Project Description

Atlas Agro

City of Richland, Washington

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Abbreviations, Initialisms, and Prefixes

ANSI	American National Standards Institute
API	American Petroleum Institute
ASU	air separation unit
BMP	best management practice
BPA	Bonneville Power Administration
CAN	calcium ammonium nitrate
CAN 27	calcium ammonium nitrate with 27% total nitrogen
CCTV	closed circuit television
CFR	Code of Federal Regulations
ENVID	environmental impact identification
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FERA	fire and explosion risk assessment
HAZID	hazard identification study
HAZOP	hazard and operability study
Hz	hertz
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
kV	kilovolt
MCC	motor control center
NFPA	National Fire Protection Association
NO	nitric oxide *or* nitrogen (mon)oxide
NO_2	nitrogen dioxide
NO_x	NO and/or NO_2
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PGF	Pacific Green Fertilizer Plant
project	Pacific Green Fertilizer Plant project
PTZ	Pan-Tilt-Zoom
QRA	quantitative risk assessment
RP	Recommended Practice
SHERQ	Safety, Health, Environment, Risk, and Quality
SIL	safety integrity level
SPCCP	spill prevention, control, and countermeasure plan
SWPPP	stormwater pollution prevention plan
UPS	uninterruptible power supply
V	volt
VA	volt-ampere

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1 Introduction

The US is a top importer of overseas-produced fertilizer and fertilizer components. The domestic US fertilizer industry is dominated by a few producers located mostly in its Midwest and East regions. To produce ammonia or urea, these producers rely on a natural gas process that emits up to three tons of carbon dioxide per ton of nitrogen fertilizer produced. Although there are 28 fertilizer plants in the US, fertilizer is expensive in the Pacific Northwest due to the cost of importing the finished fertilizer product from outside the region. To increase nitrogen fertilizer availability in the US without adding to agriculture's carbon footprint, new large-scale, green production is required.

Atlas Agro North America Corp is proposing a fertilizer plant facility, referred to as the Pacific Green Fertilizer Plant (PGF) (referred herein as project), in Richland, Washington. The project is in the Northwest Advanced Clean Energy Park, City of Richland, Benton County, Washington, in a newly annexed portion of the city of Richland that was part of the Hanford Site. The overall industrial park is approximately 260 acres with the proposed project utilizing approximately 130 acres in the southern portion of the park.

PGF would primarily produce up to 650,000 metric tons per year of zero-carbon nitrate fertilizers (as calcium ammonium nitrate [CAN]), developed using a hydrogen gas-based process. The goal of PGF is to increase the availability of nitrogen fertilizer across the US. The Project would produce CAN fertilizer products sufficient to meet roughly 50 percent of the nitrogen fertilizer demand of the region, including Washington, Oregon, and Idaho. This would offset imports from countries including Canada, China, Norway, and Russia in addition to domestic supply imports from remote regions of the country. Farmers in the Pacific Northwest would benefit from improved access to more effective zero-carbon fertilizers and lower prices. Food manufacturers and consumer goods companies buying from regional farmers would reduce their carbon footprint. The project is estimated to bring more than $1 billion investment to the region.

2 Proposed Project Operations

The PGF would include the following elements: process units for hydrogen, ammonia, and nitric acid production; water system, including raw water, demineralized water, fire water, boiler water, and cooling water; air separation units; flare; check point entrances for security; administration building; fire station; equipment rooms; central control and laboratory room; storage buildings; truck loading station; rail unloading station; wastewater treatment facility; internal access roads; stormwater pond; and parking.

Within the process structures the raw materials undergo a chemical process to produce CAN 27, calcium nitrate, and ammonium nitrate solution fertilizer products that would be distributed to local and regional markets. Figure 1 illustrates the production process.

