

## **9. MITIGATION PLAN**

This section details the plans and measures that will be put in place to mitigate the identified environmental impacts identified in Section 7.

The primary objective of the Mitigation Plan and Environmental Management Plan (EMP) are to establish mechanisms to reduce the magnitude of the impact of the Project to an acceptable level (Class 3 or higher) for all of the Project aspects and impacts on the receiving ecosystem.

This section presents the recommended mitigation actions and procedures based the five VECs categories outlined in Section 7 (air and climate, land, water, ecology and biodiversity, and human environment).

In addition safety procedures and supervision shall ensure:

- Compliance with IFC's General EHS Guidelines
- Compliance with the Project's Standard Operating Procedures (SOP) that shall incorporate the existing SOPs of the Agrium KNO Plant
- Proper training will be provided to ensure safety both during construction (including all contractors present on-site or transporting materials offsite)
- Employee training to be provided to plant staff prior to operations start
- The use of personal protective equipment will be mandatory.

### **9.1 Air and Climate**

Dust generation as well as exhaust emissions are the major potential sources of impact on the air and climate of the Project site.

Since the background NO<sub>x</sub> levels are low, the NO<sub>x</sub> contribution to ambient air quality is very low and therefore, the ambient air quality impacts are insignificant and at acceptable levels.

The following mitigation measures and procedures will be adopted to mitigate these impacts.

#### **Construction Phase**

To prevent or reduce air pollution and impact on climate to a minimum accepted level it is recommended that the following management and control measures should be adopted by during the construction phase of the Project:

- Comply with the national and international requirements on accepted levels of exhaust emissions from equipment and vehicles
- Minimize unnecessary journeys and adopt a policy of switching off machinery and equipment when not in use
- Dust suppression should be undertaken where necessary by covering and/or spraying affected land surfaces with water.
- Most of the roads must be asphalt paved to reduce the dust level during construction.

- Vehicle movements should be kept to a minimum and hard cover areas for vehicle movements should be used where possible. All vehicles should use the same track as much as possible and minimize the creation of new tracks.
- Vehicle speed restrictions will be applied on internal roads across the Project site to avoid excessive dust generation (and prevent collisions and other accidents)
- All vehicles carrying excavation and demolition material/waste should be covered to prevent spread of dust, excavation and demolition material, etc.
- Burning of materials in open air should be strictly prohibited.
- Machinery, equipment, vehicles and materials with relatively low CO<sub>2</sub> emissions should be selected, where possible.
- Choose energy sources/fuels for equipment that produce the least amount of CO<sub>2</sub> emissions.
- Site rules will include safety procedures consistent with international standards for a construction site of this magnitude.
- All contractors and their sub-contractors will abide with site safety rules.
- The relevant contractor employee safety training will be mandatory.

### **Operational Phase**

To prevent and/or reduce air pollution and impact on climate to minimum accepted levels, it is recommended that the following management and control measures are adopted by during the operational phase of the Project:

- Air emissions from point sources shall meet all the relevant national and international standards identified in section 2 of this report
- Dry gas compressor seals should be used wherever possible
- The ammonia storage tank shall be equipped with refrigeration system and dedicated backup flare system to mitigate and limit any ammonia leaks and emissions
- Regular monitoring and maintenance of all equipment, generators, and flares should be routinely undertaken as part of the environmental monitoring plan
- In addition to point source monitoring, air quality monitoring will be carried out periodically at specific locations
- Tanks and elevated structures should be fitted with warning lights to comply with air and safety navigation regulations.
- All plant operations and maintenance staff will be trained on all the safety aspects of plant operation.
- All plant staff must adhere to the safety rules of the Plant.

### **9.2 Land**

Mitigation measures relating to land use are largely aimed at streamlining visual impact and topographic changes. The following measures are recommended during the construction and operational phases to minimize and/ or eliminate the impact on land arising from the generation and disposal of solid waste:

- Where possible, demolition and excavation wastes from the removal of existing roads should be reused during the construction of new roads and other construction works at the Project

- Municipal solid wastes (combustible or non-combustible) generated by the Project should be collected through the dedicated solid waste management system set up for the project. Waste management system details are presented in section 10 of this ESIA report.
- No materials containing PCBs or asbestos should be used for construction.
- Solid process wastes (particularly spent catalyst) should be returned to the supplier and/or sent for recycling/precious metal recovery where possible.
- A recycling policy should be implemented for all solid wastes including office materials to the extent possible.
- Spent lubricants, lube oil and/or solvents should be re-used, recycled or disposed in environmentally appropriate ways at an approved disposal site.
- All hazardous wastes generated by the project operations should be transported to waste disposal facilities through approved and certified waste handlers/transporters. Transportation of all hazardous wastes would be conducted in full compliance with national and International laws governing the transport of hazardous wastes (MARPOL, Basel).
- Records of all offsite waste transfers should be maintained, listing date of transfer, destination, compound identification, volumes removed, and personnel responsible.

