnata	Sandy soils on lowlands; sand plain fynbos	Spring
Lobelia alata	Wet soils near water; mountain fynbos	Late Spring-Autumn
Monopsis lutea	Sandy and damp soils on lowlands; sand plain fynbos	Late Spring-Autumn
Oedera imbricata	Widespread on lower slopes; sand plain fynbos	Winter-Spring
Osteospermum clandestinum	Lower slopes; Renosterveld	Winter-Spring
Osteospermum fruticosum	Sandy soils near coast; sand plain fynbos	
Otholobium decumbens		Spring
Pelargonium peltatum	Strandveld	Late Winter-Summer

Pelargonium suburbanum subsp. bipinnatifidum	Sandy soils on lowlands; sand plain fynbos	Winter-Summer
Pelargonium tomentosum	Sandy, moist soils in Hottentots-Holland; forest margins	Spring-Summer
Plecostachys serpyllifolia	Sandy soils on lowlands; sand plain fynbos	Autumn-early Winter
Scabiosa columbaria	Sandy soils on lowlands and lower slopes; sand plain fynbos	Late Winter-early Autumn
Scabiosa incisa	Sandy soils on lowlands; sand plain fynbos	All year
Senecio elegans	Sandy soils on lowlands and lower slopes; sand plain fynbos	Spring
Solanum quadrangulare	Sandy soils on lowlands; sand plain fynbos	Autumn-Spring
Stachys aethiopica	Rocky soils on lower slopes; mountain fynbos	All year
Ursinia anthemoides	Sandy soils; sand plain fynbos	Late Winter-early Summer
Bulbs		
Agapanthus africanus	Rocky soils on upper slopes; mountain fynbos	Spring-Summer
Albuca canadensis	Sandy soils on lowlands and lower slopes; renosterveld	Spring
Amaryllis belladonna	Clay soils near water; renosterveld	Late Summer-Autumn
Aristea major	Sandy soils on lower slopes	Spring-early Summer
Babiana stricta	Sandy or granite soils	Winter-early Spring
Bobartia indica	Widespread on lower and upper slopes; renosterveld and mountain fynbos	Spring-early Autumn
Brunsvigia orientalis	Sandy soils on lowlands; sand plain fynbos	Autumn-early Winter
Bulbine alooides	Sandy soils on lower slopes; sand plain fynbos	Late Autumn-early Spring
Chasmanthe aethiopica	Damp soils; mountain fynbos	Late Autumn-Winter
Chasmanthe floribunda	Damp soils on lower slopes; mountain fynbos	Winter-early Spring
Gladiolus carinatus	Sandy soils on lowlands and lower slopes; sand plain fynbos	Winter
Gladiolus carneus	Sandy or wet soils on lower and upper slopes; mountain fynbos	Spring-Summer
Gladiolus tristis	Damp soils near water; mountain fynbos	Winter-early Spring
Homeria collina	Sandy soils on lowlands and lower slopes; sand plain fynbos and renosterveld	Winter-Spring
Ixia flexuosa	Widespread	Winter-Spring
Kniphofia uvaria	Wet soils near water	Spring-Autumn
Lachenalia aloides var. aloides	Rocky soils; mountain fynbos	Winter-Spring
Lachenalia aloides var. quadricolor	Rocky soils on granites; mountain fynbos	Winter-Spring
Moraea tripetala	Widespread	Late Winter-Spring
Nerine sarniensis	Rocky soils on upper slopes; mountain fynbos	Summer-early Autumn
Ornithogalum suaveolens	Rocky soils on lower slopes and sandy soils on lowlands; sand plain fynbos	Late Spring-Summer
Ornithogalum thyrsoides	Sandy and clay soils on lowlands and lower slopes; sand plain fynbos and renosterveld	Late Winter-Spring
Oxalis flava	Sandy soils on lowlands; sand plain fynbos	Late Autumn-early Winter
Oxalis pes-caprae	Sandy or clay soils; sand plain fynbos	Winter-early Spring
Oxalis purpurea	Rocky soils on lower slopes; mountain fynbos and renosterveld	Autumn-early Spring
Pelargonium triste	Sandy soils; sand plain fynbos	Late Winter-Summer
Sparaxis bulbifera	Sandy and damp soils on lowlands; sand plain fynbos	Spring
Trachyandra divaricata	Sandy soils on lowlands; sand plain fynbos	Winter-early Spring
Trachyandra muricata	Clay soils; renosterveld	Winter-Spring
Tritonia crocata	Clay soils on lowlands and lower slopes; renosterveld	Spring
Tulbaghia alliacea	Sandy soils on lowlands; sand plain fynbos	Autumn
Wachendorfia paniculata	Widespread on lowlands; sand plain fynbos and renosterveld	Winter-Spring
Wachendorfia thyrsiflora	Wet soils near water; sand plain fynbos	Spring-early Summer
Watsonia borbonica	Sandy and damp soils on slopes; mountain fynbos	Spring

Watsonia marginata	Widespread on sandy and damp soils	Spring
Zantedeschia aethiopica	Wet soils on lowlands; sand plain fynbos	All year
Restios, ferns, grasses, sedges		
Blechnum capense	Streambanks; forests	
Blechnum punctulatum	Sheltered rocky areas and streambanks; forests	
Blechnum tabulare	Wet and exposed slopes; mountain fynbos	
Cheilanthes viridis	Semi-sheltered areas; forest margins	
Chloris gayana	Resiliant grass, hot and dry environments	
Chondropetalum tectorum	Sandy and wet soils on lowlands; sand plain fynbos	Late Winter-Spring
Cyathea capensis	Forests	
Cynodon dactylon	Widespread	Spring-early Autumn
Cyperus textilis	Wet soils and streambanks; sand plain fynbos	Late Spring-early Autumn
Elegia capensis	Damp soils; mountain fynbos	
Eragrostis tef	Resiliant grass, hot and dry environments	
Hemarthria altissima	Damp soils, streambanks and vleis	Spring-early Winter
Heteropogon contortus	Resiliant grass, hot and dry environments	
Imperata cylindrica	Damp soils and streambanks on lowlands; sand plain fynbos	All year
Juncus kraussii	Damp soils in dune slacks, vleis and streambanks; sand plain fynbos	
Leersia hexandra	Damp soils, streambanks and vleis	All year
Phragmites australis	Wet soils in streams and on streambanks; sand plain fynbos	Summer-early Winter
Restio multiflorus	Rocky soils on upper slopes; mountain fynbos	
Rumohra adiantiformis	Forests and forest margins	
Scirpus nodosus	Sandy soils; sand plain fynbos	Summer-early Autumn
Stenotaphrum secundatum	Sandy soils on lowlands; sand plain fynbos	Spring-Autumn
Thamnochortus spicigerus	Sandy soils on lowlands; sand plain fynbos	Winter
Themeda triandra	Widespread	Spring-Winter
Todea barbara	Moist streambanks on upper slopes; mountain fynbos	
Typha capensis	Wet soils in streams and on streambanks; sand plain fynbos	All year
Succulents		
Aloe maculata	Rocky soils on lower slopes; renosterveld	Late Winter-early Spring
Carpobrotus acinaciformis	Sandy soils on lowlands and lower slopes; sand plain fynbos and renosterveld	Late Winter-Spring
Carpobrotus edulis	Widespread in sandy soils on lowlands and lower slopes	Late Winter-Spring
Conicosia pugioniformis	Sandy soils on lowlands; sand plain fynbos	Spring-Summer
Cotyledon orbiculata	Sandy soils on lowlands; strandveld	Winter-early Summer
Disphyma crassifolium	Rocky areas on coastline	Winter-Spring
Drosanthemum floribundum	Clay and saline soils; strandveld and sand plain fynbos	Late Winter-early Summer
Drosanthemum striatum	Clay soils on Tygerberg Hills; renosterveld	
Erepsia bracteata	Clay soils on lower slopes; renosterveld	
Climbers		
Clematis brachiata	Forest margins	Autumn
Jasminum glaucum	Rocky soils on streambanks and slopes; mountain fynbos	Spring-Summer
Rhoicissus tomentosa	Ravines on upper slopes; mountain fynbos	Late Spring-Summer
Shrubs and small trees		
Agathosma capensis	Widespread	
Agathosma ciliaris	Rocky soils on upper slopes; mountain fynbos	Late Autumn-Winter
Agathosma glabrata	Mountain fynbos	Late Autumn-Winter
Agathosma serpyllaceae	Rocky soils on lower slopes; renosterveld	Autumn-Spring
Anisodontea scabrosa	Widespread on lowlands	All year
Asclepias cancellata	Widespread on lower slopes; mountain fynbos	Autumn-Spring
Athanasia dentata		Late Spring-Autumn

Athanasia parviflora	Widespread	Late Spring-Summer
Athanasia trifurcata	Clay soils; renosterveld	Late Spring-early Autumn
Berzelia intermedia	Wet soils on lower and upper slopes; mountain fynbos	Late Winter-Summer
Buddleja salviifolia	Streambanks; forest margins	Late Winter-Spring
Burchellia bubalina	Forests	Spring-Summer
Carissa bispinosa	Forest margins	Spring-Summer
Chironia baccifera	Sandy soils on lowlands; renosterveld and sand plain fynbos	Late Spring-Summer
Chrysanthemoides incana	Sandy soils on lowlands; strandveld	Spring-Autumn
Chrysanthemoides monilifera	Sandy soils on lowlands; strandveld	Late Autumn-early Spring
Coleonema album	Rocky soils on coastline; sand plain fynbos	Winter-Spring
Crotalaria capensis	Widespread on lowlands and lower slopes	Spring-early Autumn
Diospyros glabra	Forest margins	Spring-Summer
Diospyros whyteana	Forests and forest margins	Late Spring-early Winter
Dodonaea angustifolia	Widespread on lowlands and lower slopes	Winter-Spring
Elytropappus rhinocerotis	Clay soils; renosterveld	Autumn-early Spring
Erica caffra	Streambanks; mountain fynbos	Winter-Spring
Erica cerinthoides	Widespread	All year
Erica coccinea	Sandy soils on lower slopes; mountain fynbos	Autumn-Winter
Erica mammosa	Widespread on sandy soils; sand plain fynbos and mountain fynbos	All year
Erica sessiliflora	Wet soils on slopes; mountain fynbos	Autumn-early Spring
Eriocephalus africanus	Clay soils on lower slopes; renosterveld	Late Autumn-Spring
Euclea racemosa	Sandy soils on lowlands; strandveld	Autumn-early Winter
Euryops pectinatus	Rocky soils on slopes; mountain fynbos	All year
Freylinia lanceolata	Streambanks in mountain fynbos	All year
Gnidia squarrosa	Sandy and limestone soils on coastline	All year
Grewia occidentalis	Forest margins	Spring-Summer
Halleria elliptica	Lower slopes and streambanks in Hottentots-Holland; forest margins	Late Winter-Autumn
Hermannia hyssopifolia	Damp soils on lower slopes; mountain fynbos and sand plain fynbos	Late Winter-Spring
Hermannia multiflora		Winter-Spring
Knowltonia vesicatoria	Forest margins	Late Autumn-Spring
Leonotis leonurus	Widespread on lowlands; strandveld and sand plain fynbos	Autumn-Winter
Leonotis ocymifolia		Late Spring-Winter
Leucadendron salignum	Widespread; mountain fynbos and sand plain fynbos	Autumn-Spring
Leysera gnaphalodes	Sandy soils on lowlands; sand plain fynbos	Spring
Limonium peregrinum	Sandy soils on lowlands; sand plain fynbos	Spring-Summer
Linum africanum	Sandy and limestone soils on coastline	Late Winter-Summer
Lobostemon fruticosus	Sandy soils on lowlands; sand plain fynbos	Winter-Spring
Maurocenia frangularia	Riverine areas near coast; forest and strandveld	Winter-early Spring
Melianthus major		Late Winter-Spring
Metalasia muricata	Sandy soils on lowlands; sand plain fynbos	Autumn-early Spring
Myrica cordifolia	Sandy soils on lowlands; sand plain fynbos	Autumn-Winter
Myrica quercifolia	Sandy soils on lowlands and lower slopes; sand plain fynbos	Winter-early Spring
Myrica serrata	Rocky soils on lower and upper slopes; mountain fynbos	Spring
Myrsine africana	Sheltered slopes; mountain fynbos	Late Spring-Summer
Nylandtia spinosa	Sandy soils on lowlands; sand plain fynbos	Winter-Spring
Orphium frutescens	Sandy soils on coastline; sand plain fynbos	Autumn
Osyris compressa	Widespread on lowlands and lower slopes; strandveld	Winter-Summer
Otholobium hirtum	Clay and granite soils; renosterveld	
Passerina rigida	Sandy soils on lowlands; sand plain fynbos	Spring
Passerina vulgaris	Sandy soils on lowlands; sand plain fynbos	Spring
Pelargonium betulinum	Sandy soils on lowlands; sand plain fynbos	Late Winter-Spring

Pelargonium capitatum	Sandy soils on lowlands and lower slopes; sand plain fynbos	Spring-Summer
Pelargonium cucullatum	Widespread on lowlands and lower slopes; sand plain fynbos and mountain fynbos	Spring-Summer
Peucedanum ferulaceum	Slopes; mountain fynbos	Summer-early Autumn
Phylica ericoides	Sandy soils on lowlands and lower slopes; sand plain fynbos	All year
Phylica plumosa	Clay soils on lower slopes; renosterveld	Late Autumn-Winter
Phylica pubescens	Lower slopes; mountain fynbos	Late Autumn-Winter
Podalyria calyptrata	Rocky soils; mountain fynbos	Late Winter-Spring
Podalyria sericea	Lowlands and lower slopes; sand plain fynbos	Spring
Polygala futicosa		All year
Polygala myrtifolia	Lowlands and lower slopes; strandveld and sand plain fynbos	All year
Polygala virgata	Widespread on lowlands and lower slopes; forest margins	Winter-Summer
Protea cynaroides	Rocky soils on slopes; mountain fynbos	All year
Protea neriifolia	Rocky soils on slopes in Hottentots-Holland; mountain fynbos	Late Summer-Spring
Protea repens	Widespread; mountain fynbos and sand plain fynbos	Late Autumn-Spring
Psoralea pinnata	Moist soils; mountain fynbos	Spring-Summer
Putterlickia pyracantha	Sandy soil on lowlands; strandveld	Spring-Summer
Rhus crenata	Sandy soils on lowlands; strandveld	Autumn
Salvia africana-caerulea	Widespread on lowlands and lower slopes; sand plain fynbos	Winter-Summer
Salvia africana-lutea	Widespread; sand plain fynbos and mountain fynbos	Winter-early Summer
Salvia chamelaeagnea	Widespread; sand plain fynbos and mountain fynbos	Spring-Autumn
Scabiosa africana	Sheltered slopes; mountain fynbos	Winter-Spring
Selago corymbosa	Widespread on lowlands; sand plain fynbos	Late Spring-early Winter
Senecio halimifolius	Sandy and wet soils on lowlands; sand plain fynbos	Late Spring-Summer
Stoebe plumosa	Clay soils on lower slopes; renosterveld	Autumn-early Winter
Sutherlandia frutescens	Widespread on lowlands and lower slopes; sand plain fynbos and renosterveld	Winter-early Summer
Tephrosia capensis	Widespread	Spring-Summer
Zygophyllum morgsana	Sandy soils on lowlands; strandveld	Spring-early Autumn
	Trees	
Acacia karroo	Streambanks on lowlands and lower slopes; renosterveld	Spring-Summer
Apodytes dimidiata	Forests	Spring-Summer
Brabejum stellatifolium	Streambanks; mountain fynbos	Summer
Brachylaena neriifolia	Streambanks; mountain fynbos	Summer
Buddleja saligna	Forests	Winter-Summer
Canthium inerme	Forests	Late Winter-Spring
Canthium mundianum	Forests	Late Winter-Spring
Cassine peragua	Forests	Spring-Summer
Celtis africana	Forests	Late Winter-Spring
Cunonia capensis	Streambanks; forests	Autumn-early Spring
Curtisia dentata	Forests	Summer
Ekebergia capensis	Forests	Late Autumn-Winter
Gymnosporia buxifolia	Forest margins	Late Summer-Autumn
Halleria lucida	Forests and forest margins	Winter-Summer
Ilex mitis	Forests	Spring-early Summer
Kiggelaria africana	Riverine areas; forests	Spring-early Summer
Metrosideros angustifolia	Streambanks; mountain fynbos	Spring-early Summer
Ocotea bullata	Forests	Late Spring-early Autumn
Olea capensis subsp. macrocarpa	Forests	Spring-early Autumn
Olea europaea subsp. africana	Rocky soils on lower slopes; mountain fynbos	Spring-early Autumn

Olea exasperata	Sandy soils on lowlands; strandveld	Late Winter-Spring
Olinia ventosa	Forests	Spring-Summer
Podocarpus elongatus	Streambanks; forests	
Podocarpus latifolius	Forests	
Pterocelastrus tricuspidatus	Widespread on lowlands and lower slopes; forests and strandveld	Winter-early Spring
Rapanea melanophloes	Forests	Late Autumn-Winter
Rhus lucida	Widespread; forest margins and strandveld	Late Autumn-early Spring
Rhus undulata	Rocky areas; mountain fynbos and forest margins	Autumn-early Winter
Salix mucronata	Streambanks; mountain fynbos and renosterveld	Spring
Scutia myrtina	Forest margins and strandveld	Spring-Summer
Sideroxylon inerme	Sandy soils on coastline; strandveld	Summer-early Winter
Tarchonanthus comphoratus	Widespread on sandy soils; forest margins and strandveld	Summer-Autumn

{*Note: Many species are hardy and will grow in a wide range of soil types. However, to revegetate an area as accurately as possible to its original flora, plant species used should be those that occur naturally in the nearest site with a similar soil type and aspect. A suitably qualified botanist should be consulted with in this regard.*}

Shrubs and trees

1. All plant material shall be obtained either from nurseries, from the Site prior to clearing or from an area in close proximity to and of the same veld type as the Site, as indicated by the Engineer.
2. Indigenous plants shall be obtained either from the Site prior to clearing or from an area in close proximity to and of the same veld type as the Site, as indicated by the Engineer.
3. Plants shall be obtained from nurseries. Nursery plants shall be grown from locally obtained seed unless approved by the Engineer. The Contractor shall inform the Engineer of the source of his plants
4. Plants shall be obtained from their natural habitat. {*provide site specific detail on exactly where*}
5. The Contractor shall ensure that each plant is handled and packed in the approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on Site in a proper condition for successful growth.
6. Trucks used for transporting plants shall be equipped with covers to protect the plants from windburn. Containers shall be in a good condition. Plants shall be protected from wind during the transportation thereof.
7. No plants or plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force-feeding at any time after purchase.
8. The Contractor shall ensure that the plants are in a good condition and free from plant diseases and pests. The Contractor shall immediately remove plants containing any diseases and/ or pests from the Site.
9. All plants supplied by the Contractor shall be healthy, well formed, and well rooted. Roots shall not show any evidence of having been restricted or deformed at any time. The potting materials used shall be weed free.
10. There shall be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they shall be maintained to ensure that the root systems remain moist.

Grass

Sods and runners

1. Grass sods shall be clean of invasive plants or weeds.
2. Sods shall be obtained from a source approved by the Engineer. Sods rejected by the Engineer shall be removed from the site immediately.
3. Grass shall have been grown specifically for sod purposes, mown regularly and cared for to provide an approved uniformity to the satisfaction of the Engineer. It shall be harvested by special machines manufactured for this purpose to ensure an even depth of cut with sufficient root material and soil.
4. Sods shall be delivered in healthy conditions and be free from weeds and disease.

5. Sods shall be obtained from an approved nursery. Nursery sods shall have been maintained regularly to the required quality. Nursery grass sods shall have at least a 30 mm layer of topsoil.
6. Sods shall be obtained directly from the veld. Veld sods shall contain at least a 50 mm topsoil layer and the roots shall be minimally disturbed. They shall be obtained from the near vicinity of the site from an area selected by the Engineer. The soil shall be compatible with that removed from the area to be revegetated and shall not have been compacted by heavy machinery.
7. Runners shall be of an approved quality and free from disease or weeds.

Basic regrassing seed mix

{These are basic seed mixtures to use when regrassing. When developing basic regrassing spec, ensure that information on mulch, soilbinder, fertilisers, applications rates etc. is included.}

1. Summer seed mixture:
    a. *Cynodon dactylon {germinates in summer from end September onwards and is widespread}*
    b. *Eragrostis tef {germinates in summer from September, smaller in stature than Lolium and has a very short growing season. Although this species is exotic to the Western Cape, it is not invasive and is good for stabilisation. It is widespread.}*
    c. *Hyparrhenia hirta {well-drained stoney soils}*

2. Winter seed mixture:
    a. *Lolim multiflorum {widespread, germinates in winter, grows until November/ December. Don't sow after September since temperatures too high.}*
    b. *Ehrharta villosa {coastal sand dunes}*
    c. *Chaetobromus dregeanus {well-drained sandy soils}*

Indigenous vegetation sods

1. Sods of indigenous vegetation (e.g., rushes, sedges and restios) shall be obtained from areas approved by the Engineer, within or near the site.
2. The Contractor shall identify suitable sods, as directed by the Engineer.
3. Sods rejected by the Engineer shall be removed from the site immediately.
4. Indigenous vegetation sods shall be clean of weeds or invasive plants in specified areas before planting.

Seed

1. The seed mix quantities and purity levels shall be specified and approved by the Engineer.
2. Seed shall be utilised for the cultivation of material for revegetation.
3. Seed shall be utilised for direct sowing.
4. Seed must be pre-dried then stored under cool, dry, insect free conditions until required either for cultivation in the nursery or in the rehabilitation process. Only viable, ripe seed shall be used.
5. A record of stock relevant to the project that is held in the nursery shall be provided to the Engineer on a monthly basis.
6. Seed shall be stored at the Contractors expense.

Commercial seed

1. All seed used shall be labelled in accordance with the Government Seed Act No. 28 of 1961 or amendment thereof. The Contractor shall furnish the Engineer with signed copies of a statement from the seed merchant certifying that each container of seed delivered is fully labelled in accordance with the Government Seed Act. This certification shall appear on, or be submitted with, all copies of invoices for the seed.
2. Commercial seed shall only be used in previously disturbed areas.

Harvested seed

1. Indigenous seed shall be harvested in an areas which are free of alien/ invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites, as indicated by the Engineer.

2. Following harvesting, the seed shall be dried under cool airy conditions. The seed shall be insect free and shall be stored in containers under cool conditions that are free of rodents or insects. No wet, mouldy or otherwise damaged seed is acceptable.
3. Seed harvested by hand from selected species, should be treated and stored separately.
4. Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs shall be kept apart from individually harvested seed .
5. Harvested seed obtained by means of vacuum harvesting, shall be free of excessive quantities of organic and/ or substrate material.