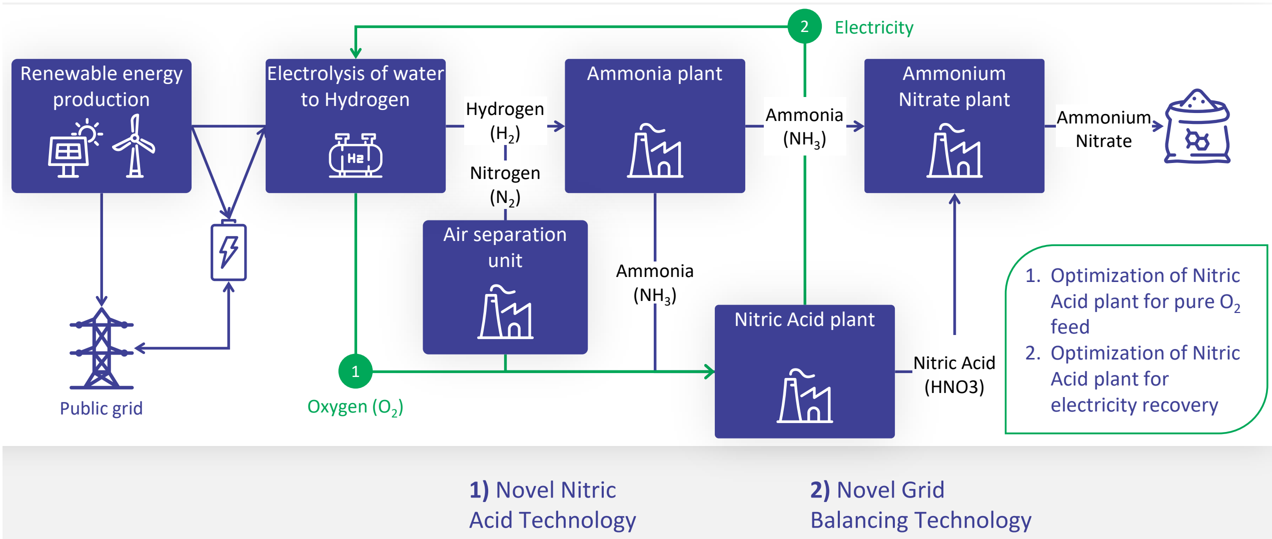

Figure 1. Atlas Agro production process-overview.

Using zero-carbon electricity, water electrolysers convert demineralized water into hydrogen and oxygen. The hydrogen is used in the ammonia plant and the oxygen is used to improve the efficiency of the nitric acid plant. A different process uses an air separation unit to split out nitrogen from atmospheric air molecules. The nitrogen is a feedstock for the nitric acid and ammonia plants.

Within the ammonia plant, nitrogen and hydrogen are processed together at high temperatures and pressure resulting in the creation of ammonia. About half of the created ammonia is sent to the ammonium nitrate plant and the other half to the nitric acid plant.

The nitric acid is then sent to the ammonium nitrate plant where it is combined with ammonia sent directly from the ammonia plant. Ammonia effectively neutralizes the acid and forms ammonium nitrate solution. The addition of limestone (calcium carbonate) and dolomite (calcium carbonite plus magnesium carbonate) into the ammonium nitrate creates calcium ammonium nitrate with 27 percent total nitrogen (CAN 27) and into nitric acid creates calcium nitrate, both are inert substances. The inert CAN and calcium nitrate are then dried and sent to a granulation unit where both are processed into a granulated solid form of fertilizer. The final products are stored for shipping to customers.

The depicted technologies have been proven in multiple installations with long operating histories, complying with all applicable safety and environmental regulations. Atlas Agro has filed patents for further energy integration beyond the common process schemes. The facility would integrate the steam grids to reduce waste steam and use the additional steam to generate power for the electrolyser, thereby reducing the primary energy need.

3 Process Components

The facility's design includes the production of various compounds. Of these products, CAN 27, calcium nitrate, and ammonium nitrate solution are finished products for regional distribution. The subsections that follow describe each of these products in more detail.

3.1 Hydrogen

The production of hydrogen would involve using only zero-carbon electricity and pure water. The electrolysers would produce approximately 40,000 metric tons of hydrogen annually, equivalent to approximately 115 metric tons per day. The hydrogen produced would be purified and dried to feed the ammonia plant downstream.

3.2 Ammonia

Ammonia is produced via the well-known Haber-Bosch process in an ammonia reactor. Hundreds of such reactors exist and operate all over the world, including in the US. The facility would convert atmospheric nitrogen, separated from the air in a cryogenic air separation unit, to ammonia by a reaction with hydrogen, produced in the hydrogen plant mentioned above. For conversion, both raw materials would feed a reactor using an iron catalyst under high temperatures and pressures. The facility would produce approximately 635 metric tons of ammonia per day. Ammonia produced would be stored in a double-walled atmospheric tank with a capacity of 15,000 metric tons at -27 degrees Fahrenheit (°F). Ammonia produced would be pumped to the nitric acid plant and ammonium nitrate plant as feed stock raw material.

3.3 Nitric Acid

Nitric acid is produced by oxidizing ammonia with oxygen from the atmosphere. The reaction between ammonia and oxygen forms nitric oxide and water over a platinum catalyst at high temperatures.

The nitrous oxide produced would be oxidized to nitrogen dioxide in the piping and heat exchangers downstream. Nitrogen dioxide would finally be absorbed with water in the absorption tower to produce nitric acid. The new nitric acid plant would be designed to produce 60 percent acid. The daily capacity of the nitric acid plant would be 1,160 metric tons (100 percent nitric acid). Nitric acid produced would be stored in an atmospheric tank with capacity for five days of production, which is approximately 300,000 cubic feet.

3.4 Ammonium Nitrate Solution

The ammonium nitrate solution plant would produce ammonium nitrate by exothermic reaction of gaseous ammonia with nitric acid in a neutralization reactor. This neutralization would be upstream of a concentration section in vacuum to achieve the required concentration of 96 percent ammonium nitrate to feed the calcium ammonium nitrate plant. The ammonium nitrate solution plant capacity would produce 1,530 metric tons per day (100 percent ammonium nitrate solution). The ammonium nitrate solution would be stored in a vessel with a capacity of 100 to 150 metric tons, corresponding to around two hours for 100 percent capacity.

