

5 ENVIRONMENTAL AND MANAGEMENT CONTROLS

Grizzly will implement its corporate Health, Safety and Environment (HSE) Management System as part of the development of the Project. The HSE Management System reflects Grizzly's high priority to manage the Project in a safe and environmentally responsible manner.

The HSE Management System is applied equally to employees, affiliates, contractors and agents, and will cover construction, operations, decommissioning and reclamation of the Project. The HSE Management System provides for continued compliance with regulations and provides appropriate training and equipment for employees and contractors.

5.1 AIR EMISSIONS MANAGEMENT

The largest air emissions source for the Project will be the steam generation equipment. As part of detailed engineering, Grizzly will select a steam generator which will meet NO_x emissions requirements. Grizzly will meet the compliance limits of ESRD's *Interim Emissions Guidelines for Oxides of Nitrogen (NO_x) for New Boilers, Heaters and Turbines using Gaseous Fuels for the Oil Sands Region in the RMWB North of Fort McMurray based on a review of Best Available Technology Economically Achievable (BATEA; AENV 2007)*.

Vapours from storage tanks containing hydrocarbons will be controlled with a natural gas pressure blanket in conjunction with a vapour recovery system. The vapour recovery system will allow for collection of liberated gas to supplement the fuel gas supply to the steam generation equipment.

5.1.1 Air Control Technologies

The largest air emissions source for the Project will be the steam generation equipment. As part of detailed engineering, Grizzly will select a steam generator which will meet NO_x emissions requirements. Grizzly will meet the compliance limits of ESRD's *Interim Emissions Guidelines for Oxides of Nitrogen (NO_x) for New Boilers, Heaters and Turbines using Gaseous Fuels for the Oil Sands Region in the RMWB North of Fort McMurray based on a review of Best Available Technology Economically Achievable (BATEA; AENV 2007)*.

Vapours from storage tanks containing hydrocarbons will be controlled with a natural gas pressure blanket in conjunction with a vapour recovery system. The vapour recovery system will allow for collection of liberated gas to supplement the fuel gas supply to the steam generation equipment.

All produced gas generated at the Project will be blended with sweet dry natural gas and combusted in the steam generators. Sulphur emissions from the Project were conservatively assessed based on an assumed H₂S concentration of 0.08 mole percent in the produced gas stream. This resulted in an SO₂ emission rate of 0.98 t/d (0.49 t/d of sulphur) being emitted from the Project, as presented in Table 1 of the air quality assessment report in Appendix G. Grizzly is requesting a license to emit up to 0.98 t/d of SO₂ from the Project.

Sulphur recovery facilities are not required for the Project, since the estimated sulphur production rate is lower than the 1.0 t/d inlet sulphur threshold (2.0 t/d SO₂) established in ERCB ID 2001-3 (EUB 2001b). Grizzly will monitor inlet gas sulphur rates throughout the life of the Project for continued compliance with ID 2001-3.

The Project sulphur balance is shown in Section 4.2.13.

5.1.2 Greenhouse Gas Management Plan

A summary of the predicted greenhouse gas (GHG) emissions for the Project is presented in the air quality assessment report in Appendix G. The total GHG emissions for the Project are estimated to be 0.470 Mt/y CO₂E. The Project operations are estimated to contribute 0.191% and 0.067% to the year 2011 Alberta and Canada GHG emission totals, respectively (Environment Canada 2011). As Grizzly expects to emit more than 100,000 t/year of CO₂E, Grizzly will comply with the *Specified Gas Emitters Regulation*.

5.2 WATER MANAGEMENT

5.2.1 CPF Stormwater Management

Two stormwater collection systems will be constructed at the CPF site. One for the main production area and one for the dilbit loading/LACT area. Surface water collected at each area will be routed to the applicable stormwater pond. Approximately 30,000 m³ of runoff water from the CPF could collect in the ponds annually. Pond capacities and the associated calculation are shown below in Table 5.2-1. If the ponds are becoming filled, the water will be tested to meet the anticipated approval conditions prior to being released to the environment. Mitigation measures for releasing the water from the pond are presented in Section 6.5.4. In some instances, Grizzly may utilize this water for its operations instead of releasing the water into the surrounding environment; the applicable licence will be applied for under the *Water Act*.