PSER3.02 Mulch

Mulch shall be {*give details of required mulch*}

Brush-cut mulch

1. The stockpiled vegetation from the clearing operations shall be reduced to mulch.
2. Indigenous plant material shall be kept separate from alien material. The vegetative material, shall be reduced by either mechanically means (chipper) or by hand-axing to sticks no longer than 100mm. The chipped material shall be mixed with the topsoil at a ratio not exceeding 1:1.
3. Mulch shall be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants.
4. No harvesting of vegetation outside the area to be disturbed by construction activities shall occur.
5. Mulch shall be harvested from areas in close proximity to the site, as approved by the Engineer. Any collection of indigenous material from nearby veld that will not be subject to complete denudation shall only be done in mature vegetation in areas identified by the Engineer.
6. Harvesting shall be performed in a chequer board fashion, cutting the indigenous vegetation down to ±100 mm above the ground, in 2 m wide strips, leaving 2 m gaps of undisturbed vegetation in between.
7. The Contractor shall take every effort to ensure the retention of as much seed as possible in mulches made from indigenous vegetation. Mulches shall be collected in such a manner as to restrict the loss of seed.
8. Brush-cut mulch shall be stored for as short a period as possible, and seed released from stockpiles shall be collected for use in the rehabilitation process.
9. Fynbos vegetation cleared from the site prior to construction activities, that is suitable for mulching, shall be stockpiled for later use. The Contractor shall ensure that no alien species are used to make indigenous vegetation brush cut mulch without the approval of the Engineer.
10. Natural topsoil shall be mixed with fynbos.

Processed commercial mulches

1. Processed commercial mulch, in the form of a 'roll-on blanket' or fibrous product shall be utilised as mulch during revegetation and rehabilitation of the site.
2. The mulch used shall be weed free, of a reputable make and approved by the Engineer.
3. The packaged fibrous mulch shall be processed in such a manner as to contain no growth or germination inhibiting factors. The mulch shall remain in uniform suspension in water under agitation.
4. When packaged fibrous mulch is used together with seed and fertiliser in a hydro-seeder, the Contractor shall ensure that it blends with other constituents to form homogenous slurry.

Wood chips

1. Wood chips (including bark) shall be utilised as mulch during revegetation and rehabilitation of the site.
2. The chips shall be no longer than 50 mm in length or breadth and shall be free of seed. The Engineer shall approve the source of chips.
3. The wood shall be chipped during winter
4. Chips shall not be made from wood treated with preservatives.
5. Half-composted chips shall be utilised in preference to non-composted chips
6. Indigenous seed shall always be added to wood chip mulches.

Compost

1. Compost shall be utilised as mulch during revegetation and rehabilitation of the site.
2. The compost shall be well decayed, friable and free from weed seeds, dust or any other undesirable materials.
3. Seed free, half-composted material, such as mulled-bark, shall be used as an additive to extend indigenous mulch. No more than 50% compost shall be used under these circumstances.

Alternative products

1. Molasses extract (Foermol)/ Aquasorb/ Stoscosorb/ Synpol H or other product approved by the Engineer shall be utilised as mulch during revegetation and rehabilitation of the site.

PSER3.03 Slope stabilisers and anti-erosion measures

Slope stabilizer and/ or anti-erosion materials shall be {*give details of required materials*}

Stabilisation cylinders

1. Stabilisation cylinders shall consist of cylindrical capsules approximately 125 mm in diameter by 1.5 m in length.
2. Stabilisation cylinders shall be manufactured from biodegradable material such as hessian or of extruded biodegradable plastic netting. The plastic material shall be sufficiently robust to last for a period of not less than 3 years and not more than 10 years before disintegrating under normal service conditions.
3. Stabilisation cylinders shall be filled with shredded or partly compressed pine chips or similar material. Only material passing through a 31 mm sieve with round holes and retained on a 5 mm sieve with square holes shall be used. Wood chips shall be treated with Tanalith C wood preservative. Splinters and flat chips are not acceptable.
4. A seed approved by the Engineer shall be included in the cylinders.
5. Cylinders shall be anchored in position using biodegradable material.
6. Cylinders shall not be used to stabilise any rock faces.

Biodegradable netting / matting

1. Biodegradable netting/matting shall be made from jute, sisal, coir or similar material.
2. A 1 m² sample of the geofabric, geogrid or nylon (biodegradable) fabric shall be submitted to the Engineer for approval prior to procurement.
3. The netting/matting shall be sufficiently robust to last for a period of not less than 5 years under normal service conditions.
4. Holes in the netting/matting shall have a minimum size of 400 mm^2 and a maximum size of 900 mm^2 and be made from at least 4-6 mm thick cord.

Logs

1. The Contractor shall ensure that for slopes of less than 1:3, the Site shall be stabilised by means of "geojute" and continuous rows of logs, secured to the slope with timber pegs, parallel to the contour. Logs shall be untreated pine (or gum) poles of not less than 150 mm⌀ with a taper of not more than 75 mm over its length. Timber pegs to be treated and not less than 400 mm in length. Timber pegs must be longer if thicker logs than the minimum are used.
2. The slope shall be covered with "geojute" prior to placing the logs. The Contractor shall install Kaytech Soil Saver 292 (or a similar product) as per the manufacturer's specifications except for the pegging that is replaced by the log stabilization.
3. Logs shall be secured to the slope in such a manner that they will not become dislodged during construction and/ or planting. Logs to be secured to the slope by means of a minimum of two pegs driven into the soil not less than 250 mm deep. For logs longer than 3 m, additional pegs shall be required. Log ends to be butt-jointed and plugged with wood chips or similar to prevent water from washing through at the joint. Logs shall be placed at 2 m intervals with a bottom row parallel to the edge of the road. Logging of the slope to start at the top of the slope to prevent the stretching of the "geojute".

Hard structures

1. All hard structures used for slope stabilisation shall have natural pebble face finishes.

PSER3.04 Soil stabilisers

1. Flobond/ Hydropam or other product approved by the Engineer shall be utilised as mulch during revegetation and rehabilitation of the site.
2. Soil stabilisers shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and form an encrustation.
3. Soil stabilisers shall be of such a quality that grass and indigenous seeds may germinate and penetrate the crust. Samples of the proposed material shall be supplied to the Engineer before any of the material is delivered to the Site.

PSER3.05 Fertiliser

Fertiliser shall be {*give details of required materials*}

Hydro-seeding

1. Liquid fertiliser shall be used where fertiliser is applied during the hydro-seeding process {*The fertilizer ratio would be dependant on the seed used during hydro-seeding*}.

Mountain and acid Sandplain Fynbos

1. The Contractor shall use 3:1:1, 3:1:2, 4:1:1, 8:1:1, or similar in a solid form and 4:1:1 (19) Phosan, or similar, in a liquid form, as approved by the Engineer.

Granite soils

1. The Contractor shall use 3:1:0 and 4:1:0, or similar as approved by the Engineer.

Basic regrassing

1. The Contractor shall use 2:3:2 and super-phosphate.

Cultivated lawns

1. The Contractor shall use 3:2:3, super-phosphate or similar as approved by the Engineer.

PSER3.06 Manure

PSER3.07 Topsoil and subsoil

1. All soil imported to act as bedding material shall be free of alien plant seeds, and their use shall be restricted to 500 mm below the soil surface.

PSER3.08 Boulders and rocks

1. Boulders or rocks used in rehabilitation shall come from comparable geomorphological units to those that they are being utilised to rehabilitated.
2. Where possible, boulders and rocks utilised during rehabilitation, shall be collected from the Site and stockpiled prior to the commencement of construction activities on Site.

PSER3.09 Rock stains

1. Where required, viakote bitumen primer solution, or a similar product, as directed by the Engineer, shall be used as a rock stain.
2. Care shall be taken to ensure that the stain does not inhibit plant growth.
3. Where required, cement-based screed or grout sprayed onto the rock face, shall be used to rehabilitate and stabilised cut rock surfaces.

PSER4 PLANT

PSER4.01 Hydro-seeder

1. The hydro-seeder shall be capable of pumping the specified seed mix, fertiliser, soil stabiliser, aqueous smoke solution, mulch and wetting-agent (mixed in water) at specified rates over the areas to be seeded.
2. The hydro-seeder shall have an agitation system, which shall be sufficient to agitate, suspend and homogeneously mix the specified slurry.
3. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.
4. The slurry tank shall be mounted on a travelling unit, either self-propelled or drawn by a separate unit. The travelling unit shall be capable of placing the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.

PSER4.02 Seed store

1. Facilities should be available to store seed, collected or required on-site, in rodent- and insect-free, cool (7 - 10 °C), dry, conditions.

PSER4.03 Site-specific nursery

1. On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for revegetation. The nursery shall be suitably located and constructed under the supervision of the Engineer.
2. An off-site nursery shall be made available for the holding of rescued plant material and the propagation of appropriate species for revegetation. The plants shall be cultivated and stored separately from other material in the nursery.
3. The site-specific nursery shall be utilised for the cultivation and maintenance of the stocks of living plant material required for the revegetation and rehabilitation of the Site.
4. The nursery, including irrigation, water shall be free of Phytophthora.
5. Irrigation water shall be de-chlorinated.
6. Soil used to cultivate or grow plants shall be weed free.
7. The area where plants are stored shall be kept free of weeds.
8. A record of stock relevant to the project that is held in the nursery shall be provided to the Engineer on a monthly basis.

PSER4.04 Irrigation

1. The design and layout of the irrigation shall be indicated on a plan and approved by the Engineer prior to its installation.
2. The 100 mm uPVC sleeves connecting the planters shall be installed by others, but the Contractor shall insure that all sleeves are in the correct position prior to the installation of paving. The irrigation system shall meet the following requirements:
    a. It shall be connected to an appropriate water supply with a water meter.
    b. The system shall be semi-automatic.
    c. Six drippers per tree shall be required (underneath mulch level)
    d. The system shall be operated by means of a hand-operated stopcock in a lockable metal box.

PSER5 CONSTRUCTION

PSER5.01 Method Statements

The following Method Statements shall be provided by the Contractor 14 days after receipt of the Letter of Appointment (*only Method Statements relevant to the particular project should be selected*):

1. Rehabilitation of disturbed areas and revegetation after construction is complete.
2. Use of herbicides, pesticides and other poisonous substances.

PSER5.02 Preparation of ground surfaces

1. Prior to the application of topsoil, the ground surface shall be ripped or scarified with a mechanical ripper to a depth of approximately 150 mm.
2. Prior to the application of topsoil, the ground surface shall be ripped or scarified by hand tilling to a depth of approximately 150 mm. {*this specification shall be used on small sites*}
3. Compacted soil shall be ripped to a depth of greater than 250 mm. The ripped area shall be hand-trimmed.
4. The subsoil shall be thoroughly tilled to a depth of at least 100 mm by means of a plough, disc, harrow or any other approved method until the condition of the soil is acceptable, as approved by the Engineer.
5. Were tilling is difficult, the Contractor shall use rotary tillage machinery until no clods or lumps larger than 40 mm in size remain, and the mixing of soil is acceptable to the Engineer.
6. In road cuttings, a weed-free gravel / sand / organic mix shall be utilised as a sub-surface layer.
7. Topsoil shall be applied {*give such details as are required additional to SABS 1200D Cl 5.2.4.2*}
8. Subsequent to the addition of the sub-soil, topsoil shall be spread evenly over the ripped or tilled surface to a depth of 75-150 mm on flat ground or to a minimum depth of 75 mm on slopes of 1:3 or steeper or as specified in this specification.
9. The final prepared surface shall not be smooth but furrowed to follow the natural contours of the land, with scattered rocks of varying sizes according to the natural condition of the area.
10. Where sodding is required slight scarification shall be carried out to contain the sods. The soil shall be uniformly moist to a depth of 150 mm prior to planting or seeding. If this condition is not met by rainfall, the Contractor, as directed by the Engineer, shall carry out irrigation.
11. In artificial wetland areas, topsoil shall be removed to a depth of approximately 200 mm, the wetlands excavated, and topsoil replaced. Wetland areas are then to be selectively composted, as determined by the Engineer, and permanent irrigation systems installed where necessary.
12. Prior to any site clearance, the wetland areas, along with 10 m buffer zones, as indicated on the Revegetation Plan are to be effectively fenced off to prevent any damage to wetland material on sites prior to transplanting.

PSER5.03 Mulch

Basic regrassing

1. Aquasorb, Stoscosorb, Synpol H are a similar product approved by the Engineer, shall be applied at a rate of 24 kg/ha. The mulch shall be worked into the soil prior to seeding.

PSER5.04 Soil stabilization

Methods for soil stabilisation shall be *{give details of required methods}*

Straw stabilisation

1. Straw shall be utilised as a binding material in areas with deep sand.
2. Baled straw shall be placed on the cleared area, opened and spread evenly by hand or machine at a coverage rate of 1 bale per 10 m^2 over the area to be stabilised. It shall then immediately be rotovated into the upper 100 mm layer of soil. This operation shall not be attempted when the wind strength is such as to remove the straw before it can be rotovated into the sand.

Mulch stabilisation

1. Mulch shall be applied by hand to achieve a layer of uniform thickness. The mulch shall then be lightly worked into the topsoil layer so that it mixes with the soil and serves to bind it.
2. The mulch shall be spread at a coverage rate of 100 kg per 250 m^2 or 4 t/ha.
3. Where brush-cut material is to be utilised as mulch, this material shall be evenly spread across the area to a uniform depth of 25 mm. The mulch shall then immediately be rotovated into the upper 100 mm layer of soil. This operation shall not be attempted when the wind strength is such as to remove the mulch before it can be rotovated in.

4. In very rocky areas a layer of mulch shall be added prior to adding the top-material. The mulch must then be worked into the top-material to bind it.
5. Alien vegetation mulch shall be in a non-seed bearing state and shall be chipped prior to application. The preparation of alien vegetation mulch shall be done at source.
6. The Contractor shall cut bush to a height of 400 mm above ground level from designated areas. This vegetation shall then be passed through the chipping machine as above, and be stockpiled for later use as mulch.
7. If the area is exposed to strong wind the mulch stockpile shall be covered with a fine nylon net with 100 mm × 100 mm openings.

Compost stabilisation

1. The soil shall be stabilised by placing and lightly compacting a 75 mm layer of compost over the designated areas or by working a 75 mm layer of compost into the ground to a depth of 150 mm.

Gravel stabilisation

1. The soil shall be stabilised by the placing of a 50 mm layer of gravel wearing course quality material complying with the physical properties specified in subclause 3.2.2 of SABS 1200 ME.
2. The material shall be placed, spread, trimmed and compacted by means of 3 passes of the same compaction equipment used for the bulk earthworks.

Stabilisation of steep slopes

1. The Contractor shall take measures to protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. The Contractor shall take any other measures that may be necessary to prevent surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
2. If runnels or erosion channels develop, they shall be back-filled and compacted, and the areas restored to a proper condition. The Contractor shall not allow erosion to develop on a large scale before effecting repairs.
3. Where artificial slope stabilisers are used, these shall be applied to the slope, preferably before topsoiling, but according to the detailed construction plan and as specified in this specification.
4. Near vertical slopes (1:1 to 1:2) shall be stabilised using hard structures following specifications.
5. Where the slopes are 1.3 to 1:6 they shall be logged or otherwise stepped (using stabilisation cylinders or similar) in order to prevent soil erosion. Logs/ cylinders must be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope. These logs/ cylinders must be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.
6. In areas where slopes are less than 1:6, horizontal grooves, shallow steps or ledges parallel to contours shall be made on the cut slopes. They shall be made at random to appear natural.
7. In areas where slopes are less than 1:6 these slopes shall be stabilised by using logs in parallel rows, or stabilisation cylinders fastened randomly into position or using biodegradable netting. These structures shall hold the top-material on the slopes and serve as erosion prevention structures.
8. Shallow slopes shall be stabilised using commercial available and approved anti-erosion compounds.

Basic regrassing

1. Flobond soil binder shall be applied at a rate of 12 kg/ha prior to the application of the grassing seed mixture.

PSER5.05 Slope modification and stabilisation

Cut slopes

1. Cut and fill slopes shall be shaped and trimmed to approximate the natural condition and contours as closely as possible and be undulating. Levels, incongruous to the surrounding landscape, shall be reshaped using a grader and other earthmoving equipment.

2. All cut and fill slopes shall be left as rough as possible, and shall contain ledges to facilitate the accumulation of topsoil. The ledges shall be dug at random to appear natural. Furthermore, the Contractor shall ensure that any embedded rocks that will not pose a danger to traffic, remain on the slopes.
3. Boulders / rocks, collected on the site before disturbance, shall be scattered at a predetermined density approved by the Engineer.
4. Any eroded areas deeper than 50 mm shall be either trimmed down by back cutting the slope face or repaired to the satisfaction of the Engineer with boulders and soil or any other approved method.
5. Catchwater drains shall be installed above the cut slopes.
6. Where cut slopes are greater than 4 m in height, the Contractor shall construct berms at regular intervals.
7. Natural water flow paths shall be identified and subsurface drains (using riprap or superfluous rock material) or surface drains and chutes {*use water speed control structures where necessary*}, preferably using cemented natural rock, shall be constructed along the flow paths.
8. Near vertical slopes (1:1 to 1:2) shall be stabilised using natural rock wall structures constructed using conventional building methods or in forms with slurry forced between the structures. All structures shall have a 'natural' look and facilities for plants to grow in.
9. Near vertical slopes (1:1 to 1:2) shall be stabilised using stacked precast concrete terraforce/ löffel blocks. All structures shall have a 'natural' look and facilities for plants to grow in.
10. Near vertical slopes (1:1 to 1:2) shall be stabilised using rock-filled gabion baskets.
11. All areas where the slopes are 1.3 to 1:6 shall be logged or otherwise stepped (using stabilisation cylinders or similar) in order to prevent soil erosion. Logs/ cylinders shall be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope. These logs/ cylinders shall be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.
12. In areas where slopes are less than 1:6 horizontal groves and shallow steps and ledges parallel to contours shall be made on the cut slopes. They shall be made at random to appear natural.
13. In areas where slopes are less than 1:6 horizontal, these slopes shall be stabilised by using logs in parallel rows, or stabilisation cylinders fastened randomly into position shall be utilised. These structures shall hold the top-material on the slopes and serve as erosion prevention structures.

Borrow pits

1. Borrow pits shall be shaped to have undulating slopes and surfaces and upon completion shall blend into the natural terrain. {*in terms of minimising legislation these areas require an approved rehabilitation programme on application to use as a borrow pit*}

Blasted areas

1. Blasted areas shall be finished so as to be as rough as possible to facilitate establishment of vegetation.

PSER5.06 Fertilisation

Trees and shrubs

1. One third of the fertiliser shall be scattered at the bottom of the hole, one third dug into the topsoil to be replaced in the hole and the remainder watered into the soil at surface level.

Basic regrassing

1. 2:3:2 fertiliser shall be applied with the seed mix, at the rate of 400 kg/ha. Super phosphate shall be applied post germination at the rate of 200 kg/ha

PSER5.07 Timing of planting

1. Reseeding shall occur in late Summer to Autumn (January to March).
2. Replanting shall occur during April / June.
3. Wetland preparation shall occur during Autumn and planting shall occur during early Winter after the first rains (May to June). If planting occurs in a dry late Autumn (end March) or early Winter (April to June) season it shall be necessary to irrigate plants to ensure their successful establishment.

4. Plant material shall be planted into the ground within a maximum period of 5 days after delivery to the Site, unless otherwise specified by the Engineer.

PSER5.08 Planting guidelines

Planting shall be carried out as follows {*give details of required methods*}

Reseeding

1. Aqueous smoke solution (= smoke water) treatment shall occur after the first Early Winter rains following sowing.
2. If mulching is done at the end of Autumn to Early Winter, aqueous smoke solution (= smoke water) shall be applied as part of the hydro-mulch mixture.
3. For natural areas a 1 delbs solution of aqueous smoke shall be diluted in a ratio of 1:150.
4. Seed shall not be left exposed to smoke water.
5. Hydro-seeding machines shall be thoroughly cleaned after each operation and before different seed mixes of different origins are introduced into it. The mixture shall be kept uniform during the seeding operation by means of a power-driven agitator.
6. The following components shall be added to the hydro-seeding slurry:
    a. Compost;
    b. Fertiliser;
    c. Soil binding agents (such as Surfasol or similar);
    d. Wetting agents (such as Aqua-gro or similar);
    e. Seed and growth stimulants;
    f. Micro-organisms; and/ or
    g. Anti-erosion compounds.
7. Where broadcast seeding is carried out, the seed shall be sown evenly over the designated area. During sowing half the seed shall be sown by the sower moving in one direction and the remainder by the sower moving at right angles to the first sowing.
8. In confined areas the seed shall be covered by means of rakes or other approved hand tools. Broadcast seeding shall not be done under windy conditions.
9. Drill seeding shall be done in rows not more than 0.25 m apart. The seeding shall be done with an approved grain drill with fine seed attachment or a combination grass planter and land packer or pulveriser. A combine grain and fertiliser drill may be used where appropriate, as directed by the Engineer.
10. Reseeding shall only occur during a period approved by the Engineer.
11. The Contractor shall demonstrate to the Engineer in a trial section that the application of the materials required can be made at the rates specified in this specification.

Basis regrassing

1. Grass seed shall be applied at the following rates {*specify applicable grass mix depending on season and nature of soils*}:

Summer mix -	*Cyndon dactylon*	20 kg/ha
	Eragrostis tef	10 kg/ha
	Hyparrhenia hirta	5kg/ha
Winter mix -	*Lolium multiflorum*	10kg/ha
	Ehrharta villosa	5kg/ha
	Chaetobromus dregeanus	5 kg/ha

Planting of grass runners

1. The runners shall be planted within 30 hours of being harvested. Storage in the interim period shall be in aerated bags under cool dry conditions. The runners shall be planted at even spacing, by hand or mechanically at a rate of at least 70 grain bags of runners per hectare.
2. Only fresh runners, that are in good condition and have not dried out, shall be accepted. These runners shall be planted in trenches not less than 50 mm deep with leafy ends, and not roots, exposed.
3. The runners shall be well watered after planting and rolled with a light agricultural roller when the soil has dried sufficiently, as directed by the Engineer.

Sodding

1. Prior to sodding, the area shall be re-innoculated with microbes contained within natural veld sods. Veld sods of restios or grasses shall be collected, as directed by the Engineer, and replanted in shallow hollows for this purpose.
2. Re-innoculation shall occur during or immediately after a rain event. Innoculation sods shall be watered lightly after placement.
3. Revegetation sods shall be planted in strips to reduce erosion.
4. Sodding shall take place on moist, rock free topsoil that has been scarified.
5. Sods, once harvested or delivered from a nursery, shall not be allowed to dry out and shall be planted within 30 hours of being removed from the soil or growing medium. If necessary, they shall be lightly watered prior to planting.
6. Sods shall be planted so they abut tightly against one another. The first row shall be in a straight line with subsequent rows planted so that the joints are staggered. Any gaps shall either be planted with a sod reduced to the gap size or filled with topsoil.
7. Where grass sods are planted on slopes steeper than 1:2, wooden stakes of 500 mm diameter shall be used to anchor the sods in position.
8. In the absence of rain, sods shall be well watered after planting and not be allowed to deteriorate through a lack of moisture.
9. Where grass sods are planted in the floodplain, wooden stakes of 500 mm in diameter shall be used to anchor the sods in position.