3.5 Calcium Ammonium Nitrate 27

The granulation plant would produce CAN 27 with 96 percent concentrated ammonium nitrate solution and dolomite and/or limestone that would be supplied by others. The ammonium nitrate solution would be sprayed on a granulator over a rolling bed of solid dolomite and/or limestone and recycle particles to produce the granules of CAN. Downstream drying, particle size distribution, cooling and coating sections would conform the final product with required specifications. The CAN plant daily capacity would be 2,276 metric tons (27 percent nitrogen). A product storage building would be designed to store approximately 30 days of production (68,000 metric tons).

3.6 Calcium Nitrate

Calcium nitrate would be produced by dissolving the limestone with nitric acid along with raw process water to adjust the solution concentration. The reaction section would be upstream of a filtration stage. The whole operation of this plant would be designed to produce batches and to operate when the CAN plant is offline (*i.e.,* during a general annual shutdown). The calcium nitrate operation's daily capacity would be 320 metric tons.

4 Materials

4.1 Raw Materials

4.1.1 Raw Water and Potable Water

Raw water would be obtained from the City of Richland (City) via an existing irrigation line at an interconnection at Horn Rapids Road. The water right for this irrigation water allows for year-round use and the City has confirmed the pump station and water lines to the project site have capacity to handle the requested water needs for the project. The irrigation line would be used to provide both raw water for process uses as well as potable water needs.

Raw water from the City's non-potable water delivery system would be required as a feedstock at up to 32,000 cubic feet per hour. Raw water would be required in the ancillary buildings, in the process and utility areas where chemicals are managed, and for fire suppression water.

Potable water would be required in the buildings for domestic uses (kitchen sinks, toilets, showers), safety eyewashes, and for process use in the hazardous chemical areas. Potable water would either be obtained from the City at an interconnection at Horns Rapids Road or treated and produced on site. Domestic water use is not expected to exceed 7,000 gallons per day.

4.1.2 Atmospheric Air

Atmospheric air would be required as a feedstock of the nitric acid and ammonium nitrate plants. Atmospheric air would be broken out into nitrogen and oxygen in the air separation unit using a combination of high pressure and heat exchangers.

4.1.3 Dolomite and Limestone

Dolomite, limestone, and micronutrients are added to the ammonium nitrate to create CAN 27. The addition of these two minerals helps to neutralize the acidity of the ammonium nitrate by raising the pH in the soil when applied and making it more conducive to growing plants. These raw materials are readily available in powder form in the region and would be brought to the project site via truck or rail and stored in a warehouse on site until needed.

4.2 Waste Materials

4.2.1 Industrial Wastewater

Approximately 400 cubic feet per hour of industrial wastewater would be treated within the facility in the wastewater treatment system. The treatment would meet the Washington Department of Ecology and City water quality requirements. Main effluents collected in the system for treatment would be:

- Raw water treatment reverse-osmosis rejection stream that would be mainly ions concentrated in water;
- Water from the paved process areas that can potentially be contaminated due to accidental leaks or spills; and
- Water cooling tower blowdown discharge.

The oily drainages generated from the following would be sent to the oil/water separator:

- Interiors of the buildings
- Process area
- Emergency diesel generator area
- Firefighting diesel pump
- Transformers
- Other necessary contaminated areas

The oily drainage from the oil/water separator would be conducted to a lamellar basin oil separator, downstream of which it would be pumped to the wastewater pit. Oil removed would be taken off site for disposal by an authorized handler.

The non-oily effluents coming from the following areas would be delivered to the effluent wastewater treatment system and would include:

- the chemical dosing area

- the water treatment plant area
- the battery room area
- emergency showers and eyewashes

There would be other minor water effluents produced in the nitric acid and ammonium nitrate plants that would be collected, recycled, and reprocessed within the plants.

A portion of treated process wastewater would not be suitable for reuse within the facility and would be discharged to the City sewer system at an interconnection at Horn Rapids Road. The facility design complies with the City code requirements regarding water quality and capacity for wastewater treatment.

Solids remaining following water treatment would be collected and disposed of off-site by a qualified contractor in accordance with federal, state, and local regulations.

4.2.2 Sanitary Wastewater

Sanitary wastewater would be generated from domestic uses, including toilets, kitchens, and showers in the operations and administrative buildings and discharged to the City sanitary sewer system at an interconnection at Horns Rapids Road.

4.2.3 Stormwater

Precipitation from impervious surfaces and roofs, including non-contact water, would be collected and directed to a stormwater retention basin on site. Some of the stormwater from the basin would then be routed through the on-site wastewater treatment facility to be reused inside the plant and/or treated in the on-site wastewater treatment plant. Remaining water in the stormwater basin, after treatment, would be infiltrated on site.

