Applied Utility Systems, Inc.

Engineered

Solutions

for

Fossil Fuel

Utilization

Statement of Qualifications

Consulting Services for
NO_x Emissions Control

Our mission is to offer our clients cost-effective engineered solutions for the clean and efficient utilization of fossil fuels that will enhance our clients' commercial competitiveness and add value to their products

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1. Introduction

Applied Utility Systems, Inc. (AUS) is a California corporation established in 1985 for the purpose of providing consulting engineering services related to controlling emissions from fossil fuel-fired equipment. AUS has a strong background in emission controls from industrial and utility combustion systems. AUS offers a broad range of NO_x control technologies. Some of the technologies offered are listed below.

- Low NO_x Burners (LNBs)
- Flue Gas Recirculation (FGR)
- NH_3 injection (Thermal $DeNO_x$) or Selective Non-Catalytic Reduction Systems (SNCR)
- Selective Catalytic Reduction Systems (SCR)

AUS specializes in the identification of innovative approaches to achieve emission reduction goals in the most cost-effective manner. The Company offers unique expertise in the evaluation and implementation of both combustion based and post-combustion NO_x control systems for a variety of end-use applications, including heaters, boilers, internal combustion engines, and combustion turbines.

2. Qualifications and Experience

AUS has extensive experience in NO_x reduction projects, including support of California utilities and industries to comply with air emissions rules and regulations. These projects have included engineering studies, design tasks, preparation of comprehensive build-to specifications, design and fabrication of combustion and post-combustion based NO_x control systems, installation of equipment, plant start-up, and testing. Extensive work in optimizing combustion processes to reduce NO_x has also been performed by AUS.

Significant experience has been gained in several applicable areas. These activities include:

- Designed urea injection systems including urea storage, transport, injectors and controls, and provided turnkey installations for several units.
- Assessed potential NO_x emissions reductions and cost effectiveness for gas- and oil-fired boilers. Control techniques considered included LNBs, combustion modifications, SNCR, and SCR.
- Designed LNBs for gas and oil firing in utility and industrial boilers.
- Prepared engineering studies to apply catalytic air heaters (CAT-AH) to utility boilers. Units studied ranged in size from 200 MW to 750 MW. CAT-AH involves the coating of Ljungström air heater baskets with SCR catalyst whereby the heater can provide for the preheating of combustion air and reduction of NO_x emissions in a single step.

AUS has provided significant regulatory support for several electrical utility and industrial clients. Assessments were performed for a variety of these clients to determine the most cost-effective approach to comply with their respective compliance limits. Control strategies that were examined included combustion and post-combustion systems. The types of activities performed include:

- For the Cities of Glendale, Burbank, and Pasadena (Cities) and Southern California Edison (SCE) Company, AUS developed compliance strategies for two (2) South Coast Air Quality Management District (SCAQMD) NO_x emissions regulations: Rule 1134, which restricts emissions from gas turbines and Rule 1135, which restricts emissions from electric utility boilers. The compliance strategies included the installation of advanced emission controls, utilization of alternative resources, and implementation of operational changes. The development of the compliance strategies required that numerous NO_x reduction technologies be assessed.
- Provided direct regulatory support to the Cities to obtain more favorable compliance requirements for Rule 1135.
- Provided direct regulatory support to SCE to obtain more favorable compliance requirements for Rule 1134.
- Conceived and implemented an alternative emissions reduction strategy to allow the merger between SCE and San Diego Gas and Electric (SDG&E).
- Provided significant support to SDG&E as their technical consultant for the Rule 69 rule-making process. Activities which were performed included analysis of individual generating units and system loads, technology evaluation of NO_x control alternatives, and cost and cost-effectiveness analysis of alternatives.
- Drafted a proposed Rule 69 for regulatory agency consideration on behalf of SDG&E. The proposed draft rule was ultimately adopted saving SDG&E millions of dollars.

- For SCE, AUS assessed future electricity demand, electricity consumption, and fuel use impact of the committed and uncommitted control measures contained in the SCAQMD 1989 Air Quality Management Plan. Control measures having the potential for major impact were analyzed to estimate accurately the electricity and/or fuel use impact and the cost effectiveness of the available emissions control options.
- On behalf of SCE and the Cities, presented direct testimony to SCAQMD on the assessment of NO_x reduction technologies. Areas reviewed were pre-combustion controls, such as windbox modeling, windbox FGR, and reduced air preheat; LNBs and optimization of combustion processes; and implementation of post-combustion controls, such as SNCR and SCR systems.

AUS has also provided direct regulatory support and licensing efforts in the reduction of the emission of volatile organic compounds in Los Angeles and Orange Counties. Permit applications to construct and to operate have been prepared for clients. These application packages were submitted, in turn, to the SCAQMD for approval.

Additional information on AUS' experience and accomplishments is provided in the following tables. Table 1 provides a partial listing of selected relevant projects performed. Table 2 presents a summary of our regulatory successes and significant achievements in the emissions reduction and air quality areas.