Planting trees, shrubs and herbs

1. The Contractor will be provided with an approved planting/ landscaping plan.
2. Where planting is not direct, the plants must be brought to an approved holding area in the intended planting area where they shall be suitably maintained. The Contractor, as directed by the Engineer, shall provide sufficient shade and water. The operation of relocation from the nursery to the planting site must occur on the same day so as to minimise losses through death and to maintain or improve their condition at delivery.
3. During transplanting of indigenous plants care shall be taken to ensure that they are not exposed to the sun. The roots as well as the leaves shall be covered with wet hessian to limit transpiration during transportation and storage. Plants shall be kept in this state for as short a time as is reasonably possible.
4. Planting shall occur as specified in this specification or planting/ landscaping plan.

Planting guidelines

1. The size of holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil, without having to be compressed. The soil around the roots of the plants being transplanted shall not be disturbed. Topsoil and subsoil from the hole shall be stored nearby to be replaced to the same depth intervals from which it was originally removed.
2. Individual spacing between trees shall be 2-3 m and clumps shall consist of 6-12 trees. The trees in the clumps shall be planted in staggered rows of 5 trees per 6 m^2 with low to medium tall shrubs planted between the clumps. The clumps shall be spaced at about 8-12 m distance.
3. In the case of transplanted trees up to 3 m tall, the hole size shall be 2 500 mm × 2 500 mm in width and 1 800 mm deep
4. Shrubs shall be planted 1-2 m apart around the trees and in the intervening areas between the clumps or as circumstances dictate.
5. Plugs of herbs shall be planted at densities of up to 12 per 1 m^2.
6. Bulbous plants shall be planted as features in selected areas and shall be protected from moles and baboons using rock linings to the holes and surface soil.
7. Before the placement of the plant specimens into prepared holes, the holes shall be watered substantially.
8. One to two handfuls of bone meal shall be added to the hole before planting.
9. Plants shall be carefully transplanted into holes.
10. Plant holes shall be back-filled using a mixture of two-thirds loamy to sandy topsoil to one-third compost. Where the natural soil is very clayey or heavy, sand shall be added at a ratio of one-third soil, one-third compost and one-third sand. The soil and compost / sand additives shall be well mixed to the satisfaction of the Engineer.
11. The topsoil shall be replaced at the same depth intervals at which it was excavated. The soil shall be lightly compacted and well watered.

12. Care shall be taken to keep root damage to a minimum when transplanting seedlings. Where plants have a taproot this shall not be cut. Excess foliage, flowers and side branches shall be pruned as directed by the Engineer.
13. Coarsely chipped bark from pine trees shall be supplied and placed in a 75 mm deep layer at the bases of the trees following planting.
14. Large rocks shall be placed around the base of planted trees in fire-prone environments.
15. Plants planted at the waters edge in wetlands and rivers shall be planted as follows:
    a. Wetland material harvested from existing wetland areas shall be transplanted directly to the newly created wetland area, along with as much soil, and surrounding material as possible.
    b. Indigenous shrubs and small trees shall be planted 3 m apart
    c. Palmiet shall be planted 1- 2 m apart
    d. Bulrushes, reeds, sedges and herbs shall be planted in sods 0.4-0.5 m apart or as circumstances dictate.
16. Plants shall be watered immediately after transplanting to ensure that the soil is wet around the plants. If necessary additional soil must be added after initial watering to fill any subsidence back up to ground level.

PSER5.09 Traffic on revegetated areas

PSER5.10 Establishment

Irrigation

1. The Contractor shall be responsible for maintaining the desired level of moisture necessary to maintain vigorous and healthy growth. The quantity of water applied at one time shall be sufficient to penetrate the soil to a minimum depth of 800 mm, where appropriate, and at a rate that will prevent saturation of the soil.
2. Water used for the irrigation of revegetated areas shall be free of chlorine and other pollutants that will have a detrimental effect on the plants.
3. All seeded, planted or sodded grass areas and all shrubs or trees planted shall be irrigated regularly at the specified intervals.
4. Grassed areas shall require irrigation coverage of 100% and a permanent watering programme. The watering programme shall be modifiable to accommodate natural climatic variations.
5. Revegetated areas shall require irrigation coverage of 100% and a modifiable watering programme.
6. Were an irrigation system is required, the Contractor shall be responsible for its installation and maintenance.
7. In the event of a delay between the planting programme and installation of the irrigation system, a water truck shall be utilised for watering, according to a programme approved by the Engineer.
8. Every effort shall be made to reduce irrigation overspray onto natural patches.
9. The Contractor shall water the planted areas as necessary, using a suitable fine spray which shall not disturb the vegetation and which will not cause any erosion.
10. The Contractor shall ensure that the planted area receives 25 mm of irrigation water, including rain, per week applied uniformly over the whole area.
11. The Contractor shall supply all water required and shall provide all pipework, pumps, irrigation equipment and other plant necessary. All this infrastructure and its positioning shall be approved by the Engineer.

Fertilising

1. The Contractor shall strictly control the use of fertilisers.
2. Care shall be exercised strict control when using such materials near sensitive natural areas, so as to avoided contamination of these areas.
3. The Contractor shall manage the fertilisation programme for different areas of planting.
4. Additional fertiliser shall be applied at the intervals specified with due regard to favourable climatic conditions and the state of growth of the vegetation. Application shall be by hand or approved mechanical spreader and shall provide uniform distribution.
5. Fertilisers shall be suitably sealed and stored in a location approved by the Engineer.

Weeding and mowing

1. The Contractor shall be responsible for controlling all woody alien/ invasive species including kikuyu grass or other invasive species. The Contractor shall ensure that all weeds and alien/ invasive species are removed as specified. {*clause not appropriate in areas infested by kikuyu*}
2. The Contractor shall be responsible for ensuring that the site remains free of kikuyu during the contract and establishment period.
3. Where seedlings occur sparsely, they should be removed manually.
4. Where dense stands of seedlings are present a foliar spray of Garlon (0.5% concentration in water with a wetting agent such as Actipron, and a blue dye to indicate area applied) shall be utilised.
5. Larger individuals of alien/ invasive species shall be controlled by cutting or loping and treating the cut stumps with herbicide to prevent regrowth (e.g. a 2% Garlon solution in diesel oil coloured with a red dye to indicate which stumps have been treated).
6. Alien/ invasive plants and weeds shall not be stockpiled, they should be removed from the site and dumped at an approved site.
7. If, during the establishment period, any noxious or excessive weed growth occurs or other undesirable vegetation threatens to smother the planted species in the seeded or planted areas, such vegetation shall be removed.
8. The Contractor shall mow the grass in specified grassed areas or on road verges at intervals ordered by the Engineer. Grass cuttings shall be collected and disposed of as directed by the Engineer. The grass shall be mown at regular intervals to stimulate lateral growth. The first cutting shall take place when the grass is 50 mm high and thereafter the height shall be maintained at between 30 and 50 mm.
9. If during the establishment period, non-indigenous weeds or other non-indigenous plants are present in the planted areas, such vegetation shall be removed by hand.

Disease and pest control

1. The Contractor shall inspect all plant materials at least once a month to locate any diseased or insect pest infestation. Once the nature and species of disease/ pest has been identified the Contractor shall submit a method statement outlining the proposed method of control to the Engineer for approval, prior to application of proposed control measure.

Pruning

1. All plant material shall be kept free from dead wood, broken branches, dead flower heads or otherwise harmful or objectionable branches or twigs. All other pruning shall be done only as directed by the Engineer.
2. All pruning wounds greater than 12 mm diameter shall be painted with an approved tree wound paint.
3. Secateurs and other cutting equipment shall be kept sterilised to avoid spreading fungal infestations.

Tree establishment

1. Trees should be watered three times weekly in summer and once weekly in winter unless sufficient rain occurs.
2. All tree guards shall be maintained in good condition. This includes ensuring that tree ties remain taut and the replacement of all such accessories when required. Where the tree ties damage the trees, this shall be rectified immediately.
3. Trees that die or become unhealthy from any cause or appear to be in a badly impaired condition shall be promptly removed and replaced, or as soon as the weather permits, as directed by the Engineer. All replacements shall be trees of the same kind and quality as those originally planted.

Erosion control

1. In the case of surface wash-away or wind erosion, the Contractor shall implement remedial measures, as approved by Engineer, as soon as possible.
2. Appropriate erosion control/ soil stabilisation measures shall be implemented.

PSEM5-14: Temporary revegetation of the areas disturbed by construction (Subclause 5.30)

Landscaping and revegetation of disturbed areas and the site in general shall be in terms of site rehabilitation and closure specifications. However, where there is likely to be a delay of greater than two weeks in the landscaping and revegetation of a disturbed area or where that site is likely to be the subject of further construction activities at a later stage, the Contractor shall ensure that the area is temporarily revegetated to combat dust generation and prevent erosion. This revegetation shall occur incrementally immediately upon completion of the construction activities at the subject location.

Prior to revegetation, structures and material not forming part of the Permanent Works, including remnants of building materials, concrete foundations, timber and other foreign debris, shall be removed and disposed of via the solid waste management system. The area shall be revegetated as follows:

- The surface shall be levelled by hand or machine as far as practically possible.
- Alien vegetation shall be cleared by cutting the plants off at ground level, and painting the stump with 0.5% Garlon in diesel.
- For areas with a slope of greater than 1:3, straw shall be utilised as a binding material to stabilise the soil during revegetation and rehabilitation of the site. Straw shall consist of natural seed-free, dried fibres of hay or chaff of various lengths between 50 mm and 400 mm, delivered to Site in bales and shall be applied evenly by hand or machine at a rate of 1 bale per 10 m^2 over the area to be revegetated. It shall then immediately be rotovated into the upper 100 mm layer of soil.
- The prepared area shall be hydro- or hand-seeded at a rate of 40 kg/ ha using Rye grass (*Lolium multiflorum*). In the event of hand-seeding, the seed mixture as specified shall be mixed with two parts per volume of clean dry plaster sand, then divided in half and applied evenly in two successive applications, one after the other, by means of an approved hand seeding machine (known colloquially as a "tefsaaier"). On completion of the seeding the surface shall be lightly raked to cover the seed with no more than 5 mm of soil.
- Water used for the irrigation of vegetated areas shall be free of pollutants that will have a detrimental effect on the plants. The vegetated area shall only be watered once, immediately following seeding. Watering should be carried out from a tanker, using a fine nozzle spray to avoid erosion and disturbance of the vegetation. Water for irrigation purposes may be drawn from the quarry water body.

No construction equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been vegetated. Only persons or equipment required for

the preparation of areas, application of fertiliser and maintenance of revegetated area shall be allowed to operate on these areas

PSER6 TOLERANCES

Void

PSER7 TESTING

PSER7.01 Seed

Commercial seed

1. Each lot of commercial seed shall be subject to sampling and testing at the discretion of the Engineer.
2. Sampling and testing shall be in accordance with the latest Rules and Regulations under the Government Seed Act.

Harvested seed

1. Purification shall be to an agreed standard
2. The quantities and quality of bulk harvested seed shall be assessed according to seed to volume ratios.

PSER7.02 Responsibility for establishing an acceptable cover

1. Where only indigenous seed, harvested from the site, has been used, acceptable cover shall mean that:
    a. Not less than 60% of the area seeded shall be covered with acceptable plants; and
    b. There shall be no bare patches greater than 800 mm in maximum dimension through the area, except where large rocks or boulders occur.
2. Where commercial grass seed is used, acceptable cover shall mean that:
    a. Not less than 75% of the area seeded shall be covered with grass; and
    b. There shall be no bare patches greater than 500 mm in maximum dimension.
3. In the case of grass sodding, acceptable cover shall mean that the full area shall be covered with live grass at the end of any period not less than three months after sodding. Where this cover is not achieved, the Contractor shall, at his/her own expense, plant additional grass and tend it in a similar manner to the original planting until the acceptable cover is achieved.

PSER8 MEASUREMENT AND PAYMENT

PSER8.01 Watering

1. There will be no separate payment for watering to establish or maintain the vegetation required and the Contractor shall include the costs thereof in the prices tendered for the various operations which have been scheduled.

PSER8.02 Slope modification

1. Slope modification will be measured and paid according to the applicable items of SABS 1200D or SABS 1200DM.

PSER8.03 Preparation of ground surfaces

By scarifying	Unit: ha
By tilling	Unit: ha

1. The unit rates shall cover the cost of scarifying or tilling the ground, as the case may be, prior to topsoiling, of shaping and finishing off, of analysing soils samples both ground and topsoil, of watering prior to application of seed, of all labour, tools, equipment and transport and of any other thin except trimming necessary to bring the ground surface to a condition to the satisfaction of the Engineer prior to the application of topsoil.

PSER8.04 Commercial seed

Commercial seed Unit: ha

1. The unit rate for commercial seed shall cover the cost of the supply of seed to the place of application, of labelling and certification, of sampling and testing, of labour, equipment and transport and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.05 Harvested seed

Harvested seed Unit: ha

1. The unit rate for harvested seed shall cover the cost of harvesting and transfer to place of application or storage, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.06 Fertiliser

Fertiliser (type stated) Unit: t

1. The unit rate for fertiliser shall cover the cost of supply and application of fertiliser whether by hand or mechanical means, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.07 Soil stabiliser

Soil stabiliser Unit: kg

1. The unit rate for soil stabiliser shall cover the cost of supply and transport to the point of application, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.08 Wetting agent

Wetting agent Unit: kg

1. The unit rate for wetting agent shall cover the cost of supply and transport to the point of application, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.09 Brush-cut mulch

Brush-cut mulch Unit: ha

1. The unit rate for brush-cut mulch shall cover the cost of harvesting, clearing, stockpiling and baling, of reducing the mulch to required size, of application by hand, of imprinting into soil, of all labour, tools, equipment, plant, transport and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.10 Commercial and other non-brush cut mulches

Commercial/ non-brush cut mulches Unit: ha

1. The unit rate for commercial and other non brush-cut mulch shall cover the cost of supply to the place of application, of application by hand, ‘roll-on’ or mechanical means other than by hydroseeding, of all labour, tools, equipment, plant, transport and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

PSER8.11 Hydroseeding

Hydroseeding	Unit: ha

1. Measurement will be by the hectare of grass established by seeding and having acceptable cover.
2. The unit rate for hydroseeding shall cover the cost of mixing and agitating of all the materials including seed, fertiliser, mulch, soil stabiliser and wetting agent required in the seed-cocktail, of applying the mixture, of watering, weeding, rehydroseeding bare patches, of all labour, tools, equipment, plant, transport and of any other thing except mowing of grass which may be necessary to establish acceptable cover and to maintain the grass during the establishment period to the satisfaction of the Engineer.

PSER8.12 Drill or broadcast seeding

Drill of broadcast seeding	Unit: ha

1. Measurement will be by the hectare of grass established by seeding and having acceptable cover.
2. The unit rate for drill or broadcast seeding shall cover of drill or broadcast seeding, as the case may be, of watering, weeding, reseeding bare patches, of all labour, tools, equipment, plant, transport and of any other thing except mowing of grass which may be necessary to establish acceptable cover and to maintain the grass during the establishment period to the satisfaction of the Engineer.

PSER8.13 Planting of runners

Planting of runner (type stated)	Unit: ha

1. Planting of runner will be measured by the area of grass planted and having acceptable cover.
1. The unit rate for planting of runners shall cover the cost of the supply and planting of runners, of watering and weeding, replanting of bare patches, of all labour, tools, equipment and of any other thing except mowing of grass which may be necessary to establish acceptable cover and to maintain the grass during the establishment period to the satisfaction of the Engineer.

PSER8.14 Sodding

Sodding	Unit: ha

1. Measurement shall be by the hectare of sods planted and having acceptable cover.
2. The unit rate for sodding shall cover the cost of procuring, excavating, loading, transporting, off-loading and placing sods, or replanting of bare patches, of watering and weeding the grass, of filling gaps between sods of topsoil, of placing stakes of all labour, tools, equipment and of any other thing except mowing of grass which may be necessary to establish acceptable cover and to maintain the grass during the establishment period to the satisfaction of the Engineer.

PSER8.15 Trees and shrubs

Trees and Shrubs	Unit: No

1. Measurement shall be by number of trees of shrubs planted and established.
2. The unit rate for each tree or shrub shall cover the cost of supplying, storing and maintaining it in a transition nursery, of excavating the hole to the specified dimension, of supplying topsoil, wooden stakes, broken rock, manure and compost, of mixing them and other soil, of watering the plants until the end of the establishment period of supplying and planting substitute plants that have died, of maintaining the plants until the end of the establishment period of all labour, tools, equipment and of any other which may be necessary to establish acceptable cover and to maintain the tree or shrub during the establishment period to the satisfaction of the Engineer.

PSER8.16 Slope stabiliser

Slope stabiliser Unit: m^2

1. Measurement will be by the square metre of ground stabilised.
2. The unit rate for slope stabilised shall cover the cost of supplying, installing and fixing the stabilising material, of all labour, tools, plant, equipment, transport and of any other thing necessary for the execution of the work to the satisfaction of the Engineer.

PSER8.17 Mowing grass

Mowing grass Unit: ha

1. Measurement will be by the hectare measured each time the grass has been cut on the order of the Engineer.
2. The unit rate shall cover the cost of mowing, of all labour, equipment, plant and transport required for each cutting of the grass, and disposal of grass cuttings to the satisfaction of the Engineer.

PSER8.18 All other requirements of the revegetation specification

1. All other work not measured elsewhere, associated with complying with any requirement of environmental management will be measured in appropriate items and units.
2. The tendered rates shall cover any cost associated with complying with the revegetation specification and shall include for all labour, equipment, plant, transport and any other thing required to execute and complete the work as specified, described in the Schedule of Quantities or shown on the drawing(s), to the satisfaction of the Engineer.

APPENDIX D

ESKOM'S POLICY ON HERBICIDE USE

Eskom

STANDARD

TITLE: **THE SAFE USE OF PESTICIDES AND AND HERBICIDES**	REFERENCE **ESKASAAL0**	REV **1**
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Introduction

The health and safety of workers and members of the public, and protection of the environment against pollution are important to Eskom. Pesticides and herbicides play a major role in agricultural practice, however, they are potentially hazardous to human and animal life if not used safely. Pesticides and herbicides can also become environmental pollutants if not properly managed and used.

Pesticides and herbicides are applied to areas and vegetation by registered and competent pest control operators under strictly controlled conditions.

Eskom believes that:

— workers and members of the public shall be protected against possible exposure to pesticides and herbicides which could adversely affect their health, safety and well-being;

— the natural environment shall be protected against pollution caused by pesticides and herbicides;

— employees shall be conversant with health, safety and other risks associated with pesticides and herbicides; and

— pesticides and herbicides should only be used and applied under strictly controlled conditions, by competent personnel, where other actions have failed to produce the required results.

This standard shall be used in conjunction with ESKPBAAD4, *Herbicide Management* policy.

1 Scope

1.1 Purpose

To provide the minimum health, safety and environmental requirements during the procurement, transport, storage, use and disposal of pesticides and herbicides.

1.2 Applicability

This standard is applicable throughout Eskom, Eskom Enterprises and subsidiaries, as well as to all employees and contractors.

2 Normative references

The documents listed below contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent revisions of the documents listed below. Information on currently valid national and international standards may be obtained from the Information Centre and Eskom Documentation Centre at Megawatt Park.

Also refer to annex C for further reference.

Conservation of Agricultural Resources Act, No. 43 of 1983. (as amended)

Environmental Conservation Act, 1982 (Act 100 of 1982). (as amended)

Hazardous Substances Act, 1973, (Act 5 of 1973). (as amended)

Occupational Health and Safety Act No. 85 of 1993. (as amended)

The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947). (as amended)

National Environmental Management Act, ActNo. 107 of 1998

National Forest Act, Act No. 84 of 1998

National Veld and Forest Fire Act, Act No. 101 of 1998.

National Water Act, 1998 (Act 36 of 1998). (as amended)

The National Road Traffic Act (No 83 of 1996).

I.L.O. — Encyclopaedia of Occupational Health and Safety. (as amended)

SABS 072:1993, *The safe handling of pesticides.*

SABS 075:1981, *List of common names and classification of pesticides and other agricultural chemicals.*

SABS 0124:1977, *Application of certain soil insecticides for the protection of buildings.*

SABS 0133:1977, *Application of pesticides in food handling, food processing and catering establishments.*

SABS 0204:1985, *The application of fumigants.*

SABS 0206:1987, *Safety procedures for the disposal of surplus pesticides and associated toxic waste.*

SABS 898:1980, *General requirements for pesticides.*

SABS 1165:1977, *Chlordane emulsifable concentrates (soil insecticides).*

SABS 1328-1:1981, *Compression type sprayers, Part 1: Manually operated.*

SABS 1343:1985, *Insecticidal solid fumigants containing aluminium phosphide (food storage premises).*

ESKPVAAO5: Rev 0, *Occupational hygience risk assessment.*

ESKPBAAD6: Rev 7, *Environmental Management Policy*

3 Definitions and abbreviations

Unless indicated otherwise, the following definitions apply throughout this standard.

3.1 Definitions

3.1.1 agricultural remedy: Any chemical substance or biological remedy, or any combination or mixture of any substance or remedy, intended or offered to be used for the destruction, control, repelling, attraction or prevention of any undesired microbe, algae, nematode, fungus, insect, plant, vertebrate, invertebrate or any part thereof.

3.1.2 pest control operator: means a person who as, or in the course of, his trade or occupation administers agricultural remedies for the purposes for which they are intended;

[Definition of "pest control operator" inserted by s. 1 (b) of Act No. 4 of 1980.]
(The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947) (as amended))

Section 7 (2)(a) No person shall for reward, or in the course of any industry, trade or business-

(i) use, or recommend the use of, any agricultural remedy or stock remedy for a purpose, or in a manner other than that specified on the label on a container thereof, or described on such container,

(ii) use any agricultural remedy unless he is a pest control operator registered in terms of this Act, or otherwise than in the presence and under the supervision of, a pest control operator so registered.

[Paragraph (a) substituted by s. 6 of Act No. 4 of 1980.]

(The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947) (as amended))

3.1.3 pesticides: A chemical substance (which may or may not be mixed with other substances), used for the destruction of an organism detrimental to man or to his interest. The word clearly has a very wide meaning and includes a number of other terms, (e.g. insecticides, fungicides, herbicides, rodenticides, bactericides, miticides, nematocides, molluscicides) which indicate the organism or pests a particular chemical or class of chemicals is designed to kill. Since different types of chemical agents are used for these general classes, it is usually advisable to indicate the particular category of pesticide.

3.1.4 herbicide: A chemical substance or cultured biological organism used to kill or suppress the growth of plants.

3.1.5 toxicity: Toxicity is expressed by the LD 50 value; this a statistical estimate of the number of mg of the chemical per kg of body weight, required to kill 50 % of a population of test animals. The dose may be administered by a number of routes, usually orally or dermally, and the rat is the standard test animal. Oral or dermal LD50 values are used according to which route has the lower value for a specific chemical.