In addition to some of the non-contact stormwater, the wastewater treatment plant is designed to treat wastewater produced during production of the final product. There are various treatment methods that would be carried out depending on the types of waste in the water including: equalization and flow regulation; oil removal; biotreatment; sludge treatment (thickening and dewatering); and additional treatment such as reagent dosing for pH control, coagulation and flocculation polyelectrolyte, granular filtration (sand or similar) and activated carbon absorption. For water to be reused in the plant, additional treatment processes would occur so the water could be safely returned to various storage tanks in the plant. It should be noted specifically for oils that once removed, oils would be disposed off site by an authorized handler.

5 Process Structures and Ancillary Buildings

The structures required for the process of creating the finished products of CAN 27, calcium nitrate, and ammonium nitrate solution are listed in Table 1 and include several buildings and shelters of varying sizes. Table 1 lists the process structures and estimated dimensions.

Table 1. Proposed process units and dimensions.

Description	Length (feet)	Width (feet)	Height (feet)
Hydrogen Production	805	264	54
Ammonia Plant	197	193	83
Ammonia Production	226 145	160 101	127
Nitric Acid Production includes: Power, Steam, and Boiler Feed Water Generation	492	210	262 (height of stack)
Ammonium Nitrate Solution Production	162	200	130
CAN Granulation Production	168	200	218
Calcium Nitrate Production	125	200	95
CAN Storage Unit	759	231	130
Cooling Water	550	260	63
Raw Water System, Demineralized Water, Fire-Service Water Systems, & Effluent Wastewater Treatment System	483	385	142
Plant and Instrumentation Air	159	65	24
Air Separation Unit	145	92	30
Flare	294	230	82

To support the production process, several ancillary buildings are proposed as shown in Table 2.

Table 2. Proposed building types and dimensions.

Description	Length (feet)	Width (feet)	Height (feet)
Check Point Entrance (Trucks)	40	20	15
Check Point Entrance (Main Access)	40	20	15
Stormwater Basin	100	46	N/A
Administration Building	120	60	16
Central Control Room, Laboratory Building, & Fire Building	100	75	21
Warehouse and Workshop Building	120	50	21
HV Main Substation	429	46	23
Distribution Substation	346	46	33
IER Instrumentation Equipment Room	90	70	26
Ammonia Storage	80	70	40
Additives Bulk storage	60	45	23
Raw Material Bulk Silo	107	200	111
CAN Storage Unit	726	213	125
CAN Truck Loading Station	106	35	167

6 Support Processes

6.1 Air Separation Unit

The air separation unite (ASU) would produce the nitrogen required for ammonia from the air via a typical cryogenic distillation process. The nitrogen produced would be distributed through the complex to required users as needed. Atlas Agro has studied and considered the reuse of the oxygen byproduct of the ASU in the nitric acid plant to improve nitric acid conversion and minimize nitrous gases from this plant. Oxygen would be compressed and distributed through the complex to the required users. The ASU daily capacity would be 520 metric tons of nitrogen.

6.2 Flare System

An ammonia emergency relief flare system is a safety measure designed to mitigate the risks associated with the accidental release of ammonia gas due to an overpressure scenario in the ammonia, nitric acid, or ammonium nitrate solution plants or the ammonia storage tanks. The emergency flare system would consist of a series of interconnected piping, safety valves, and equipment that would be designed to collect and burn the ammonia gas during an overpressure scenario.

In case of an emergency, the system would automatically trigger an alarm and activate itself. The flare system would work by burning off the ammonia gas in a controlled manner to prevent it from spreading to the surrounding environment. The system would include a flare stack, including a vertical structure with an ignition system at the base and a flare tip at the top. The gas would be ignited at the flare tip and burn cleanly, converting the ammonia into water vapor and nitrogen gas.

6.3 Raw Water Treatment

The raw water treatment plant would produce the required water quality levels per Washington Department of Ecology and City requirements for use in the process plants:

- Service water would be used for cooling, fire suppression system make-up, and utilities.
- Demineralized water would be used to produce boiler feed water and process water.
- Pure water would be used for electrolyser feed stock.

Raw water would be routed to a storage tank that would feed a reverse, two-stage osmosis system to achieve the water quality necessary for each process system in terms of hardness, chloride content and conductivity. Service water would be produced from the first osmosis stage and would be stored and pumped to the users distributed along the complex. Demineralized water and pure water would be produced in the second-stage osmosis, stored and then pumped to the boiler feed water system, hydrogen production unit and other equipment. The reverse osmosis system water rejection would be sent to the wastewater treatment system.

6.4 Cooling Water System

The cooling water system would supply cooling water to various equipment. This system would be a closed loop in which the cooling water is constantly cooled at its source and constantly heated by the equipment that it cools. The cooling water system would include a tower, a basin, a side filter and pumps. The water would be fed to the cooling tower at about 100°F and cooled to about 78°F using countercurrent dry air and pumped for distribution. A portion of the cooled water would be filtered in the side filter package to remove any solids that entered the cooling water basin.

The make-up water would be service water produced in the raw water treatment operation. To avoid concentration of impurities via evaporation and to ensure water quality, a portion of the cooling water would be continuously blown down and recycled to the raw water treatment osmosis for treatment. Also, the cooling water basin would collect the process boilers' blowdowns produced as part of make-up water to reduce water consumption. The cooling water system design capacity would be approximately 132,000 gallons per minute.

