TECHNICAL EVALUATION

&

PRELIMINARY DETERMINATION

APPLICANT

United States Sugar Corporation
111 Ponce De Leon Avenue
Clewiston, FL 33440

U.S. Sugar Clewiston Mill and Refinery
ARMS Facility ID No. 0510003

PROJECT

Draft Permit No. PSD-FL-415
Project No. 0510003-048-AC

Hydrogen Sulfide Degasification System

COUNTY

Hendry County, Florida

PERMITTING AUTHORITY

Florida Department of Environmental Protection
Division of Air Resource Management
Air Permitting and Compliance Section
2600 Blair Stone Road, MS#5505
Tallahassee, Florida 32399-2400

June 27, 2011

1. GENERAL PROJECT INFORMATION

Facility Description and Location

The United States Sugar Corporation (U.S. Sugar) operates a sugar mill and refinery in Hendry County located at the intersection of W.C. Owens Avenue and State Road 832 in Clewiston, Florida. The UTM coordinates are Zone 17, 506.1 kilometers East, and 2956.9 kilometers North. Sugarcane is harvested from nearby fields and transported to the mills by train. In the mill, sugarcane is cut into small pieces and processed in a series of presses to squeeze juice from the cane. The juice undergoes clarification, separation, evaporation, and crystallization to produce raw, unrefined sugar. In the refinery, raw sugar is decolorized, concentrated, crystallized, dried, conditioned, screened, packaged, stored, and distributed as refined sugar. The fibrous byproduct remaining from the sugarcane is called bagasse and is burned as boiler fuel to provide steam and heating requirements for the mill and refinery. Molasses is also produced as a byproduct. Molasses is stored and processed into an animal feed product for sale.

Facility Regulatory Categories

- The facility is a major source of hazardous air pollutants (HAP).
- The facility has no units subject to the acid rain provisions of the Clean Air Act.
- The facility is a Title V major source of air pollution in accordance with Chapter 213, F.A.C.
- The facility is a major stationary source of air pollution in accordance with Rule 62-212.400, F.A.C. for the Prevention of Significant Deterioration (PSD) of Air Quality.

Project Description

On April 22, 2011, U.S. Sugar submitted a complete application for an air construction permit subject to the PSD preconstruction review requirements. On February 14, 2008, U.S. Sugar was issued a water permit (Permit No. 284958-001-WC) authorizing the installation of five well pumps including piping, two hydrogen sulfide (H_2S) degasification systems, three transfer pumps, a 600 gallon day tank and a 17,100 gallon horizontal storage tank for the sulfuric acid feed system. The H_2S degasification systems essentially strip the H_2S gas in the raw water to the atmosphere. At that time, U.S. Sugar was unaware an air construction permit would be required in addition to the water permit. Based on the most current information, it was determined that H_2S emissions were approximately 18 tons per year (TPY) from the H_2S degasification system, which exceeds the PSD significant emission rate for H_2S of 10 TPY. The H_2S emissions were estimated based on the maximum water usage rate and H_2S concentration in the raw water.

The following new emissions units will be added to this project.

EU No.	Description
036	Two Hydrogen Sulfide Degasification Systems

2. APPLICABLE REGULATIONS

State Regulations

This project is subject to the applicable environmental laws specified in Section 403 of the Florida Statutes (F.S.). The Florida Statutes authorize the Department of Environmental Protection to establish rules and regulations regarding air quality as part of the Florida Administrative Code (F.A.C.). This project is subject to the applicable rules and regulations defined in the following Chapters of the F.A.C.: 62-4 (Permitting Requirements); 62-204 (Ambient Air Quality Requirements, PSD Increments, and Federal Regulations Adopted by Reference); 62-210 (Permits Required, Public Notice, Reports, Stack Height Policy, Circumvention, Excess Emissions, and Forms); 62-212 (Preconstruction Review, PSD Review and determination of Best Available Control Technology (BACT), and Non-attainment Area Review); 62-213 (Title V Air Operation Permits for

Major Sources of Air Pollution); 62-296 (Emission Limiting Standards); and 62-297 (Test Methods and Procedures, Continuous Monitoring Specifications, and Alternate Sampling Procedures). PSD applicability and the preconstruction review requirements of Rule 62-212.400, F.A.C. are discussed in Section 2 of this report. Additional details of the other state regulations are provided in Section 3 of this report.