3.2 Abbreviations

3.2.1 MSDS: Material Safety Data Sheets

3.2.2 LD: Limited Death

3.2.3 OEL: Occupational Exposure Limit

3.2.4 PCO: Pest Control Operator

3.2.5 RSA: Republic of South Africa

3.2.6 HCS: Hazardous Chemicals Substances

4 Requirements

4.1 Registration and competency of pest control operators

All contractors appointed to apply pesticides and herbicides shall be registered in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947), as amended.

Herbicides application shall be done by suitably trained personnel in possession of an appropriate course certificate, or under the direction of a qualified pest control operator, registered under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No 36 of 1947). (Refer to 3.1.2 for the definitions as per the Act)

Initial training shall be supplemented by regular further training and refresher courses, as determined by the responsible line manager.

In the case of over-exposure to herbicides, the victim shall immediately be removed from the scene and taken to fresh air, thoroughly washed and his clothing changed. This shall be done in accordance with safety procedures. Test facilities and qualified medical care shall be provided. Treatment is symptomatic and shall be carried out in hospital.

4.2 Selection of pesticides and herbicides

Purchasing of pesticides, herbicides and other agricultural remedies for use in Eskom, and the selection of such remedies for a particular application, shall be done by suitably qualified persons. Special emphasis shall be placed on:

— only using registered agricultural remedies in accordance with labelled instructions;

— all products shall be accompanied by a copy of the Material Safety Data Sheet (MSDS);

— the use of the most cost-effective, safe, environmentally acceptable remedies;

— the correct use and handling of such products;

— the prevention of the exposure of persons, the public, animals, foodstuffs and adjacent land to such chemicals; and

— the prevention of the pollution of natural resources, ground and water by such remedies.

4.3 Record keeping of the availability, use and application of agricultural remedies

A register of all agricultural remedies in use, and in stock, shall be kept and maintained on site, as well as the relevant material safety data sheets. The material safety data sheets shall be readily available at strategic points, for example, medical and first aid points, stores, fire station, etc.

A record shall be kept of the use of pesticides and herbicides as specified in the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act and ISO 14001. This includes what product, used by, when, for what purpose, amount used, particulars of personal protective equipment used, and incidents of poisoning or spillage.

4.4 Condition and labelling of containers

Containers containing agricultural remedies are subject to climatic conditions and rough handling methods which may cause them to leak, break or render instructions illegible, causing potentially hazardous conditions. Supervisors, pest control operators and storekeepers, shall ensure that stocks are regularly inspected for leaks and damaged containers. All damaged or empty containers shall be removed immediately and disposed of in accordance with the label requirements and MSDS's. No unlabelled containers shall be allowed.

Labelling provides information on the hazardous nature of the pesticide or herbicide, as well as information regarding the identification and correct use of the pesticide or herbicide in the container. Apart from the trade name, the ingredients list provides a breakdown of the substances contained in the chemical. This enables the user to identify the active ingredients and toxic substances.

The instructions on the label regarding use of the product are of major importance to the user. Many an accident or loss / damage incident has occurred due to neglect on the part of the user, to either read instructions, or apply a product as directed. The label also contains a hazard warning with signs and inscriptions, related to pesticides or herbicides (see Normative references).

4.5 General principles

While the general principles for the use of pesticides and herbicides remain the same for all compounds, the stringency with which they shall be applied depends on the toxicity of the particular chemical. The following points shall be taken into account:

4.5.1 The route of absorption

Poisons enter the body through the mouth (ingestion), the lungs (inhalation), the intact skin (percutaneous absorption), or wounds in the skin (inoculation). The inhalation hazard is determined by the physical form and solubility of the chemical. The possibility and degree of percutaneous absorption varies with the chemical, but some chemicals also exert a direct action on the skin, causing dermatitis. Pesticides and herbicides are applied in many different forms: as solids, by spraying in dilute or concentrated form, as dusts (fine or granulated), and as fogs and gases. The method of application has a direct bearing on the likelihood of absorption.

Contamination through the skin is as lethal as ingestion or inhalation, and utmost care shall be taken to prevent unnecessary contact with the skin. For practical purposes, dermal or percutaneous absorption of a chemical is more important than oral absorption in occupational situations.

4.6 Medical Surveillance and Biological Monitoring

Pest control operators and other operational personnel using, or exposed to, agricultural remedies shall undergo regular medical surveillance, as prescribed by Eskom's Chief Medical Officer. Medical surveillance and biological monitoring shall be conducted at intervals determined by the exposed worker's occupational risk exposure profile, and as prescribed in the Hazardous Chemical Regulations of the Occupational Health & Safety Act. All pest control operators and other persons potentially exposed to hazardous chemicals, shall undergo a pre-placement assessment

Line management (occupational hygienist) shall complete the employee's job specification which shall qualify, and quantify, all chemical hazards to which workers and others may be exposed, and determine the personal exposure concentrations in relation to the OELs.

4.7 Safety and health measures

Adverse effects may be avoided by following the instructions provided on the labels of pesticides and herbicides. The general toxicity, irritation and sensitisation potentials, and the mode of use, determine the protection necessary in each case. Skin contamination is an ever present danger, especially where heat and humidity preclude the use of protective clothing. Irritation of the skin and mucous membranes may result from spillings of various formulations. Extended contact is hazardous when the highest recommended application rates of working dilution are used in summer, or in greenhouses. The following points are important:

4.7.1 Availability

The toxicity of many pesticides/herbicides is such that their indiscriminate use by the general public/unauthorised Eskom personnel, is certain to result in many people being affected, often fatally. It is essential that access by the public to all formulations/products shall be restricted (behind lock and key).

4.7.2 Transportation

Pesticides and herbicides of any degree of toxicity shall be transported in accordance with national legislation and in containers which are clearly labelled, leak-proof and not easily damaged. They shall not be transported beside or above any type of food, and all spillages shall be reported immediately. Any foodstuff transported in the same compartment as a pesticide/ herbicide, might be contaminated.

4.7.3 Labelling

The requirements regarding the labelling of pesticides and herbicides are laid down in legislation and strictly applied to both imported, and locally produced chemicals. Any pesticide or herbicide shall only be used in accordance with the instructions on the original label. (See guidelines for the RSA classification code of agricultural and stock remedies and associated labelling practices).

4.8 Training

All workers using pesticide and herbicide formulations shall be trained by a registered PCO. Training programmes shall cover all aspects of pesticide and herbicide management.

4.9 Mixing

This is possibly the most hazardous phase of the use of pesticides and herbicides, since the employee is exposed to the concentrate. In any particular situation, only competent trained personnel shall be responsible for mixing. They shall be thoroughly conversant with the hazards, and provided with the proper facilities, for dealing with accidental contamination.

4.10 Application

Personal protective equipment is compulsory. The choice of particular items of equipment will depend on the hazardous nature of the pesticide/herbicide and the physical form in which it is being handled. Any consideration of protective equipment shall include not only the provision, but also adequate cleansing, maintenance and replacement, of the equipment. Where climatic conditions preclude the use of some types of protective equipment, three other principles of protection can be applied, i.e. protection by distance, protection by time, protection by change of working method.

Protection by distance: involves modifications of the equipment used for applications, so that the person is as far away as possible from the pesticide and herbicide itself, bearing in mind the likely routes of absorption of a specific compound.

Protection by time: involves limitation of hours of work. The suitability of this method depends on whether the pesticide and herbicide is readily excreted, or whether it is cumulative.

Protection by change of working method: involves a reconsideration of the whole operation. Pesticides and herbicides differ from other industrial processes in that they can be applied from the ground, or the air. Changes of method on the ground depend largely on the choice of equipment and the physical nature of the pesticide and herbicide to be applied.

Pesticides and herbicides can also be applied from the air as liquids, dusts or granules. Liquids may be sprayed from very low altitudes, frequently as fine droplets of concentrated formulations. Drift is a problem particularly with liquids and dusts. Aerial application is an economical way of treating large tracts of land, but entails special hazards to pilots and to workers on the ground.

Use up left-over spray mix, or tank rinsing fluid, by lightly spraying areas already sprayed. Do not empty tanks in one spot. Pesticides and herbicides shall not be transferred to other containers, except for application purposes.

Return all empty pesticide or herbicide containers to the stores, or the supplier. Where it is not possible or economically feasible to return the containers, they shall be rendered useless by cutting the container, or punching holes in it. Returned containers and those rendered useless, shall be recorded in the Herbicide Register. Containers rendered useless shall be kept on site, or disposed of in accordance with the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act.

4.11 Public health measures

When pesticides and herbicides are used, every reasonable effort shall be made to avoid the contamination of water supplies. This not only concerns the actual application (when there may be immediate contamination), but shall also include the consideration of remote contamination by run-off through rainfall on recently treated areas.

While pesticides and herbicides in natural watercourses may be diluted to such a degree that the contaminated water may not be hazardous in itself, the effect on fish, water, plants used as food and grown in the watercourses, and on wild life as a whole, as a result of bioaccumulation, shall not be overlooked.

4.12 Treatment of spillages

Spillages of pesticides and herbicides, at any stage of their storage or handling, shall be treated with great care. All spills shall be managed and re-habilitated in accordance with the chemical label and the associated instructions, as well as in line with group specific incident investigation procedures/processes. Spills should be reported in line with group reporting requirements.

4.13 Hygiene (Refer to annex B)

Where a pesticide or herbicide is of moderate or higher hazard and can be readily absorbed through the skin, special precautions are necessary. In some situations, where workers might become accidentally contaminated with large quantities of concentrate, a shower or bath shall be provided in addition to the usual washing facilities. Special arrangements for cleaning clothing and overalls are necessary. They shall not be left for the worker to wash at home. These facilities shall also be available when contractors do contract work for Eskom.

Contractors are responsible for providing personal protection equipment to all employees. Protective clothing shall be provided to all Eskom operators by the business unit and:

- All exposed persons shall wash/shower following application of hazardous chemical substances
- All clothing shall be changed after each shift, as appropriate, and retained for washing by the employee

Since pesticides and herbicides are often applied outdoors, depending on the chemical used, special care shall be taken to provide washing facilities at the workplace, even though this may be in remote areas. Workers shall be instructed to use these, rather than wash themselves in canals and rivers, the water from which may be subsequently used for other purposes. The washing water provided shall be disposed of with care. Smoking, eating and drinking before washing shall be prohibited when any pesticide or herbicide is being handled or used.

4.14 Medical and first-aid facilities

Medical and first aid needs to align with label specifications and MSDS's for specific substances used. If there is an antidote for a specific pesticide or herbicide which can be readily used as a first-aid measure, it shall be readily available to workers, who shall be instructed in the method of its application. The nature of the chemical used shall be well defined, so that the doctors can obtain specific antidotes where these are applicable, and be on the look-out for cases of poisoning.

Strict medical surveillance, including biological monitoring of workers exposed to concentrates of pesticides and herbicides, shall be conducted according to their occupational risk exposure profile ,as determined from their job specifications and as prescribed in the HCS regulations (Regulations for Hazardous Chemical Substances) of the OHS Act.

Information sheets on the medical management of exposed workers shall be compiled for each type of chemical used, and made available to health care service providers who may be consulted in the event of over-exposure.

4.15 Requirements for a pesticide/herbicide store (Refer to annex A)

4.15.1 Location

When choosing a site for a new store, avoid close proximity to offices, housing, schools, hospitals, shopping areas, kitchens, manufacturing or storage premises, or other populated areas. Preference shall be given to isolated locations. Avoid areas prone to flooding, or areas used for water catchment. In the case of existing stores, an assessment shall be made, based on compliance with the requirements of this standard, whether continued use of the store can be justified. All new stores shall only be constructed once an appropriate environment impact assessment has been undertaken.

4.15.2 Site access

The site shall provide suitable access for the loading and unloading of delivery vehicles. Ideally the building should stand alone, with a space of at least 10 m between it and surrounding property.

4.15.3 Drainage

The building shall be on a site that minimizes the risk of contaminated water reaching water sources, ground water reserves, or public drainage systems.

4.15.4 Buildings

Rooms used for storage shall be soundly constructed, and be equipped with automatic extraction fans and secure locks. Pesticides and herbicides shall be stored on shelves or pallets.

4.15.5 Lighting

Lighting levels shall allow for the routine inspection of stored products, and provide sufficient light for easy reading of product labels.

Artificial lighting shall be installed above aisleways and at least 1 m above the topmost stored product, to prevent damage during mechanical handling operations.

4.15.6 Ventilation

The storeroom shall be well ventilated. Natural ventilation shall be provided by vents located in the upper and lower walls and in the roof. The lower vent shall be above bund level. All vents shall be designed or protected, to prevent entry by any animal life. Ensure good air circulation in storerooms and ensure the installation of automatic extractor fans.

4.15.7 Security

The store shall be secured to prevent unauthorised access.

4.15.8 Storage hazards

Knowledge of product hazards is an essential pre-requisite for the safe storing of all chemicals. During the storage of pesticides and herbicides, hazards are likely to be encountered with products which are flammable, toxic, corrosive, reactive, or which may be oxidizing agents. Floors shall be kept clear and where re-packing is done in storage rooms, any spillages shall be cleaned up carefully according to 4.12. All pesticides and herbicides shall be clearly identified.

Chemical compounds that could interact with other compounds, shall be stored seperately. Some compounds react with other chemicals or with air, and this shall be taken into account when planning storage facilities. Examples of this reaction are, cyanide salts which react with acids to produce hydrogen cyanide gas, and dichlorvos which vaporizes on contact with air.

4.15.9 Flammable substances

These are substances which can produce flammable vapour/air mixtures, and are therefore potential sources of fire or explosion. Flammable substances shall be clearly marked.

4.15.10 Flammable liquids

Classification of flammable liquids is determined by their flash point. This is the lowest temperature at which the substance will form a flammable vapour/air mixture. Liquids with a flash point of 55 °C and below, are considered flammable. Flammable liquids shall be clearly marked.

4.15.11 Flammable solids

These are readily ignitable solids or materials that cause fast propagation of a fire once ignited. Flammable solids shall be clearly marked.

4.15.12 Toxic pesticides and herbicides

These materials may be harmful or dangerous to man by way of ingestion, inhalation or skin absorption. Skin contact is the most common route by which poisoning can occur. Many chemicals can readily pass through intact skin into the body. Inhalation of dust and vapours can produce a particularly fast reaction due to the ease with which such contaminants can enter the bloodstream through the lungs. Ingestion is perhaps the least common cause of accidental poisoning, and is probably caused by eating, drinking and smoking without having first washed the hands. Toxic pesticides and herbicides shall be clearly marked.

4.15.13 Corrosive substances

Such substances will attack skin or materials such as wood or metal, therefore leakage can corrode other packages and structures. Corrosive substances shall be clearly marked.

4.15.14 Oxidizing agents

Oxidizing agents will increase the rate at which a fire can develop. They may also react violently with other stored materials, and can be the cause of spontaneous ignition. Oxidising agents shall be clearly marked.

4.15.15 Substances that are dangerous when wet

Within the range of common pesticides and herbicides, some dithiocarbamates are known to react adversely with moisture to produce carbon disulfide, a toxic and extremely flammable gas. Spontaneous ignition of this group of chemicals is also known to occur. Such chemicals shall be clearly marked.

4.15.16 Hygiene, personal safety and housekeeping

Good standards of hygiene shall be maintained, and floors and shelves shall be regularly and systematically cleaned, preferably using an industrial vacuum cleaner. Washing facilities for employees shall be provided and, where food and drinks are consumed on the premises, a separate room shall be set aside for this purpose. Workers shall be instructed to wash their hands before eating, drinking or smoking.

Annex A
(normative)

Checklist for the handling, storage, use and disposal of pesticides and herbicides

Question	Yes	No	Comments
Location and buildings			
Does the store satisfy the requirements relating to the location? If NO, in what respects does it fail?			
Does the store satisfy the stipulations for site access?			
Does the store fulfil requirements regarding: construction materials; floor surface; internal fire break walls; roof covering and ventilation; head and smoke release; drainage; and local fire regulations? If NO, in what respects does it fail?			
Is the door sill or ramp at least 100 mm high?			
What additional system for the containment of fire-fighting water exists? none; underground retention pit; external containment wall; and other? Describe:			
What is the overall capacity of containment?			
Is this sufficient to contain the expected volume of fire-fighting water?			
Is the store well ventilated?			
Are the pesticides and herbicides in-store appropriate for their intended use?			

Annex A
(continued)

Question	Yes	No	Comments
Are all vents above door sill or ramp height?			
Is there sufficient light? Is it properly positioned?			
Is the store fitted with a lightning conductor?			
Are sufficient emergency exits provided? Do these conform to OHS Act requirements?			
If any office or amenity accommodation exists in the structure, is it adequately segregated from the store; has it an exit other than through the store?			
Store management			
Does the store have adequate precautions against arson and burglary?			
Do these precautions include: alarm systems; burglar-proof gates and windows; fenced-in premises; 24 h guard service; and perimeter lighting?			
Are all staff adequately trained with respect to: knowledge of product hazards; safe operating procedures; and emergency procedures?			
Is a supervisor present during receipt and dispatch of all goods to check documents, package integrity, etc.?			
Are material safety data sheets available for all products?			
Is an outline of the storage plan of the materials in each store kept up to date?			
Is the store divided into distinctly separate storage bays?			
Are the racks used in the store non-combustible?			
Are stock records kept up to date?			
Does this guarantee knowledge of the quantity and location of the goods any time?			

Annex A
(continued)

Question	Yes	No	Comments
Hygiene and personal safety			
Are standards of hygiene and housekeeping adequate?			
Are personnel issued with protective clothing, protective gloves and respiratory protective equipment?			
Are these routinely worn when handling products?			
Does protective equipment exist on the premises for handling spills?			
Are adequate first aid materials and facilities provided and are staff familiar with their use?			
Spillages			
Is there a written authorised procedure for dealing with spillages?			
Are spilled dry products removed by vacuum cleaner?			
Is absorbent material available?			
Are records of spillages kept?			
Waste disposal			
Are wastes disposed of in a safe manner?			
Have the methods of disposal been approved by the authorities?			
Is the disposal of emptied containers and the re-use of equipment satisfactorily controlled?			
Fire and environmental protection			
Is the non-smoking rule in the store strictly enforced?			
Are products stored at a safe distance from light fittings, electrical equipment and auxiliary equipment?			
Is the store included in the safety representative's checklist?			
Are records of accidental poisoning kept?			
Are all pest control operators and workers appropriately trained?			
Are records of medical surveillance of workers available? Does each worker have a job-specification which lists the chemicals to which he is exposed, and quantifies such personal exposure concentrations, in relation to the OELs			

Annex A
(concluded)

Question	Yes	No	Comments
Is disposal of empty containers recorded satisfactory?			
Is record keeping satisfactory?			
Availability of lists of approved pesticides and herbicides used on-site?			
Register of incident / work performed?			
Availability of material safety data sheets?			
Are pesticides and herbicides handled and applied in a safe manner?			
Are containers clearly marked?			

Annex B

(normative)

Checklist for evaluation

1 Exceptional
2 Commendable
3 Acceptable
4 Unsatisfactory

Checklist	Score	Action
1 Checklist of relevant legislation?		
2 Personal protective equipment • provided? • used? • Used correctly?		
3 Training of pest control operators and workers?		
4a) Job specification and personal exposure concentrations? 4b) Medical surveillance and biological monitoring records? 4c) Exposure records and reporting procedures?		
5 Inspection system for use and storage?		
6 Availability of job safety procedures?		
7 Safe disposal of empty containers?		
8 Availability of material safety data sheets?		
9 Personal hygiene of pesticide and herbicide users?		
10 Availability of approved list of pesticides and herbicides?		
NOTES		

Annex C
(normative)

Policy guides

C1 Liability

During the chemical control of bush-invader plants or weeds, the SBU is responsible in the following three instances:

— legal obligation;
— Eskom policy and guides; and
— moral obligation towards land owners and the public.

C1.1 Legal obligation

The following Acts directly or indirectly, regulate the selling, safety and use of weed-killers:

— Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947).
— Foodstuffs, Cosmetics and Disinfectants Act (Act No. 54 of 1972).
— Hazardous Substances Act (Act No. 15 of 1973).
— Environment Conservation Act (Act No. 73 of 1989).
— Conservation of Agricultural Resources Act (Act No. 43 of 1983).
— Forest Act (Act No. 122 of 1984).
— Water Act (Act No. 54 of 1956).
— Mountain Catchment Areas Act (Act No. 63 of 1970).
— National Parks Act (Act No. 57 of 1976)/
— Sea Fisheries Act (Act No. 58 of 1973).
— OHS Act (Act 85 of 1993).
— Provincial Ordinances.

Annex C
(concluded)

C.1.2 Eskom policies and guides

ESKADABG4: *Directive for Medical surveillance*

ESKPBAAD6: *Environmental Management Policy*

ESKPBAAD4: *Herbicide management*

ESKPVAAO5: *Occupational hygiene risk assessment.*

SASOM GUIDELINE - Medical and Environmental Surveillance Guidelines

Legal documents.

C.1.3 Moral obligation

Every Eskom employee has a moral obligation to the environment, his fellow citizens and all future generations to protect and conserve the environment.

He is also morally obliged to protect his employer, Eskom, against negative publicity, and the danger and risk of financial losses.

C.2 Safety risk management

Eskom maintains a “right-to-know” policy. It is therefore every supervisor’s responsibility to keep his sub-ordinates fully informed on the following:

— precautions to be taken when using dangerous substances; and

— the risk attached to the substances concerned, and the handling of these substances.

APPENDIX E

ESKOM'S EMERGENCY PLANS AND PROCEDURES TO DEAL WITH ANY SPILLAGES/CONTROL OF HAZARDOUS SUBSTANCES

ESKOM

DIRECTIVE

TITLE:

DIRECTIVE ON OIL SPILL CLEAN-UP AND REHABILITATION

REFERENCE	REV
ESKADABG8	**0**
DATE:	**SEPTEMBER 2000**
PAGE	**1**
REVISION DATE:	**SEPTEMBER 2003**

COMPILED BY	FUNCTIONAL RESP.	AUTHORIZED BY
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1 Preamble

This directive was compiled when a need was identified by Eskom's Corporate Environmental Affairs Department for a standardized approach for the assessment, management and reporting of oil spills to minimize incidents as well as to reduce remediation costs in terms of the latest legislation.

The purpose of this document is to direct the response actions following an oil spill on a site, in accordance with the standard ESKASABT0.

Insulating oil and related hydrocarbon compounds and synthetic oils pose a serious pollution problem when released into the environment. Not only do these compounds pose a fire hazard, but with one litre of oil having the potential to contaminate in excess of a million litres of water, it needs to be handled with care. Oil can rapidly penetrate certain soil types, which may lead to extensive soil contamination, as well as groundwater and surface water contamination. The Water Act, 1998 (Act 36 of 1998), states that "hydrocarbons should not touch the soil or water and if they do, they shall be removed immediately".