6.5 Boiler Feed Water

The boiler feed water would be produced on a deaerator where demineralized water make-up would be mixed with condensate return from the steam users. The condensate previously recovered would be cooled down, stored, filtered and fed to the deaerator. In the deaerator, the condensate and demineralized water would be stripped with steam to remove any incondensable material and diatomic oxygen to ensure proper water quality for steam production. The boiler feed water would be treated to remove oxygen and balance its pH and then pumped to the steam producers and required users distributed along the complex. The boiler feed water capacity would be approximately 440 gallons per minute.

6.6 Steam and Power Generation

The steam within the complex would be produced in the process boilers included in the ammonia and nitric acid plants as medium-pressure steam where heat is removed from the exothermic process. The medium-pressure steam production would be approximately 95 metric tons per hour. Medium-pressure steam produced would be let down on a steam turbine generator as needed for a nitric acid compressor driver or for electrical power generation. Additionally, a small auxiliary steam boiler would be provided to ensure the ammonium nitrate product line's steam jacket operation when the ammonia and nitric acid plants are shut down.

6.7 Instrument and Plant Air

The instrument and plant air would be produced from the compressed air originating from the atmosphere. A portion of the compressed air would be dried further to produce the instrument air that would feed the pneumatic instrumentation. In case of compressor failure or upset an instrument air buffer system would be provided to maintain instrument air pressure (critical for safe plant operation).

6.8 Interconnecting Piping

The interconnecting piping would include the pipe racks and piping required to transport the raw materials and processed products from and to the complex's different plants and the utilities required for each plant.

6.9 Power

Zero-carbon electricity (green energy) would be purchased from renewable energy providers and brought to the site via electrical grid managed by Bonneville Power Administration (BPA). The construction of the power grid and associated substation interconnection is part of a separate federal action being completed by BPA. The 115 kilovolt (kV) and 230 kV lines would step down at a main substation located inside the plant, through power transformers, to conform to a primary distribution system at 34.5 kV. Process loads, buildings and other loads would be fed from a substation at 34.5 kV, 13.8 kV, 4.16 kV, 480 volt (V), and 120 V as required. Under normal operating conditions, the essential power loads of the project would be supplied from the normal power supply via essential power motor control centers (MCCs) and panelboards. Upon loss of the normal power supply, essential-power MCCs would be supplied from generators driven by diesel engines. The essential supply would be engaged with an automatic transfer scheme.

6.10 Telecommunications

Telecommunications systems to be included in the project would include: an access control system, a process closed circuit television (CCTV) system, a video surveillance system, a communication system (including a data network and IP telephony), a paging system (voice evacuation system), a building management system, and a radio system. All of these would be based in a main system cabinet and some remote ones located in buildings and power supplied by uninterruptible power supplies (UPSs). Nominal power consumption for each cabinet would be 4,000 VA (at 120 V and 60 Hz). The necessary power would be supplied from the electrical substations planned.

6.11 Fire Protection

The fire water system would be served by water supplied by the City. A fire detection system and sprinkler system would be required in occupied spaces such as the operations and administration buildings as well as other structures throughout the facility. The site would require a fire water loop with hydrants at code defined locations. A branch from the water main would feed each building requiring a sprinkler system. Electrical rooms and power distribution centers would also require FM200-style fire suppression systems.

Additionally, an ammonia emergency relief flare system would be installed as a safety measure designed to mitigate the risks associated with the accidental release of ammonia gas due to an overpressure scenario in the ammonia, nitric acid, or ammonium nitrate solution plants or the ammonia storage tanks. The emergency flare system would consist of a series of interconnected piping, safety valves, and equipment that are designed to use hydrogen to burn the ammonia gas during an overpressure scenario. Natural gas could be used as a backup option if necessary.

7 Site Access

7.1 Vehicle Access

Several internal roads are proposed between various buildings within the facility and two driveways are proposed with access to Horn Rapids Road. The internal roads would be approximately 20 feet wide. The main driveway and primary internal roads would be designed to accommodate trucks and equipment.

7.2 Rail Access

To facilitate raw material import (see Section 4.1.3), the facility would connect with the existing railroad spur tracks located along the eastern edge of the site. The proposed rail infrastructure would extend approximately 2,625 feet from the connection to the existing rail spur northward into the facility. The rail layout at the facility provides an arrival and departure track for the dolomite and limestone railcars and a parallel, double-ended unloading track that would be used to unload railcars. Dolomite and limestone would be unloaded directly from the railcars to a pneumatic transport system where it would be conveyed to silos for on-site storage.

8 Security and Lighting

Access to the site would be controlled by several security features. Fixed cameras would be installed along the fence to detect intrusion to the process plant. The entries to the site would be controlled with Pan-Tilt-Zoom (PTZ) and fixed cameras. Boom barriers in each driving lane with card readers would allow controlled access into the facility. Sliding motorized gates would close the entrance on specific time schedules, and bollards would safeguard against any vehicle not stopping at boom barriers.