Federal Regulations

The Environmental Protection Agency (EPA) establishes air quality regulations in Title 40 of the Code of Federal Regulations (CFR). Part 60 identifies New Source Performance Standards (NSPS) for a variety of industrial activities. Part 61 specifies National Emissions Standards for Hazardous Air Pollutant (NESHAP) based on specific pollutants. Part 63 specifies NESHAP provisions based on the Maximum Achievable Control Technology (MACT) for given source categories. Federal regulations are adopted in Rule 62-204.800, F.A.C. Additional details of the applicable federal regulations are provided in Section 3 of this report.

2. PSD APPLICABILITY REVIEW

General PSD Applicability

For areas currently in attainment with the state and federal ambient air quality standards (AAQS) or areas otherwise designated as unclassifiable, the Department regulates major stationary sources of air pollution in accordance with Florida's PSD preconstruction review program as defined in Rule 62-212.400, F.A.C. An existing, new or modified facility is considered a major stationary source with respect to PSD if it emits or has the potential to emit:

- 5 tons per year or more of lead;
- 250 tons per year or more of any regulated air pollutant; or
- 100 tons per year or more of any regulated air pollutant and the facility belongs to one of the listed 28 PSD-major facility categories (which include Portland cement plants).

The regulated PSD pollutants include: carbon monoxide (CO); nitrogen oxides (NO_X); sulfur dioxide (SO_2); particulate matter (PM); particulate matter with a mean particle diameter of 10 microns or less (PM_{10}); volatile organic compounds (VOC); lead (Pb); fluorides (F); sulfuric acid mist (SAM); hydrogen sulfide (H_2S); total reduced sulfur (TRS) including H_2S; reduced sulfur compounds including H_2S; and mercury (Hg). There are additional PSD pollutants specific to municipal waste combustors and landfills.

A PSD applicability review is required for all projects at new and existing major and minor stationary sources. Once it is determined that the existing facility is, or that the new or modified facility will be, a major stationary source, the project emissions increases are then compared to the "significant emission rates" defined in Rule 62-210.200, F.A.C. for the PSD pollutants. If the potential emissions increase exceeds the defined significant emissions rate of a PSD pollutant, the project is considered "significant" for the pollutant. Also, note that significant emissions rate also means any emissions rate or any net emissions increase associated with a major stationary source or major modification which would construct within 10 kilometers of a Class I area and have an impact on such area equal to or greater than 1 $\mu g/m^3$, 24-hour average. For each significant PSD pollutant, the applicant must employ the Best Available Control Technology (BACT) to minimize the emissions and evaluate the air quality impacts. Although a facility or project may be *major* with respect to PSD for only one regulated pollutant, it may be "significant" for several PSD pollutants. Rule 62-210.200, F.A.C. defines "BACT" as:

> *An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account:*
>
> 1. *Energy, environmental and economic impacts, and other costs;*
> 2. *All scientific, engineering, and technical material and other information available to the Department; and*

3. The emission limiting standards or BACT determinations of Florida and any other state;

determines is achievable through application of production processes and available methods, systems and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant.

If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of an emissions unit or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice or operation.

Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63.

PSD Applicability for the Project

The project is located in Hendry County, which is in an area that is currently in attainment with the state and federal AAQS or otherwise designated as unclassifiable. The project potentially emits approximately 18 TPY of H_2S, which exceeds the PSD significant emission rate of 10 TPY. Therefore, the project is subject to PSD preconstruction review for H_2S emissions in accordance with the provisions of Rule 62-212.400, F.A.C. Therefore, a BACT determination is required for H_2S emissions. An air quality modeling analysis is not required since there is no ambient air quality standard for H_2S.

