Reduction of Regulated Emissions

The Idaho National Laboratory (INL) has discovered a simple process that greatly reduces pollutants emitted from coal plants and other emerging coal, biomass, and municipal solid waste energy conversion processes. The process is simple, very economical, efficient, and easy to retrofit on existing plants. The process effectively reduces NOx to nitrogen, carbon dioxide and water, and further provides a sorbent for elemental mercury, mercuric chloride, and many acid gas and halide compounds.

INL researchers have discovered that the injection of ground oil shale into a pulverized-coal boiler can greatly reduce the emissions of pollutants in a coal plant. U.S. oil shale is an abundant, undeveloped natural resource which has natural sorbent properties. Its ash has natural pozzolanic properties that can be used under proper conditions to help solve the nation's pressing economic, environmental and potential national security problems. The process allows for the adsorption of heavy metals released during coal combustion, especially mercury and arsenic. In addition, the kerogen in the oil shale particles could be exploited in the same manner that coal, oil and natural gas are currently used to manipulate flame stoichiometry in order to reduce nitrogen oxide pollutants to benign nitrogen. This process allows for a new clean-coal (or other clean fuel), multi-pollutant technology that can be readily deployed on existing pulverized-coal boilers and other emerging coal, biomass or municipal solid waste energy conversion processes.

How it Works

Through pyrolysis, pulverized shale oil acts as both a reductant and a sorbent particulate. The reductant effectively reduces NOx to nitrogen, carbon dioxide and water. The sorbent particulates adsorb sulfuric acid, sulfur trioxide, carbonyl sulfide, carbon disulfide, chlorine, hydroiodic acid, iodine, hydrofluoric acid, fluorine, hydrobromic acid, bromine, phosphoric acid, phosphorous pentaoxide, elemental mercury and mercuric chloride.

The oil shale particles may be introduced into a superheated zone, a reheat zone or an economizer zone of the combustion chamber. In this way, the sorbent particulates and the reductant contact the pollutants, such as NOx, SOx, and mercury. An added advantage is that the process produces heavy and light hydrocar-

Continued next page

Idaho National Laboratory

Continued from previous page

bons, which provide additional energy to the system.

NO_x Reduction

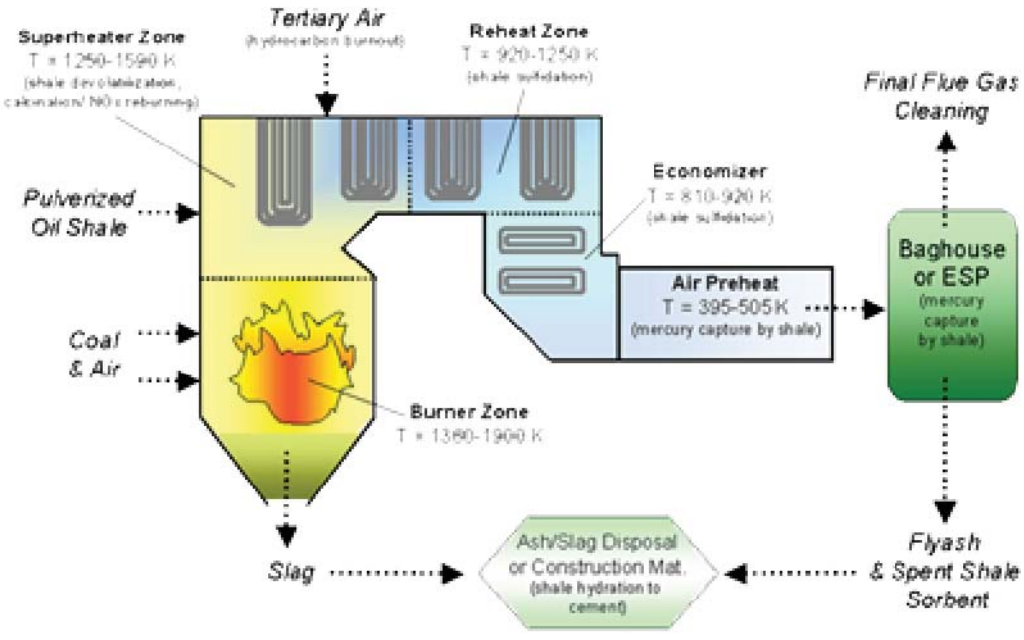
NO_x levels in the gas/entrained-particle multi-fuel reactor were shown to be reduced at high loadings of raw oil-shale and fuel-rich gas stoichiometry. The Chemkin kinetics management code was used to demonstrate that 50-70% reduction of NOx can be achieved by staging a fuel-rich zone produced exclusively by oil shale volatiles with tertiary air input into the upper boiler and super-heater sections of a pulverized-coal combustor. The oil shale would be injected through select pulverized-coal burners at the top of the boiler. Hydrocarbon burnout air would then be introduced through the top air registers or through any soot-blowing air inlets. Nitrogen oxide pollutants are readily destroyed by the light hydrocarbons that are rapidly evolved from small oil shale particles at high heating rates.

SO_x Sorption

Oil shale DPD and sorption studies conducted over a 3-year period verified oil sulfur sorption rates and capacity to be comparable to limestone sorbents for capture of SO_2.

Partnering with INL

The INL is soliciting interest from qualified industrial firms interested in participating in projects and commercializing this technology. It is anticipated that the project will be carried out through a Cooperative Research and Development Agreement with funding support being provided by the participant(s). The INL has a patent pending on the process, which may be licensed exclusively or non-exclusively. The INL invites interested parties to contact us regarding the details of licensing and implementing this technology into an operation.



For more information:

Technical Contact
Richard Boardman
208.526.3083
Richard.Boardman@inl.gov

Business Contact
Jason Stolworthy
208.526.5976
Jason.Stolworthy@inl.gov
www.inl.gov/techtransfer

A U.S. Department of Energy National Laboratory