Exterior lighting would be provided for all plant process units, buildings, and plant battery limits. Aviation lighting would be provided, if necessary, per Federal Aviation Administration (FAA) regulations. Control of the area lighting would be accomplished by photocell as per local normative regulations. Proposed lighting fixtures would include:

- Mast lighting, or similar, throughout the facility for safety
- Streetlights along internal roads, parking lots, and adjacent to buildings, as needed
- Wall packs at personnel entrances on buildings
- Stanchion and ceiling-mounted lights along walkways and stairs

Exterior building lights used for vehicle and worker safety would be in use when operations extend into nighttime hours. Lighting would be used from dusk until dawn, consistent with existing lighting in the area. Lighting intensity would be reduced to the minimum necessary for security purposes. Hence, the project would not introduce substantial new sources of light or glare.

9 Employment

The facility would operate 24 hours a day and 365 days a year. Most of the activities, such as maintenance, truck loading, and administration, would take place during daytime, whereas the nighttime operating staff would consist of the production shift. The total amount of employees is expected to be approximately 245, including managers, operational and maintenance supervisors and operators, Safety, Health, Environment, Risk, and Quality (SHERQ) personnel, engineers, and daily administrative staff. The shift pattern would be set up together with the employees and following local labor rules and regulations. Typically, there are two types of patterns: 12-hour and 8-hour shifts. Typically, the plant will have five or six shifts to cover the full rotation.

The most common 12-hour shift patterns include a "2-2-3-2" rotation, where employees work two days, have two days off, work three days, and then have two days off before the pattern repeats, or a "3-2-2-3" rotation, where employees work three days, have two days off, work two days, have three days off, and then repeat the pattern. These shift patterns require fewer shift changes and can offer employees more consecutive days off work, which can be beneficial for work/life balance.

The 8-hour shift pattern can be divided into three different shifts: morning, afternoon, and night. A typical 8-hour shift pattern for a manufacturing plant might involve employees working five consecutive days followed by two days off, which can help to ensure that all shifts are covered while still providing employees with regular breaks.

10 Project Construction

Project construction is anticipated to begin in 2025 and take approximately 3 years to complete.

Staging and material storage during construction would occur on the facility site determined by the contractor. As the facility site would be mostly paved, no additional clearing or grading outside of that already slated for development is anticipated to support staging and material storage.

Site preparation activities would include clearing and grading as well as excavation for building construction. The total surface area that would be cleared and grubbed for the project is approximately 35 acres (including roads and rail). Site grading would include stripping an approximately 3- to 12-inch-thick topsoil layer and grubbing brush root wads from the project area. Vegetation would be removed and disposed of off-site at an authorized facility determined by the contractor. Soils removed during excavation that are not reincorporated into the finished grading would be stockpiled on site or hauled off site for disposal at an authorized facility determined by the contractor. Fill material (*i.e.,* soil) for the project would be from an approved location determined by the contractor.

During construction there may be a need to transport pre-assembled process modules and/or large equipment that are shipped via barge in the Columbia River to the Port of Benton (Port). From the Port these components would be moved via truck transport to the project site (approximately 3 miles). No road widening would be required for this transport from the Port to the project site. Atlas Agro would coordinate with the City to provide appropriate traffic control (such as temporary road or lane closures) as needed to accommodate movement of the modules.

Multiple construction crews would be working at the same time. Crews would be excavating foundations and using typical methods for cast-in-place concrete while others would be erecting elements of the various structures, utilities, mechanical, electrical, and instrumentation equipment. This would include the use of cranes, forklifts, welding machines, bulldozers, drill rigs, and so forth. Construction would include the following major components:

- Civil Works
- Mechanical Works
- Heavy Lifting
- Electrical and Instrument Works

The exact breakdown of workers and number of shifts could change, but, based on the contractor, most of the work is anticipated to be one shift per day, 10 hours per day, five days a week. To maintain the construction schedule potential weekend or night shifts may be necessary. Workers reporting for their shifts would access the construction site from Horn Rapids Road.

During project construction, appropriate erosion control measures would be implemented prior to clearing, grading, or excavation activities. These control measures would be identified in the project plans and construction specifications and implemented as required by the city building permits, the stormwater pollution prevention plan (SWPPP), and the erosion control plan prepared in compliance with the National Pollutant Discharge Elimination System (NPDES) Construction Storm Water General Permit. Best management practices (BMPs) for construction activities would include, but are not limited to:

- development, implementation, and maintenance of an SWPPP to minimize erosion of sediments due to rainfall runoff at construction sites and to reduce, eliminate, and prevent the pollution of stormwater during construction
- installation of filter fabric fences around disturbed areas
- installation of silt traps in storm drain inlets
- installation of gravel construction entrances
- stabilization of temporary soil stockpiles and exposed soils
- regular street cleaning for mud and dust control
- use of appropriate means to minimize tracking of sediment onto public roadways by construction vehicles