Rational Method Equation:

$$Q = C * I * A$$

where:

Q = Discharge or Flow (cfs)

C = Runoff coefficient (assumed to be 0.40)

I = Rainfall intensity

A = Drainage Area

Table 5.2-1 Pond Capacity

	Contributing Areas	Storm Event	Rainfall Intensity (10 ⁻⁶ m/s)	Runoff Coefficient C	Drainage Area (m ²)	Runoff (m ³ /s)	24 hr Volume (m ³)	24 hr Volume (m ³)
Pond 1	CPF Production Area	1:50 year	1.056	0.9	59,280	0.05632	4,866	5,639
	Soil Stockpiles			0.4	21,204	0.00895	774	
Pond 2	Dilbit Loading/LACT	1:50 year	1.056	0.9	24,500	0.02328	2,011	2,011

Rainfall Intensity has been interpolated from Environment Canada (2012).

5.2.2 Well Pads and Roads Stormwater Management

Well pads will be designed with surface water drainage directed to a low area of containment within the well pad. Berms or drainage swales will be utilized to promote surrounding surface water to flow around facilities. Culverts will be provided along the roads to maintain the natural flow of water around facilities.

5.2.3 Waste Water Disposal

5.2.3.1 Processed Water Disposal

Waste water disposal options around the Project are limited to the McMurray, Keg River and Granite Wash Formations. Lower McMurray aquifers are up to 8 m thick in the Project lease area; however, regional mapping and testing is required to determine if they are connected to a regional aquifer that would allow disposal.

The Devonian Keg River Formation is commonly targeted as the best deep disposal option in the Athabasca area. In the May River area, the Keg River has a porous zone that is up to 10 m thick. Two disposal wells (100-15-23-077-09W4 and 100-03-07-77-07W4) have been injecting into this zone since 1977 and have collectively injected 950,000 m³ of water. The 100-15-12-077-09W4 Keg River disposal test well was drilled at May River by Petrobank. This well encountered an over pressured aquifer that flowed more than 100 m³/d of water to surface. Further testing and mapping is needed to determine if this aquifer would be a suitable for deep disposal.

The Granite Wash is a Devonian sandstone that overlies the Precambrian basement in structurally low areas and has been used as a disposal zone. However, disposal is untenable in areas where pore throats are occluded with salt.

Trucking waste water to a third party disposal site remains the best short-term option for the Project. Grizzly will continue to evaluate long-term disposal solutions and will apply for appropriate approvals as required.

The waste brine generated in the evaporation process will be trucked to an approved disposal facility. The disposal volume at steady state is estimated to be 254 m³/d.

5.2.3.2 Sewage Treatment

Domestic wastewater and sewage generated at the Project will be stored in holding tanks and then disposed of by an authorized third party. Grizzly is exploring other options to treat and/or handle sewage, which will be finalized during detailed design.

5.3 WASTE MANAGEMENT PLAN

A waste management plan for the Project will be designed to effectively control waste by minimizing waste generation and the waste disposal required. The over-riding principles of the plan are to reduce, reuse and recycle. The waste management plan will routinely obtain feedback on the effectiveness of the plan and identify opportunities for continual improvement.

Waste management at the site will comply with the following waste management processes, procedures and guidelines including the EPEA Waste Control Regulation (AEP 1996). Practices will include:

- classifying, measuring and controlling waste generation;
- handling, storage, treatment and disposal;
- tracking and reporting;
- offsite disposal of DOW (dangerous oilfield waste) and non-DOW wastes as appropriate; and
- recycling as appropriate.

Waste management practices will meet or exceed the requirements of the AER. Specifically, these waste management requirements are outlined in both Directive 58 - Oilfield Waste Management Requirements for the Upstream Petroleum Industry (EUB 1996a) and Directive 50 - Drilling Waste Management (EUB 1996b). Directive 58 requires the preparation of an Annual Oilfield Waste Disposition Report summarizing the types and quantities of disposed oilfield wastes, the points of generation, and the disposal methods utilized.

All wastes will be disposed in a responsible manner complying with all appropriate regulations and guidelines and in accordance with waste handling requirements contained in the anticipated EPEA Approval. Detailed waste disposal practices and procedures will be developed prior to the start of construction and operations and will be continuously reviewed throughout the life of the Project.