3. PROJECT DETAILS

U.S. Sugar is requesting an after-the-fact air construction permit for the installation of the five water wells and two degasification systems.

Water Wells

The U.S. Sugar Clewiston Mill uses water throughout the mill for process water, cooling water and to produce steam in the boilers. Prior to installing the wells, U.S. Sugar withdrew water directly from Lake Okeechobee. Installation of the water wells helps stabilize mill operations when the water level in the lake is low due to drought and low rainfall. Additionally, the lake water is much higher in total dissolved solid than the well water, which resulted in a reduction of chemical and polymer usage in the mill's waste water treatment facility.

H_2S Degasification System

The degasification system is a fiberglass, forced-draft, which promotes the removal of carbon dioxide (CO_2) to reduce corrosion of distribution piping and fittings, reduces total dissolved solids concentration prior to treatment with anion/cation resins, increases dissolved oxygen concentration to meet the discharge criteria and strips H_2S gas to the atmosphere. The degasification process treats water by cascading down through a highly efficient polypropylene packing media. The media allows the water to break into droplets creating a highly active and larger surface area. The blower forces air up through the unit in a cross current direction for rapid and efficient gas removal. Each degasification unit has the following specifications:

- The maximum design water flow rate is 2,000 gallons per minute (gpm).
- Based on given design parameters and an influent pH of 5.0, the equipment could achieve an H_2S removal efficiency of 96.4%. This equates to an effluent H_2S concentration of 107.9 micrograms/liter (µg/L).
- The exhaust stack parameters are 3 feet in diameter and 30 feet in height with a stack flow rate of 8,021 actual cubic feet per minute (acfm).

Daily samples were taken from the water wells between April 7, 2010, and May 27, 2010, showing an average H_2S concentration of 2,867 µg/L. The maximum annual water usage was based on a 12-month rolling average of the total water drawn from the water wells, which was 1,058,183,000 gallons. However, the maximum annual water usage from the five wells could reach an estimated 1.5 billion gallons per year (GPY). The projected annual emissions for H_2S were estimated to be 5.74 pound (lb)/hour and 17.94 TPY. Annual emissions from the degasification systems were estimated based on the measured H_2S concentration in the well water and the maximum annual water usage from the five new wells. However, when calculating the H_2S emissions on an hourly basis, the design of the degasification system needed to be considered using the maximum water flow rate of 2,000 GPM from each system. Therefore, the calculations used were very conservative estimations of the potential emissions for H_2S.

New Source Performance Standards (NSPS) Provisions

There are no NSPS provisions applicable to this project.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Provisions

There are no NESHAP provisions applicable to this project.

Air Quality Modeling Analysis

In accordance with the requirements of 40 CFR 52.21(m) and Rule 62-212.400, F.A.C. any application requesting a PSD permit must contain an analysis of continuous ambient air quality data in the area affected by the proposed major stationary source or major modification (preconstruction monitoring data). However, there is no approved ambient monitoring method for H_2S and no requirement to conduct such monitoring; therefore, an ambient monitoring analysis is not required.

4. BACT DETERMINATION FOR H_2S

The project to install five water wells and two H_2S degasification systems is a physical modification of the facility. As previously described, the project is subject to PSD preconstruction review for H_2S compounds from the degasification systems (EU-036).

BACT Emission Limits Proposed by Applicant (Two Degasification Systems Combined)

Pollutant	Emissions Limit	Control Technology
H_2S	5.74 lb/hour and 17.94 TPY	No Control Equipment

General Discussion of H_2S Emissions

The degasification systems are the source of H_2S emissions from this project. The annual H_2S emissions were based on the maximum water usage rate and H_2S concentration in the raw water. The H_2S hourly emissions were based on the actual design water flow rate of the degasification systems. The potential annual emissions produced by the degasification systems are 5.74 lb/hour and 17.94 TPY.

