

NPRI RY2016

Annual Review of Current Toxic Substance Reduction (TSR) Plans Air Products Canada Ltd., Corunna, ON Hydrogen Facility

Toxic Substance Reduction (TSR) Plans

The Ontario MOE Toxics Reduction Act (TRA) requires applicable facilities to develop plans to reduce the use and creation of applicable toxic substances. In accordance with Ontario Regulation 455/09, TSR Plans are required to be prepared based on the manufacture, process or otherwise use (MPO) of toxic substances during the NPRI reporting year.

**NPRI RY 2016 – No additional TSR Plans were required to be prepared.
The original Plans are described below, and remain in place.**

NPRI RY2011 (Phase 1) Toxic Substance Reduction Plans were prepared for our:

- “manufacture” of Methanol, and
- “otherwise use” of Hexavalent Chromium compounds.

Summaries of those NPRI RY 2011 TSR Plans were submitted to Ontario MOE in December 2012, via the Single Window Information Management (SWIM) reporting system.

Methanol TRS Plan - No toxic reduction options will be implemented

Methanol is created as a by-product in the HTS reactor where the water gas shift reaction occurs. Methanol is produced from a reaction between hydrogen and carbon monoxide, one of the impurities in the syngas stream, and can be found as a constituent of the process condensate stream.

In preparing the methanol TRS Plan, the contracted planner addressed regulatory prescribed options which included:

- materials or feedstock substitution,
- product design or reformulation,
- equipment or process modification,
- spill or leak prevention,
- on-site re-use,
- recycling or recovery,
- improved inventory management or purchasing techniques and
- good operator practice or training.

In his review, the planner concluded that none of the above options were beneficial. In addition, his review did not identify any reduction option for the creation of methanol. Given current process conditions, we will continue to monitor for optimization of system efficiency, to find possible means for reducing the creation of methanol while remaining in compliance with applicable Environment Canada and Ontario MOE regulations.

Hexavalent Chromium TRS Plan - -

No toxic reduction options will be implemented

Hexavalent Chromium (Cr VI) is a residual constituent in any new High-Temperature Shift Catalysts, (Katalco 71-5M and 71-6M) that are brought onsite. Iron oxide is a major constituent of the catalysts. Cr(VI) acts as a structural promoter to reduce the thermal sintering of iron oxide from the Haematite (Fe_2O_3) form to the Magnetite (Fe_3O_4) form without changing the activity of the catalyst. This reduction of iron oxide is required for the successful operation of the HTS catalyst over the life cycle.

After new HTS catalyst is placed into service, the Cr (VI) is converted to Cr (III). Accordingly, Cr VI is only found onsite when new catalyst is made available, prior to the actual charging of the HTS vessel.

Given his review, the contracted planner identified three options for the potential reduction of Cr(VI) use at the Facility –

- Material Substitution (Future),
- Process Modification (Future),
- Inventory/Purchasing (Future).

Potential reductions were estimated based on each of the three options. All three are very Facility-specific and are meant for future purposes. Evaluation will occur when the life of the catalysts is closer to maturity or when it is scheduled for replacement during the next maintenance outage, hence, the technical analyses are Facility-specific, as well, and are beyond the expertise of the Planner. These analyses can be undertaken by Air Products process engineers, the facility manager and the catalyst supplier during their routine semi-annual performance review of process catalysts.

During the semi-annual performance reviews, detailed attention is paid to the existing condition of the catalysts that are in use to estimate the remaining life of the material. The review will also evaluate the suitability of any alternatives catalysts currently available in the market to maintain and achieve an efficient manufacturing process. These evaluations are made while ensuring compliance with applicable Environment Canada and Ontario MOE regulations.

NPRI RY2012 (Phase 2) Toxic Substance Reduction Plans were prepared for our:

- “manufacture” of Ammonia, and
- fuel combustion emissions of Criteria Air Contaminants - NO_x , CO, PM10 and PM2.5.

Summaries of the NPRI RY2012 Ammonia, CO, NO_x , PM10 and PM2.5 TSR Plans were submitted to Ontario MOE on 20 Dec 2013, via the Single Window Information Management (SWIM) reporting system.

Ammonia TSR Plan - No toxic reduction options will be implemented

Ammonia is created as a by-product in the H₂ reformer as a side reaction between H₂ and N₂, and is an impurity in the process syngas stream. It subsequently drops out of the syngas as a constituent of the process condensate.

Need for an Ammonia TSR Plan is no longer applicable, because ammonia no longer meets the 10 tonnes NPRI reporting threshold.

As part of the CY2013 NPRI report, a TRA Exit Record was created for ammonia.

Explanation: Prior to preparation of the CY2013 NPRI report, our process engineers reviewed the creation of ammonia in the process and concluded that it is not correct to assume that all ammonia generated is actually “new” ammonia. Instead... the ammonia in the process condensate is believed to be in a state of equilibrium, because condensate is being constantly recycled within the SMR process. “New” ammonia can only be created when the equilibrium reaction shifts to replace any ammonia that is purged from the re-circulating condensate. Only the amount of ammonia that is actually being purged from the process equilibrium cycle should be considered to be “manufactured” ammonia. In the SMR process, this purging includes the amount of ammonia that escapes the condensate stripper, the amount that remains in the syngas prior to entering the PSA, and any amount that may be released to the air during a process shutdown. Only those amounts of ammonia need be counted towards the 10 tonnes NPRI reporting threshold. At Corunna, per our design max production rates, the sum of these purge amounts is only 221 lbs/year, thus NPRI reporting of ammonia is not required.

**TSR Plans for Criteria Air Contaminants - CO, NO_x, PM₁₀, and PM_{2.5},
No toxic reduction options will be implemented**

These 4 Criteria Air Contaminants (CACs) are created unintentionally as a byproduct of the combustion of the natural gas and PSA Purge Gas, both used as fuels for the reformer burners. In the preparation of the TSR Plans for each, the URS planner addressed the 8 regulatory prescribed options, and concluded that none were beneficial at this time. In addition, the planner did not identify any reduction option for the creation of these pollutants. Given current SMR process conditions, we will continue to monitor for optimization of system efficiency. This will be done to find possible means for reducing the creation of these CACs while remaining in compliance with applicable Environment Canada and Ontario MOE regulations.