

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

**Source/Sectors:** Waste

**Technology:** Options to reduce nitrous oxide emissions from the waste sector (B.6)

### **Description of the Technology:**

Waste management is one of the minor sources of N<sub>2</sub>O emissions. The emissions can come from domestic wastewater and industrial wastewater. Nitrogen compounds, such as urea, ammonia, and proteins, are converted to nitrate (NO<sub>3</sub><sup>-</sup>) under aerobic nitrification. Denitrification occurs under anoxic conditions (absence of free oxygen, but presence of nitrate) and converts nitrate into nitrogen. Nitrification/denitrification (N/DN), which is to remove nitrogen compounds from wastewater, is required for many municipal wastewater treatments. Nitrous oxide is an intermediate product of both nitrification and denitrification processes, but is more often associated with denitrification (USEPA, 2006a).

In contrast to methane emission reduction technologies, which are primarily focused on untreated wastewater and on-site small wastewater treatment plants, N<sub>2</sub>O reduction should be more focused on N<sub>2</sub>O emission from denitrification in large-scale, centralized plant (de Jager *et al.*, 2001). Under optimal operating conditions, N<sub>2</sub>O formation can be reduced by up to one-third during nitrification and two-thirds during denitrification (IEA, 2000). Although no cost figures have been reported, it is expected that process optimization can be accomplished with negligible costs (Hendriks *et al.*, 1998). It has also been reported that, from comparisons of N<sub>2</sub>O emission from several wastewater treatment processes, intermittent aeration in the nitrification/denitrification process is optimal with regards to reduction of N<sub>2</sub>O emissions as well as high nitrogen removal (Inamori *et al.*, 2003). When nitrogen removal in wastewater treatment is not necessary and the application of wastewater sludge to agricultural land as a nitrogen source is allowable, the net N<sub>2</sub>O emission from wastewater sector may be reduced (de Jager *et al.*, 2001). Nitrous oxide is an intermediate by-product of decomposition of organic nitrogen compounds, such as protein and urea, in industrial wastewater. N<sub>2</sub>O generation and emission mechanisms are not well understood (IEA, 2000). No specific technological options for emission reduction were found from the literature search.

**Effectiveness:** Fair

**Implementability:** Fair

**Reliability:** Fair

**Maturity:** Low

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

**Cost Effectiveness:** None reported.

**Industry Acceptance Level:** Low

**Limitations:** Nitrification/denitrification is required at many wastewater treatment plants.

### **Sources of Information:**

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