2 Definitions

2.1 clean-up: The act of remediation, this may include soil excavation, bioremediation, landfarming,

solvent soil wash or electrochemical treatment.
2.2 containment: The prevention of the spreading of the oil spill.
2.3 remediation: A method of clean-up that will ensure a minimum hydrocarbon or synthetic oil presence of 1000 parts per million (ppm) or (0,1 %) above the background level.
2.4 spill: Any amount of oil present out of its "normal" container – where normal refers to a transformer or a drum etc.

3 Directive

All Eskom employees, contractors and maintenance teams shall, in the event of an oil spill take immediate corrective and effective action in accordance with the Eskom standard ESKASABT0, to limit the spill and minimize the environmental damage and consequential remedial costs.

4 Responsibilities

The Business units shall ensure that:

4.2.1 All employees, maintenance teams and contractors working on their sites or other persons who have access to oil, are well versed and trained in the contents of the Eskom standard ESKASABT0.

4.2.2 The Environmental co-ordinators responsible for the site ensure that appropriate training in the use of spill equipment, reporting and emergency response is given to the relevant staff.

4.2.3 All assessments, corrective action and reporting of oil spills are managed in terms of the Eskom standard ESKASABT0 in consultation with the responsible Environmental co-ordinator.

4.2.4 All waste absorbent material recovered from an oil spill property is disposed of in a class HH registered site following consultation with NIOSC.

4.2.5 All reporting of oil spills has been recorded.

4.2.6 Only Eskom approved remediation suppliers/contractors are used in the spill remediation process.

4.2.7 Preventive measures are taken by ensuring that each site is in possession of a relevant spill kit, which shall be freely accessible.

4.2.8 The Environmental co-ordinators ensure the availability and the visibility of relevant emergency response contact numbers on each site.

ESKOM

STANDARD

TITLE: **OIL SPILL CLEAN-UP AND REHABILITATION**

REFERENCE	REV
ESKASABT0	**0**
DATE:	**SEPTEMBER 2000**
PAGE	**1**
REVISION DATE:	**SEPTEMBER 2003**

COMPILED BY	FUNCTIONAL RESP.	AUTHORIZED BY
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D D Mokgatle	**Executive Director (Transmission)**

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Foreword

This standard has been compiled to set a uniform standard addressing oil spill emergencies and long term action following the need identification by Eskom's Corporate Environmental Affairs Department. The standard addresses the containment and the remediation issues surrounding an oil spill. It also gives a risk rating and response reaction guideline. The standard was compiled following various discussions with staff involved in oil spills as well as response teams from various organizations

NOTE All comments for revising and updating this document must be directed to the Environmental Liaison Committee (ELC), who will in turn liaise with the Technology Standardization Manager.

Queries concerning this standard may be directed to the compilers, Ms A Lombard at Technology Services International (TSI), Rosherville or Mr M Hunter at Distribution, Megawatt Park.

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- Ms W Poulton – Corporate Environmental Affairs

- Various Eskom staff members who participated in the oil spill questionnaire survey

Introduction

Insulating oil and other related hydrocarbon and synthetic compounds pose a serious pollution problem when released into the environment. Not only do these compounds pose a fire hazard, but with one litre of oil having the potential to contaminate in excess of a million litres of water, it needs to be handled with care. Oil can rapidly penetrate certain soil types, which may lead to extensive soil contamination as well as ground water and surface water contamination. The Water Act 36 of 1998, states that "hydrocarbons should not touch the soil or water and if they do, they shall be removed immediately".

1 Scope

1.1 Purpose

The purpose of this standard is to communicate a standard policy and response action following an oil spill on a site. It includes a rating system to enable a risk assessment that will assist with the reporting and especially the level of reporting of an oil spill.

This standard is applicable to any oil handling site and oil containing equipment, which includes distribution, transmission, generation sites as well as all contractors working on Eskom sites. It is of particular importance for employees in oil storage areas, maintenance teams and contractors to be familiar with the contents of this standard.

1.2 Applicability

This standard is applicable to all Eskom employees and contractors who in the event of their daily activities come across an oil spill.

2 Normative references

The following documents contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards and specifications can be obtained from the Information Centre and Corporate Technology Standardization Division at Megawatt Park.

Erickson, MD:1993, *Remediation of PCB Spills*. Lewis publishers, Tokyo.

Waste-tech:1999, *National spill response service.*

MRO Product Management:1999, *Inland oil spill contingency plans*.

Eskom:1999, *NIOSC Insulating Oil Manual.*

ESKADABG8:Rev.0, Directive on oil spill clean-up and rehabilitation.

3 Definitions and abbreviations

3.1 Definitions

3.1.1 clean-up: The action of remediation, this may include soil excavation, bio-remediation, solvent soil wash, landfarming or electrochemical treatment.
3.1.2 containment: The prevention of the spreading of the oil spill.
3.1.3 drip: Where continuous dripping is taking place and can result in pooling of the oil.
3.1.4 explosion: A situation, which occurred due to the rupture of electrical equipment as a result of an electrical fault.
3.1.5 leak: A continuous dripping that will result in pooling of oil that will require corrective action as the electrical equipment will have to be topped-up.
3.1.6 off-site: A site, road or property not belonging to Eskom.
3.1.7 on-site: Any Eskom site (including any Eskom leased site).
3.1.8 remediation: A method of clean-up that will ensure a minimum hydrocarbon or synthetic oil presence of 1000 ppm or (0,1 %) above the background level.
3.1.9 Responsible Person: The person appointed by the relevant line manager, who will take responsibility during remedial action following a spill. This might be the environmental co-ordinator or the relevant site manager.
3.1.10 spill: Any amount of oil present out off its "normal" container – where normal refers to a transformer or a drum etc.
3.1.11 weep: Where no free running oil is visible, but the area is damp with oil. It will be an area where dust is accumulating but no effective loss of oil is evident.

3.2 Abbreviations

3.2.1 NIOSC: National Insulating Oil Steering Committee
3.2.2 PCB: polychlorinated biphenyls
3.2.3 ppm: parts per million
3.2.4 TSI: Technology Services International
3.2.5 UTO: used transformer oil

4 Requirements

4.1 General

An oil spill may be defined as being any amount of oil no longer present in its normal container or equipment. The Water Act, 1998 (Act 36 of 1998) states that “hydrocarbons should not touch the soil or water and if they do, shall be removed immediately". Oil spills can be categorized as being small or large, historic, weep, seep, drip, leaks on Eskom or neighbouring sites or major catastrophic events. However, the immediate prevention and clean-up is considered to be essential in all of the above.

4.2 Assessment of the spillage

Assessment of the oil spill will need considerable judgement to perform. Evaluating the cause, extent and ultimate corrective action can be done using the table given in annex A. The assessment shall include the following factors:

a) identifying the source of the spill;

b) the age of the spill;

c) life-threatening conditions;

d) weather conditions;

e) properties affected (Eskom, neighbours, National roads);

f) traffic implications;

g) threat to any water bodies;

h) PCB presence;

j) soil types; and

k) public relations threat.

4.3 Securing of sites

Where necessary, secure the site and contain the spill to avoid further pollution, determine the spill boundaries, prevent unauthorized access to the spill site and, where required, notify all parties involved. The securing can include barricades, ropes, plastic taping or covers, or any other appropriate measures in order to prevent access or spread of the contamination.

4.4 Spill on an Eskom site

4.4.1 Limit the spillage

The need for immediate corrective action to limit the spillage cannot be overemphasised as this will minimize the environmental damage and reduce remediation costs. This can involve actions such as:

a) closing a valve;

b) repairing the leak with rags, plugs or other appropriate material;

c) repositioning the container so that the leaking area is at the highest level or lifting a fallen drum/container;

d) placing a leaking container or equipment into a collecting tray or bund area; and

e) collecting the spilt oil in a container located underneath the leak or channelling the leak into a container.

4.4.2 Containing the spillage

The containment of a spillage will involve an action that will either prevent or stop a spill from spreading. It is vital to prevent any oil spill from entering waterbodies such as drains, stormwater systems, dams or rivers. Containment of the oil near the source will minimize pollution and will enable easy clean-up and/or remediation. This shall be done using one or more of the following:

a) soil barriers;

b) sand bags;

c) bund walls; and

d) absorbent materials.

4.4.3 Removal of oil

The free oil (puddles) shall be captured and put into a suitable container such as a drum or tanker for proper disposal as soon as possible.

This oil shall not re-enter the Eskom insulating oil pool for regeneration and re-use in electrical equipment.

4.4.4 Final clean-up/remediation

After removal of excess oil, saw dust, suitable absorbents or solvents shall be used to complete the clean-up of the spill. This might include the removal of leaking equipment, cleaning of pavements, removing contaminated soil and vegetation, as well as disposing of clean-up equipment. The absorbing material shall be bagged and disposed of at a class HH registered site.

PCB material shall be incinerated, encapsulated or de-chlorinated following consultation with NIOSC who will advise on the most viable option.

4.4.5 Bio-remediation/Landfarming

Bio-remediation/landfarming are based on the principle of stimulating the relevant microbes in order to break down the hydrocarbon molecules present in an oil spill. Landfarming will entail treatment of the soil away from the affected area, whereas bio-remediation will be done in-situ. Generally these processes may need stimulation or human intervention and are normally performed after the initial remediation phase to ensure total remediation of the site. These processes will need to be completed by bio-remediation /landfarming specialists in accordance with Eskom's approved supplier/contractor list.

4.5 Spill on a non-Eskom site

This shall be considered as a major spill greater than 25 points on the assessment scale in annex A and shall be treated as such.

4.6 Recommended spill kit

To allow for a rapid response and clean-up to an oil spill, it is mandatory for all Eskom sites and vehicles handling oil to have access to a recommended basic spill kit. The vehicle kit shall be a smaller version of the site spill

clean-up kit, that meets the basic requirements for the volume of oil transported. This shall be used in the event of a spill that is less than 12 points as assessed using the table in annex A.

Adequate and relevant training shall be given to all staff, maintenance teams and contractors working with oil on an Eskom site. This shall involve the actions to be taken following an oil spill as well as the use of the recommended oil spill kit.

The recommended oil spill kit shall contain the following:

a) 2 pairs of latex or neoprene gloves;

b) 20 heavy duty disposable bags (rubbish bags);

c) 1 shovel;

d) 1 hard bristle broom;

e) 5 absorbent pads;

f) 3 bags of absorbent material (cellulosic or other efficient material); and

g) 1 pair of plastic goggles.

If a station or site is close to surface water, oil absorbing material for removal and containment of oil on water shall form part of the standard kit.

4.7 Remediation contractors

Because of the emergency situation surrounding an oil spill clean-up, and to avoid bureaucratic delays in obtaining necessary approvals for appointing contractors, it is recommended that annual contracts are established on an “as and when required” basis with approved and relevant hazardous or emergency response teams. This will involve the availability of such a team, and agreement on relevant costs if an unforeseen event occurs.

4.8 Testing

Samples for both hydrocarbon and PCB content or other synthetic oil level evaluation shall be taken and submitted to TSI or approved laboratories for analysis. This shall form part of the evaluation of the oil spill assessment as well as the remediation procedure and prior to final payment, to ensure compliance with the relevant legislation.

4.9 Oil storage

To limit any potential oil spill, it is recommended that all sites where insulating oil is stored are accredited in terms of Eskom’s NIOSC manual. For all other oils, the relevant Eskom standards shall be adhered to.

UTO removed from equipment shall be promptly salvaged and returned to the closest, authorized regeneration facility after its removal from the equipment.

4.10 Reporting

All oil spills shall be assessed using the standard formats in annexes A and B. The completed forms shall be copied to the environmental co-ordinator who shall ensure that all appropriate reporting is carried out in accordance with the latest legislation.

4.11 Training

The Environmental co-ordinators responsible for the site shall ensure that appropriate training is given in the use

of the spill equipment, reporting and emergency response procedures.

4.12 Preventive measures

Prevention remains better than cure and for this reason each spill shall be evaluated and analysed and appropriate preventive measures adopted. Any oil site design or facility shall be evaluated using relevant tools such as the Electrical Power Research Institute (EPRI) Mineral Oil Spill Evaluation System (MOSES) MP software that is available to the Eskom line groups.

Annex A

(normative)

Model oil spill assessment table

Using your judgement and the facts available, allocate the relevant points (1, 3 or 5) to each of the following and add them together. The cumulative score will dictate the appropriate corrective action.

Condition	1		2		5	
Source of the spill	Weep		Drip/Leak		Explosion/Incident	
Age of spill	Historic		Happened recently - spill still moist		Happened within last 24 h	
Threat to any waterbody	No threat		Threat with rain		Access to waterway	
Containment	Leak is minor – can be controlled, contained and plugged with oil spill kit		Leak is moderate – cannot be successfully managed with spill kit.		Leak is serious, containment is impossible	
Life threatening Conditions	Not at all		Moderate (Environmental or health risk only)		Serious (Explosion, fire, health and major environmental)	
Weather conditions	Good weather and will last until spill is cleared		Moderate, but may change suddenly to weather conditions which will hamper containment		Raining	
Properties affected	None		On-site (Only Eskom's property is affected)		Off-site (Eskom's neighbouring properties and public roads) **≥25 points**	
Public relations threat	Small		Medium		Large	
Soil types	Clay or compacted ground		Loose or loam soil		Sandy soil and Gravel	
Traffic implications	Not on any road		Public road		Road closed	
PCB presence*	None		Less than 50 ppm in the oil		Over 50 ppm in the oil will automatically get ≥25 points	
Total score	Sub total		Sub total		Sub total	

Signature _____Name _____ __Date _____Site_____

Minor spill	Moderate spill	Major spill
£ 12 points		**³ 25 points**

	13 – 24 points	
Clean-up must be performed and a report issued to the relevant Environmental co-ordinator	Contain and call in the assistance of the Environmental co-ordinator	Contain, call on Environmental co-ordinator who will assecess the situation and if needed and call upon an emergency response team

*If the PCB levels of the oil are not known through prior testing, the spill shall be treated as a PCB spill, until such time that analysis proves otherwise.

Annex B

(normative)

Model oil spill feedback form

Please attach additional notes if necessary or if the space supplied is not sufficient

1	Give a short description of the oil spill incident.	
2	Give a short description on the following: -What was done immediately after the spill was discovered? -Could it be contained and how? -Was an emergency team involved and was it a contracted team? -Was free oil evident, how was this removed and what happened to this oil? -Has final remediation begun and what is being done? -Were PCB test results available and during which phase was this established?	
3	Which role did you fulfill within the process?	
4	How many litres of oil were involved?	
5	How big was the area that was polluted?	
6	Did any water pollution occur in the following areas? -trap dam -river -dam (water supply) -streams -underground	
7	How would you describe the incident – major or minor?	
8	Were there any other hazards or issues that needed attention?	
9	What were the weather conditions? -wind	

	-temperature -precipitation, for example, rain or fog	
10	What were the causes - please explain? -human -technical -physical -organizational	
11	What was affected? -installation - describe -establishment -off-site local -off site regional	
12	How many people were affected? -staff -locals Describe the possible risks.	
13	What were the ecological effects? -pollution/contamination/damage -residential area -common wild fauna/flora -water catchment areas -land -marine or other fresh water	
14	What were the material losses (in Rands)? -material (costs to Eskom) -response -clean-up -restoration	
15	Was any community life disrupted?	
16	Was any utility such as electricity, sewage or water interrupted?	
17	Was there significant public concern?	
18	Who was notified within Eskom?	
19	Who was notified outside of Eskom?	

20	What lessons were learnt from this? -measures to prevent recurrence -measures to mitigate consequences -useful references	
21	Did you experience a lack of: -guidance -expertise -standards -directives -reference material -Eskom assistance -Outside assistance	
22	Any recommendations	
23	Any other comments	

Name_____**Signature**_____

Date_____**Site**_____

ESKOM

ESKOM DIRECTIVE

TITLE: **CORPORATE DIRECTIVE FOR THE DECHLORINATION OF POLYCHLORINATED BIPHENYL (PCB) CONTAMINATED OIL**

REFERENCE	REV
ESKAD	0
DATE:	**January 2000**
PAGE	**1**
REVISION DATE:	**OCTOBER 2003**

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Preamble

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Strategy

References

1 Preamble

PCB is the generic name for a group of hazardous dielectric fluids used in electrical equipment. Spillage of and exposure to PCB can cause adverse health effects and environmental pollution.

Since 1979, no new PCB products have been brought into Eskom, but a large quantity of Napthenic oil used in transformers have been contaminated with PCB. This poses an environmental and safety risks if correct disposal procedures are not followed.

2 Policy

The well being, health and safety of staff, customers and every member of the community is of paramount importance to Eskom.

PCB will be managed in accordance with internationally accepted standards and in compliance with South African Legislation as well as Eskom Directives.

3 Strategy

3.1 The relevant Executive Directors will ensure that Eskom and its contractors will comply with legislation and accepted practices as reflected in the Eskom Corporate Standard (ESKASAAC2), with regard to the storage, handling, use, transport and disposal of PCB.

32 Disposal will be effected by approved and registered contractors.

33 Pure PCB will **NOT** undergo dechlorination - (this will typically be found in Capacitor cans and have names such as Askarel)

3.4 In order to phase PCB contaminated oil out of the Eskom insulating oil pool, the following action will be taken:

- Equipment containing insulating oil with a PCB count in excess of 500 parts per million (ppm) (classed as PCB), will be drained and the oil replaced with non-PCB certified regenerated oil.
- Equipment containing insulating oil with a PCB count between 50 – 499 ppm (classed as PCB contaminated), undergoing repairs or treatment, will be re-filled with non-PCB certified regenerated oil.
- Equipment containing insulating oil with a PCB count of between 20 – 49 ppm, undergoing repairs on site may be re-filled with the same oil following regeneration treatment.
- Insulating oil containing PCB between 20 – 49 ppm, leaving a site will be treated on an ad hoc basis, following consultation with Eskom's Assets Disposal Manager.
- The above oil will undergo blending (mixing with oil containing PCB < 20 ppm) or dechlorination for the sole purpose of disposal.
- The dechlorinated oil will **NOT** re-enter the Eskom insulating oil pool.
- **NOTE:** ALL INSULATING OIL DISPOSAL WILL ONLY BE PERFORMED FOLLOWING CONSULTATION WITH ESKOM'S ASSETS DISPOSAL MANAGER AND THE NATIONAL INSULATING OIL STEERING COMMITTEE (NIOSC).

4 Reference documents

Corporate Directive - Waste Management ESKADAAJ5.

Corporate Directive - Corporate Directive for the Management of Polychlorinated Biphenyl (PCB) ESKADAAO3.

Corporate Standard - Management of Polychlorinated Biphenyl ESKASAAC2.

ESKOM

DIRECTIVE

TITLE: **DIRECTIVE ON TRANSFORMER OIL SAMPLING AND SAMPLE TRANSPORTATION**

REFERENCE **ESKADABC2**
REV 1
DATE: **OCTOBER 2000**
PAGE **1**
REVISION DATE: **OCTOBER 2003**

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CONTENTS

Preamble

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Directive

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1 Preamble

Quality of product and customer focus is of the utmost importance to Eskom with the ultimate objective of an uninterrupted power supply to the customers. The Eskom network incorporates numerous generation, transmission and distribution transformers that need to be maintained to enable Eskom to meet this objective.

Insulating oil is the lifeblood of a transformer where it surrounds the coils as well as the windings and serves as both an insulant and coolant. With the vital parts of the transformer submerged in large volumes of oil, fault conditions, such as overheating and arcing occurring within the transformer may be detected at early stages. The oil will reveal the moisture levels and the overall condition of the cellulose material as well as the potential remaining lifespan.

Insulating oil analysis is known to be one of the most powerful tools in establishing the internal condition of power equipment. The most significant method of testing the condition of the equipment is by taking either routine or periodic oil samples and sending them for analysis to an accredited laboratory.

Quality sampling techniques contribute vastly to the outcome and eventual action following the transformer oil analysis. To achieve the desired analysis, factors such as cleanliness and weather conditions and the attitude and overall technique of the sampler are critical. Incorrect sampling may not only result in costly resampling but also in expensive and unnecessary maintenance.

It was realised by the Insulating Oil Steering Committee that a need to train oil samplers exists within Eskom. It was decided to establish a transformer oil sampling course that will not only train the samplers, but will also ensure certification for quality purposes.

The Insulating Oil Steering Committee has identified a suitable training course that will meet the need for training all Eskom employees who are required to take oil samples.

2 Definitions

transformer oil: Oil that consists of a hydrocarbon mixture of the three main types namely napthenes, aromatics and paraffins. The oil shall contain a larger portion of napthenes and shall be classed as a Napthenic transformer oil. The oil shall contain no added inhibitors and shall be classed as uninhibited.

3 Directive

All Eskom employees who take transformer oil samples for analysis shall attend the Oil Sampler training course co-ordinated by Quantum College, Rosherville and presented by Rotek and TSI.

This certification will be valid for three years, where-after the sampler will need to undergo an assessment.

4 Responsibilities

The Business Unit shall ensure that:

a) all employees required to take transformer oil samples have attended and passed the Oil Sampler training course.

b) all oil samples are taken in accordance with the procedures prescribed on the Oil Sampler training course,

c) all oil samples are transported in accordance with EHTHUA 02(B)000.

APPENDIX F

ESKOM'S EFFLUENT CONTROL MEASURES

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Our Ref: 1917GWA-00/00/L001 Refer to: A Grobbelaar / ag

06 March 2006

ROSHCON
Roshland Office Park
Lower Germiston Road
Rosherville

ATTENTION: MR. NICO VERMEULEN

Sir

PROJECT: ATLANTIS & MOSSEL BAY OCGT POWER STATION: CIVIL WORKS AND INFRASTRUCTURE

SUBJECT: POLLUTION CONTROL: STORM WATER AND SEWER DESIGN PHILOSOPHY

1. GENERAL

The OCGT power generation plants is regarded as an industrial plant where the activity of power generation is taking place by means of the open cycle gas turbines. The main pollutant hazard is the fuel that is stored on site and transported to the turbines. Spillage from these points of storage and pipe lines needs to be addressed and contained separately from normal “clean” storm water run-off from unpolluted areas.

The polluted water areas is regarded as the footprint area of the fuel storage tanks, the fuel supply pipe lines in the underground ducts and the footprint area of the turbine itself where, through maintenance or other activities, fuel can be spilled. Other minor polluted water areas are regarded as the area immediately surrounding large transformers where transformer oils can potentially be spilled.

Domestic sewage is transported from the discharge point to a suitable on-site or off-site treatment facility, complying wit the requirements of the EIA and ROD for each respective site.

2. Design criteria

2.1 Storm Water

The storm water flood return period is to be 1:5-years as the process carried out on site is regarded as industrial in nature i.e. it does not fall in the Mining environment which requires a containment of polluted water from the mining activities for the 1:50 years storm return period.

Furthermore, in the case of the Atlantis site, the storm water drains are to connect to the existing Municipal Storm water drains which is designed for the 1:5 year storm return period.

The polluted storm water system is to be separate from the “clean” water system which discharges either to the natural environment (Mossel Bay Site) or to the existing Municipal drains (Atlantis Site)

The storm water pipes are to be of the concrete spigot & socket type with O-ring joints, ensuring water tightness in accordance with the relevant SANS specification.

