# RCRA PERMIT

# FOR THE

# IDAHO NATIONAL LABORATORY

## Volume 14
## INTEC Liquid Waste Management System

## Appendix IX

## ETS Mercury Concentration Justification

Revision Date: April 12, 2011

# JUSTIFICATION FOR A MERCURY FEED CONCENTRATION LIMIT OF 3000 PPM FOR ETS

A risk-based mercury (Hg) feed limit for ETS can be determined by evaluating the sampling results from NWCF ETS Offgas Emissions Inventory issued in February 2002 (INEEL/EXT-02-00198)[1]. These results showed that an ETS Hg feed concentration of 149 ppm resulted in an offgas Hg concentration of 39 ug/dscm (dry standard cubic meter) (Figure S-3 in reference 1) and an offgas Hg emission rate of 1.3E-5 g/s. The hazard quotient (HQ) calculated for this Hg emission rate at the off-site location of maximum impact was 7.56E-7 (pg. 80, reference 1). The mercury hazard accounted for 12% of the total ETS hazard index (HI) of 6.2E-6 from all contaminant emissions. The total HI for all contaminants was a very small fraction (2.48E-5) of the target HI of 0.25 typically used for RCRA combustion source risk assessments.

Mercury offgas emissions from the ETS will be a function of ETS process conditions, primarily temperature, redox chemistry, and waste feed rate. If these process conditions remain essentially the same, as they have since the time the emissions sampling was conducted, then Hg fractionations to offgas should remain relatively constant. Since process condition for the ETS have remained relatively unchanged, the Hg concentration in the offgas should be directly proportional to the Hg feed concentration. This also means that for a given waste feed rate, the Hg offgas emission rate will be directly proportional to the Hg feed concentration. For example, if the Hg feed concentration was increased from 149 ppm to 1490 ppm (factor of ten increase), then ETS emissions should increase from 1.3E-5 g/s to about 1.3E-4 g/s.

The human health and environmental impacts from ETS pollutant emissions were calculated using the models and equations in EPA's Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities.[2] These models assume that downwind concentration and deposition rate are directly proportional to the pollutant's emission rate. Pollutant impacts (risk, hazard) are then calculated by multiplying the receptor concentration by a number of exposure scenario factors. This means that downwind impacts for a specific pollutant from a particular source are directly proportional to the emission rate of that pollutant (i.e., a factor of 10 increase in emissions will increase the calculated risk or hazard by a factor of 10).

Given these conditions, the new offgas emissions rate and resulting HQ for a proposed ETS Hg feed concentration limit of 3000 ppm can be estimated by multiplying the Hg emissions rate and HQ determined in the ETS offgas emissions inventory[1] by the ratio of the proposed Hg feed concentration limit (3000 ppm) to the feed concentration that existed during the offgas sampling (149 ppm):

New ETS emission rate = 1.3E-5 g/s x (3000 ppm/149 ppm) = 2.6E-04 g/s

and

New ETS HQ = 7.56E-7 x 3000 ppm/149 ppm = 1.5E-05

This is a factor 20.1 increase (3000 ppm/149 ppm) in the Hg emission rate and HQ but is still a very small fraction of the RCRA HI target criteria of 0.25. It should be noted that ETS Hg feed concentrations may often be less than the 3000 ppm limit, and, when this occurs, Hg emissions and hazard will decrease proportionately.

## TOTAL MERCURY EMISSIONS AND HAZARD FROM ILWMS OPERATIONS

Table 1 lists the hazard quotients and total hazard index for all emitted pollutants from all emission sources within the INTEC Liquid Waste Management System (includes LET&D, PEWE, and ETS) as calculated in the ILWMS risk assessment[3]. The proposed 3000 ppm Hg ETS feed concentration does not significantly increase the total ETS hazard nor does it increase the total hazard ILWMS source emissions.

Table 1. Hazard quotients (HQs) and hazard index calculated for all ILWMS sources.

| | **Non-cancer Hazard Quotients/ Hazard Index** | | | | |
|---|---|---|---|---|---|
| **Process** | **Anions** | **Metals** | **SVOCs** | **VOCs** | **Total** |
| LET&D | 6.6E-03 | 1.6E-03 | 8.2E-05 | 5.8E-07 | 8.3E-03 |
| PEWE | 2.0E-03 | 4.8E-04 | 2.5E-05 | 1.7E-07 | 2.5E-03 |
| ETS | 4.1E-07 | 7.6E-07[a]<br>1.5E-05[b] | 3.9E-06 | 1.2E-08 | 6.5E-06 |
| **Total** | **8.6E-03** | **2.1E-03** | **1.1E-04** | **7.7E-07** | **0.011** |
| | | | | **Target** | **0.25** |

**a. Based on 149 ppm Hg feed concentration for ETS from reference 3.**
**b. New HQ estimated for 3000 ppm Hg feed limit for ETS.**

## COMPARISON TO NWCF MERCURY EMISSIONS

The Hg emissions measured from the New Waste Calcining Facility (NWCF) during the Phase IV offgas emission testing ranged from 1.1E-03 g/s (test 4) to 3.2E-03 g/s (tests 1-3)[4]. The estimated Hg emission rate from ETS at the proposed 3000 ppm Hg feed concentration limit is 2.6E-04 g/s or about 8 to 23% of the NWCF measured Hg emissions.

## COMPARISON TO IDAHO DEQ TOXIC AIR POLLUTANT EMISSION LIMITS

The estimated ETS Hg emission rate at the 3000 ppm feed concentration (2.6E-04 g/s or 2.1E-3 lb/hr) is about 30% of the Idaho DEQ Toxic Air Pollutant Emission Limit (EL) for inorganic Hg emissions (7E-3 lb/hr) specified in Section 585 of IDAPA 58.01.01.

# REFERENCES

1. Boardman, R.D., Lamb, K.M., Matejka, L.A., Nenni, J.A., NWCF Evaporator Tank System 2001 Offgas Emissions Inventory, INEEL/EXT-02-00198, February 2002.

2. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, EPA530-D-98-001A, July 1998.

3. Human and Ecological Risk Assessment of Air Emissions from the INTEC Liquid Waste Management System, ICP/EXT-04-00399, May 2004.