UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

November 7, 2016

Mr. David O'Neill
President
LandGas Technology LLC
5487 N. Milwaukee Avenue
Chicago, IL 60630

RE: Approval of Revised Blue Lake Power Boiler Engineering Study Protocol

Dear Mr. O'Neill:

Pursuant to Paragraph 12 of the Proposed Consent Decree lodged in *United States et al. v. Blue Lake Power LLC*, Blue Lake Power, LLC ("BLP") submitted a revised October 2016 Boiler Engineering Study Protocol to EPA and the North Coast Unified Air Quality Management District (the "District") on October 11, 2016.[1] EPA has reviewed the revised Boiler Engineering Study Protocol and consulted with the District regarding approval of the revised Protocol. Pursuant to Paragraph 34 of the Proposed Consent Decree, EPA hereby approves the revised Boiler Engineering Study Protocol.

Please contact me at 415-972-3965 if you have any questions.

Sincerely,

Mark A. Sims
Environmental Engineer
Air & TRI Enforcement Office (ENF-2-1)
U.S. EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

cc: Mr. Glenn Zane, Blue Lake Power LLC (e-copy only)
Ms. Jane Luckhardt, Day Carter & Murphy LLC (e-copy only)
Mr. Brian Wilson, North Coast Unified Air Quality Management District (e-copy only)
Ms. Nancy Diamond, Law Offices of Nancy Diamond (e-copy only)
Ms. Sheila McAnaney, U.S. Department of Justice (e-copy only)
Mr. Brian Riedel, U.S. Environmental Protection Agency

[1] BLP submitted previous versions of the Protocol to EPA and the District. EPA provided comments on these previous versions, including on August 11, 2016.

Boiler Engineering Study Protocol
Blue Lake Power LLC
Rev. October 2016

Background and Purpose

Blue Lake Power LLC (Blue Lake) owns and operates a biomass boiler facility in the city of Blue Lake, Humboldt County. The subject boiler is a nominal 185 MMBtu/hr stoker-type biomass boiler with a traveling grate fuel feed system. The boiler is equipped with a forced over-fire air system, multi-clone cyclone, and electrostatic precipitator for emissions control. The boiler is fired on woody biomass and uses a Zurn propane gas burner rated at 80 MMBtu/hr during startup periods.

This Protocol has been prepared to meet the requirements of Paragraph 12 of the Consent Decree between Blue Lake, the US Environmental Protection Agency (EPA) and the North Coast Unified Air Quality Management District (NCUAQMD) filed with the court on September 22, 2016, and to address the comments provided by EPA via email on August 11 and October 7, 2016.[1]

The purpose of the Boiler Engineering Study (Study) is to optimize the reduction of CO and NOx emissions through improvements in boiler combustion controls (including the overfire air system) and the installation of a selective noncatalytic reduction (SNCR) system. The Study will include the following elements:

- Overfire air (OFA) system assessment, including an assessment of the adequacy and of the capacity of the boiler's induced draft fan
- Selective noncatalytic reduction (SNCR) system effectiveness analysis
- Furnace gas sampling plan
- Prediction of best achievable emission rates of oxides of nitrogen (NOx) and carbon monoxide (CO) after installation and optimization of the OFA and SNCR systems

Each of these elements is described in more detail below.

The Study will be performed by Sheldon Schultz of Yanke Energy. Mr. Schultz's resume is included as an attachment to the protocol. This Study protocol was prepared by:

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[1] Blue Lake recently entered into a Consent Decree with the US Environmental Protection Agency and the North Coast Unified Air Quality Management District to resolve alleged violations of Clean Air Act requirements related to operation of the boiler. The Consent Decree requires Blue Lake to take certain actions, with the goal of reducing emissions from the boiler and the rest of the facility. One action required by the Consent Decree is the preparation of a Boiler Engineering Study Protocol (Protocol) that lays out a procedure for performing a Boiler Engineering Study.

Study Protocol

I. Optimization of the OFA System to Reduce CO Emissions

The engineering assessment performed in 2014 determined that the conditions necessary for an effective reaction between urea and NO are not currently available in the Blue Lake furnace. Both temperature and CO must be reduced to achieve an effective SNCR control reaction. Therefore, the OFA system will be optimized first to reduce CO and furnace temperature.

