## 7.13 Evaluation of In-furnace $NO_x$ Reduction (Reburning)

Objective: The objective is to evaluate the use of in-furnace $NO_x$ reduction (reburning) for potential application on a variety of U.S. stationary combustion sources.

Approach: In the early 1970's fundamental combustion research showed that a secondary fuel injected into combustion product gases at high temperatures will form a reducing atmosphere which will convert $NO_x$ to $N_2$ and $H_2O$. Additional air added later at lower temperatures will complete combustion. Results of recent testing in Japan and the U.S. using this concept indicate significant $NO_x$ reductions (of the order of 50 percent). Analyses will be made of the limited data from Japan to assess the applicability of the technique to U.S. designed combustion equipment. Small-scale tests will be made to provide a better understanding of the combustion processes involved with a variety of fuels, and how to optimize their application to practical systems, including utility and industrial boilers and industrial process combustors. In-house tests will be run on commercial-sized combustors firing gas and oil, and contract studies will be run on industrial-sized combustors firing gas, oil and coal. The results will be used to determine different types of combustion equipment on which pilot-scale evaluations could be run. In addition to determining the potential for $NO_x$ reduction, measurements would be made to determine the effect on other combustion-related emissions, equipment performance and product quality (for direct-fired processes). These tests would also provide information on the retrofit potential of reburning.

Rationale: Data already available indicates that in-furnace $NO_x$ reduction has excellent potential. In the U.S., the process has been applied on a limited basis on combined cycle units under EPA Contract 68-02-2144. Also, during preliminary tests run in a bench-scale stoker-fired furnace using coal as the primary fuel, and methane (equivalent to 5% of coal feed) as the secondary fuel, $NO_x$ reductions greater than 40% were achieved. Using methane as both primary and secondary fuel, an $NO_x$ reduction greater than 50% was achieved. These tests were run on existing facilities with no attempt to optimize conditions. Further research and performance tests are needed to optimize the process and determine the full extent of its potential application.