- designation of personnel to inspect and maintain temporary erosion and sediment control measures
- development, implementation, and maintenance of a spill prevention, control, and countermeasure plan (SPCCP) to manage toxic materials associated with construction activities (*e.g.,* equipment leakage, disposal of oily wastes, cleanup of spills, storage of petroleum products and chemicals in contained areas away from streams and wetlands)
- establishment of a communication protocol for handling spills (applicable spill response equipment and material designated in the SPCCP would be maintained at the job site)
- refueling of construction equipment and vehicles, away from surface waters whenever practical
- containment of equipment and vehicle wash water associated with construction and keeping it from draining to surface waters
- storing fuels and other potential contaminants away from excavation sites and surface waters in secured containment areas
- prevention of oil, fuels, and chemicals from discharging to surface waters and onto land where there is a potential for entry into surface waters
- conduction of regular inspections, maintenance, and repairs of fuel hoses, hydraulically operated equipment, lubrication equipment, and chemical and petroleum storage containers
- restoration of temporarily disturbed areas by establishing grass or other vegetative cover on the construction site as soon as possible after disturbance is complete or when the soil would remain unworked for greater than 30 days

Soils, including stockpiles, would not remain exposed and unworked for more than the following time periods:

- 30 days during the dry season (July 1st through September 30th)
- 15 days during the wet season (October 1st through June 30th)

11 Safety

The project facility would store and produce hazardous chemicals as part of the processes described in previous sections. These include hydrogen gas, ammonia gas, nitric acid, ammonium nitrate solution, ammonium nitrate, and CAN 27 fertilizer. Table 3 summarizes these chemicals and potential hazards as described in the Hazard and Operability (HAZOP) and Safety Integrity Level (SIL Determination).

Table 3. Potential hazardous chemicals from project operations.

Process Components	Symbol	Chemical Description
Hydrogen (gas)	H_2	Hydrogen is a colorless, odorless, and potentially explosive gas if mixed with sufficient quantities of oxygen (most likely from air) and sufficiently heated. If released in a large quantity, hydrogen could displace enough oxygen to cause rapid suffocation. It burns with an invisible flame.
Ammonia (gas)	NH_3	Anhydrous ammonia is a flammable liquefied gas (as its vapor may form explosive mixtures with air). Its vapor is lighter (less dense) than air at atmospheric conditions, and it has the same pungent odor as household ammonia. Although ammonia vapor is lighter than air at atmospheric conditions, vapors from an accidental leak are likely to hug the ground, appearing as a white cloud, until they warm to atmospheric temperature. These vapors can displace oxygen and cause rapid suffocation. Ammonia can cause severe skin burns and eye damage and is very toxic to aquatic life.
Nitric Acid (liquid)	HNO_3	Nitric acid is often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen dioxide. Nitric acid is an oxidizer that can corrode certain metals, can cause severe skin burns and eye damage, is toxic if inhaled, and is corrosive to the respiratory tract.
Ammonium Nitrate Solution (liquid)	NH_4NO_3 (also referred to as ANSOL)	Ammonium nitrate is a salt of ammonia and nitric acid. Ammonium nitrate is a colorless, crystalline substance. It is highly soluble in water and soluble in alcohol and liquid ammonia. Ammonium nitrate is not in itself combustible, but because it is an oxidizing agent, it can assist other materials to burn, even if air is excluded.
Calcium Nitrate (solid)	$Ca(NO_3)_2$	Since calcium nitrate is an oxidizer, it may intensify a fire. It may cause damage to organs through prolonged or repeated exposure.
Calcium Ammonium Nitrate (solid)	CAN 27	CAN 27 is a granular nitrogen fertilizer based in CAN for use on any crop. CAN 27 contains nitrogen as nitrate and ammonium. This material is not considered hazardous by the OSHA hazard communication regulation (29 CFR 1910.1200).

Hydrogen gas has been used for many years as a fuel in the space industry as well as in industrial processes. The other chemicals above are commonly used and produced as part of a fertilizer plant operation. The Occupational Safety and Health Administration (OSHA) and industry groups have set standards and guidelines for safely storing and handling the various chemicals processed during fertilizer production. These safety risks to workers and the public would be prevented through the implementation of safety and emergency plans in compliance with the federal, state, and industry standards.

Safety practices during factory operation would meet or exceed industry operating standards. Company personnel and contract employees would undergo safety and process operations training on a routine basis, including training in emergency response and evacuation plans.

Atlas Agro would store and process chemicals subject to OSHA's regulation for process safety management of highly hazardous chemicals (29 CFR 1910.119). Other main safeguards to reduce or mitigate environmental health hazards include the installation of safety instrumentation (e.g. ammonia detectors, alarms), safe routing of expected emission streams, fire suppression systems, and other measures. Safety showers would be installed in various buildings for employee use as required.

Additionally, escape routes and assembly points within the plant would be developed. The equipment and escape routes/plans are developed based on Washington Administrative Code (WAC) 296-24-567, WAC 296-800-310, WAC 296-842, WAC 296-824 as well as the Washington State Building Code; along with international standards ANSI Z358.1 (2014), National Fire Protection Association (NFPA) 1989 (2008), and other applicable codes by the Environmental Protection Agency (EPA) and OSHA.