Among the findings of the 2014 engineering assessment was that the existing OFA system was unable to provide the degree of penetration and mixing required to improve CO performance. The first element of the Study will consist of optimizing the secondary air system to improve penetration and mixing in order to determine the extent to which CO and combustion temperatures can be reduced through the following actions:

a. Perform cold flow testing of air flows (including evaluation of the capacity of the FD fan) and fuel placement on the grate
b. Unplug nozzles, insure control operation and make minor adjustments to existing nozzles (such as inserts) to manipulate and optimize performance
c. Assess whether changes to the secondary air system are needed (such as larger diameter nozzles, adjusted nozzle spacing and/or changes to the capacity of the FD and ID fans) to achieve the required CO emissions and combustion temperature controls
d. Operate the boiler at a load where the oxygen level in the lower furnace is controllable and the temperature in the furnace shaft about 0.5 second from the outlet is suitable for SNCR

When mixing is improved and oxygen is increased in the combustion zone, NOx emissions may increase while CO emissions are reduced. Baseline CO, O_2, and NOx concentrations at the boiler stack and in the furnace will be measured during each phase of the study to determine an optimal combination that minimizes CO and NOx concentrations.

II. Control of NOx Emissions

Following optimization of the OFA system, Blue Lake will evaluate and optimize a SNCR system to reduce NOx emissions from the boiler using the procedure outlined below.

During the first phase of SNCR optimization, a 50% urea solution mixed with varying amounts of diluent water would be injected at the air assisted nozzle. Varying amounts of water diluent will have a small localized impact on the temperature and can be used to enhance the $NOx:NH_3$ reaction. Fuel feed rate will be varied to achieve O_2 concentrations ranging from approximately 3.5 to approximately 5.0 percent dry at boiler loads ranging from 50% to nominal 100% load. Stack NOx, CO, and ammonia slip concentrations and furnace gas conditions will be measured at each boiler load/O_2 concentration/fuel feed rate combination to evaluate the NOx reductions achievable without additional modifications.

Following these new baseline emissions measurements, upper furnace conditions will be varied to evaluate the extent to which additional NOx reductions can be achieved. These conditions include increasing airflow through the furnace (overfire air) by the forced draft and induced draft fan capacity, reducing furnace temperature through higher water injection rates, varying ammonia injection rates and locations, and increasing residence time. Emissions and furnace gas conditions will be measured and fan capacity will be evaluated during each set of conditions to evaluate the effect of each combination of conditions on boiler operations and emissions.

III. Fuel Analysis

A composite fuel sample will be collected during each of the three engineering test runs. Each composite sample for an individual test run will be based on three separate samples collected in accordance with the procedure outlined below.

a. Fill three one-gallon sealable plastic bags with a sample of the fuel in the metering bin at evenly spaced intervals during the test run. For example, if the test run is 60 minutes long, the samples would be collected at minutes 10, 30, and 50 of that run.

b. Label each sample bag with the date and time of collection and initials of the person collecting the sample. Seal each sample bag immediately.

c. Following the end of each test run, create the composite sample as follows:

- Line a 5-gallon bucket with a clean plastic liner bag.
- Empty the three sample bags into the plastic-lined bucket and mix thoroughly.
- Fill a new, clean one-gallon sealable plastic bag with a sample of the mixed fuel from the bucket. Seal the sample bag immediately.
- Label the bag with the test run number, time and date.

Following the end of all three test runs, the three sealed and labeled composite sample bags shall be delivered to the Plant Manager, who shall deliver the samples to the lab for analysis. Ultimate (which includes sulfur content) and proximate analyses will be performed by a qualified laboratory. Chloride content of the fuel will also be analyzed using either ASTM E776 or another EPA-approved test method.

IV. Furnace Gas Sampling Plan

Boiler flue gas will be monitored for O_2, NOx, and CO concentrations as well as temperature on the left side, in the center, and on the right side of the furnace opposite the fuel feeders at the front of the boiler. Additional ports will be installed as described in the 2014 engineering report to provide additional sampling access.

These measurements will be used to develop a furnace temperature profile, and to determine residence time for each of the CO and NOx engineering test procedures outlined under I and II above.