The applicant reviewed data in EPA's RACT/BACT/LAER Clearinghouse (RBLC) to identify control technology determinations for H_2S or TRS emissions from degasification systems and other similar processes. BACT determinations issued within the last 10 years were searched. However, no information was found identifying control technology determinations for degasification systems or similar processes.

The Florida Department of Environmental Protection (FDEP) air permit data base was also searched in order to identify other water treatment or water disposal facilities in Florida that have controls in place for H_2S emissions. The following facilities were identified:

- Miami-Dade Water and Sewer Department (Permit No. 0250600-007-AV)
- City of Largo Environmental Services Department (Permit No. 1030060-007-AV)

The Miami-Dade Water and Sewer Department operates a publicly owned treatment works that processes a

maximum of 49 billion GPY of water, based on a design treatment capacity of 135 million gallons/day. All liquid process units are covered and vented to an odor control scrubber units for reduction of H_2S and odors. The facility does not consider the scrubbers to be an air pollution control device. The Miami-Dade facility is approximately 50 times larger than the U.S. Sugar H_2S degasification systems in terms of water treatment capacity.

The City of Largo Environmental Services Department operates a wastewater reclamation facility. The Pelletizer building contains a sewage sludge drying operation at the wastewater treatment plant, which is controlled by an odor control system. However, the odor control system is allowed to remain in cold storage until such time as the Department, Pinellas County Department of Environmental Management, or the City of Largo receives an odor complaint.

The applicant believes that there are many more H_2S degasification systems in operation at the publicly owned treatment works facilities and industrial/electric utility plants throughout Florida, but these systems are generally not listed in their Title V operating permits. Most Title V operating permits have "wastewater liquid processes" included in the list of unregulated emissions units, which most likely have H_2S degasification systems.

BACT for H_2S

Identification of Control Technologies

The applicant provided the following control technologies:

- *Packed Tower Wet Scrubber:* Wet scrubbers are systems that involve removal of the gaseous H_2S using liquid scrubbing media. The gaseous H_2S is captured in the liquid by several different mechanisms. Wet scrubbers create a liquid waste that may require additional treatment prior to disposal. There are multiple types of wet scrubbers, such as Spray Chamber, Impingement Plate, Venturi, Orifice and Condensation. However, the packed bed scrubber is the most effective at efficiently to remove gaseous (non-particulate) pollutants.
- *Thermal Oxidizers:* Incineration or thermal oxidation is the process of oxidizing combustible materials by raising the temperature of the material above its auto-ignition point in the presence of oxygen and maintaining it at high temperature for sufficient time to complete combustion. In the case of H_2S, this combustion results in water and SO_2 emissions to the atmosphere. Time, temperature, turbulence (for mixing) and the availability of oxygen all affect the rate and efficiency of the combustion process. The auto-ignition temperature of H_2S is 500ºF. Therefore, the combustion of gases containing H_2S would require an auxiliary fuel source. The use of catalytic oxidation could reduce the temperature requirement for H_2S oxidation.

Identification of Technically Feasible Control Alternatives and Ranking

- *Packed Tower Wet Scrubber:* Wet scrubbers are technically feasible for the H_2S degasification systems. Based on the equipment manufacturer's specifications (Schutte & Koerting) the removal efficiency of H_2S is 99%. Therefore, this is the top-ranked control technology.
- *Thermal Oxidizers:* Thermal oxidizers are not practicably feasible for the H_2S degasification systems. The gas exiting the degasification systems is saturated with water vapor, and the concentration of H_2S in the gas stream would be too low to maintain an effective combustion oxidation temperature.

Evaluation of Economic, Environmental and Energy Impacts of Feasible Technologies

The only feasible control option for the H_2S degasification system is the packed tower wet scrubber. The applicant provided the following estimates of energy, environmental and economic impacts for the wet scrubber.