Atlas Agro has conducted several studies to evaluate potential risks associated with the project. These studies have been conducted to comply with federal and state safety codes OSHA 29 CFR 1910.119, WAC 296-67, and EPA 40 CFR 68; and international safety standards OSHA 1910, International Organization for Standardization (ISO 17776:2016, American Petroleum Institute (API) Recommended Practice (RP) 752, International Electrotechnical Commission (IEC) 61882, IEC 61508, and IEC 61511. Emergency scenarios such as spills, toxic releases or fire explosions have been evaluated through additional studies:

- Hazard Identification (HAZID). HAZID provides a structured approach to identify hazards and potential undesirable consequences and to evaluate the severity and likelihood of what is identified.
- Environmental Identification (ENVID). ENVID is a structured examination of aspects of a facility for early identification of concerns that may affect the environment.
- HAZOP & SIL Determination Study. The purpose of a HAZOP is to identify potential hazards and operability problems, review the adequacy of the planned protective measures and either propose solutions or identify areas for further evaluation. A SIL determination provides a methodology to guide users to the safe, cost-effective and consistent design, implementation and maintenance of safety-instrumented functions (SIFs) by determining the SILs with which they have to comply in order to cover the risk gaps allocated to different scenarios.
- Quantitative Risk Assessment (QRA). A QRA is a formal and systematic approach to estimating the likelihood and consequences of hazardous events and expressing the results quantitatively as risk to people, the environment or business.
- Fire and Explosion Risk Assessment (FERA). FERA is a structured and systematic process to identify and assess risks from fire and explosion hazards.

The HAZOP and SIL Determination identified potential events that could occur at the facility, potential impacts, and proposed safeguards to include in the facility design and operation. The recommendations from this study are summarized in general terms in Table 4.

Table 4. Emergency scenarios and recommendations.

Event	Potential Sources	Areas Potentially Affected	Potential Impacts	Planned Safeguards
Spill	• Ammonia hydrocarbons • Acid/Base • Nitric acid	• Aquatic environment • Groundwater • Soil • Terrestrial vegetation	• Vegetation damage • Fauna damage • Chronic contamination • Nutrient enrichment	• Online instrumentation (e.g., NO_x analyzer, ammonia detectors, etc.) and monitoring (e.g., motor run status) with engineered set points, alarm limits, & corresponding interlocks • Safe routing of expected emission streams • Compressor anti-surge system • Condensate traps • Backup utilities (e.g., instrument air) • Maintenance procedures • Emergency response procedures • Gas & fire detection systems • Fire suppression systems • Personal protective equipment
Extraordinary Emissions	• Wastewater – nutrients (phosphorus, nitrogen, ammonia, ammonium nitrate) • Atmospheric – NO_x, ammonia vapor	• Aquatic environment • Vegetation	• Nutrient enrichment • Vegetation damage (due to acid deposition) • Degradation of rock art (due to acid deposition)	
Toxic Release	• Ammonia leak	• Plant Site • Plant Surroundings	• Vegetation Damage • Fauna Damage • Chronic Toxicity	
Fire or Explosion	• Ammonium nitrate • Natural gas • Diesel fuel • Hydrogen	• Plant site • Plant surroundings	• Vegetation damage • Fauna damage • Formation of toxic residues	

The QRA and the FERA demonstrated that the greatest risk associated with the project is an accidental ammonia leak. The FERA indicated the statistical probability of an ammonium gas dispersion outside of the facility could occur approximately 1 in 10,000 years. To avoid and minimize this potential risk, the project design includes the following mitigation measures:

- The ammonia storage tank will be designed as a double wall as per the best industry practice. The double wall is designed for full containment in case an ammonia leak occurs inside the tank. The tank also will be surrounded with water cannons as best practice to mitigate ammonia leaks. Additionally, leak detectors are included to activate the facility alarms.
- The project design includes a minimal number of flanges, thereby reducing the potential for leakage to the lowest feasible extent.
- In buildings located near process areas with risk of accidental release, detectors would be provided at the entrances to the air ducts. If a release is detected, a signal will be sent to the fire and gas system and the air intake will be closed.

- All alarm signals can be observed immediately by the operator in the Control Room, differentiating between a fire or a gas leak alarm.
- An ammonia emergency relief flare system would be installed as a safety measure designed to mitigate the risks associated with the accidental release of ammonia gas due to an overpressure scenario in the ammonia, nitric acid, or ammonium nitrate solution plants or the ammonia storage tanks. The emergency flare system would consist of a series of interconnected piping, safety valves, and equipment that are designed to collect and burn the ammonia gas during an overpressure scenario.
- Every process unit is equipped with a manual alarm to be activated by personnel in the event of a possible ammonia leak or fire.
- The electrolysers building roofs would be designed to ensure the relief of potential overpressure of hydrogen through a safe route to avoid damages to humans or other facilities.
- The operator's room of the hydrogen production unit would be in a separate building, and no occupancy is foreseen in the electrolysers buildings.