

15. Environmental Management

15.1 Overview

Section 15 summarises the framework for managing the environmental risks associated with the development and operation of the proposed WtE facility. It particularly focuses on the management of risks that may occur during non-routine operations such as during maintenance, failure of individual process components or during emergency shutdown.

REA is committed to the development of an Environmental Management System (EMS) consistent with the ISO 14001 framework and it will be this system which will form the basis for environmental management of the site during construction, commissioning, steady state operations and non-routine operations. The EMS will be developed during the detailed design phase. This Section therefore addresses the scope of the EMS and outlines the various management procedures and design features which minimise the risks of emissions during non-routine conditions.

This Section should be read in conjunction with Section 5 – Risk Assessment and Appendix 4 which reviews the risks and identifies a number of risks that will be addressed in the EMS and the various specific management plans associated with the EMS.

15.2 EPA Requirements

The Works Approval Application Guideline (Publication 1658) requires an assessment of the WtE facility on emissions in the context of “*upset or non-routine operation conditions (eg. power failure, loss of gas or water supply, equipment failures, accidents, leaks, spills and releases)* and sufficient detail on “*precaution measures to prevent or minimise unexpected environmental impacts*”.

15.3 Non-Routine Operations and Emergency Management

The environmental risk assessment identified a number of potential risks to the environment which could occur during upset or non-routine conditions. The risk assessment is summarised in Section 5 and detailed in Appendix 4. Other sections of the Works Approval Application provide further detail on various pertinent aspects of the WtE facility. Section 6 describes the mechanisms, management and equipment incorporated into the facility design to minimise environmental impacts, Section 8 describes the impacts on greenhouse gas emissions and Section 10 and Section 11 describe the modelled impacts of air emissions and noise respectively.

15.3.1 Risk Assessment of Non-Routine Operations

A number of risks rated medium were identified associated with non-routine shutdown and emergency shutdown (Section 5.4 and Appendix 4). These were associated with equipment failure and power outages and have been summarised in Table 15-1. These were predicted to have a potential to decrease ambient air quality and consequent potential to be associated with health impacts for employees and neighbouring receptors.

Table 15-1 outlines the major risks and summarises the design and operational interventions which reduce the risk level to moderate. The modular multi-gasifier design and multiple processing lines characteristic of the proposed system have a number of advantages over single furnace thermal production facilities. These include:

- Each gasifier can be isolated from the production process should issues develop. This circumstance provides a risk mitigation measure during upset or emergency conditions and allows greater control of emissions during these conditions;

- Each processing train which includes the chemical oxidation chamber, heat recovery boiler and flue gas treatment system can be isolated and shut down during upset conditions or during an emergency whilst keeping the remainder of the plant operating. This allows management of each emission stream and provides an emissions risk mitigation measure not available to single line thermal operation facilities;
- Every piece of major equipment in each processing train is individually monitored in real-time so that each process can be discretely optimised by its own control systems providing for the rapid rectification of any out-of-specification activity or, if required, shutoff and diversion to an alternate process line

A range of design and operational systems have been included to minimise the potential impacts of upset or non-routine operations. These include:

- Continuous Emission Monitoring System (CEMS) Installed and Calibrated;
- Backup CEMS installed and maintained live to allow immediate utilisation in case of primary CEMS outage or when maintenance and/or upgrades of the primary CEMS are in progress;
- Operational Control System and feedback Systems to ensure appropriate temperatures, air supply and gas mixtures;
- Emission Control Systems including alkali flue gas scrubbing, injection of powdered activated carbon, particulate recovery in filter bag house;
- Installation of SNCR system for the control of NO_x should these gases fall outside operational specifications;
- Sequential start-up and shutdown procedures which ensures the emission control systems are the first and last systems on line and off line;
- Backup generator to provide emergency power to ensure all emission control systems and monitoring continue to operate under emergency conditions;
- Design Controls detailed in the Preliminary Hazard and Safety Assessment and as design proceeds in a detailed HAZOP Study;
- Storage of materials compliant with appropriate codes of practice and regulations;
- Fire control systems installed;
- Development and Implementation of Environmental Management Plan;
- Development and Implementation of Commissioning Start-up and shutdown Procedure;
- Development of an Emergency Management Plan;
- Continuous mixing of MSW in waste pit to ensure an even compositional supply to the gasifiers ;
- Air quality testing of stack emissions compliant with IED monitoring requirements;
- Maintenance schedule for all equipment;
- Regular calibration of monitoring equipment;
- Appropriate training of operations staff;
- Noise monitored by site personnel.

