Japanese tests, 100 ppm with coal and 50 ppm with oil — a reduction of 75 to 80% compared to uncontrolled emissions. However, an advanced degree of combustion modification can cause slagging in the boiler and corrosion of heat transfer surfaces.

Typical emission limits achievable using combustion modification techniques and their associated capital costs are:

| | | |
|---|---|---|
| Low Excess Air | 0.9 lb $NO_x/10^6$ Btu | $0. |
| Staged Combustion | 0.7 " | $2-3/kW |
| Low-$NO_x$ Burner | 0.4-0.5 " | $2-10/kW |

Emissions are based on coal-fired units emitting 1.0 lb/$10^6$ Btu when uncontrolled.

Since $NO_x$ emissions are complex functions of boiler design and operation, and also fuel characteristics, emissions vary widely, (e.g., for wall-fired units, the range is generally 0.7 to 1.3 lb $NO_x$ per million Btu input). This wide range of uncontrolled emissions leads to uncertainty on controlled emission rates when combustion modification is employed.

The capital costs are dependent in part on site-specific variables, and the accuracy of the costs quoted is not better than -10% to +30%.

b) Flue Gas Treatment: The leading method is injection of gaseous ammonia to reduce $NO_x$ to harmless nitrogen. Operation without a catalyst requires very high temperature and removal is limited to about 35 - 40%. With a catalyst, 90% or higher is feasible but 80% gives much less operating difficulty and may be the upper practicable limit for high-sulphur coal.

c) Process Choice: The situation is similar to that for other pollutants — process choice depends on the degree of control required.

| $NO_x$ removal efficiency level, % | Process ranking |
|---|---|
| 90% or higher | 1. Catalytic reduction* with more than the normal amount of catalyst, preceded by combustion modifications |
| 50-80% | 1. Catalytic reduction with a normal amount of catalyst<br>2. Combustion modification (all types) followed by non-catalytic reduction (ammonia injection without catalyst) |

* This technology has not been proven on coal-fired boilers.