

# PROCESS ECONOMICS PROGRAM

SRI INTERNATIONAL

Menlo Park, California

94025

## Abstract

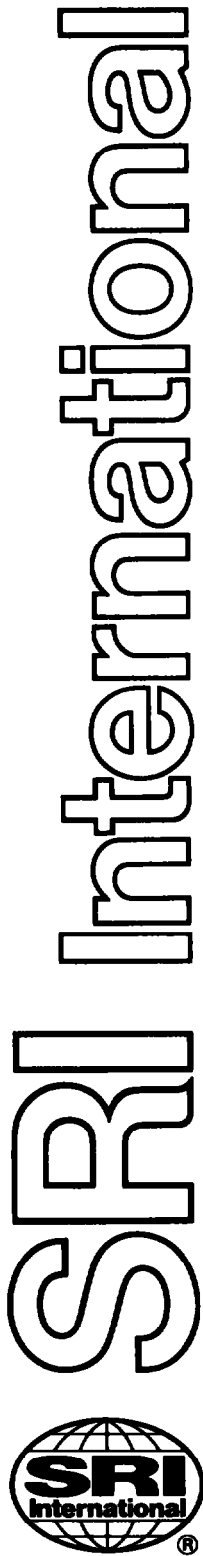
Process Economics Program Report No. 200

## NO<sub>x</sub> REMOVAL

(May 1989)

This report summarizes the current regulations for NO<sub>x</sub> abatement in the United States, the European Community, and Japan. In that context, various NO<sub>x</sub> control process technologies and economics are evaluated, with emphasis on applications in the chemical industry.

Combustion control methods applicable to boilers, process furnaces and heaters, and gas turbines include both burner and furnace modifications. Gas treating processes evaluated include selective noncatalytic reduction, selective catalytic reduction for boilers, and extended absorption for nitric acid plants.



Report No. 200

## **NO<sub>x</sub> REMOVAL**

by **EARL D. OLIVER\***

**May 1989**

A private report by the  
**PROCESS ECONOMICS PROGRAM**

Menlo Park, California 94025

\* Under Contract with SRI International

For detailed marketing data and information, the reader is referred to one of the SRI programs specializing in marketing research. The *CHEMICAL ECONOMICS HANDBOOK* Program covers most major chemicals and chemical products produced in the United States and the *WORLD PETROCHEMICALS* Program covers major hydrocarbons and their derivatives on a worldwide basis. In addition, the SRI *DIRECTORY OF CHEMICAL PRODUCERS* services provide detailed lists of chemical producers by company, product, and plant for the United States and Western Europe

**Symbol****Meaning**

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AGA	American Gas Association
AVC	Adjustable vortex control (burner)
B&W	Babcock & Wilcox
BH	Babcock-Hitachi
BOOS	Burners out of service
CE	Combustion Engineering
CGCC	Coal gasification/combined cycle
DAF	Distributed air flow (burner)
EC	European Community
EDTA	Ethylene diamine tetraacetic acid
EER	Energy and Environmental Research Corp.
EPDC	Electric Power Development Company
EPRI	Electric Power Research Institute
ER&E	Exxon Research & Engineering
ESP	Electrostatic precipitator
FBC	Fluidized-bed combustion
FD	Forced draft
FGD	Flue gas desulfurization
FGR	Flue gas recirculation
FGT	Flue gas treating
FRG	Federal Republic of Germany; West Germany
FW	Foster Wheeler
GE	General Electric
GFAVO	West German large source regulations
GRI	Gas Research Institute
HMTA	Hexamethylenetetramine
HRSG	Heat recovery steam generator (for combined cycle plant)
ID	Induced draft
IFNR	In-furnace NO <sub>x</sub> reduction
IFP	Institut Francais du Petrole
IHI	Ishikawajima-Harima Heavy Industries
JM	Johnson Matthey
KHI	Kawasaki Heavy Industries
KVB	KVB, Inc.
KW	Kilowatts
KWH	Kilowatt-hour
LEA	Low excess air
LIMB	Limestone injection-multistage burning
LNB	Low-NO <sub>x</sub> burner
MHI	Mitsubishi Heavy Industries
MMBtu	Million Btu
MW	Megawatts
NFK	Nippon Furnace K.K.
NO <sub>x</sub>	Nitrogen oxides (NO + NO <sub>2</sub> )
NSPS	New Source Performance Standards
OFA	Overfire air

<b>Symbol</b>	<b>Meaning</b>
PFBC	Pressurized fluidized-bed combustion
PSD	Prevention of significant deterioration (of air quality)
PURPA	Public Utilities Regulatory Policies Act
RAP	Reduced air preheat
RS	Riley Stoker
SCA	Staged combustion air
SCAQMD	South Coast Air Quality Management District (in California)
SCFM	Standard cubic feet per minute (1 atm., 60°F or 15.56)
SCR	Selective catalytic reduction
SDG&E	San Diego Gas & Electric
SFA	Side fire air
SIP	State implementation plan (in United States)
SNR	Selective noncatalytic reduction
STIG	Steam injected gas turbine
TA Luft	West German small source regulations
TFC	Total fixed capital
TP&MS	Turbo Power & Marine Systems
TVA	Tennessee Valley Authority
UBA	Umweltbundesamt
U.K.	United Kingdom
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
ton	short ton (2,000 lb)
t	metric ton

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