Action	Event/result	Potential Impact	Primary Risk Level				Design Control Measure	Operational Management Measure	Residual Risk Level			
			Consequence	value (column ref)	Likelihood	Risk			Consequence	Value	Likelihood	Risk
Aspect: Air quality												
<p><u>Commissioning of the MWSZE Plant:</u> <i>Incomplete gasification of MSW and incomplete combustion of syngas, operator error, Issues with start-up and shut-down, CEMS out of calibration, Operator error</i></p>	Stack emissions from processing MSW	Decrease in ambient air quality for employees and neighbouring receptors. Potential health impacts for employees	Moderate	3	Possible	High	<p>Continuous Emission Monitoring System Installed and Calibrated. Emissions control system started before operations and run after any operation cease; Operational Control System and feedback Systems to ensure appropriate temperatures, air supply and gas mixtures. Emission Control Systems including alkali flue gas scrubbing, injection of powdered activated carbon, particulate recovery in filter bag house. Can shut down individual gasifiers or process lines should out of specification conditions persist.</p>	<p>Development and Implementation of Commissioning Startup Procedure. Continuous mixing of MSW in Bunker. Air quality testing of stack emissions Maintenance schedule for all equipment. Regular calibration of monitoring equipment. Appropriate training of operations staff. Environment Management Plan Implemented.</p>	Moderate	2	Unlikely	Moderate
<p><u>Operation of the MWSZE Plant:</u> <i>Incomplete gasification of MSW and incomplete combustion of syngas, Operator Error, CEMS out of calibration</i></p>	Stack emissions from processing MSW	Decrease in ambient air quality for employees and neighbouring receptors. Potential health impacts for employees	Moderate	3	Possible	High	<p>Continuous Emission Monitoring System Installed and Calibrated. Emissions control system started before operations and run after any operation cease; Operational Control System and feedback Systems to ensure appropriate temperatures, air supply and gas mixtures. Emission Control Systems including alkali flue gas scrubbing, injection of powdered activated carbon, particulate recovery in filter bag house. Can shut down individual gasifiers or process lines should out of specification conditions persist.</p>	<p>Development and Implementation of Environmental Management Plan. Continuous mixing of MSW in Bunker. Air quality testing of stack emissions Maintenance schedule for all equipment. Regular calibration of monitoring equipment. Appropriate training of operations staff.</p>	Moderate	2	Unlikely	Moderate
<p><u>Operation of the MWSZE Plant:</u> <i>Emergency Shutdown due to equipment failure (eg, power system shutdown, flue gas treatment failure eg, bag house failure)</i></p>	Stack emissions from processing MSW	Decrease in ambient air quality for employees and neighbouring receptors. Potential health impacts for employees	Moderate	3	Possible	High	<p>Backup power system to provide emergency power. Design Controls detailed in HAZOP Study. Online monitoring and feedback loops. Can shut individual process lines while keeping remainder of facility operating;</p>	<p>Emergency Management Plan. Maintenance schedule for all equipment. Regular calibration of monitoring equipment. Appropriate training of operations staff.</p>	Moderate	2	Unlikely	Moderate