The following management and control measures are recommended to reduce visual impact during the construction and operation phases:

- On-going good housekeeping will mitigate the potential aesthetic concerns associated with litter/waste accumulation/deposition, dust, etc., both on and off site, that result from construction and operation activities.
- Containment facilities for non-hazardous solid waste should be established prior to commencing site work, and waste should be regularly removed from site to prevent unacceptable accumulations.
- Where possible, stack heights will be kept to a minimum to prevent visual intrusion.

## **9.3 Water**

### **9.3.1 Groundwater**

In order to prevent or reduce any groundwater contamination to the minimum possible level, the following measures are recommended to be adopted during the construction and operational phases of the Project:

- Stop and prevent the release of any materials that infiltrate and contaminate groundwater.
- Maintain adequate control of any subsurface pipelines (such as freshwater, domestic wastes) in order to prevent any accidental or potential leakage locally.
- Minimize the use of chemical substances or additives that could leach through concrete and infiltrate aquifers and use preventive measure to protect the aquifers.
- The elaboration and implementation of a continuous and regular site inspection

system that includes spill control and pollution prevention procedures for handling and storage of any contaminants.

- The elaboration, adoption and strict application of a labeling system for containers to identify and include all needed data of contents, including hazardous or potentially contaminative components.
- The elaboration of a spill response plan that includes all Project activities should be in place including the placement of emergency spill kits in storage areas.
- Spills should be contained or absorbed to prevent ground and groundwater contamination.
- Ensure that all linings of the first flash and the storm water catch ponds are intact and undamaged post routine removal of solids.
- All hazardous storage tanks should be constructed above ground.
- Placing of readily accessible emergency spill response kits to ensure rapid and effective emergency intervention in case of need.
- All personnel operating on the site should have personal protective equipment ready and easily accessible for rapid use in case of emergency.
- The installation of a modern system for check up and maintenance of subsurface pipes for the prevention of any leakage or breakdowns.

### **9.3.2 Surface Water (Freshwater)**

The following measures are recommended for adoption during the construction and operational phases of the water intake pipeline in order to ensure the protection of the fresh water at the intake location from any potential contamination:

- Ensuring that all personnel operating around or within the intake location are aware of the importance of maintaining the highest standards whilst operating around the Ossiomo river.
- A strict control system should be set in place to prevent any release of any contaminant into the river water.
- The design of the water intake pipeline should include the prevention of fish entrance into the intake system.
- Water velocity should be limited to an appropriate low level to minimize the possibility of fish capture.
- The design of a reliable and adequate emergency spill response system for the intake area (ground and water).
- Assuring the practice of a sustainable good housekeeping system during the installation of water pipelines to avoid the spreading and/or the leaving behind of any litter and wastes following construction activities.

### **9.4 Ecology and Biodiversity**

Construction and operational activities may result in the degradation or destruction of some terrestrial habitats, and the disturbance to and/or displacement of some of the fauna currently utilizing areas within the site. In addition, a number of floral species that are found in the area could be lost.

### **9.4.1 Terrestrial Ecology and Biodiversity**

The following management and control measures are recommended to control the impacts to terrestrial ecology and biodiversity during the construction and operation phases:

- There is no mitigation for loss of habitat as a result of construction activities, however, re-colonization will likely occur in areas not in the pathway of site operations.
- Contingency plans will be put in place and emergency response procedures developed to enable immediate response to accidental spillage and/or releases of chemicals or other hazardous materials.
- General and appropriate housekeeping will be adopted constantly to prevent litter and other wastes associated with site activities from fouling the site and areas adjacent to the site.
- Pipelines will be constructed below ground to allow regeneration of habitats. This will also enhance pipeline operational safety as well reduce the visual impact of the construction activity.
- Native plants will be used for landscaping along the corridor.
- Vehicles and equipment will be well maintained to minimize unnecessary emissions and leaks.
- Established vehicle tracks and roads will be used to minimize habitat destruction from off-road travel.
- Adequate materials and product storage and handling practices will be followed to reduce uncontrolled releases.

## **9.5 Human Environment**

### **9.5.1 Socio-Economics**

During the construction and operation phases, significant positive impacts will be gained by the local community through employment opportunities and increased economic activity.

Employment prospects will extend to skilled and unskilled labor, administration staff, caterers and medical staff.

