KULJIAN CAPABILITY IN ENGINEERING SERVICES FOR AIR QUALITY CONTROL SYSTEMS/ SCR RETROFIT OF BOILERS

Introduction

Selective Catalytic Reduction (SCR) is a proven process for reduction of NO_x content in flue gas. To meet EPA guidelines, retrofit of SCR is being adopted by a number of utilities for their power stations. Problem with such retrofit is that the SCR block needs to be installed at a location where flue gas temperature is within the range for efficient boiler. Space is usually limited in this part of the flue duct. For a retrofit of the SCR, it is needed to modify the ducting in this area and add new ducting to accommodate the ammonia injection grid and the SCR blocks. This also needs a new tall structural supporting system.

In plants, where it is almost impossible to locate the SCR before the air pre-heater or particulate is major concern, it may be located downstream near the stack. IN this situation, arrangement of the flue gas heating is required to achieve desired minimum temperature and a regenerative heat exchanger needs to be added to conserve heat energy. Here also new ducting and tall support structure is needed for the installation.

Process requirements and detail design of SCR blocks are usually provided by the SCR block supplier.

Engineering for such SCR retrofit installation is, therefore, predominantly related to design of tall structural supporting system in a confined space and design of flue gas ducting. Indicated below are Kuljian capabilities in undertaking engineering for such SCR retrofit installations.

Kuljian Capabilities

Kuljian is a multi-discipline engineering firm with extensive experience in the field of power generation both with conventional boiler & steam turbine and with gas turbines in simple and combined cycle. As a part of design activities, our engineers have performed design of complex & heavy structures, heavy foundations and ducting. Such design work for structures has been performed by space frame analysis utilizing state-of-the-art computer software, as required.

We are locating below a list design activities, which may be involved in an SCR retrofit project. Kuljian has experienced engineers to perform all these activities.

- Development of General Arrangement of the ducting system and reactor including SCR block, access platforms, etc., based on the study of the existing boiler duct arrangement and requirements of the SCR equipment.
- Development of supporting arrangement of the SCR block including access stairs after study of the existing supporting system in the area.
- Design of the flue gas ducting.
- Analysis and design of the structural support and issue of design drawings.
- Design of foundations based on loading data generated by analysis.
- Design of associated mechanical systems including ammonia storage and piping system.
- Design of associated electrical and I&C systems.

Relevant Projects:

Indicated below are descriptions of a few projects, which are relevant to engineering related to a SCR installation project.

In addition, we have included in Attachment-1 a list of major thermal power projects engineered by Kuljian, which will demonstrate our familiarity with various designs of the boilers.

90 MW Wygen 1 Unit 3 Coal Fired Thermal Power Project in Gillette, Wyoming, USA:

The project includes a coal fired boiler with SCR located before air pre-heater for NO_x control. Kuljian is responsible for basic and detailed engineering for all civil, structural, architectural, mechanical, electrical and I&C disciplines for the complete power project on behalf of the EPC contractor in the USA. Scope includes design of the complete boiler structure including the SCR along with necessary platforms, walkways etc. Scope also includes all mechanical and electrical utilities and I&C interface with the plant DCS and Continuous Emission Monitoring System (CEMS) for the SCR. The SCR system uses Anhydrous Ammonia for which necessary foundation and utilities are included in Kuljian Scope of work. The project is currently on-going with design activities completed to a large extent.

125 MW Saba Thermal Power Station in Pakistan:

Kuljian performed complete basic and detailed engineering for all disciplines on behalf of an EPC Contractor in the USA. Scope included design of support structural steel with access stairs, galleries and walkways and concrete foundations for boiler with associated air pre-heater and electrostatic precipitator. The project also involved design of power house structure and TG foundation.