Wastes will be generated during two main stages of the proposed development; during construction and during the ongoing operation of the Project. Construction and development includes construction of roads, CPF, wellpads, and steam, gas, emulsion and power distribution lines connecting the CPF to the well pads.

Summaries of the wastes generated for each stage are shown in Table 5.3-1 including proposed storage locations, disposal sites, disposal method and, where possible, estimated annual quantities.

Quantities of waste generated during operations have been estimated in Table 5.3-1 by using process flow diagrams and material balance calculations, but the quantities of construction waste and camp waste have not been determined. These will be disposed of in approved disposal facilities on an as-generated basis.

Table 5.3-1 Waste Management Plan

Waste Description	AER Waste Code*	Storage Location	Disposal Responsibility	Disposal Method	Annual Volume
Construction:					
Packing materials	DOMWST	Bin	Contractor	Incinerator/Recycle	As Generated
Cardboard	DOMWST	Bin	Contractor	Incinerator/Recycle	As Generated
Pallets	CONMAT	Bin	Contractor	Incinerator/Recycle	As Generated
Wood	CONMAT	Bin	Contractor	Incinerator/Recycle	As Generated
Scrap Metal	SMETAL	Bin	Contractor	Landfill/Recycle	As Generated
Glass	CONMAT	Bin	Contractor	Landfill/Recycle	As Generated
Paint	WPAINT	Bin	Contractor	Recycle	As Generated
Sand blast	CONMAT	Bin	Contractor	CL2 LF**	As Generated
Insulation	CONMAT	Bin	Contractor	CL2 LF**	As Generated

Waste Description	AER Waste Code*	Storage Location	Disposal Responsibility	Disposal Method	Annual Volume
Welding rods	CONMAT	Bin	Contractor	CL2 LF**	As Generated
Lubricants	LUBOIL	Drums	Contractor	Recycle	As Generated
Oil filters	FILLUB	Drums	Contractor	Recycle	As Generated
Cable Cutoffs	SMETAL	Bin	Contractor	Landfill/Recycle	As Generated
Construction – Camp					
Kitchen waste	DOMWST	Bins	Contractor	Landfill	As Generated
Cardboard	DOMWST	Bins	Contractor	Landfill/Recycle	As Generated
Containers	EMTCON	Bins	Contractor	Incinerator	As Generated
Septic Fluids	WSTMIS	Septic System	Contractor	Digester/Contractor	As Generated
Operations – Drilling					
Drilling mud/cuttings	Various	Tank	Contractor	Recycle or MBC***	As Generated
Lubricants	LUBOIL	Drums	Contractor	Recycle	As Generated
Mud additives	Various	Bins	Contractor	Return or Recycle	As Generated
Scrap metal	SMATAL	Bins	Contractor	Recycle	As Generated
Pallets	CONMAT	Bins	Contractor	Landfill/Recycle	As Generated
Cement	CEMENT	Bins	Contractor	CL2 LF**	As Generated
Solvents	Various	Drums	Contractor	Return or Recycle	As Generated
Mud sacks	EMTCON	Bins	Contractor	CL2 LF**	As Generated
Operations – CPF					
Filter: Glycol	FILGY	Bins	Swan Hills	Swan Hills	0.1 m ³
Filter: Raw Water	FILFWT	Bins	Owner	CL2 LF**	0.5 m ³
Filter: Pressure	FILOTH	Bins	Swan Hills	Swan Hills	5.0 m ³
Filter: Oil removal	FILOTH	Bins	Swan Hills	Swan Hills	4.0 m ³
Ion exchange resins	IEXRES	Bins	Owner	CL2 LF**	50.0 m ³
Filter Backwash Sludge/Liquid	WESTMIS	Tank	Owner	Recycle	
Boiler Blowdown Water	WSTMIS	Vessel	Owner	Recycle	
Evaporator Blowdown Water	WSTMIS	Tank	Owner	Recycle	66,430 m ³
Septic Fluids	WSTMIS	Septic System	Owner	Site septic field	800 m ³
Caustic	CAUS	Tank	Owner	Recovery	986 m ³ /yr
Acid	ACID	Truck in as needed	Third Party	Return or Recycle	
Batteries	BATT	Bin	Owner	Recycle	
Containers: Drums/barrels	EMTCON	Bin	Owner	Return or Recycle	
Containers: herbicide	PSTCON	Bin	Owner	Return or Recycle	
Containers: pesticide	PSTCON	Bin	Owner	Return or Recycle	
Containers: biocide	EMTCON	Bin	Owner	Return or Recycle	
Filters: lube oil	LUBOIL	Bin	Third Party	Recycle	0.5 m ³ /yr
Filters: produced oil	FILWWT	Bin	Swan Hills	Swan Hills	As Generated
Garbage: office paper	DOMWST	Bin	Owner	Landfill/Recycle	As Generated
Pallets	DOMWST	Bin	Owner	Landfill/Recycle	As Generated
Packing materials	DOMWST	Bin	Contractor	Landfill/Recycle	As Generated
Hydrotest fluids: methanol	METHNL	Tank	Contractor	Recycle	
Insulation	CONMAT	Bin	Contractor	CL2 LF**	As Generated
Lab. Chemicals –	INOCHM/OR	Drums	Owner	Recycle	