V. Final Report

Following completion of the Study, a final report will be prepared that includes the following elements:

a. As-built drawings for the existing boiler configuration.

b. Description of the Study procedures, including test conditions, test program schedule, test procedures, and quality assurance procedures.
c. Copies of all fuel analyses, data sheets, emissions calculations, and quality assurance data.
d. Summary of findings and recommendations, which shall include, but not be limited to:
    i. Recommendations for improvements to the OFA system (which may include, but not be limited to, modifications to the sizing and/or placement of the secondary air nozzles) and for the configuration of SNCR to optimize the reduction of CO and NOx emissions to achieve the emission rates set forth in paragraphs 18 and 19 of the Consent Decree;
    ii. If the emission rates set forth in paragraphs 18 and/or 19 of the Consent Decree cannot be achieved, recommended NOx and CO emission rates and averaging periods based on the best achievable emission rates achieved during the Study;
    iii. Boiler operating parameters required to achieve compliance with the recommended emission rates;
    iv. Results of the testing of air and urea at locations modeled and/or predicted to best control CO and NOx emissions, at rates sufficient to enable compliance with the emission rates set forth in paragraphs 18 and 19 of the Consent Decree;
    v. Description of boiler changes or modifications required to achieve compliance with the recommended emission rates;
    vi. Assessment of the adequacy of the capacity of the boiler's induced draft fan;
    vii. Recommendation as to the highest achievable urea injection level for the SNCR, based upon the recommended location of injection ports and the urea injection testing, while consistently maintaining ammonia slip at 20 parts per million ("ppm") or less by volume, corrected to 3% excess oxygen;
    viii. Prediction of best achievable emission rates for CO and NOx from the boiler main stack after installation and operation of the optimized and/or improved OFA and SNCR systems;
    ix. Recommendations for continuous monitoring, which may include continuous emissions and/or parametric monitoring, to ensure compliance with the recommended emission rates; and
    x. Schedule for implementation, including any required permit applications, equipment ordering, boiler modifications and boiler commissioning.

SHELDON L. SCHULTZ, P.E.
Consulting Engineer

FIELDS OF EXPERTISE	Boiler Design, Operations, Performance, and Life-Assessment Biomass, Wood, Coal, and Natural Gas Fuel in Combustion and Gasification Processes NO_X, CO, SO_2 PM, VOC and HAP Evaluation and Controls Solid Fuel Processing, Storage and Feeding Boiler Efficiency Improvement and Monitoring
EDUCATION	BS Electrical Engineering, Washington State University (1971)
AFFILIATIONS	Tau Beta Pi, ASME Registered Professional Engineer in Washington, Wyoming, Idaho, and Minnesota
EXPERIENCE	More than 40 years of practical engineering experience: Principal of Yanke Energy, Inc. (1982 to present) – Designed, Built, Owned and Operated renewable energy facilities and provided consulting and repair services to the independent power and industrial energy industries. Conversion of coal fired stoker boilers to bubbling atmospheric fluidized bed combustion for biomass firing. Conversion of biomass fired combustion boilers to biomass gasification boilers.
SELECTED BOILER, DISTRICT HEATING, BOILER CONVERSION	**Washington State University, Pullman WA** – Evaluation of coal-fired boiler performance, emission controls and life assessment for campus heating system **KFx, Inc, Gillette, Wyoming –** Consulting on coal beneficiation process development and demonstration plant start-up and commissioning **Wyoming Research Institute, Laramie, Wyoming-** Designed, built and tested pilot scale pulverized coal research combustor **Seattle Steam Company, Seattle, WA** – Fluidized bed combustor improvements, fuel delivery improvements and controls modifications **Greenville Steam Company, Greenville, ME-**Start up and alteration of a vibrating hydro-grate boiler converted to a bubbling bed wood fired gasifier **Dapp Power, Dapp, Alberta Canada** – Start up and alteration of a circulating fluidized bed biomass boiler to a wood fired gasifier boiler. **Tamarack Energy, Wood Power, Dinuba Energy, Auberry Energy, North Fork Energy, Soledad Energy, Drayton Valley Power-** design, build, own, operate and maintain wood and biomass fueled co-generation plants converting existing coal fired boilers to wood and biomass fired boilers. **Biomass One, White City, Oregon-** Manage operation and implement plant improvements of 25 MW biomass fired energy plant