- *Economic Impacts:* The cost analysis for a packed tower (chlorine/caustic) wet scrubbing system shows an estimated total capital investment of $423,060 and an annual operating cost of $180,692 per year. The wet scrubbing system would reduce the H_2S emissions by 99%, which would result in controlled H_2S emissions

of 0.18 TPY for a 17.77 TPY reduction. Therefore, the cost effectiveness of the wet scrubber for H_2S control is $10,174 per ton of H_2S reduction. Based on the cost analysis, this technology is not cost effective for the project.

- *Environmental and Energy Impacts:* There are no ambient air quality standards for H_2S and H_2S is not classified as HAP. Therefore, the only potential air quality issue is objectionable odors. Since U.S. Sugar has begun operating the water wells in 2008, there have been no known odor complaints associated with the H_2S degasification systems. However, if the wet scrubbing system was required for H_2S removal, wastewater created by the wet scrubbing system would be sent to U.S. Sugar's on-site pond system. The additional sulfur added to the ponds would increase the likelihood of creating an objectionable odor from the ponds due to the anaerobic degradation of the sulfur compounds. In addition, the wet scrubber has a high-energy usage and creates a liquid waste stream that must be treated and properly disposed.

Select or Reject the Top-Ranked Control Option

Based on the following determinations regarding control technology used for H_2S or TRS emissions from degasification systems the applicant rejects the top-ranked control, packed tower wet scrubber, for BACT and proposes no add-on controls.

- There was no control technology identified within the last 10 years on the RBLC data base for H_2S or TRS emissions for degasification systems.
- The DEP air permit data base identified other water treatment or water disposal facilities in Florida that have controls in place for H_2S emissions. The following two facilities were identified:
  - Miami-Dade Water and Sewer Department operates a publicly owned treatment works that processes a maximum of 49 billion GPY of water versus U.S. Sugars 1.5 billion GPY, which is much smaller in terms of water capacity. The facility does not consider the odor control scrubbers to be an air pollution control device.
  - City of Largo contains a sewage sludge drying operation at the wastewater treatment plant, which is controlled by an odor control system. However, the odor control system is allowed to remain in cold storage until such time an odor complaint is made.
- Other than the PSD provisions, the degasification systems are not subject to any industry-specific state or federal air quality regulations.
- EPA has not established an acceptable ambient monitoring method for H_2S.
- The estimated cost effectiveness is very high at $10,174 per ton of H_2S removed.
- If a new wet scrubbing system was required for H_2S removal, the additional sulfur added to the ponds would enhance the probability of creating an objectionable odor due to the anaerobic degradation of the sulfur compounds.

Therefore, at this time, there are no recognized and cost-effective add-on controls for reducing H_2S emissions from the degasification systems. Therefore, the Department establishes the following the preliminary BACT determination for H_2S emissions from the degasification systems:

H_2S: 18.0 tons per consecutive 12-month rolling total based on monthly raw well water flow rates quarterly water sampling to determine the H_2S concentration in each of the water wells.

According to the applicant, the site currently has no objectionable odors. The Department's South District Office verified that there have been no odor complaints for the past several years. Therefore, the BACT should not cause or contribute to an objectionable odor. An "objectionable odor" is defined as any odor present in the outdoor atmosphere, which by itself or in combination with other odors, is or may be harmful or injurious to human health or welfare, which unreasonably interferes with the comfortable use and enjoyment of life or

property, or which creates a nuisance." The draft permit will also include a requirement to revisit BACT should the facility receive valid odor complaints from the degasification systems.

5. PRELIMINARY DETERMINATION

The Department makes a preliminary determination that the proposed project will comply with all applicable state and federal air pollution regulations as conditioned by the Draft Permit. This determination is based on a technical review of the complete application, reasonable assurances provided by the applicant, and the conditions specified in the Draft Permit. Tammy McWade is the project engineer responsible for reviewing the application and drafting the permit changes. Additional details of this analysis may be obtained by contacting the project engineer at the Department's Bureau of Air Regulation at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.