SECTION 2
PROJECT DESCRIPTION

2.1 Project Description

The proposed project includes construction of eight (8) new steam cracking furnaces and recovery equipment. The major pieces of recovery equipment include a quench tower, caustic wash facilities, a process gas compressor, a sour water stripper, a wet air oxidation unit, a deethanizer, an ethylene/ethane (C_2) splitter, and a demethanizer. Bottoms product from the new quench tower and deethanizer will be routed to the existing base plant. In addition, a new cooling tower and a new flare system will be constructed. Existing utilities (such as plant air, electric, marginal steam product) will support the proposed project as needed. A duct burner will be installed in existing Train 5. Figures 2-1 through 2-4 show the basic process flow of the proposed project. As built configurations may differ without impact to the GHG emissions and/or controls.

The emissions from the proposed project will be controlled using the following control technologies: ultra low NO_x burners and Selective Catalytic Reduction (SCR) units on the proposed furnaces, cyclonic separators on the proposed decoking drums, drift eliminators on the cooling tower, and staged flare system to control off gas streams.

2.2 Detailed Project Description

The new facilities will process ethane to produce ethylene and other products. The ethane recovered from the process is recycled to the feed stream. A process flow sequence is shown on the block flow diagram, Figure 2-1. The proposed project will contain typical process equipment including vessels, drums, exchangers, rotating equipment, pipe and piping components, utilities, instrumentation including analyzers, and chemical injection facilities. Design capacity is included in Appendix A and the operating schedule is included in Table 7-1 of this application for each of the proposed sources.

2.2.1 Furnace Section

The unit will operate by firing the furnace section, consisting of eight steam cracking furnaces, continuously (EPNs: XXAF01-ST through XXHF01-ST). The furnace design is proprietary and is equipped with ultra low NO_x burners and SCR systems to control NO_x emissions. The furnaces will crack fresh ethane that is combined with recycled ethane. Steam is introduced as part of the process. The furnace outlet stream is cooled in the Quench Tower.

The furnaces will fire imported natural gas or a blended fuel gas that consists of imported natural gas and tail gas. Tail gas is a recycle stream resulting from an initial separation of methane and hydrogen during the chilling step within the Demethanizer System. The composition of blended fuel gas will vary and will depend on current hydrogen production and disposition.

2.2.1.1.1 Decoking

In the cracking operation, coke (molecular carbon) gradually builds on the inside walls of the furnace tubes. This layer of coke impedes heat transfer and must be removed while the furnace is offline through a steam/air decoke operation. The coke is removed from the walls of the furnace tubes through oxidation and spalling. The spalled coke fines are disengaged from the furnace effluent in the decoke drum. Particulate matter emissions are controlled through cyclonic separators at the decoke drum vent which releases to atmosphere (EPNs: XXAB-DEC through XXGH-DEC). Figures 2-2 and 2-3 provides a comparison of the on-line furnace operation versus the decoke furnace operation.

2.2.2 Quench Tower

The combined furnace effluent flows into the Quench Tower where it is cooled with quench water. The majority of the dilution steam and some of the heavier hydrocarbons are condensed and exit the tower bottoms. Cooled cracked gases from the tower overhead are caustic scrubbed and compressed. Pyrolysis water in the Quench Tower contains trace amounts of hydrogen sulfide, organic acids, phenols, and some heavy hydrocarbons through direct contact with the process gas. A stripper removes these hydrocarbons from the quench (pyrolysis) water stream that will be used for dilution steam. The heavier hydrocarbons removed from quench water stream are sent to the base plant for recovery. Some process water is removed from the circulating dilution steam and is processed in water treatment facilities.

2.2.3 Recovery Section

The processing steps within the Recovery Section consist of process gas compression, ammonia removal, caustic scrubbing, and feed drying; deethanizing and acetylene conversion; feed chilling and demethanizing; and ethylene recovery. Refrigeration required for the heat removal in low temperature fractionation is provided by refrigeration systems.

2.2.3.1 *Caustic Wash and Compression*

Caustic Water Wash Towers are located between compressor stages, where carbon dioxide (CO_2) and hydrogen sulfide (H_2S) are removed in stages of caustic scrubbing. Spent caustic resulting from the caustic scrubbing of the Quench Tower overhead is oxidized in a Wet Air Oxidation Unit prior to neutralization with sulfuric acid and introduction to the wastewater treatment system. Gases from the Wet Air Oxidation Unit are combusted to minimize VOC emissions.

The duty of the process gas compressors is to transfer low pressure gas from the Quench Tower overhead stream to a higher pressure disposition. This process allows the gas to move through the Recovery Section for separation. Once washed and compressed, the Quench Tower overhead stream is dried.

2.2.3.2 *Deethanizer and Acetylene Converter*

The Deethanizer separates the hydrocarbons with two or less carbon atoms from heavier hydrocarbons. The overhead stream is sent to the Acetylene Converters where acetylene is converted to ethylene and ethane. If the Acetylene Converter requires regeneration online, the gases from the Acetylene Converter regeneration are minimal and are directed to a new Acetylene Converter Regeneration Vent (EPN: ACETCONVXX). The Deethanizer bottoms product, hydrocarbons with more than two carbon atoms, is sent to the BOP Depropanizer in the existing plant facilities. The heavier products from the new facilities such as propylene, propane, 1,3-butadiene, isoprene, pyrolysis gasoline, and benzene are recovered along with the same products from the existing facilities.