Table 15-1: Risk Assessment for Non-Routine and Emergency Stoppage

Action	Event/result	Potential Impact	Primary Risk Level				Design Control Measure	Operational Management Measure	Residual Risk Level			
			Consequence	value (column ref)	Likelihood	Risk			Consequence	Value	Likelihood	Risk
Aspect: Noise												
<p><u>Operation of the MWS2E Plant:</u> Non-routine plant shutdown- Power Trip, Boiler Trip, Turbine Trip - release of high pressure steam (+120 dBA)</p>	Noise generation from equipment	Disturbance to neighbours. Hearing Impacts on employees.	Moderate	3	Possible	High	Enclosure of all major components of MSW2E system in buildings. Equipment selection to minimise noise. Orientate safety relief valves away from nearest sensitive receptors.	Noise modelling conducted to ensure levels below Guideline at nearest receptors. Development and Implementation of Environmental Management Plan , Noise monitored by site manager. Regular scheduled maintenance for all equipment. Operating Procedures and Emergency Shutdown Procedures.	Moderate	3	Unlikely	Moderate

Table 15-1: Risk Assessment for Non-Routine and Emergency Stoppage continued

15.4 Hazard Analysis

15.4.1 Preliminary Hazards Analysis

A preliminary hazard and safety assessment has been completed which details the major hazards, operation controls and personnel safety measures incorporated into the plant design (Appendix 19). The main risks have been summarised in Table 15-2 which also details the management and operational aspects that will be put in place to minimise the risks. This assessment includes evaluation of each of the major process components: the MSW Supply, Bunker and Crane Feed System, Gasifier and Syngas Combustion Chamber, Boiler System, Steam Turbine System; Flue Gas Treatment System and the Compressed Air System.

Preliminary Hazard and Safety Assessment						
Activity: MSW Supply, Bunker and Crane Feed System Operation						
HAZARD	HAZARD EFFECT	SEVERITY	PROBABILITY	RISK	MINIMISE RISK BY	RESIDUAL RISK
Generation of odourous gases in MSW feed pit	Odour escape impacts on amenity of site, health of personnel and possibly impacts on neighbours	High	Possible	High	Tipping area and pit within a building, building under negative pressure as air drawn to gasifier, fast acting doors, Installed deodouriser, 6 gasifiers and 3 processing trains means it is unlikely that all systems suffer an outage together so negative pressure maintained, in unlikely case of all gasifiers and trains down draft fan will still operate to induce a negative pressure in waste pit, in case of total electrical outage backup generator will operate emergency systems and draft fan.	Medium
Generation of hazardous gases in MSW feed pit	Methane is a Class A combustible gas which can mix with air to form an explosive mixture injuries to personnel	High	Possible	High	Air drawn from pit to gasifier creating a negative pressure in pit area, methane concentration detection alarm, 6 gasifiers and 3 processing trains which can all be operated independently which means it is unlikely that whole system would suffer an outage simultaneously so negative pressure maintained in waste pit area, even in case where all gasifiers down then draft fan can still draw air to continue negative pressure, Pit treated as closed space and work on tank requires permitting and appropriate PPE	Medium
Leakage of hazardous gases from leachate collection tank	Methane is a Class A combustible gas which can mix with air to form an explosive mixture injuries to personnel	High	Possible	High	Leachate collection tank is capped with forced ventilation to gasifier causing negative pressure in air space in tank, tank treated as closed space and work	Medium
HAZARD	HAZARD EFFECT	SEVERITY	PROBABILITY	RISK	MINIMISE RISK BY	RESIDUAL RISK
Activity: Gasifier and Secondary Combustion Chamber						
Leakage of hazardous gases from Gasifier	If syngas escaped gasifier could cause fire or explosion - result in injuries to personnel. Other gases could impact on health of employees and possible on neighbours.	High	Low	High	Water seals, step feeder and choke feed system to gasifier prevent the escape of syngas,	Medium
Overpressure, over temperature in gasifier	Explosion risk in gasifier - injury to personnel	High	Low	High	Alarms installed to indicate pressure and temperature in gasifier, feedback loops to control room, pressure and temperature controlled by adjusting air volume into furnace, individual gasifiers easily shut down.	Medium
HAZARD	HAZARD EFFECT	SEVERITY	PROBABILITY	RISK	MINIMISE RISK BY	RESIDUAL RISK
Activity: Boiler System						
Overpressure, over temperature in boiler	Explosion risk - injury to personnel	High	Low	High	Temperature and pressure monitoring with interlocks on boiler feed water increasing and decreasing water as appropriate to adjust temperature. Water levels are controlled by three feedback loops -drum, feed water flow and superheater steam flow. Water supply is automatically adjusted by feedback loops. Pressure monitoring is installed on the drum and safety valve on the outlet of the boiler and superheater. Any of the 3 processing lines can be shut down independently.	Medium
Steam leakage from steam pipes	Burns to employees or contractors	High	Possible	High	Scheduled maintenance system operates, Appropriate training for employees and contractors, permit to work systems in place,	Medium