Table 1 Selected Project Listing

- Assessment of NO_x control options and industrial boiler retrofit
- Assessment of energy conservation options and industrial boiler retrofit
- Use of industrial heat pumps for air emissions control
- Technology transfer for industrial air emissions control
- Development of plant-wide NO_x compliance plan for industrial facility
- Gas temperature profiling on utility boilers (SDG&E)
- NO_x emissions controls for a refinery CO boiler
- Study of air toxics emissions in SCAQMD
- Demonstration of urea injection (SDG&E)
- NO_x control from combined cycle gas turbines
- Evaluation of advanced repowering options
- Develop NO_x controls for stationary internal combustion engines
- Assessment of NO_x control options (Unocal, Golden West and Fletcher Oil)
- Regulatory support for Burbank, Glendale, and Pasadena
- Demonstration of SCR air heater at Mandalay
- Assessment of emissions control options for Mohave generating station
- Regulatory support for SDG&E
- CAT-AH engineering study
- Energy demand and consumption impacts of SCAQMD AQMP
- Development of plant-wide NO_x compliance plan for industrial facility
- NO_x control from combined cycle gas turbines
- Regulatory support for Burbank, Glendale, and Pasadena
- Gas temperature profiling on utility boilers (SDG&E)
- Preparation of Permit calculations and documents for a variety of projects, including:
  - Re-powering of existing combined cycle power plant, including installation of duct burners and SCR system for City of Glendale
  - Boiler landfill gas firing and low NO_x burner conversion for General Motors Corporation
  - Boiler coke oven gas firing and low NO_x burner conversion for Indianapolis Power & Light Company
  - Various industrial boiler low NO_x burner projects

Table 2 Regulatory Successes and Significant Accomplishments

REGULATORY SUCCESSES

- NO_x emissions compliance for the Cities:
  - Increased compliance limit from 0.15 lb NO_2/MWh to 0.2 lb NO_2/MWh.
  - Extended compliance date from 1996 to the year 2000.
  - Enhanced compliance flexibility by structuring the Rule based on a system-wide average rather than a unit specific limit and included in the Rule the option to comply with either a daily emissions limit or an emissions rate.
  - Exempted equipment from compliance during start-up as well as during oil firing.
- NO_x emissions compliance for SDG&E:
  - Increased compliance limit from 0.10 lb NO_2/MWh to 0.2 lb NO_2/MWh.
  - Extended compliance date from 1997 to the year 2003.
  - Rewrote NO_x compliance rules to protect utility's interest.
  - Allowed oil firing for economic reasons.
  - Enhanced compliance flexibility by structuring the Rule based on a system-wide average rather than a unit specific limit and included in the Rule the option to comply with either a daily emissions limit or an emissions rate.
  - Provided a favorable NH_3 slip limit in the implementation of SCR and SNCR systems.
- NO_x emissions compliance strategies for various industrial clients:
  - Created opportunities for sale of excess emissions allowances.
  - Avoided any expenditure for air emissions control prior to the adoption of a market-based trading system.
  - Postponed any expenditure for air emissions control until the year 1998.

SIGNIFICANT ACCOMPLISHMENTS

- Commercialized the implementation of urea injection technology as an SNCR system eliminating the need to retrofit six (6) SCE boilers with LNBs. Cost savings were estimated at $32 million. Twelve (12) other SNCR systems were used to delay the implementation of, and decrease SCE's requirements for, SCR systems.
- Demonstrated CAT-AH technology which was estimated to save SCE about $8 million for SCR systems at six (6) 320 MW boilers. Greater savings were projected when CAT-AH is combined with an SNCR system.
- Demonstrated steam injection to achieve 10 ppm NO_x (@ 15% O_2) at the SCE Combined Cycle Plant. Further NO_x reductions using SCR exceeded cost-effectiveness criteria, and AUS was able to influence changes in regulatory limits, saving SCE $48 million by avoiding the installation of SCR systems. Additional savings were achieved by de-superheating the steam to reduce steam consumption by 40 percent.
- Emissions regulations have incorporated AUS suggestions for improving cost-effective energy conservation. Revised regulations provided favorable treatment to repowering using Best-Available-Control-Technology (BACT) as well as strategic conservation and other DSM measures. Higher emissions rates were allowed for smaller electric utilities operation systems that have higher cost for NO_x emissions control in the Los Angeles Air Basin.
- Electro-technologies were introduced by AUS as a means for air emissions compliance. Emissions offsets from electrification of stationary internal combustion engines were estimated to save $250 million in the proposed merger between SCE and SDG&E. This electrification was also estimated to increase SCE's electricity sales by 200 MW.
- Demonstration projects have assisted utility customers in evaluating electro-technology applications, including volatile organic compound (VOC) emissions control. These demonstrations documented thermal efficiencies, customer acceptance, and cost effectiveness. As a result of these demonstrations, electro-technologies were incorporated into the air quality management plans for the Los Angeles Basin.