2.2.3.3 *Demethanizer System*

The objective of the Demethanizer System is to separate ethylene from lighter components. The Demethanizer Chilling Train and Demethanizer accomplish this separation through progressively colder temperature levels and distillation. A tail gas stream consisting of methane and hydrogen is produced from the Demethanizer system. This stream can be further processed to purify and recover the commercial value of the hydrogen. If this disposition is unavailable, the tail gas may be routed to the fuel gas system.

2.2.3.4 *Ethylene Recovery*

Ethylene and ethane are fractionated in the C_2 Splitter to produce the ethylene product. The residual ethane is recycled to the steam cracking furnaces where it is mixed with fresh feed.

2.2.4 Cooling Tower

A new cooling tower (EPN: BOPXXCT) will be constructed to provide process heat removal and supply cooling water to the proposed project. This cooling tower will be a multi-cell, induced draft, counter-flow type cooling tower. No increase in GHG emissions are being requested from the proposed cooling tower.

2.2.5 Flare System

A new flare system (EPNs: FLAREXX1 and FLAREXX2) will be designed to provide safe control of gases vented from the proposed project. This system will be equipped with a totalizing flow meter and an on-line analyzer to speciate the hydrocarbons in the flare gases, including Highly Reactive Volatile Organic Compounds (HRVOCs).

2.2.6 Wastewater Collection and Treatment System

The proposed project will operate a system to collect process wastewater, separate hydrocarbons from the water and segregate the streams in storage tanks. The wastewater will be further processed in an existing treatment system. The treated water will then be discharged to an approved outfall location.

2.2.7 Storage Tanks

Several new storage tanks will be constructed for the proposed project. These tanks will be ancillary to the process and will store materials such as slop oil, diesel fuel, wastewater, ammonia, compressor wash oil, lube oil, caustic, spent caustic, sulfuric acid, methanol, various additives, and bleach. Some tanks will be routed to control. No increase in GHG emissions are being requested from the proposed storage tanks with atmospheric vents.

2.2.8 Engines

2.2.8.1.1 Backup Generators

The proposed project includes three backup generators, estimated at three (3) megawatt total. Each unit is powered by a diesel engine (EPNs: DIESELXX01-DIESELXX03) and there is one diesel tank associated with each backup generator. The normal operation of the generators is to test for proper operation weekly, in the event it needs to be used in an emergency or backup situation.

2.2.8.1.2 Firewater Booster Pumps

The proposed project will provide two booster pumps for the existing firewater system. These pumps will be powered by two diesel engines (EPNs: DIESELXXFW1 and DIESELXXFW2). The normal operation of the booster pump and engine is to test for proper operation weekly, in the event it needs to be used in an emergency or backup situation.

2.3 Planned Maintenance, Start-Up, and Shutdown Activities

The emissions represented in this application reflect the planned maintenance, start up and shut down (MSS) activities requested to be authorized in this new permit application action. Planned MSS activities and associated emissions including equipment degassing/opening, vacuum trucks, frac tanks, and consumables are described below. Planned MSS activities with associated GHG emissions are emitted from the flare and are therefore represented in flare emissions.

2.3.1 Equipment Openings

Equipment is cleared throughout the year in preparation for maintenance activities. GHG emissions are generated when the cleared vapors are controlled by the flare system. No GHG emissions are proposed from opening the equipment to atmosphere.

2.3.2 Furnace Start-Up

Planned MSS emissions from the proposed furnaces are due to the SCR warm-up during start up. This operation is intermittent and infrequent and is not expected to result in increased GHG emissions compared to normal operation.

2.3.3 Consumables

Small, generally disposable items termed "consumables" will be included as planned MSS activities for the proposed project; however, no increase in GHG emissions are being requested from the planned MSS activities due to consumables.

2.3.4 Vacuum Trucks

A vacuum truck operates by reducing the pressure on its tank prior to or during pickup of materials and venting released vapors through the vacuum pump and sometimes to a control device. Vacuum trucks are utilized at BOP on a daily basis to transfer materials from one container/vessel to another or from a container/vessel into a closed drain system, usually for purposes of routine maintenance such as: removing the contents of a tank prior to degassing, washing, and/or changing service of the tank; removing water or solids buildup; or collecting materials for treatment in waste/wastewater management units. No increase in GHG emissions are being requested from vacuum truck operations.

2.3.5 Frac Tanks

Frac tank is a generic term for small portable tanks of 500 barrels or less that are used as a repository for cleared/dewatered equipment. The tanks temporarily hold material so that it can be tested prior to reinsertion into the process or treatment in a wastewater treatment unit. Ancillary equipment from fugitives, deoiling/dewatering devices, and waste containers are included with this source. No increase in GHG emissions are being requested from the planned MSS activities due to frac tanks.

2.3.6 Flare System

The flare system is used to control emissions from planned MSS activities related to equipment clearing and startup and shutdown activities.