Manholes are to be provided at all changes in directions or at least every 80m intervals on a straight line. The Manhole rings are to be of the concrete type with sealed joints between rings, all in accordance with the relevant SANS specification. The manholes are to be watertight and tested accordingly.

2.2 Sewer

The sewer effluent discharge is based on the number of sanitary facilities and the number of operational personnel during the normal operation of the plant. It is assumed that no more than 10 people will be present at any time. The design for the sewer system will comply with SANS0252-2 of 1993

The discharge assumed per person is 70l/capita per day in accordance with SANS252 guidelines. The minimum velocity in the sewer is 0.7m/s. The slope of the sewer is to be such that the minimum velocity is maintained.

The pipes are to be spigot and socket type pipes of uPVC (heavy Duty class). Manholes are to be provided at 80m intervals or at any change in direction. The sewers are only

intended for domestic sewer and “grey” water. No other pollutants are to be discharged into the sewer system.

3. Design philosophy

3.1 Mossel Bay

3.1.1 Storm Water

Clean storm water system.

The Mossel bay “clean” storm water system is to discharge into the natural stream located approximately 300m from the OCGT terrace. The “clean” water is separated from the polluted water through bund walls surrounding the fuel tankers and through sloping platforms at the turbines areas. The” clean” water is collected in the roads at kerb inlets and low points of the terrace and discharged into an underground clean storm water pipe system.

Polluted Storm Water System

The polluted storm water system is running below the fuel pipe duct, the cable duct and the fuel storage tanks. The polluted water enters the pipe system through grid inlet manholes or through special collector drains (cable duct). At the fuel storage tanks, the grid inlets located at each bunded fuel storage tank collects the spilled fuel/polluted water and discharge it to a treatment facility off the terrace (site). The capacity of the polluted water drain pipe can cater for the quick release of the fuel tank or an emergency spillage (approximately 2000kl). Each fuel storage tank is separately bunded and can store all 2000kl of fuel.

The off-site treatment facility caters for the treatment of polluted water at a rate of the estimated 1:5 year rainfall return period. The catchment areas are as descried above. The treatment facility is design as an underflow/overflow facility with an oily water separator and recovery unit. The detail design is to be provided by specialist environmental consultants. In the event of a major incident where all the fuel is “dumped” to the polluted water system, an attenuation dam off site at the oily water separator plant will contain the fuel for recovery or treatment through the system. The capacity of this attenuation dam is 11,000 kl. This allows for 110% of the total fuel storage capacity on the site.

In the normal day to day operation of the plant, the oily/polluted plant will separate the oil/ fuel from the water and discharge it to the natural environment. The discharge will comply with at least the General Effluent Limits for discharge of treated polluted water in accordance with the new Water Act.

3.1.2 Sewer

Due to the remote site of the Mossel Bay plant, three options will be considered for treatment of the domestic sewer and grey water.

Option 1 – The source of the effluent will be stored in a conservancy tank, large enough to require fortnightly emptying. This requires the contracting of a tanker company capable of pumping the conservancy tank empty and transporting it to the nearest effluent treatment facility. This is environmentally friendly as no discharge is required to the immediate environment. It does however require an ongoing operation and maintenance input for the duration of the plant operation. At the large discharge points, an insitu type water retaining concrete structure must be build to cater for approximately a 7000l tank. (This can be made larger if the emptying cycle is to be 3 to 4 weeks.) At the smaller sanitary facilities at other site locations, a pre-fabricated conservancy tank can be used for a capacity up to 5000l. The advantage of the system is that no deep sewers would have to be installed with very little pipe work required.

Option 2- A central on site sanitation facility can be provided for the small number of people during the operation of the plant, a suitable septic tank and French drain (Soak away) system can be used. This is a well known proven system that provides acceptable primary treatment of sewage that is then discharged into the environment via a soak away drain. If this system is maintained and operated correctly, it can provide an acceptable solution. It however also needs maintenance and emptying of the septic tank. This must be done once every 2 years (Depending on the design criteria, the intervals can be made longer between emptying). Also, soak away tests of the insitu soils would have to be done to check if it is suitable for the intended purpose. The advantage of the system is similar to the conservancy tank in that no deep sewers would have to be installed with very little pipe work required.

Option 3- The third option is to connect the sewers to the Petro SA sewer reticulation network. This is however some 2km from the site and will be costly. The advantage is however that no treatment is required and very little operational costs are required. This option is however dependant on Petro SA accepting the sewage (although very little) into their treatment plant.

3.2 Atlantis

3.2.1 Storm Water

Clean storm water system.

The clean water system is designed similar to the system at Mossel Bay as far as the demarcated run-off areas are concerned, except that the discharge of the water is to be into the existing Municipal storm water system. In the case of Atlantis, the water supply in the area is very dependant on the replenishing of the underground aquifers in the area. It is therefore essential that the clean storm water is returned to the water cycle in the area. In this regard, the clean storm water system is to be discharged into an existing piped system that discharges nearby into a existing municipal detention pond.

Polluted storm water

The pollute storm water collection system is the same as for the Mossel Bay plant as far as run off areas are concerned and the demarcation of polluted water and "clean" water are concerned.

The difference is again in the discharge of the polluted water. Because of the sensitivity of the underground water in the Atlantis site, the Cape Town Municipality will not allow the discharge of any polluted water (even after treatment to the general effluent discharge standards) to be discharged into the Municipal storm water system. The discharge must be to the Municipal sewer system. Because the existing sewer system is reticulated with a 150mm diameter pipe, and would not cope with the calculated 1:5-year storm water system, the discharge is to a polluted water attenuation pond on site at the oily water treatment facility. From here, the discharge is into the sewer system after treatment at a rate equal to the capacity of the existing sewer system. (The detention pond capacity is 11,000kl and can contain the expected 1:5year flood from the polluted water areas.)

3.2.2 Sewer

Because there is an existing sewer network in close proximity to the Atlantis plant, it was not considered feasible to provide on site sanitation in the form of a conservancy tank. A septic tank with a soak away pit would not be acceptable due to the sensitivity around the underground water harvesting for human consumption. The sewer is therefore connected to the Municipal sewers nearby and treated at the municipal effluent treatment facility.

4. Ground water pollution control

It is a requirement of the Department of Water Affairs and Forestry that a ground water polluted monitoring program be implemented. The plant must have a minimum of 4 boreholes in the immediate vicinity (or as agreed to by DWAF) with sampling facilities. Regular ground water monitoring must form part of the operations of the plant. This is applicable to both the Mossel Bay and Atlantis plants. A further requirement from the Cape Town municipality is that a sampling/monitoring point be installed on the "clean" storm water system as well.

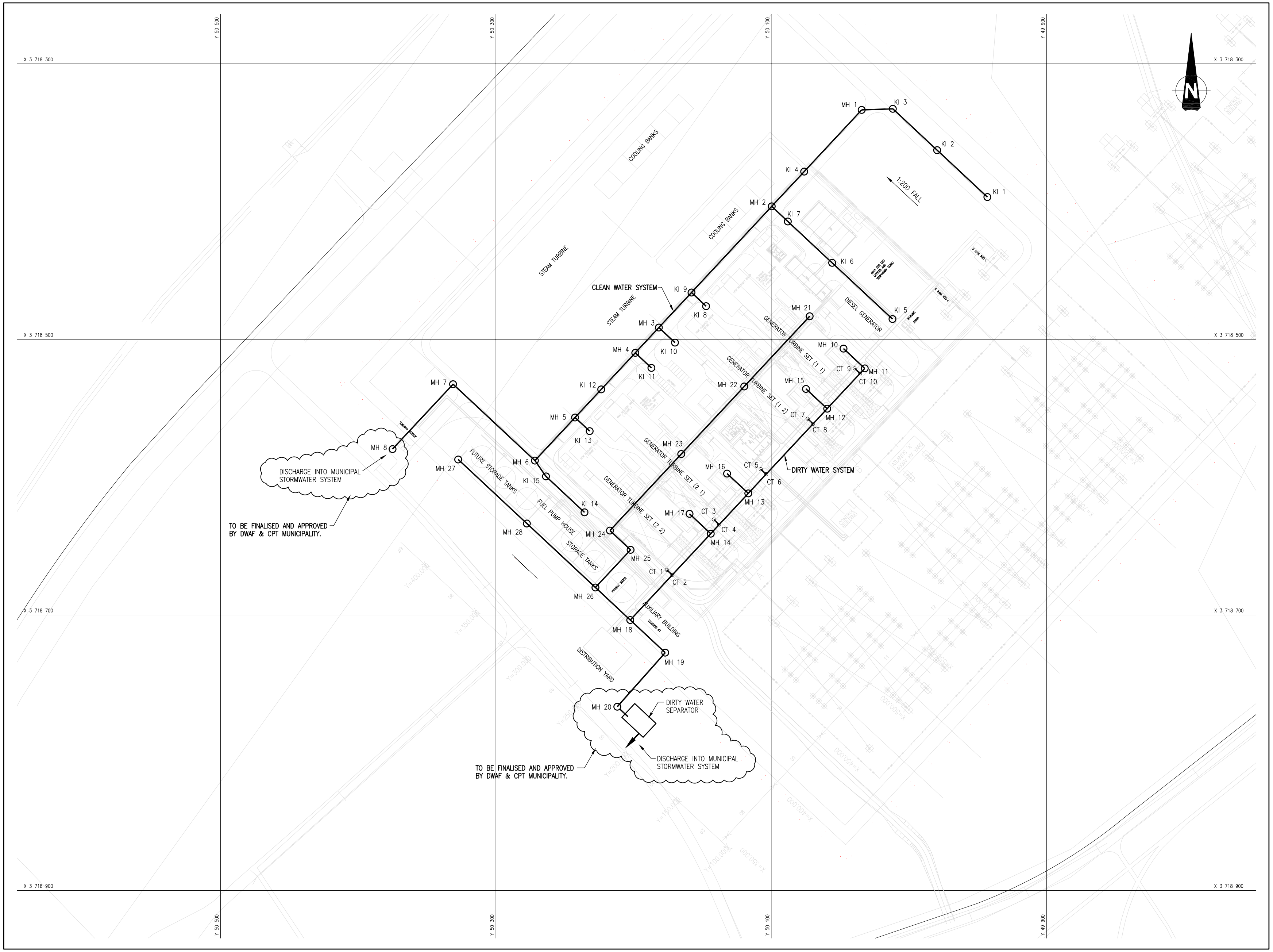
I trust the above will provide you with the required details of the design philosophy and we await you earliest approval/comment.

Yours faithfully,
GOBA (Pty) Ltd

Adriaan Grobbelaar
Technical Director

APPENDIX G

EFFLUENT SITE PLAN



MANHOLE SETTING OUT CO-ORDINATES		
NUMBER	Y	X
KI 1	49 943.028	3 718 396.701
KI 2	49 979.534	3 718 362.671
KI 3	50 011.726	3 718 332.654
KI 4	50 076.086	3 718 378.216
KI 5	50 011.958	3 718 485.235
KI 6	50 055.769	3 718 444.449
KI 7	50 087.983	3 718 414.412
KI 8	50 147.333	3 718 475.900
KI 9	50 157.945	3 718 466.000
KI 10	50 169.938	3 718 502.338
KI 11	50 187.048	3 718 520.690
KI 12	50 223.500	3 718 536.298
KI 13	50 231.900	3 718 566.589
KI 14	50 235.638	3 718 625.537
KI 15	50 263.639	3 718 599.444
MH 1	50 034.335	3 718 333.443
MH 2	50 099.688	3 718 403.438
MH 3	50 181.649	3 718 491.417
MH 4	50 198.760	3 718 509.767
MH 5	50 242.515	3 718 556.689
MH 6	50 271.671	3 718 587.955
MH 7	50 331.118	3 718 532.520
MH 8	50 375.069	3 718 579.649
MH 10	50 047.516	3 718 506.696
MH 11	50 032.107	3 718 521.067
MH 12	50 059.387	3 718 550.323
MH 13	50 116.674	3 718 611.753
MH 14	50 143.955	3 718 641.010
MH 15	50 074.798	3 718 535.952
MH 16	50 132.120	3 718 597.420
MH 17	50 159.371	3 718 626.636
MH 18	50 202.418	3 718 703.694
MH 19	50 177.030	3 718 727.362
MH 20	50 211.814	3 718 766.609
MH 21	50 072.115	3 718 483.217
MH 22	50 119.629	3 718 534.166
MH 23	50 165.362	3 718 583.211
MH 24	50 217.173	3 718 638.774
MH 25	50 202.182	3 718 652.755
MH 26	50 227.711	3 718 680.088
MH 27	50 327.380	3 718 587.163
MH 28	50 277.538	3 718 633.641
CT 1	50 175.865	3 718 667.312
CT 2	50 171.926	3 718 670.985
CT 3	50 141.765	3 718 630.745
CT 4	50 137.824	3 718 634.420
CT 5	50 107.664	3 718 594.178
CT 6	50 103.722	3 718 597.854
CT 7	50 073.564	3 718 557.610
CT 8	50 069.620	3 718 561.289
CT 9	50 039.464	3 718 521.043
CT 10	50 035.517	3 718 524.724

NOTES:

1. REFERENCE DRAWINGS:
   15917/00/00/500/004, 005 – LONGITUIDNAL SECTIONS
   15917/00/00/500/007, 008 – TYPICAL STORMWATER DETAILS
2. PREFIXES 'KI' REFERS TO KERB INLET, 'MH' TO MANHOLE AND 'CT' TO CABLE TRENCH.

REV		BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS
B	MANHOLES AND KERB INLETS Nos. CHANGED.	A.deO.	E.C.	-	16/01/06	-
A	ISSUED FOR COMMENT.	A.deO.	E.C.	-	09/01/06	-
	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS

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Eskom
ESKOM HOLDINGS LIMITED
REG NO. 2002/015527/06

ATLANTIS POWER STATION
STORMWATER
GENERAL LAYOUT

APPROVED BY: -
DATE: -
CHECKED BY: E. CARVALHO
DATE: JAN 2006
DRAWN BY: A. de OLIVEIRA
DATE: JAN 2006
SCALE: 1:1000

15917/00/00/500/003

SHEET NUMBER: 1 OF 1
REVISION: B

MANHOLE SETTING OUT CO-ORDINATES		
NUMBER	Y	X
S1	50 093.739	3 718 445.757
S2	50 112.134	3 718 428.603
S3	50 144.943	3 718 463.771
S4	50 181.548	3 718 503 004
S5	50 226.332	3 718 551.062
S6	50 271.149	3 718 599.125
S8	50 082.505	3 718 788.239
S9	50 132.195	3 718 741.916
S10	50 162.732	3 718 700.141
S11	50 196.879	3 718 668.414
S12	50 231.026	3 718 636.545
S13	50 333.152	3 718 541.310
S14	50 379.881	3 718 591.428
S15 (EXT)	50 330.244	3 718 647.944
S16	50 122.410	3 718 568.820
S17	50 131.076	3 718 578.144
S18	50 087.106	3 718 619.160
S19	50 128.015	3 718 663.112
S20	50 015.967	3 718 492.475
S21	50 080.859	3 718 431.951
S22	50 048.067	3 718 648.712
S23	50 064.457	3 718 377.472
S24	50 152.966	3 718 456.290
S25	50 234.378	3 718 543.589
S26	50 007.878	3 718 483.799

NOTES:

1. REFERENCE DRAWINGS:
   15917/00/00/500/002 – LONGITUIDNAL SECTIONS
   15917/00/00/500/006 – TYPICAL SEWER DETAILS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS
B	EXTRA MHS. & MHS. RELOCATED.	A.deO.	E.C.	·	13/02/06	·
A	ISSUED FOR COMMENT.	A.deO.	E.C.	·	09/01/06	·

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DATE	·
CHECKED BY	E. CARVALHO
DATE	JAN 2006
DRAWN BY	A. de OLIVEIRA
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Eskom
ESKOM HOLDINGS LIMITED
REG NO.
2002/015527/06

ATLANTIS POWER STATION
SEWERS
GENERAL LAYOUT

DRAWING NUMBER	SHEET NUMBER	REVISION
15917/00/00/500/001	1 OF 1	B

ESKOM

POLICY

TITLE: **WASTE MANAGEMENT POLICY**

REFERENCE **ESKPBAAC4** REV **3**
DATE: **DECEMBER 2000**
PAGE **1** OF **3**
REVISION DATE: **DECEMBER 2003**

COMPILED BY	FUNCTIONAL RESP.	AUTHORIZED BY
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This document has been seen and accepted by:

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Dr W J Kok	**Executive Director (Finance)**
Dr S J Lennon	**Executive Director (Resources and Strategy)**
R P J Maroga	**Executive Director (Distribution)**
T J Matsau	**Executive Director (Office of the Chief Executive)**
E N Matya	**Executive Director (Generation)**
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1 Preamble

Effective waste management is pivotal to the well being of industry, society and the environment. An integrated approach is required to minimize and manage waste and associated risks in a cost effective manner.

2 Definition

(a) **waste:** For the purposes of the definition of "waste" in section 1 of the Environment Conservation Act, 1989 (Act No 73 of 1989), the Minister of Environment Affairs identify as an undesirable or superfluous by-product, emission, residue or remainder of any process or activity, any matter, gaseous, liquid or solid or any combination thereof, originating from any residential, commercial or industrial area, which -

a) is discarded by any person; or

b) is accumulated and stored by any person with the purpose of eventually discarding it with or without prior treatment connected with the discarding thereof; or

c) is stored by any person with the purpose of recycling, re-using or extracting a usable product from such matter, excluding -

(i) water used for industrial purposes or any effluent produced by or resulting from such use which is discharged in compliance with the provisions of section 21 (1) of the Water Act, 1956 (Act No 54 of 1956) or on the authority of an exemption granted under section 21 (4) of the said Act;

(ii) any matter discharged into a septic tank or french drain sewerage system and any water or effluent contemplated by section 21 (2) of the Water Act, 1956;

(iii) building rubble used for filling or levelling purposes;

(iv) any radio-active substance discarded in compliance with the provisions of the Nuclear Energy Act, 1982 (Act No. 92 of 1982);

(v) any minerals, tailings, waste-rock or slimes produced by or resulting from activities at a mine or works as defined in section 1 of the Mines and Works Act, 1956 (Act No. 27 of 1956); and

(vi) ash produced by or resulting from activities at an undertaking for the generation of electricity under the provisions of the Electricity Act, 1987 (Act No 41 of 1987).

(Environment Conservation Act, 1989 (Act No 73 of 1989), GN. 1986, GG12703, 24 August 1990)

(b) **waste:** An undesirable or superfluous by-product, emission, or residue of any process or activity which has been discarded, accumulated or been stored for the purpose of discarding or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area. This definition includes industrial waste water, sewage, radioactive substances, mining, metallurgical and power generation waste. (GN 227, GG20978, 17 March 2000, **WHITE PAPER ON INTEGRATED POLLUTION AND WASTE MANAGEMENT FOR SOUTH AFRICA)**

PLEASE NOTE: Definition (a) is currently law. Definition (b) will take precedence once the White Paper is formally passed as a law.

2.1 Waste generated within Eskom primarily includes:

2.1.1 Unusable Eskom coal stocks and mill rejects.

2.1.2 Domestic/office refuse including swill ("Food waste")

2.1.3 Medical waste.

2.1.4 Hazardous waste as defined in the Hazardous Substances Act (No 15 of 1973) including but not limited to oils (mineral, lubricating etc.), greases, asbestos, mercury bearing fluorescent tubes, chemical waste and solvents.

2.1.5 Sewage waste and sludge from water treatment plants.

2.1.6 Building rubble.

2.1.7 Discarded equipment.

2.1.8 Liquid effluents (including cooling water blowdowns, spent regenerants and desalination brines).

Nuclear waste is addressed under Nuclear Legislation. Please refer to the following Eskom documents:

a) Directive – Radiation Protection and the Safety of Radiation Sources (ESKADAAB4).

b) Policy – Radiation Protection and the Safety of Radiation Sources (ESKPBAAU6 – DRAFT).

c) Standard – Radiation Protection Requirements for Non-Nuclear installations (ESKASAAG1).

d) Standard – The Radiation Protection Standard (OPS 7000).

3 Policy

Eskom will manage waste responsibly through the identification and pro-active management of waste. Reduction of waste generation and the conservation of resources shall be promoted through judicious resource utilization, recycling, re-use of waste and by resource recovery.

4 Strategy

Eskom shall apply the following strategy in terms of waste management throughout the utility:

4.1 All legislation shall be adhered to as a minimum requirement, including but not limited to:

4.1.1 All Eskom waste disposal sites shall be licensed by the Department of Water Affairs and Forestry.

4.1.2 Environmental Impact Assessments shall be undertaken prior to establishing waste disposal sites.

4.1.3 Permitted /licensed waste disposal facilities shall be used.

4.2 Where economically feasible and viable, Eskom will:

4.2.1 Use technology that supports waste reduction.

4.2.2 Give preference to recycled products and materials and promote waste recycling programmes.

4.2.3 Maximize the use of ash as a resource.

4.3 Standards, Operating Procedures and Guides as well as Emergency Preparedness/ Contingency plans for waste management shall be implemented at all Eskom facilities as part of their EMS.

4.4 Co-operation with national and international centres of expertise in terms of economically viable research and technology transfer shall be supported.

4.5 Staff involved with waste management shall be appropriately trained in all aspects of waste management including the requirements of the Occupational Health and Safety Act No. 85 of 1993.

4.6 Appropriate information systems shall be implemented to monitor performance. This shall include a register of waste types, volumes, legal contraventions and disposal destinations.

4.7 Internal or, as prescribed, external audits shall be conducted at appropriate intervals. These shall include suppliers of goods and services, contractors, and commercial waste facilities embracing the lifecycle of the process.

4.8 All waste contractors will be required to provide Eskom with a waste manifest document detailing the type of waste disposed of, the quantities disposed of and how and where the waste was disposed of. The transport of waste shall be in accordance with National legislation.

4.9 Resources shall be provided to support this policy.

4.10 Littering shall be discouraged and facilities for litter disposal shall be provided.

5 Responsibility and accountability

5.1 This policy shall apply throughout Eskom.

5.2 Suitable targets shall be established by all Business Unit Managers to support this policy and strategy.

5.3 The Waste Management Forum (WMF) will co-ordinate waste related issues within Eskom and develop appropriate guidelines for the management of these wastes.

5.4 The Environmental Liaison Committee (ELC) will consider and approve, as appropriate, all recommendations/guidelines made by the Waste Management Forum (WMF).

6 References

The National Waste Management Strategy Action Plans

ESKPBAAD6:Rev.6, *Environmental management policy.*

ESKADAAO3,Rev.1, *Corporate directive for the management of polychlorinated biphenyls (PCB).*

ESKASAAC2:Rev.1, *Management of polychlorinated biphenyls (PCB).*

ESKASAAE1:Rev.2, *The safe handling of sulphur hexafluoride gas and its by-products* (SF_6).