Waste Description	AER Waste Code*	Storage Location	Disposal Responsibility	Disposal Method	Annual Volume
spent					
Rags: oily	OILRAG	Bin	Owner	CL2 LF**	As Generated
Sludge: Separators	SLGPRO	Tank	Owner	Recycle	In Produced Sand
Sludge: oil slop tanks	SLGHYD	Tank	Owner	Recover	In Produced Sand
Well Workover fluids	WNOFLD	Tank	Contractor	Bioremediation	As Generated
Operations – Camp					
Kitchen waste	DOMWST	Bins	Contractor	Landfill	As Generated
Cardboard	DOMWST	Bins	Contractor	Landfill/Recycle	As Generated
Containers	EMTCON	Bins	Contractor	Landfill/Recycle	As Generated
Septic Fluids	WSTMIS	Septic System	Contractor	Digester	As Generated
Incinerator Ash	INCASH	Bin	Contractor	CL2 LF**	As Generated

* Waste Listings of AER Directive 58 – Oilfield Waste Management Requirements for the Upstream Petroleum (ERCB, 1996)

** CL2LF – Class II Landfill

*** MBC – Mix Bury Cover

5.4 HEALTH, SAFETY, AND ENVIRONMENTAL MANAGEMENT

5.4.1 The Environment

Protection and preservation of the environment is a fundamental belief of the Company. Grizzly is committed to developing a comprehensive management policy to mitigate the occurrence of environmental issues in the design and operation of the Project.

Employees, contractors and consultants will be expected to operate equipment according to vendor recommendations and procedures. Workers will be trained to manage and respond to operating situations that may impact the environment by expeditiously determining the cause and remedying the problem, to the extent of shutting in a process in order to control the situation.

Preparation and adherence to environmental standard operating procedures and practices (SOPs) will form part of the guiding operating principles throughout the life of the Project. All employees, contractors and consultants will be advised of these procedures and practices with daily and routine activities being managed according to the guiding principles.

Appropriate signage, markings and other designations will be implemented to guide and inform personnel with respect to environmental considerations. With knowledge, training and understanding of the situation, these directions, along with applied procedures and practices, will minimize the risk of occurrence of an undesirable incident.

Continuous learning, training and improvement will be ongoing throughout the life of the Project. This will ensure operating staff are current with the knowledge and information on regulatory issues and environmental considerations associated with the development and operation of the Project.

Environmental monitoring will be reviewed by designated Grizzly personnel to ensure the Project is in compliance with environmental approval requirements. Ongoing assessments and audits will be

carried out throughout the life of the Project on a regular basis to ensure Grizzly's objectives with respect to environmental stewardship have been met.

5.4.2 Health and Safety

Grizzly will conduct all operations in a safe and environmentally sound manner. In support of this commitment, Grizzly has developed a General Policy on Health, Safety and the Environment in addition to a Safety Program.

The Safety Program includes a Management Plan in support of implementing the Program. The presentation of the Plan will be in the form of a manual which will be provided to management, employees and contractors with the tools, information and references they will need to carry out that Plan.

It will be Grizzly's standard practice to provide each user of this manual (i.e., operators, supervisors and contractors) with appropriate training in its use. The training will be considered as the primary orientation of all new personnel to Grizzly's operations.

