

## Non-CO<sub>2</sub> Greenhouse Gases: Nitrous Oxide

**Source/Sectors:** Industrial Processes/Nitric Acid Production

**Technology:** High-temperature catalytic reduction (B.3.1.1)

### Description of the Technology:

Nitric acid (HNO<sub>3</sub>) is used in production of synthetic fertilizers, adipic acid, and explosives. Virtually all of the nitric acid production in the United States is manufactured by the catalytic oxidation of ammonia. During this reaction, N<sub>2</sub>O is formed as a by-product and is released from reactor and vented into the atmosphere (USEPA, 2006b).

N<sub>2</sub>O concentrations in flue gases of nitric acid plants typically range from 300 to 1,700 ppmV. This range is generally more suitable for catalytic conversion than for direct incineration because of less energy input (de Jager *et al.*, 2001). This abatement option has several variations developed by different companies, such as BASF, Grand Paroisse, Norsk Hydro, and HITK, all involving the decomposition of N<sub>2</sub>O into nitrogen and oxygen using various catalysts. The average estimated reduction efficiency is approximately 90% (USEPA, 2006b; IEA, 2000 & 2003).

**Effectiveness:** Good

**Implementability:** Fair

**Reliability:** Fair

**Maturity:** Fair

**Environmental Benefits:** It reduces nitrous oxide emission.

### Cost Effectiveness:

Technology	Lifetime (yrs)	MP (%)	RE (%)	TA (%)	Capital cost	Annual cost	Benefits
High-temp catalytic reduction (BASF) <sup>1</sup>	10	-	80	100	\$2.76	\$0.17	\$0.00
High-temp catalytic reduction (Grand Paroisse) <sup>1</sup>	10	-	77.6	100	\$3.09	\$0.16	\$0.00
High-temp catalytic reduction (HITK) <sup>1</sup>	10	-	100	100	\$3.18	\$0.22	\$0.00
High-temp catalytic reduction (Norsk Hydro) <sup>1</sup>	10	-	90	100	\$2.32	\$0.15	\$0.00

Note: MP: market penetration; RE: reduction efficiency; TA: technical applicability; costs are in year 2000 US\$/MT<sub>CO<sub>2</sub>-Eq.</sub>  
1: IEA (2000); IEA (2003); USEPA (2004)

**Industry Acceptance Level:** Good

**Limitations:** They are presently still in experimental and R&D stages.

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