ESKAGAAD7:Rev.0, *Oil spill clean-up and rehabilitation*.

ESKPBAAA4:Rev.1, *Ozone depleting compounds (ODC) management and phase-out.*

ESKPBAAD4:Rev.0, *Herbicide management.*

EVP-076:Rev.0, *The safe processing, storing, removing and handling of asbestos or asbestos containing material.*

ESKADAAB4:Rev.0, *Eskom corporate radiation protection directive* (Draft).

ESKPBAAU6:Rev.5, *Radiation protection and the safety of radiation sources*.

ESKASAAG1:Rev.2, *Radiation protection requirements for non-industrial installations*.

OPS 7000:Rev.6, *The radiation protection standard.*

Guide for the disposal and handling of solvents (incl. safety, disposal & purchasing) (Draft).

White Paper on Integrated Pollution and Waste Management.

Guide for the correct handling and disposal of fluorescent tubes (Draft).

ESKADAAQ9:Rev.1*, Eskom Occupational Health and Safety Directive*

ESKADABJ3:Rev.0, *Waste Reporting Directive*

7 Compilers

This document was compiled by Eskom's Waste Management Forum:

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R Chetty (Corporate Environmental Affairs)

R Bothma (Generation Environmental Management)

P Jacobs (Transmission Environment)

M Hunter (Distribution Environment)

L Mthombeni (Environmental Audit)

B Gore (Environmental Technologies – TSI)

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Eskom

Procedure Annex

Waste Procedure

REFERENCE: EPR
REVISION: 0
DATE:
Total Pages:
REVISION DATE:

COMPILED BY	FUNCTIONAL RESP.	AUTHORISED BY
.....	.....	.....
WMF	Chair ELC	Chair SLC

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2OUTLINE 2
3GENERAL REQUIREMENTS 2
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5DEFINITIONS AND ABBREVIATIONS 3
6NORMATIVE / INFORMATIVE REFERENCES 3
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ANNEX J: WASTE REPORTING REQUIREMENTS ..... **ERROR! BOOKMARK NOT DEFINED.**
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1 INTRODUCTION

Eskom Holdings Pty Ltd supports the Government's commitment to Waste Reporting and Tracking as a means of ensuring the protection of South Africa's environment as defined in the National Waste Management Strategy.

Effective waste management is pivotal to the well being of industry, society and the environment. An integrated approach is required to minimize and manage waste and associated risks in a cost effective manner. Eskom will manage waste responsibly through the identification and pro-active management of waste. Reduction of waste generation and the conservation of resources shall be promoted through judicious resource utilization, recycling, re-use and disposal of waste.

In order to support the Safety, Health & Environment (SHE) policy (REF NUMBER) and legislative requirements, it is essential that waste is reported and tracked.

2 OUTLINE

The document will consist of the following sections as annexes

Annex A Fluorescent Tube and Mercury Device Management

Annex B Disposal and Safe Handling of Sulphur Hexafluoride Gas (SF6) and by-products

Annex C Polychlorinated Biphenyl (PCB) management

Annex D Oil management

Annex E Asbestos Management

Annex F Health Care Risk Waste

Annex G Metals

Annex H Printer Cartridges Recycling

Annex I E-Waste

Annex J Waste reporting need to get from FH

3 GENERAL REQUIREMENTS

- Permitted /licensed waste disposal facilities shall be used.
- All Eskom waste disposal sites shall be licensed in line with the latest National legislation (Department of Water Affairs and Forestry/DEAT/other authorities).
- Environmental Impact Assessments (EIA) shall be undertaken prior to establishing waste disposal and storage sites in accordance with EIA regulations.
- Eskom will, where sustainable, use technology that supports waste reduction.
- Standards, Operating Procedures and Guides as well as Emergency Preparedness/ Contingency plans for waste management shall be implemented at all Eskom business units as part of their Environmental Management Systems (EMS).
- Staff involved with waste management must be appropriately trained in all aspects of waste management including the requirements of the Occupational Health and Safety Act No. 85 of 1993.
- Appropriate information systems shall be implemented to monitor performance. This will, as a minimum, include a register of waste types, volumes, and disposal destinations.
- Audits shall be conducted at appropriate intervals. These shall include suppliers of goods and services, contractors, and commercial waste facilities.

- All waste contractors will be required to provide Eskom with a **route risk analysis and waste manifest procedure** detailing the transportation, type of waste disposed off, the quantities disposed off, and how and where the waste was disposed off and a certificate of disposal. The transport of waste shall be in accordance with National legislation.
- All records must be maintained in accordance with applicable legislation.
- All waste shall be managed in accordance with the divisional EMS with appropriate documentation and records.
- All waste reporting to be in accordance with Environmental Reporting Procedure.
- Changing legislative requirements will be monitored, and reporting procedures modified appropriately

4 SCOPE

Refer to Procedure Control Document

5 DEFINITIONS AND ABBREVIATIONS

Refer to Procedure Control Document

6 NORMATIVE / INFORMATIVE REFERENCES

Included in Annexes

7 IMPLEMENTATION DATE

Included in Annexes

8 MONITORING PROCESSES

All monitoring included in Annex x and Environmental Reporting Procedure.

9 RELATED DOCUMENTS

Included in Annexes

10 AUTHORISATIONS

This document has been approved by the ELC and Authorised by the SLC.

ELC Members

List Members here

SLC Members

List members here

11 REVISIONS

Revision	Date	
0	August 2005	New document

12 ANNEXES

ANNEX A: FLUORESCENT TUBE AND MERCURY DEVICE MANAGEMENT

1. Introduction

Mercury is an essential compound in fluorescent lamps, high-pressure sodium lamps and other lighting devices. Lamp manufacturers use mercury because it is cheap, plentiful and conducts electricity with great efficiency. However, a problem exists due to the mercury vapor being released into the environment when lamps are broken or disposed of in a landfill or incinerator. The toxic metal vapor will contaminate the air, soil, surface water and groundwater. Despite the fact that the fluorescent tubes contain mercury, its use as a consumer product still makes environmental sense. They are three to four times more efficient than the incandescent light bulb, thus much less electricity is required to operate them. This translates into less air pollution from power plants' *(The Mercury Menace-http://www.portland.commercury/).*

Fluorescent tubes and lamp ballasts are found throughout the environment in residences and commercial buildings. Their disposal, however, because of the mercury content can create hazardous waste. According to the information presented by the main suppliers and internet searches, the quantity of mercury within fluorescent tubes varies from approximately 2mg to > 40mg per lamp *(RES/RR/99/00098).*

2. Purpose

The purpose of this section is to communicate a standard environmental approach to the safe handling and disposal of fluorescent tubes and ballasts by both Eskom, and any contractor providing services to Eskom, with regards to the relevant legislation.

3. Background

Fluorescent tubes contain small quantities of mercury, cadmium as well as antimony and proper disposal throughout Eskom is essential. It should also be realised that lack of literature does not imply a lack of liability. A further concern is the fact that some ballast may still contain Polychlorinated Biphenyls (PCBs).

If not correctly disposed of the mercury and/or PCBs may leach through landfills and end up in ground water. Small amounts of PCBs or mercury can contaminate sizeable water supply, thereby creating problems for the water users. Both compounds are chemically stable, thus do not readily break down over time.

4. Health Effects (Mercury)

Mercury (Hg) is the only metal in a liquid form at room temperature. The major source of human exposure to mercury is through the consumption of contaminated fish and fish products, via a process of bioaccumulation in these aquatic organisms. Uptake of mercury vapor is through inhalation. The lung is the primary target organ after acute respiratory exposure. Once absorbed, mercury in all forms is distributed via the blood stream to all tissues in the body. This is only critical when the mercury is in a concentrated form. Exposure to very high concentrations of mercury vapor for brief periods can cause symptoms such as respiratory difficulties, chest pains and mouth inflammation. The primary reason for mercury being a toxicological problem, is due to the fact that it bio-accumulates and therefore increases its concentrations as it gets consumed up the food chain. Another route of exposure for Mercury is via skin absorption (handling without gloves and long sleeves) and ingestion (eating without washing hands). The target organs also includes the central nervous system and the kidneys.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY - MINIMUM REQUIREMENTS PROCEDURE (Edition?) 1998

The table below (table 1) details the hazardous waste classification for mercury metal according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, as published by the Department of Water Affairs and Forestry (DWAF) (second edition, 1998). The preferred technology for mercury disposal includes recovery (recycling, reuse and utilisation techniques).

Table 1: Hazardous Waste Classification for Mercury Metal

Substance Indicator Number (SIN)	2809
Chemical Abstract Service Number (CAS)	[7439-97-6]
Industrial Group	G2 – Electronic and Electrical Engineering (an industry which illustrated widespread use of the substance)
SABS (0228) Class and Danger Group	Class 8: Corrosive substance (Substances shall be pre-treated to pH 6 to pH 12 and thereafter given a hazard rating Danger Group III: Substances and goods that present a relatively low risk for transport purposes
Hazard Rating	Extreme Hazard
Acceptable Environmental Risk (ppm)	0.022 (LC50 * x 0.1). This should be comparable to the EEC**.
Disposal Allowance g/ha/m	2 (amount of Hg that can be safely disposed of per hectare per month)
Preferred Technology	Recovery Immobilisation then landfill (micro-encapsulation, vitrification, solidification)
Allowed Technology	Encapsulation Oxidation then landfill/co-dispose residues
Unacceptable Technology	Landfill without treatment

*LC50 * - The median lethal dose is a statistical estimate of the amount of chemical, which will kill 50% of a given population of aquatic organisms under standard control conditions.*

*EEC** - The Estimated Environmental Concentration represents the concentration of a substance in the aquatic environment when introduced under worst case scenario conditions, i.e. directly into the body of water. It is used to indicate possible risk, by comparison with the minimum concentration estimated to adversely affect aquatic organisms or to produce unacceptable concentrations in biota, water or sediment.*

The acceptable risk level for mercury is 0.9ppb (0.0009mg/kg or mg/l) for disposal on an H: H waste site. Mercury may only be disposed off on an H: h site if the concentration in the waste is less than 0.0009ppb ($9x10^{-6}$ mg/kg or mg/l) AND the mercy component is less than 1% of the total waste stream (Correspondence received from DWAF during July 2002).

Fluorescent tubes collected in large quantities are considered as extremely hazardous waste since they contain approximately 2mg/kg of mercury. The disposal of mercury in large quantities or bulk shall take place on a registered hazardous waste disposal site (Correspondence from DWAF dated? XX July 2002).

5. Eskom owned sites

The following is recommended within Eskom:

Bulk or large quantities of fluorescent tubes from large business premises or industries shall be disposed of at a registered hazardous waste site. All Eskom sites that produce bulk fluorescent tubes, should invest in a crushing facility as this contributes to waste minimization and is more economically viable, as the disposal of untreated whole tubes is a more expensive option. Please refer to **section 8** for further information relating to disposal and handling.

Smaller amounts of tubes can be stockpiled, for a period of no longer those 3 months, prior to being crushed at a central crushing facility, or disposed of whole at a registered hazardous waste disposal site.

PLEASE NOTE: It should be noted that DWAF is moving towards central collection points/bins, for residentially used fluorescent tubes. When full, these bins will be treated as bulk and disposed of accordingly.

6. Non Eskom sites (Leased buildings)

The building owner is responsible for the disposal of the used fluorescent tubes.

7. Disposal and handling of Fluorescent Tubes

Fluorescent tubes and lamp ballasts are found throughout the environment and can create hazardous waste because of the mercury content. Hazardous waste shall be handled either by a treatment, storage, disposal or recycling facility.

Service providers shall be credible and provide traceable procedure action/proving proper disposal of fluorescent waste.

7.1 Disposal Options

The following options are available for the disposal of fluorescent tubes:

7.1.1 Recycling of used tubes

Recyclers separate the tubes into their component materials such as glass, metal, phosphor powder and mercury, in order for these materials to be recycled or reused. Fluorescent tubes can be recycled to reclaim 80% glass and 15% aluminium and other metals. Unfortunately, due to the lack of mercury recovery facilities in South Africa, this re-utilisation of the mercury is not an option.

7.1.2 Incineration

Some industrial users have turned to incinerators as a disposal option. Due to the emission of mercury vapors over large areas as well as the spreading thereof, this is not recommended as an option for Eskom.

7.1.3 Crushing

Eskom has, at a number of sites, purchased tube-crushing units, which are operated to reduce the volume of hazardous waste and disposal costs. The crushed tubes are captured in a 210L-drum with a suitable lid and locking device. When the drum is full, the contents are

treated with an equivalent amount of sodium sulphide prior to disposal at a registered hazardous waste disposal site. This is the recommended option for use within Eskom.

7.2 Tube crushing Units/Facilities

The crushing of whole fluorescent tubes contributes towards waste minimization and is more economically viable, as the disposal of untreated whole tubes is much more expensive due to the increased volume of tubes to be disposed of. In order to contribute to waste minimization and ensure that the mercury is adequately immobilized, the preferred specifications for a tube crushing unit/facility include: a water spray to facilitate the rapid condensation of mercury vapors, thereby reducing the amount of hazardous mercury vapours produced; crushing units shall be situated in well-ventilated areas and personnel shall be equipped with the necessary safety equipment, including breathing apparatus; the crushed tubes shall be treated with an equivalent amount of sodium sulphide, to immobilise the mercury, prior to disposal at a registered hazardous waste disposal site.

Employees handling the disposal of used tubes and lamps shall have the proper equipment and training to comply with legislative requirements. Crushing activities shall be contained within a dedicated, demarcated area. Proper ventilation is required??. Appropriate breathing apparatus shall be worn at all times by the operator. Safety gloves shall be worn. Full-face protection shall be worn to protect any eye injury.

Typical crushing plant

Warning signs

8 Polychlorinated Biphenyls (PCBs)

Some fluorescent lamp ballasts may contain PCBs. PCBs are banned substances and include a family of man-made chemicals that contain 209 individual compounds. In fluorescent fixtures, PCBs were usually found in ballasts either within small capacitors or in the form of a black tar compound. Since 1979 PCBs have been banned from manufacture as evidence indicated that they accumulate in the environment and were detrimental to human health.

The following should be used to determine if ballasts contain PCBs: All ballasts manufactured before 1979 contain PCB. Ballasts manufactured after 1979 that do not contain PCBs are labeled “NO PCB”. If ballast is not labeled “NO PCB” assume it contains PCBs (Ballasts can operate for 20 years or more). Please refer to Annex C for further information relating to PCB’s:

ANNEX B: Safe Handling and disposal of Sulphur Hexafluoride Gas (SF6) and its by-products

Introduction

Sulphur hexafluoride (SF6) gas is widely used in switchgear installations as an insulating and arc-extinguishing (quenching) medium. The potential hazards associated with SF6 and its by-products are described in this standard. The SF6 by-products are XXXX.

Purpose

The purpose of this section is to communicate and ensure the safe handling and use of SF6 gas and/or its by-products.

Background

Sulphur Hexafluoride (SF6) is a colorless, odorless, non-flammable gas which is primarily used in the electrical and electronics industry as insulation in switchgear and circuit breakers and are commonly referred to as Gas Insulated Switchgear (GIS). SF6 has been identified as a greenhouse gas (under the 1997 Kyoto Protocol) which is 22,500 times more effective at trapping infra-red radiation than an equivalent amount of CO_2.

Health Effects

Pure sulphur hexafluoride is non-toxic. It can act as a simple asphyxiant by displacing the amount of oxygen in the air necessary to support life. Inhalation of 80% SF6 and 20% O_2 for five minutes can produce peripheral tingling, and some altered hearing. Inhalation of SF6 gaseous decomposition products on the other hand can lead to serious health complications.

The following are the hazards of the decomposition/by-products of SF6.

4.1 DiSulphur decafluoride (S_2F_{10}) is the most toxic but least understood product. It is odourless and non-irritating to the respiratory tract. It has a low melting point and is insoluble in water. It can be fatal at levels higher than 0.025ppm in air.

4.2 Thionyl fluoride (SOF_2) is soluble in hot and cold water to produce toxic corrosive vapours. The gas is irritating to the skin, eyes, mucous membranes and lungs.

4.3 Sulphuryl fluoride (SO_2F_2) is a colorless and odorless gas. It is soluble in cold water and reacts to emit toxic and corrosive vapors. It may act as a narcotic at high concentrations. Oral exposure may cause death or permanent injury.

4.4 Hydrogen fluoride (HF) is highly corrosive. Contact can cause severe burns to the eyes, skin and respiratory tract. It can penetrate the skin and destroy deep tissue layers as well as the bone.

4.5 Aluminium trifluoride (AlF_3) is a colorless, solid substance. It forms part of the white powder deposit. It causes irritation of the skin and eyes.

4.6 Hydrogen sulfide (H_2S) has an odor that is similar to that of rotten eggs. It can cause eye irritations at relatively low levels while at high concentrations it can be fatal.

4.7 Carbon tetrafluoride (CF_4) is a colorless, odorless and non-flammable gas. It is narcotic and can act as an asphyxiant.

4.8 Sulphur tetrafluoride (SF_4) is colorless gas with an odour similar to that of Sulphur dioxide. It is very toxic and deadly at concentration of over 0.1 ppm in air.

4.9 Sulphur dioxide (SO2) is a colorless, non-flammable gas with a strong suffocating odor. The gas is oxidised in water to form Sulphurous acid which can further be oxidised to Sulphuric acid. The gas is fatal at concentrations over 2ppm in air. It is also irritating to the eyes, skin and respiratory tract mainly because it is an acidic gas.

5 Requirements

5.1 A minimum of two (2) persons shall enter any affected area and they should be fully equipped with protective equipment. A third person, fully equipped with protective equipment, shall be on standby at the entrance of the area, for emergency rescue purposes.

5.2 Smoking, drinking and eating shall be prohibited in affected areas, since inhalation or ingestion of toxic by-products or decomposition products can occur. Avoid wiping eyes, nose or face other than with clean paper tissue.

5.3 The use of protective equipment, shall be compulsory.

5.4 Emergency showers and ablution facilities shall be provided at power stations and substations where an extensive GIS (Gas Insulated System) is employed, e.g. Croydon, Craighall, Drakensberg, Alpha, Beta, Invubu and Koeberg.

5.5 All SF6 (GIS) plants and storage areas shall have a clearly visible safety sign at the entrance by which the plant can be identified as an SF6 plant. Signs shall also be provided for:

- prohibiting smoking during maintenance work or emergencies;
- indicating location of protective equipment (respiratory protection);
- warning notices indicating that when plant fails or where maintenance work is being done on switchgear, that SF6 gas and its by-products are hazardous, and that protective equipment shall be used (e.g. spill, burn through, maintenance);
- the location of an emergency shower; and
- a notice stating that enclosed and lower situated areas shall be ventilated when emergencies occur.

5.6 All safety signs where applicable, shall comply with the requirements of SANS, 0140-Parts 1 and 2 and the colours shall comply with SANS 1091.

5.7 Inspection, handling, storage, transport, use and marking of SF6 metal containers

Sulphur hexafluoride (SF6), as a high-pressure liquifiable gas, is kept in Class 1 containers. Cylinders shall be inspected, handled, stored, transported and used in accordance with the requirements as set out in SABS 019.

6. Safe handling methods during emergencies

SF_6 leakage management procedure

In the event of a SF_6 Leakage,

- Evacuate the affected areas and report any incident to the Risk Manager of the unit/area immediately.
- Remove sources of heat and electrical arcing. Provide adequate ventilation by ventilating the area until air/oxygen levels is normal (18% volume O_2 minimum).
- Carry out air quality monitoring, with calibrated measuring equipment
- Emergency personnel must use self-contained breathing equipment when entering areas where leaks have occurred. Remove leaking containers or cylinders outdoors into an open area with good ventilation. Allow gas to discharge at a moderate rate.
- Defective cylinders shall be tagged as defective. Close valve after gas discharge.

Precautions during a major leak of SF_6 gas

- Sulphur hexafluoride is more than 5 times heavier than air; asphyxiation is a possibility in low-lying, confined spaces where this heavy gas can become concentrated and displace normal air. Enter these areas with appropriate caution.

- All persons entering the area shall wear self-contained breathing apparatus

7. SF_6 Disposal

7.1 Cylinder Marking

SF_6 cylinders are supplied to ESKOM by the gas suppliers such as Afrox, Fedgas (now operating as Messer) and Air Products with testing markings, volume and mass capacities and serial numbers stamped on the cylinder shoulders to indicate quality testing. Identifying colours are pink as well as green with silver shoulder cap.

7.2 Disposal of empty cylinders (B49-SABS 0140)

SF_6 cylinders are classified as Class 1 - Seamless steel containers. Only refilling with SF_6 gas is allowed. The re-use of cylinders for any gas other than SF_6 or any other purpose, is subject to the prior approval of the Department of Labour and compliance with the requirements of SABS 019. Cylinders should be returned to the supplier when empty.

7.3 Disposal of solid SF_6 by-products or decomposition products

The solid SF_6 by-products or decomposition products are treated with calcium chloride ($CaCl_2$ $6H_2O$) or sodium bicarbonate ($NaHCO_3$) to form a non-toxic end product.

7.4 Thermal destruction

Destruction of redundant SF6 cylinders may be done using thermal desorption. Only DEAT approved facilities shall be used for this activity.

8. References

TRMPVAES6 - Procedure for Topping Up SF_6 For Gas Insulated Switchgear (GIS)

TRMPVADX8 - Sprecher and Schuh Hgf 100 / 200 SF_6 Circuit Breakers Maintenance Manual

ANNEX C: POLYCHLORINATED BIPHENYL (PCB) MANAGEMENT

Introduction

Polychlorinated Biphenyls are synthetic liquids with exceptionally high chemical and thermal stability. PCBs were mainly utilised as substitutes for mineral oil in high-powered electrical equipment to enhance its thermal resistance. Their characteristics also rendered them non-biodegradable, bio-accumulative and Persistant Organic Pollutants (POPs) under the Stockholm Convention.

PCBs are found in equipment which were manufactured to "intentionally" contain them or by accidental mixtures with "un-contaminated" oils through processes such as oil filtration, top-ups, regeneration or oil replacement.

Purpose

The purpose of this section is to communicate a standard environmental approach to the safe handling, storage and disposal of polychlorinated biphenyl contaminated materials including oil, capacitors, soil, etc. by both Eskom and any contractor in fulfillment of the requirements set by Eskom (doc ref), the Department of Water Affairs & Forestry in the "Minimum Requirements for the Handling and Disposal of Hazardous Waste" and the Stockholm Convention on Persistent Organic Pollutants.

Background

PCB is the generic term for a broad class of fire-resistant synthetic insulating liquids. PCBs comprise of a family of 209 chemical compounds, commonly referred to as congeners, for which there are no known natural sources. PCBs are soluble in most organic solvents, but insoluble in water. It is denser than water. Most PCB mixtures are non-volatile at around 40^{o}C, with a flash point in excess of (three?) 300^{o}C.

PCBs were commercially produced as complex mixtures since 1929, but production ceased in 1976 when it became evident that PCBs were environmental contaminants. The sale and use of PCB has been banned in various countries from 1977. The Stockholm Convention on POPs – surely this is incomplete

Health Effects

A study on the health and environmental impacts of PCBs were undertaken by the United Nations Environmental Programme. The key findings of the UNEP study are summarized be.