Table 15-2: Preliminary Hazard Analysis – Risks Greater than Medium Delineated.

Activity: Steam Turbine System and Air Cooling Island							
NO.	HAZARD	HAZARD EFFECT	SEVERITY	PROBABILITY	RISK	MINIMISE RISK BY	RESIDUAL RISK
1	Steam leakage from steam pipes	Burns to employees or contractors	High	Possible	High	Scheduled maintenance system operates, Appropriate training for employees and contractors, permit to work systems in place,	Medium
2	Contact between turbine oil and superheated steam	Fire causing injury to personnel and damage to facility	High	Possible	High	Steam turbine lubricating oil piping is placed below high temperature steam pipe, protective covers	Medium
3	Rotating equipment	Injury to employees or contractors.	Medium	Possible	Medium	Protective covers on equipment to prevent mechanical injury, Appropriate PPE worn by Operators and contractors	Low
4	Electrocution	Injury to employees or contractors.	High	Possible	High	All electrical equipment is installed to appropriate standards, includes appropriate grounding protection, leakage protection and appropriate insulation.	Medium
5	Noise from turbines	Auditory impacts to employees or contractors.	Medium	Possible	Medium	Turbines are enclosed within sound proofed building, operators and contractors working on or near equipment use appropriate PPE	Low
Activity: Flue Gas Treatment System							
1	Alkali dust from loading and use of lime from lime silo	Impacts respiratory system of employees or contractors	Medium	Possible	Medium	Lime bin includes a dust removal devise, operators transferring lime into silo or working near lime silo wear appropriate PPE, Safety showers located in close	Low
2	Powdered activated carbon dust when loading hopper	Impacts respiratory system of employees or contractors	Medium	Possible	Medium	Activated carbon bin and feeder are enclosed, includes a dust removal devise, operators transferring activated carbon into silo or working near silo wear	Low
3	Handling of liquid caustic in IBC's and loading lime to silo	Burns to employees or contractors	Medium	Possible	Medium	Operators unloading, moving or installing caustic containing IBC's wear appropriate PPE. Safety	Low
4	Breakdown in alkali supply to acid tower	Acid gas emissions - impacts on health and amenity of neighbours and environment	High	Possible	High	Operations personnel monitor alkali use in real time, issues identified early and corrected, alkali delivery system has standby pump and level alarm installed with feedback loop to control room. Individual processing lines can be shut down for corrective measures if a problem is found to persist.	Medium
5	Breakdown in activated carbon supply to acid tower	Volitile base metal emissions - impacts on health and amenity of neighbours and environment	High	Possible	High	Activated carbon system has level alarm installed with feedback to contol room, operations personnel monitor activated carbon use in real time, issues identified early and corrected, can shut processing line if issue persists.	Medium
6	Dust from bag house filtration system	Impacts respiratory system and general health of employees or contractors	High	Possible	High	Dust removed from the bag house is discharged into an enclosed hopper and transferred by enclosed screw feeders to an enclosed pneumatic transfer system which deposits ash into an enclosed tank with dust control devises fitted. Stabilisation of ash is a wet process to prevent dust generation.	Medium
7	Electrocution	Injury to employees or contractors.	High	Possible	High	All electrical equipment is installed to appropriate standards, includes appropriate grounding protection, leakage protection and appropriate insulation.	Medium
8	Dew point reached in bag house	Reduced efficiency of bag house, emissions to atmosphere - impacts on health and amenity of neighbours and environment	Low	Possible	Medium	The bag house includes a heating control system with temperature monitoring to prevent the dew point being reached	Low
Activity: Compressed Air System							
1	Overpressure of compressed air reciever	Explosive destruction - injury to personnel	High	Possible	High	Installed pressure recording and feedback to control room, over pressure safety valves installed.	Medium
2	Noise from compressors	Auditory impacts to employees or contractors.	Medium	Possible	Medium	Compressors are enclosed within sound proofed building, operators and contractors working on or	Low
3	Mechanical injury from rotating equipment	Injury to employees or contractors.	Medium	Possible	Medium	Protective covers on equipment to prevent mechanical injury, Appropriate PPE worn by	Low
4	Electrocution	Injury to employees or contractors.	High	Possible	High	All electrical equipment is installed to appropriate standards, includes appropriate grounding protection, leakage protection and appropriate insulation.	Medium