The following management and control measures are recommended to mitigate socio-economic impacts during the construction and operation phases:

Where available, personnel to be hired by the project should be chosen from the local communities which in this context extends to Benin-City, where possible and feasible.

The local stakeholders should be regularly kept abreast of Project development.

Create a standing forum for dialogue and communication with representatives from the local communities, the Edo State Government and the Benin Traditional Council.

Actively consider supporting local charitable organizations.

### **9.5.2 Accidental Events (Fire, Explosion, and Releases)**

The following management and control measures are recommended to minimize any impact resulting from accidental events during the construction and operational phases of the Project:

- Quantitative risk assessment of the plant operating risks and hazards.
- A detailed emergency response plan must be put in place for all potential accidental events (fire, explosion, and releases).
- Operational systems should have, at least, two shut down systems to provide redundancy.
- Remote and automatic shutdown controls for all key of process equipment.
- Emergency warning alarms should be located at all key process areas.
- issues.
- The plant alarm system must be capable of detecting all fire, releases to atmosphere, spills and leakages
- Secondary containment for all hazardous materials to collect accidental spillage.
- Employees should be fully trained to implement the relevant emergency response plans in the event of emergency.
- Alarm system tests and drills should be conducted on a regular basis.

### **9.5.3 Noise**

Under normal operating conditions, a processing plant of this nature will generate a significant amount of noise. All staff within the process plant areas will be required to use noise-protection equipment. However noise disturbance to communities outside the plant will be negligible given that all such communities are located several kilometers from the Project site.

### **9.5.4 Health and Safety Issues**

The following management and control measures are recommended during the construction phase:

- Compliance with all relevant national and international HSE laws and standards.
- Government emergency services (fire and medical services) should be aware of rapid access routes defined in emergency response plans.
- An emergency notification system should be implemented to inform nearby industries and communities of any incident.
- A site health and safety plan should be developed (including emergency procedures) and all employees and subcontractors (for construction and maintenance works) should have induction training.
- Appropriate training should be given for particular tasks (where necessary), and subcontractors should prove employee competency.
- Adequate personal protective equipment should be provided to all relevant staff, based upon risk assessments for particular tasks or handling of hazardous materials.
- Method statements should be developed to cover all aspects of construction.

- Require construction workers and suppliers to drive safely on local roads.
- Work with local transport authorities on scheduling of large loads that are being transported by road.

### **9.5 Summary of Residual Impacts Following Mitigation**

After appropriate (1) application of the mitigation measures, provided in this report, to different assessed activities; (2) proper implementation of the monitoring plan; and (3) ensuring normal efficient operation; residual construction and operation impacts, if any, are expected to be minor or insignificant.

Table 9-1 summarizes the expected residual impacts (after application of mitigation, monitoring, etc.) resulting from the Project activities. Based on this analysis, the assessment team concludes that if recommended mitigation and monitoring measures are followed, the proposed urea/ammonia project can be constructed and operated without significant impact to the environment. It should be noted that non-routine events will always carry a higher significance therefore every precaution must be taken to ensure that the probability of these events is absolutely minimized.

**Table 9.1: Summary of Residual Impacts – Construction Phase**

<b>Project Component</b>	<b>Activity</b>	<b>VEC</b>	<b>Impact</b>	<b>Significance before Mitigation</b>	<b>Significance after Mitigation</b>
<b>CONSTRUCTION PHASE – SITE PREPARATION</b>	Soil and land leveling	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT
		Geomorphology and landscape	Geomorphologic changes and visual impact	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Effect on flora and fauna	MODERATE	MINOR
		Noise pollution	Noise generation	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE
	Construction of access roads	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT
		Geomorphology and landscape	Geomorphologic changes and visual impact	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Noise pollution	Noise generation	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE



**Table 9.1: Summary of Residual Impacts – Construction Phase (continued)**

<b>Project Component</b>	<b>Activity</b>	<b>VEC</b>	<b>Impact</b>	<b>Significance before Mitigation</b>	<b>Significance after Mitigation</b>
<b>CONSTRUCTION PHASE – SITE PREPARATION</b>	Transport and use of construction equipment	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Effect on flora and fauna	MINOR	MINOR
		Noise pollution	Noise generation	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE
	Purchase of supplies and services	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE
	Human resources	Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE
	Workers' temporary accommodation	Water resources	Increased demand	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE

**Table 9.1: Summary of Residual Impacts – Construction Phase (continued)**

<b>Project Component</b>	<b>Activity</b>	<b>VEC</b>	<b>Impact</b>	<b>Significance before Mitigation</b>	<b>Significance after Mitigation</b>	
<b>CONSTRUCTION PHASE – CIVIL WORKS AND MECHANICAL ERECTION</b>	Excavation, foundation, building works and mechanical erection	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT	
		Terrestrial ecology and biodiversity	Effect on flora and fauna	MINOR	MINOR	
		Noise pollution	Noise generation	MINOR	INSIGNIFICANT	
		Agriculture	Degradation of vegetation (exhaust, dust etc)	MINOR	INSIGNIFICANT	
		Socio-economic activities	Employment opportunities	POSITIVE	POSITIVE	
	Purchase of supplies and services	Air quality	Increased air emissions (dust, exhaust etc)	MINOR	INSIGNIFICANT	
		Socio-economic activities	Employment opportunities	POSITIVE	POSITIVE	
	Human resources	Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE	
	Workers' temporary accommodation	Water resources	Increased demand	MINOR	INSIGNIFICANT	
		Socio-economic activities	Employment opportunities	POSITIVE	POSITIVE	
			Community	Potential impact		

		Health	of HIV/AIDs and other communicable diseases	MINOR	MINOR
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**Table 9.1: Summary of Residual Impacts – Construction Phase (continued)**

Project Component	Activity	VEC	Impact	Significance before Mitigation	Significance after Mitigation
<b>CONSTRUCTION PHASE – CIVIL WORKS AND MECHANICAL ERECTION</b>	Use of vehicles and construction equipment	Air quality	Increased air emissions (exhaust, dust etc)	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	MINOR
		Agriculture	Degradation of vegetation (exhaust, dust etc)	MINOR	INSIGNIFICANT
		Socio-economic activities	Employment opportunities and increased economic activity	POSITIVE	POSITIVE
	Construction of infrastructure OSBL (gas pipeline, water intake pipeline and marine outfall pipeline)	Marine ecology and biodiversity	Degradation of ecosystem	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	POSITIVE	POSITIVE
		Socio-economic activities	Increased economic activity	POSITIVE	POSITIVE
	Sewage and	Groundwater quality	Leaching of waste into aquifer	MODERATE	INSIGNIFICANT
		Terrestrial	Loss of habitat	MINOR	INSIGNIFICANT

	waste disposal	ecology and biodiversity	and damage to vegetation		
		Community health and safety	Adverse health impacts	MODERATE	INSIGNIFICANT

**Table 9.1: Summary of Residual Impacts – Construction Phase (continued)**

Project Component	Activity	VEC	Impact	Significance before Mitigation	Significance after Mitigation
<b>CONSTRUCTION PHASE – CIVIL WORKS AND MECHANICAL ERECTION</b>	Testing and commissioning	Groundwater quality	Contamination	MODERATE	INSIGNIFICANT
		River-water quality	Contamination	MODERATE	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Degradation of ecosystem	MINOR	INSIGNIFICANT
		Air quality	Gaseous emissions	MODERATE	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-economic activities	Increased economic activity	POSITIVE	POSITIVE

**Table 9.2: Summary of Residual Impacts – Operation Phase**

<b>Project Component</b>	<b>Activity</b>	<b>VEC</b>	<b>Impact</b>	<b>Significance before Mitigation</b>	<b>Significance after Mitigation</b>
<b>OPERATION PHASE</b>	Process plant operation and maintenance	Groundwater quality	Contamination	MODERATE	INSIGNIFICANT
		River-water quality	Contamination	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Degradation of ecosystem	MINOR	INSIGNIFICANT
		Air quality	Gaseous emissions	MODERATE	MINOR
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-economic activities	Increased economic activity	POSITIVE	POSITIVE
	Transportation	Air quality	Gaseous emissions	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-economic	Increased economic activity	POSITIVE	POSITIVE

		activities			
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**Table 9.2: Summary of Residual Impacts – Operation Phase (continued)**

<b>Project Component</b>	<b>Activity</b>	<b>VEC</b>	<b>Impact</b>	<b>Significance before Mitigation</b>	<b>Significance after Mitigation</b>
<b>OPERATION PHASE</b>	Operation of freshwater intake and marine outfall pipelines	Groundwater quality	Contamination	MODERATE	INSIGNIFICANT
		River-water quality	Contamination	MODERATE	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Degradation of ecosystem	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-economic activities	Increased economic activity	POSITIVE	POSITIVE
	Operation of natural gas pipeline (spur connection to process plant)	Air quality	Gaseous emissions	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-economic activities	Increased economic activity	POSITIVE	POSITIVE
	Solid waste disposal	Groundwater quality	Leaching of waste into aquifer	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat and damage to vegetation	MINOR	INSIGNIFICANT
		Community	Adverse health		

		health and safety	impacts	MINOR	INSIGNIFICANT
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