Flue gas Cleaning System (FGCS) for Inland Steel Heat Recovery Facility (HRCF) at East Chicago, Indiana

Performed on Behalf of General Electric Environmental Services, Inc. (GEEST); detail design for support steel, ductwork and access for installation of bag filter. The system will clean flue gas from coke ovens using 2 x 100% capacity lime slurry type spray dry absorbs for removal of SO_2 and 2 x 100% capacity fabric filter baghouse for particulate removal. Scope of the project starts from a single terminal point at flue gas duct for inlet to the spray dry absorbers and terminals at the stack interconnecting the equipment involved.

Hallim Gas Turbine Project of 3D MW Capacity in Korea:

Kuljian performed detailed engineering services for GT integral systems for KHIC. Scope included detailed design and fabrication drawings for inlet duct, high temperature exhaust duct, and bypass stack along with supports and foundations.

Central Power Plant Modernization and Cogeneration Plant at Yale University, New Haven, Connecticut, USA:

Kuljian was responsible for complete basic and detailed engineering for all disciplines. Project included installation of SCR using aqua ammonia for NO_x control from exhaust of gas turbines and diesel generator. Scope included ammonia unloading, storage and delivery piping. The project involved design in a highly confined space.

FGD Plant for 14 Units 500 MW each Coal Fired Power Plants in Korea:

Preliminary engineering performed on behalf of a Turnkey Contractor for a Flue Gas Desulfurization (FGD) plant for KEPCO, Korea for 14 units of 500 MW each coal fired power stations located at Tean, Boryung, and Hadong. The FGD plant uses limestone as the chemical for desulfurization and gypsum is produced as a by-product. Preliminary engineering was performed for structural work for all plant buildings, pipe rack, duct support structures, bulk limestone storage silo; and for all related building services including HVAC, fire protection system, plumbing system, lighting, grounding, power supply to building service equipment, drainage, etc.

Rehabilitation of Diesel Generator Power Plant at Indiana University of Pennsylvania (IUP):

The project included installation of new stack and modification of the exhaust flue duct from 4 DG sets each 6 MW, combining to a common duct and connecting to the new stack. Scope included design of the high temperature flue duct along with supporting structures and foundations.

Retrofit of Baghouse and existing Boiler Renovation at State Correctional Institution, Camphill, Pennsylvania:

The project included retrofitting of a common baghouse to three (3) existing coal fired boilers and installation of new ductwork from the outlet of boilers to the common stack, including induced draft (ID) fans and drives.

Detail Design of Support Steel Ductwork and Access for Flue Gas Cleaning System (FCGS) for the Inland Steel Heat Recovery Coke Facility (HRCF)

The Flue Gas Cleaning System of the Heat Recovery Coke Facility includes two (2) 100% capacity line slurry type spray dry absorbers, two (2) 100% capacity reverse air type fabric filters, one (1) common lime handling and slaking and slaked lime storage and delivery system, three (3) 50% capacity induced draft (ID) fans, ductwork, and all structural supporting steel.

The projected included detail design and drawings for ductwork support steel; SDA inlet ductwork, SDA to MPJ ductwork, MPJ to stack ductwork/slide plates/guide bars; and access within structural steel.

Shoaiba Phase-I and Shuqaiq Phase-I Dust Collection Equipment and Other Components for Burning Heavy Fuel Oil in Saudi Arabia

The boilers were originally designed to fire both crude and heavy fuel oil (HFO). Since the availability of fuel was initially limited to crude oil, all the equipment for firing HFO were not installed.

The following equipment was installed for firing HFO at both plants: Electrostatic Precipitator for each boiler including all accessories, electrical, controls, and instrumentation; Dust handling, transportation and storage system covering dry transfer system, bulk storage silo, vacuum pumps, etc.; Dust Transportation Road Vehicles (Vacuum Trucks); Magnesium Fuel Additive System covering bulk storage tank, day oil additive tank, transfer pumps, metering pumps, piping and instrumentation; Emissions Monitoring Equipment (Opacity Meter); Fire protection system and HVAC system.

The scope of the contractor also included Computational Fluid Model Testing for each boiler unit to ensure proper gas distribution and minimum pressure drop.