Table 15-2: Preliminary Hazard Analysis Continued – Risks Greater than Medium Delineated.

Further work in this area is planned (eg. completion of HAZOP Study) and it is recognised that development of design and operational controls and action plans is an iterative process, is ongoing and will be informed by the detailed design phase of the project. REA will expect to capitalise on the experience of the technology provider, Ecowaste and the EPC contractor Sedin for further insight into identifying and minimising risks associated with up-set or non-routine operating conditions.

The approach to identifying best practice in managing the environment risks includes the following:

- Review of the European Commission Reference documents on best practice for Waste Incineration and Large Combustion Plants to inform design and operation of the WtE proposed facility;
- Work with the technology provider and the EPC contractor through the detailed design phase to ensure that all options to minimise risks have been considered and assessed;
- Integrate the process control procedures into the management plans incorporated into the EMS to ensure a consistent approach to the management of risk.

15.5 Environmental Management System

REA is committed to the development of an Environmental Management System (EMS) consistent with the ISO 14001 framework. The development of the EMS will be undertaken in parallel with the detailed design and will continue through the construction program so that key management and operational staff have the opportunity for input into the EMS and associated environmental management strategies, plans and procedures. This will include specific details referred from the HAZOP study which will inform the procedures associated with non-routine plant shut down associated with equipment failure and emergency shutdown procedures associated with power failure, flue gas treatment failure and of the occurrence fire.

Environmental Management System (EMS) is a tool that operators can use to address these design, construction, maintenance, operation and decommissioning issues in a systematic, demonstrable way. An EMS includes the organisational structure, responsibilities, practices, procedures, processes and resources for developing, implementing, maintaining, reviewing and monitoring the environmental policy.

The development of the EMS will include specific management plans to address and manage risks and ensure compliance with relevant Guidelines and statutes. Specific management plans will include the following:

- Construction Environmental Management Plan;
- Commissioning Management Plan;
- Operations Management Plan;
- Emergency Procedure Management Plan;
- Traffic Management Plan.

Monitoring of the environmental performance of the facility will utilise the data gained from the CEMS monitoring system which includes continuous monitoring of stack emissions. Regular sampling of stack emission will be undertaken together with sampling of the wastes generated from the process, noise levels and stormwater runoff from the site. These will be reported as required by the EPA in Annual Performance Statements.

15.6 Construction Impact Management

A number of moderate risks were identified associated with the construction phase of the Project (Section 5.4 and Appendix 4). These were associated with dust generation, exhaust emissions from equipment and erosion and sedimentation following intense rain events. The main risks have been reproduced in Table 15-3. Table 15-3 outlines the design and operational interventions which reduce the risk level to moderate. These include:

- Disturbed areas minimised;
- Trafficable and working areas sealed with bituminised tarmac or concrete;
- Water sprays used to wet surface in new excavation areas if dust an issue;
- Fuel combustion engines meet Australian Design emission standards;
- Noise mitigation measures prescribed in construction contracts;

- Erosion/sedimentation mitigation measures prescribed in construction contracts;
- Operational vehicles kept to work zones and 5km/h speed limits imposed compliant with Traffic Management Plan;
- Operations monitored by site manager;
- Installed erosion/sedimentation containment devices;
- Lined bunded area for equipment washdown;
- Fuel and chemical storage bunded in accordance with Australian Standards;
- Spill Kits available near operations and storage areas;
- Revegetation/Landscaping/stabilisation completed as soon as practical.