Complementary documents, tools and training will include:

- Health, Safety, & Environment Handbook;
- Emergency Response Plan(s); and
- Supervisory Training.

This manual in its entirety should always be considered a work-in-progress. All users will be encouraged to provide suggestions for improvements to its content and format.

The development of this Safety Program, together with supporting training, will help all Grizzly staff, contractors and supervisors to:

- make maximum use of the combined resources of Grizzly, government agencies, and other outside services to:
 - assist with orienting, informing, guiding and motivating Company employees and contractors;
 - implement policies, procedures, practices and standards relating to Company operations; and
 - provide and maintain a safe working environment including tools, machines and equipment.
 - maintain effective communication;
 - ensure immediate, competent responses when handling and emergency; and
 - control work site hazards, thus minimizing the risk to Grizzly employees, its contractors and the public.

All personnel directly involved with Grizzly's operations, including both Company and Contract personnel, are responsible for ensuring their activities are consistent with this manual.

5.4.3 Integrated Environmental Health and Safety Management Plan

Integration of the environment, health and safety management plan will be adopted into all facets of the Grizzly Project. The objective of the management plan is to ensure compliance with Grizzly's environmental and health and safety stewardship objectives. The program will be implemented through the following mechanisms:

- Loss Control and Environmental Compliance Program;
- Emergency Response Plan;
- Waste Management Plan;
- Substance Release Controls and Monitoring; and
- Wildfire Response Plan.

5.4.4 Loss Control and Environmental Compliance Program

Designated Grizzly personnel will act as the site custodian to ensure that environmental and safety operating procedures are regularly evaluated and, if necessary, altered to address any adverse effects that may occur.

5.4.5 Emergency Response Plan

As part of its operating procedures, Grizzly has developed an emergency response plan (ERP) that sets out procedures and identifies responsible personnel and third party support expertise to deal with emergency situations. The plan will be enhanced to specifically address alert levels, evacuation requirements, call down procedures and external emergency agency involvement for the construction and operation components of the Project.

Response equipment will be documented, kept current, and made readily available as part of the emergency response plan.

The emergency response plan will address incidents such as:

- serious onsite injury to facility personnel, contractors, consultants, or members of the public;
- CPF shutdown;
- major equipment or instrumentation failure;
- major spills or releases to the environment;
- fire in or near facilities;
- security issues such as criminal acts, threats or acts of terrorism;
- loss of well control; and
- pipeline rupture.

The primary objective of the ERP is to limit the danger to facility personnel, the public, the environment and operating equipment.

5.4.6 Substance Release Monitoring

The two primary emission destinations from which emissions sources from the Project can occur are air and water. Substance release monitoring will be carried out under the supervision of the onsite

Project Manager. The types and volumes of project emission sources will be tracked and recorded as per the applicable regulations and operating approval conditions. The maintenance of pollution abatement and monitoring equipment will be an integral component of normal maintenance and operations of the facility.

5.4.7 Fire Control Plan

The fire control plan for the Project will address:

- the Project as a source of fire; and
- wildfire impact on the Project.

Potential sources of fire resulting from the Project include operations within the CPF, the electrical distribution system, flare system and steam piping. “Fire-Eye” sensors capable of detecting open flame will be installed in critical areas of the CPF and well pads. In addition, combustible gas and smoke detectors will be located throughout the facility. All sensors will be tied into the process-control system to allow prompt response in the event of fire.

Plans for fire suppression during the operation of the Project will require a combination of wall-mounted and wheeled fire extinguishers located around the CPF and well pads. In addition, operators’ trucks will be outfitted with portable fire extinguishers.

Other fire reduction measures incorporated will include:

- use of non-combustible building materials;
- where deemed appropriate, absence of combustible ground cover;
- adequate setback of facilities from the surrounding forest;
- adequate building separation; and
- placement of fire blankets in strategic locations within the Project Area.

A wildfire control plan will be developed in consort with the Forest Protection Division of ESRD. It will describe the equipment and level of readiness that is present by Grizzly for the Project to assist in wildfire control. It will also include maps of roads and accesses to Grizzly’s lease area to provide valuable information for the local forest protection division. Forest Fire awareness training will also be added to the suite of training programs for Grizzly employees.