Bio-accumulation of PCBs in organisms

- PCBs are easily absorbed through skin, inhalation, etc by humans and animals and remain in the fatty tissue, where they tend to accumulate. More than 90% of ingested PCBs cross the intestinal walls and are retained in the organisms. The organ favoured by PCBs is the liver, which stores PCBs.

Carcinogenicity of PCBs

- Epidemiological studies have shown no significant increase in the incidence of cancer among individuals exposed to PCBs. Skin cancer, liver tumors and leukemia have been attested; however scientific analyses have failed to establish a link between increased skin and pancreatic cancer rates and occupational exposure of the victims to PCBs.
- The International Agency for Research on Cancer (IARC), which is part of the World Health Organisation (WHO), measures the carcinogenic risk of various chemicals and classifies them in two groups:

- Those which are “carcinogenic to humans” – group 1;
- Those which are “potentially carcinogenic to humans” – group 2.
- Group 2 is further subdivided into groups A and B:
  - For group 2A, evidence of carcinogenicity is “fairly well established”;
  - For group 2B, evidence is less well established”.
- PCBs are classified as group 2B.
- The airborne limit of permissible exposure is 1 mg/m^3 (42% chlorine) and 0.5 mg/m^3 (54% chlorine) over eight hours of exposure.

Requirements

4.1 PCB Classification

4.1.1 Mineral insulating oils tested for the presence of PCB shall be classified according to the PCBs content of the oil.

4.1.2 The oil shall be classified as one of the levels in table 1.

Table 1– Classification of mineral insulating oils

1	2
PCB content levels mg/kg (ppm)	Levels
Undetectable	0
0-10	1
11-20	2
21-50	3
51-500	4
>500	5

4.1.3 Any equipment or items (capacitors, transformers, etc.) that are sealed and intentionally filled with PCBs where the PCB concentration is unknown shall be handled and managed as PCB level 5.

4.2 PCB Labelling

4.2.1 Equipment or any other containers that contain or come into contact with mineral insulating oils classified in accordance with table 1 shall be labeled in visible indelible markings in accordance with section XXX of the SANS 290: Mineral insulating oils – Management and Handling of Polychlorinated Biphenyl (PCB)

4.2.2 In the case of it being established that sealed equipment is PCB contaminated, equipment with the same /similar risk profile shall be labeled and handled as PCB contaminated.

4.2.3 The labels shall be identical in appearance and dimensions, for each particular PCB level, to those in Annex C of SANS 0290: Mineral insulating oils – Management and Handling of Polychlorinated Biphenyl (PCB).

4.2.4 In addition to the labeling required, information pertaining to the disposal of PCBs, and the maintenance and use of equipment that contains PCBs shall be available.

PCB Storage and Transportation

A designated area or facility shall be established in a designated area for the temporary storage of PCB contaminated and PCB electrical equipment / insulating oil designated for disposal. This temporary storage shall be properly secured and marked in accordance with the national requirement as detailed in section 2 of DWAF's Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste.

Disposal Options

Disposal will only be undertaken by DEAT approved and registered disposal or decontamination contractors.

PCB contaminated materials > 500 parts per million (ppm) will NOT undergo decontamination - (this will typically be found in Capacitor cans and are commonly referred to as Askarel). These materials will undergo destruction at a DEAT registered thermal destruction facility and will not be land filled in its PCB state.

Oil removed from service for purposes of disposal, shall be placed in approved drums for placement in DWAF approved storage area. The PCB levels in each individual drum shall be determined and the drums shall be labeled accordingly. Drums of oil containing PCB > 50 ppm but < 300 ppm shall be disposed of by means of decontamination. In order to phase PCB contaminated oil out of the Eskom insulating oil pool, the following action will be taken:

- Equipment containing insulating oil with a PCB count in excess of 500 ppm will be drained and the oil replaced with non-PCB certified regenerated oil.
- Equipment containing insulating oil with a PCB count between 50 – 499 ppm, undergoing repairs or treatment, will be re-filled with non-PCB certified regenerated oil.
- Equipment containing insulating oil with a PCB count of between 20 – 49, undergoing repairs on site may be re-filled with the same oil following regeneration treatment.
- Insulating oil containing PCB between 20 – 49ppm, leaving a site will be decontaminated and re-used by informed users. This oil may be scrapped if the user/owner feels that other reasons or contaminants render it to be scrapped.

The decontaminated oil will only be used by informed users.

References

SANS 290: 200X Edition 1: Mineral insulating oils – Management and Handling of Polychlorinated Biphenyl (PCB)

This standard covers the requirement, classification, labeling, handling, storage, transportation, decontaminination and disposal of PCB contaminated oil. It also covers management provisions for the phase-out of the use of PCB contaminated mineral insulation oils.

NRS 081 (draft):2004 Polychlorinated biphenyls - Phase-out plan for inhibited and uninhibited insulating oils

This is a guideline document relative to the disposal and ultimately the phase-out of PCB and items containing PCBs in accordance with the relevant statutory requirements / framework

These documents will become the standard for PCB management. The Existing Eskom policy and procedure will remain in force until the NRS and SANS documents are formalized

ANNEX D: OIL MANAGEMENT

1. Introduction

Insulating oil originates as a fossil fuel (crude oil) and may be classified as Napthenic, Parrafenic or Aromatic depending upon relative proportions of these compounds. Eskom has standardised on the use of uninhibited Napthenic insulating oil in the electrical equipment. This oil is also often referred to as a mineral oil.

Insulating oil, as well as other related hydrocarbon compounds poses a serious pollution problem once released into the environment. Not only do these compounds pose a fire hazard, but with 1L of oil having the potential to contaminate in excess of a million litres of water, it needs to be handled with care. Oil may rapidly penetrate certain soil types, which may lead to extensive environmental as well as groundwater and surface water contamination

2. Purpose

Numerous factors such as unscrupulous oil handlers, processes, pricing decisions, definition and terminology of insulating oil as well as inappropriate handling resulted in the contamination of Eskom's oil pool. This will have an adverse effect on the expected life of the equipment. The purpose of this section is to communicate and ensure the correct handling, storage, transportation and disposal of mineral insulating (transformer) oil.

3. Background

Due to the strategic nature that insulating oil plays in Eskom equipment, aspects such as usage, handling, storage, transport and general control of this commodity needs to be carefully managed. Macro political factors necessitated Eskom to purchase and maintain large volumes of oil as strategic stock. The issuing and receiving of all used and regenerated oil was managed centrally. This management system was effective. However, due to the ever changing business needs, the opening of world markets to South Africa and the influx of oil operators these processes were modified to ensure the desired quality.

4. Health Effects

Toxicological Information for mineral transformer oils is as follows:

4.1 Inhalation

Only at elevated temperatures excessive concentrations may cause nervous system depression, headache and weakness leading to unconsciousness.

4.2 Skin Contact

Prolonged or repeated contact may cause skin to become dry or cracked.

4.3 Eye Contact

Causes eye irritation

4.4 Ingestion

Swallowing this material may result in health hazard (pneumonia due to aspiration)

Exposure control against the above occurrence can be prevented through the use of appropriate Personal Protective Equipment. Refer to NRS 079-2, appendix 1 for the full material safety data sheet for transformer oil.

5. Requirements

As listed in the NRS079-2 document entitled: Mineral insulating oils (uninhibited) – Purchase, management, maintenance, testing and safe disposal.

6. Disposal Options

It is in Eskom's best interest to salvage the insulating oil for re-utilisation. Factors such as unscrupulous oil handlers, processes, pricing decisions, etc resulted in the contamination of Eskom's oil pool. These factors necessitate that the disposal of insulating oil be managed in a correct and controlled manner. The disposal of mineral oil is governed by the following factors:

6.1 PCB contamination levels

Oil leaving the equipment, and that has not previously been tested for PCB, must be tested for PCB.

- Pure PCB, as well as redundant PCB equipment, must be disposed off.

6.2 Acid content

All used insulating oil removed from equipment, including all switchgear oil, with/has?? an acidity level of 0.2 mg KOH/g oil.

6.3 Synthetic fluid and other solvent contamination

All insulating oil removed from any electrical equipment for inclusion in the Eskom oil pool, will be tested for presence of contaminants such as solvents and synthetic oils including electrical cleaner, silicone oil and motor oils.

6.4 Levels of metal, carbon and particulate contamination

All used oil not suitable for regeneration will be sold as scrap oil to be used as fuel oil. This includes oil removed from electrical equipment, with an acidity of greater than 0.2mg KOH/g oil and/or the presence of contaminants such as synthetic fluids and PCB.

NOTE: The above will be determined by means of analysis

6.5 DISPOSAL METHODS

Disposal of insulating oil will be handled by Eskom's Assets Disposal section.

- PCB contaminated and PCB oil will be disposed off as per the criteria set in Appendix WC of this document. The asset owner will be liable for the costs incurred for the destruction.
- Scrap oil will be sold on the open market as a burning fuel and not as insulating oil. This is to prevent the oil from entering the system via the backdoor.

NOTE: Re-usable oil should always be retained for re-use in Eskom.

7. References

- The Eskom Insulating Oil Manual: http://teknowrep.eskom.co.za/Ins_Oil_Manual/Default.htm
- NRS 079-2: Mineral insulating oils (uninhibited) – Purchase, management, maintenance, testing and safe disposal.

OIL SPILL CATEGORIES

Model oil spill assessment table

Using your judgement and the facts available, allocate the relevant points (1, 3 or 5) to each of the following and add them together. The cumulative score will dictate the appropriate corrective action.

Condition	**1**		**3**		**5**	
Source of the spill	Weep		Drip/Leak		Explosion/Incident	
Age of spill	Historic		Happened recently - spill still moist		Happened within last 24 h	
Threat to any waterbody	No threat		Threat with rain		Access to waterway	
Containment	Leak is minor – can be controlled, contained and plugged with oil spill kit		Leak is moderate – cannot be successfully managed with spill kit.		Leak is serious, containment is impossible	
Life threatening Conditions	Not at all		Moderate (Environmental or health risk only)		Serious (Explosion, fire, health and major environmental)	
Weather conditions	Good weather and will last until spill is cleared		Moderate, but may change suddenly to weather conditions which will hamper containment		Raining	
Properties affected	None		On-site (Only Eskom's property is affected)		Off-site (Eskom's neighbouring properties and public roads) ≥25 points	
Public relations threat	Small		Medium		Large	
Soil types	Clay or compacted ground		Loose or loam soil		Sandy soil and Gravel	
Traffic implications	Not on any road		Public road		Road closed	
PCB presence*	None		Less than 50 ppm in the oil		Over 50 ppm in the oil will automatically get ≥25 points	
Total score	Sub total		Sub total		Sub total	

Minor spill ≤ 12 points	Moderate spill 13 – 24 points	Major spill ≥ 25 points
Clean-up must be performed and a report issued to the relevant Environmental co-ordinator	Contain and call in the assistance of the Environmental co-ordinator	Contain, call on Environmental co-ordinator who will assess the situation and if needed call upon an emergency response team

*If the PCB levels of the oil are not known through prior testing, the spill shall be treated as a PCB spill, until such time that analysis proves otherwise. Signature _____Name _____ __Date _____Site_____

ANNEX E: ASBESTOS MANAGEMENT

Introduction:

This annexure only deals with disposal of asbestos and asbestos containing materials, equipment and articles. For more information on general management of asbestos, safe processing, storing, removing and handling of asbestos containing materials, equipment and articles, an Eskom procedure (ESKPVAAG5) is available.

Disposal Options

All asbestos and asbestos containing material shall be disposed of only in registered waste disposal sites specifically designated for this purpose in terms of the Environment Conservation Act, 73 of 1989. Where such a registered site for the purpose of asbestos dumping is not locally available, the employer must apply in writing to the Department of Water Affairs and Forestry prior to negotiating with any site owner.

Only after a suitable site has been allocated by the Department of Water Affairs and Forestry the detailed arrangements for asbestos disposal shall be agreed upon with the appropriate site owner.

Asbestos containing waste shall be deposited in such a manner as to minimize dust dispersal as well as the need for further disturbance of the waste. The permit conditions for each site shall be adhered to. The waste should be covered with at least 200mm of topsoil or sand or other suitable material capable of forming a seal to prevent the dispersal of dust. No asbestos waste should be left uncovered at the end of a workday.

All used air filters from vacuum cleaners, air-conditioners and ventilation equipment must be stored in impermeable bags or similarly effective containers. These containers must be sealable for disposal (the outside of all containers shall be cleaned before leaving the workplace).

Liquids or sludge containing asbestos shall be collected in collecting-tanks from where it may be pumped into sealable drums or closed type tankers for transit to the waste disposal site. Transport and disposal must take place in such a way that there is no risk of the material drying out before it has been disposed of and covered as provided for in (3) above.

High-density materials such as asbestos cement products and sheets containing asbestos are not likely to release asbestos dust when handled by hand. However, a hazard may arise if the waste is subjected to pounding by vehicles passing over it, or tipping from the vehicles, therefore these should also be covered.

The employer concerned with the collection, transport and disposal of asbestos waste is responsible for complying with the provisions of the Occupational Health and Safety act, 1993, and the regulations.

References:

ESKPVAAG5: Requirements for the Safe Processing, Storing, Removing and Handling of Asbestos and asbestos containing materials, equipments and articles,

ANNEX F: HEALTH CARE RISK WASTE

Introduction

This section should be followed for Health Care Risk Waste (medical waste) management in order to comply with National Management Act 107 of 1998 and the Bill of Rights Act 108 of 1996.

Purpose

The purpose is as follows:

a) To ensure safe collection. handling, storage and disposal of all medical waste generated by the Health Services (clinics) within ESKOM.

b) To minimize the occupational health risks associated with handling and disposal of health care waste

c) To ensure compliance on all national, provincial and municipal regulations and legislation

d) To describe the criteria for segregation, collection, handling, storage and disposal.

Background

Health Effects

Requirements

Disposal Options

References

- THRPV0218: Disposal of Medical Waste Simmerpan Occupational Health Care
- DISPVAEV9: Medical Waste Management
- SABS 0248: 1993

ANNEX G: Metals

Introduction

Purpose

Background

Health Effects

Requirements

Disposal Options

All disposals of Eskom assets will be in compliance with the commercial policies and procedures applicable, where the approved Delegated Authority has approved the process. The sale of an Eskom asset should never be performed by the asset owner.

1.1 Non-Ferrous metal (Copper, Aluminium etc.)

All disposals, without exception of this commodity, must be done through the current Distribution National Contract (DNC) for the disposal of non-ferrous metal. The following service is provided in the DNC, with the proviso that a Business Unit may opt to deliver the material to the contract holder:

- Collection from stores;
- Collection from Sub Stations and constructions camps;
- Dismantling of disused lines;
- Collections from reconductoring projects.

These disposal services are approved by the Eskom Management Board Procurement Committee at contract award, and overseen by the manager responsible for Eskom's Distribution Group's Commercial Function.

1.2 Waste paper

Eskom's commitment to the preservation of the environment will be reflected in environmentally-friendly processes being used.

As waste paper can be recycled, local annual contracts will be established for each Eskom building. These will be flexible and adapted to suit each specific requirement. Assets Disposal or Procurement may establish these contracts and obtain the necessary approval.

1.3 Scrap steel etc. (Ferrous metal)

To maximize the return for Eskom's scrap returned to stores, and to make the disposal process of these commodities simple, local or regional annual contracts will be established covering all stores and workshops. To improve the monetary return of the sale, it is suggested that some form of sorting into the different commodities is performed, e g.:

- Steel sub grade;
- Steel Heavy grade;
- CT's VT's and switchgear (Current Transformers, Voltage Transformers);
- Plastic and PVC;
- **Wood / general cleanup.**

The tender method will be used as the process to establish such a contract and to obtain the necessary approval.

References

ANNEX H: Cartridge recycling:

Introduction

Recycling is a series of activities that includes collecting recyclable materials that would otherwise be considered waste, sorting and processing recyclables into raw materials such as fibers, and manufacturing raw materials into new products.

Purpose

The objective of Eskom's cartridge recycling component of the waste management strategy is to develop a realistic and practical approach towards a culture of recycling, and compliance with prospective legislation.

Background

In the 2001 Polokwane Declaration set objectives and goals wrt waste management. The recycling component of the declaration states that the recycling of waste is to be increased and extended. Furthermore the declaration reaffirms Sourth Africa's commitment to the Integrated Pollution and Waste Management Policy, the National Waste Management Strategy and the principles of waste minimization, reuse, and recycling for sustainable development.

The recycling component of the national waste management indicates the following:-

- in the pilot areas new waste streams will be identified,
- existing initiatives will be expanded and improved, and
- new initiatives will be implemented
- appropriate mechanisms will be identified and developed that promote sustainable recycling by all members of the recycling chain.
- appropriate mechanisms for recycling within specific circumstances will be based on an appraisal of the social, environmental and economic benefits and costs of recycling in comparison with one-way consumption and disposal.

Health & Environmental Effects

The ink within the cartridge has certain health effects. The potential routes of overexposure are via the skin as well as eye contact. Inhalation of vapor and ingestion are not expected to be significant routes of exposure for this product under normal use conditions. Acute health hazards occur if the product (ink) is ingested. It may cause kidney and liver damage, and it could depress the central nervous system.

Some kinds of toner dust contain hazardous materials. Inkjet inks can also contain a range of chemicals that are harmful to the environment. These materials pose no threat while they are contained within the cartridge. However, these pollutants can escape when cartridges are pulled apart in poorly managed refilling or recycling operations or when dumped cartridges start to deteriorate in landfill. Toner dust is also extremely fine (5 – 15 microns), so it can easily leach from landfill into nearby waterways, ground water and ultimately the oceans.

Requirements

Divisions are encouraged to perform the following:-

- set up targets for printer cartridge recycling
- to initiate contracts for printer cartridge recycling
- to monitor the progress wrt to the recycling

Disposal Options

A cartridge can be disposed off as solid waste after having completed its life cycle as a consumer item, but otherwise should be refurbished for reuse (remanufactured, restored, renovated, repaired, or recharged). Refurbishing a cartridge is defined as disassembling the cartridge, cleaning it, changing parts if needed and refilling it with toner.

References

http://www.hp.com/hpinfo/globalcitizenship/environment/productdata/pdf/ij_c9434a_eng_v1.pdf

http://www.hp.com/hpinfo/globalcitizenship/environment/productdata/pdf/sp_51600coriginal_eng_v1.pdf

http://www.nwmsi.co.za

http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

ANNEX I: E-Waste

Introduction

Management of Waste emanating from electrical equipment and components has been well recognised—recycling and resource recovery that it has to be environmentally acceptable. The RSA-Swiss e-waste assessment has confirmed possible environmental impacts associated with the recycling of computer waste, however, further assessment needs to be carried out on a national level covering, other components of the Waste Electrical and Electronic Equipment (WEEE) stream. It is thus envisaged that the management of this waste stream will be a legislative requirement in future. Industry is thus expected to do an inventory of this waste stream to fulfill the requirements of future legislation. A strategy to meet these requirements is to:

1 Extend the scope of the assessment to cover other components of WEEE

2 Assess their present WEEE handling in industry i.e. collection, repair/refurbish, dismantle, recover and disposal practices and their environmental and health impacts.

3 The data collected (including past, current and future quantities of equipment) shall be recorded as the WEEE element in the National Waste Information System (WIS).

Purpose

The purpose of this document is to encourage the organisation in being proactive in managing waste emanating from its electrical and electronic equipment. This waste stream is commonly referred to as E-waste, with recycling being the environmentally acceptable strategy in managing this waste. Precious metals such as gold and platinum group metals; copper and aluminium being the materials recycled. Industrial recyclers doing all the recycling

Background

In South Africa, any electronic and electrical waste that is recycled is firstly dismantled and manually sorted into its various fractions which include printed circuit boards (PCBs), cathode ray tubes (CRTs), cables, plastic components, precious metals, strategic metals and base metals (ferrous and non-ferrous), condensers and other, nowadays invaluable materials like batteries, LCDs and even wood.

The valuable fractions are processed further by the large recyclers treated in refining and conditioning processes. The different e-waste fractions are processed to directly reusable components and to secondary raw materials in a variety of refining and conditioning processes.

Solid waste is deposited in a municipal landfill. Systematic gas and leachate collecting systems are installed on sites permitted in accordance with the Minimum Requirements for Waste Disposal by Landfill as administered by the Department of Water Affairs & Forestry; hence significant emissions to water and air are controlled. Informal salvaging is discouraged in accordance with government's directives. Very little e-waste is recovered from permitted landfills in South Africa. It is only in the major centres that e-wastes are produced in significant quantities and nearly all the landfill sites managed in these areas have been permitted.

Health Effects

Electrical and electronic equipment are made up of a multitude of components, which contain toxic substances, e.g. carcinogens such as lead and arsenic. The recycling processes and disposal of these components, while being a lucrative business proposition for some, poses serious health risks and environment dangers. The formation or discharge of hazardous emissions during the recycling of electrical and electronic equipment depends highly on the handling of electronic waste. Hence hazardous substances contained in computers and televisions do not lead automatically to a risk for the environment and the human health. Some recycling processes applied in transition and developing countries can cause serious health problems and contaminate air, water and soil.

Requirements

Key legislation and processes relevant to waste management activities in South Africa have been identified and are briefly outlined below.

The National Environmental Management Act (Act 107 of 1998) (NEMA) is intended to provide the principal framework for integrating good environmental management into all development activities NEMA makes provision for waste management through the principles that refer to avoidance or minimisation and remediation of pollution, including waste reduction, re-use, recycling and proper waste disposal, and the "polluter pays" and "cradle to grave" principles.

Minimum Requirements for the handling, classification and disposal of hazardous waste provides guidelines on collection and storage. A generator who treats, stores for a period exceeding 90 days, or disposes of hazardous waste on site is subject to section 20(1) of the **Environmental Conservation Act** and must apply for a permit for a waste disposal facility from the department.

The Municipal Services Act (Act 32 of 2000) provides the principles and mechanisms to achieve effective governance at the local level, and includes implications for the environmental management function exercised by local government (which includes waste management).

The Hazardous Substances Act: Act No. 15 of 1973 provides the regulations to control the management of hazardous substances and the disposal of hazardous waste.

However, at present, in South Africa, there is no specific legislation regarding the handling or recycling of e-waste.

ANNEX J: Waste Reporting Requirements

Waste Management reporting to be done in accordance with ESKPVABX8, Environmental Liaison Committee Performance Indicator Reporting Procedure, Annex K.

Each Division within Eskom shall develop an internal reporting system, which shall comply with the WIS system requirements. Divisions shall report the following additional figures on a six monthly basis from 2001 onwards:

- Kilograms of SF_6 disposed of (purchased)
- Kilograms of medical waste disposed of
- No of 200L drums of compacted fluorescent tubes disposed of no drum
- Tons of domestic waste disposed of
- Tons of building rubble disposed of (if used as a fill, it shall be reported under “Other category” under point E of the above table).