The management of the risks associated with the construction phase will be detailed in the Construction Environmental Management Plan (CEMP). This will include a comprehensive list of roles, responsibilities, management measures and operating guidelines. These will be developed with reference to the following Guidelines:

- Construction Techniques for Sediment Pollution Control (EPA publication 275);
- Environmental Guidelines for Major Construction Sites (EPA publication 480);
- Noise Control Guidelines (EPA publication 1254).

Action	Event/result	Potential Impact	Primary Risk Level				Design Control Measure	Operational Management Measure	Residual Risk Level			
			Consequence	value (column ref)	Likelihood	Risk			Consequence	Value	Likelihood	Risk
Aspect: Air quality												
Construction: <i>Site Preparation Earthworks (clearing, excavation for foundations, material stockpiles), Mobile Plant and Vehicle movements</i>	Dust emission	Reduced visibility and public nuisance. Human health impacts to employees/public, in particular respiratory system irritation.	Negligible	2	Possible	Moderate	Disturbed areas minimised. Trafficable and working areas sealed bituminised tarmac or concrete Water sprays used to wet surface in new excavation areas if dust an issue	Development and Implementation of Construction Environmental Management Plan (CEMP), Dust monitored by site manager. Dust suppression measures instituted if required (wet down with water truck and/or hoses) Operational vehicles kept to work zones and 5km/h speed limits imposed compliant with Traffic Management Plan. Revegetation/Landscaping/stabilisation completed as soon as practical	Negligible	1	Unlikely	Low
Construction: <i>Site Preparation Earthworks, Factory Construction, Mobile Plant and Vehicle movements, Temporary generators and Lighting Plants</i>	Greenhouse gas emission - fuel, combustion products	Substantial Contribution to Greenhouse effect	Negligible	1	Possible	Moderate	Fuel combustion engines meet Australian Design emission standards.	Equipment chosen and maintained to ensure efficient operation to minimise exhaust emissions Vehicle speed and movements minimised. CEMP implemented.	Negligible	1	Unlikely	Low
Aspect: Air quality												
Construction: <i>Site Preparation Earthworks, Factory Construction, Mobile Plant and Vehicle movements, Temporary generators and Lighting Plants</i>	Noise generation from equipment and trucks	Disturbance to neighbours. Hearing Impacts on employees.	Minor	2	Possible	Moderate	Noise mitigation measures prescribed in construction contracts	Development and Implementation of Construction Environmental Management Plan (CEMP), Noise monitored by site manager. Maintenance Program for all equipment. Operational vehicles kept to work zones and 5km/h speed limits imposed compliant with Traffic Management Plan. High noise activities limited to hours 7am - 6pm	Negligible	1	Unlikely	Low
Aspect: Surface Water												
Construction: <i>Site Preparation Earthworks, Factory Construction, Mobile Plant and Vehicle movements, Temporary generators and Lighting Plants</i>	Contamination - uncontrolled release of hydrocarbons, Increased potential for erosion and sedimentation	Adverse impact on surface water quality	Minor	2	Possible	Moderate	Erosion/sedimentation mitigation measures prescribed in construction contracts	Development and Implementation of Construction Environmental Management Plan (CEMP), Monitored by site manager. Installed erosion/sedimentation containment devices. Lined bunded area for equipment washdown. Fuel and chemical storage bunded in accordance with Australian Standards. Spill Kits available near operations and storage areas. Revegetation/Landscaping/stabilisation completed as soon as practical	Minor	2	Possible	Moderate

Table 15-3: Risk Assessment for the Construction Phase of the Project