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July 1, 2009

Mr. Allan Hambley
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Dear Al,

I've taken a look at the ISC3 dispersion model outputs shown in Table 3 of the June 22, 2009 letter from Mr. Kimball at Olsson Associates. For acetaldehyde, the only compound listed that is a carcinogen, I have calculated a cancer risk level. For all of the compounds, I have compared the predicted ambient concentrations to various ambient air quality standards and guidelines.

**Acetaldehyde**

In order to calculate an estimate of increased cancer risk associated with exposure to a substance in ambient air, the estimated max GLC is multiplied by the cancer unit risk estimate. The cancer unit risk estimate is an estimate of the increase in cancer risk associated with exposure to 1 ug/$m^3$ of the substance of interest. The most common source of unit risk estimates used in this type of calculation is the US EPA's IRIS database.

The unit risk level taken from the IRIS listing for acetaldehyde is $2.2 \times 10^{-6}$/ug/$m^3$. The ISC3 dispersion model predicts an annual average GLC acetaldehyde concentration of 0.11 ug/$m^3$. The risk level associated with this concentration is:

$0.11 \text{ ug/m}^3 \times 2.2 \times 10^{-6} \text{ /ug/m}^3 = 2.4 \times 10^{-7}$

This risk level is an order of magnitude lower than the $10^{-6}$ (1 in a million) risk level considered acceptable. Thus, the proposed RTO elimination does not represent any unacceptable risk of increased cancer associated with acetaldehyde exposure.

Expected max GLCs of acetaldehyde following RTO elimination can also be compared to exposure limits based on non-cancer endpoints in order to determine whether any non-cancer health effects are likely to be associated with acetaldehyde emissions. The table below lists several exposure limits based on non-cancer endpoints along with the relevant max GLCs.

| Type of exposure limit | Exposure Limit (ug/m$^3$) | Max GLC[1] (ug/m$^3$) |
|---|---|---|
| Alberta 1-hr average ambient | 90 | 5.63 |
| Ontario ½-hr average ambient | 500 | 5.63 |
| Ontario 24-hr average ambient | 500 | 1.54 |
| California Acute REL[2] 1-hr average | 470 | 5.63 |

[1] ISC3 dispersion model predictions for the max GLC are: 1-hour (5.63 ug/m$^3$) and 24-hour (1.54 ug/m$^3$)
[2] Reference Exposure Level

In every case, the relevant max GLC is much less than the exposure limit, thus the likelihood of non-cancer adverse effects is negligible.

**Acrolein**

Conducting a risk assessment for acrolein is more complicated because the state of the science of acrolein toxicity is evolving as a result of studies recently completed and published by the Chemical Industry Institute of Toxicology (CIIT) at the Hamner Institutes for Health Sciences. The potential impact of this research on the derivation of ambient air quality limits for acrolein are described in the attached memo, which specifically addresses the Ontario process, but is equally applicable to standard setting in other locales. I understand that a scientist from CIIT has been invited to make a presentation to Ontario Ministry of Environment staff so that this research can be considered in support of the derivation of a new provincial air quality standard for acrolein.

There are a number of ambient exposure limits for acrolein. The ISC3 dispersion model predictions for max GLCs for acrolein can be compared to these limits in order to assess the likelihood that any non-cancer adverse effects would be associated with the proposed RTO elimination. The table below lists several of these exposure limits along with the relevant max GLC.

| Type of Exposure Limit | Exposure Limit (ug/m$^3$) | Max GLC[1] (ug/m$^3$) |
|---|---|---|
| California Acute REL[2] 1-hr average | 2.5 | 1.35 |
| ATSDR MRL[3] Acute[4] | 6.88 | 0.42 |
| Ontario 24-hr AAQC[5] | 0.08 | 0.42 |
| Proposed CIIT derivation of Ontario 24 -hr AAQC[6] | 0.62 | 0.42 |
| Ontario ½ -hr AAQC[5] | 0.24 | 1.35 |
| Proposed CIIT derivation of Ontario ½ -hr AAQC[6] | 1.86 | 1.35 |
| US EPA AEGL-1[7] ½-hr or 1-hr | 68.8 | 1.35 |
| IRIS RfC[8] | 0.5 | 0.02 |
| Health Canada TC[9] | 0.4-0.6 | 0.02 |

[1] ISC3 dispersion model predictions for max GLC are 1.35 ug/m$^3$ (1-hour), 0.42 ug/m$^3$ (24-hour), and 0.02 ug/m$^3$ (annual)
[2] Reference Exposure Level
[3] Agency for Toxic Substances and Disease Registry Minimal Risk Level
[4] Exposure duration = 1-14 days
[5] Implementation date February 1, 2010
[6] CIIT Acrolein Studies and Their Potential Impact on Ambient Air Quality Standard Development in Ontario, March 14, 2008, Table 1 (memo attached)
[7] Acute Exposure Guideline Level-1 (Defined as the airborne concentration above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.)
[8] US EPA IRIS Reference Concentration (RfC), the concentration at which a lifetime exposure is expected to have no adverse effect
[9] Tolerable Concentration - levels to which a person may be exposed daily over a lifetime without deleterious effect.

Not only are the Ontario AAQCs for acrolein considerably lower than comparable ambient air quality guidelines or standards, they are also lower than chronic exposure guidelines. For example, the US EPA Reference Concentration (RfC), is 0.5 ug/m$^3$. In Health Canada's CEPA assessment for acrolein, Tolerable Concentrations of 0.4 - 0.6 ug/m$^3$ were calculated.

The ISC3 dispersion model predictions for the 1-hour and 24-hour max GLCs of acrolein following RTO elimination are 1.35 and 0.42 ug/m$^3$, respectively. While these values exceed the new Ontario AAQC, the modeling results indicate that the max GLCs will be in compliance with the Ontario AAQC at the 99$^{th}$ percentile. Also, if the CIIT derivation of the Ontario AAQC is used, both the 1-hr and 24-hr would be met. In addition, the max GLCs are well below other current relevant comparable ambient air quality guidelines and standards. The annual average GLC is an order of magnitude lower than the US EPA and Health Canada lifetime exposure guidelines. This point bears repeated emphasis: not only is the modeled annual average below both the US and Canadian guidelines for safe lifetime exposure to acrolein, the modeled 24-hr max GLC is also in compliance with those guidelines, thus the likelihood of non-cancer adverse effects is negligible.

**Methanol**

Methanol is relatively non-toxic following inhalation exposure. This is reflected in those ambient air quality guidelines and standards for methanol that do exist.

| Type of exposure limit | Exposure Limit (ug/m$^3$) | Max GLC[1] (ug/m$^3$) |
|---|---|---|
| Alberta 1-hr average ambient | 2,600 | 63.57 |
| Ontario 24-hr average ambient | 4,000 | 18.66 |
| California Acute REL[1] 1-hr average | 28,000 | 63.57 |

[1] ISC3 dispersion model predictions for max GLC are 63.57 ug/m$^3$ (1-hour) and 18.66 ug/m$^3$ (24-hour)
[2] Reference Exposure Level

These predicted concentrations are considerably lower than the regulatory limits thus the likelihood of non-cancer adverse effects is negligible.

**$PM_{10}$**

| Type of exposure limit | Exposure Limit (ug/m$^3$) | Max GLC[1] (ug/m$^3$) |
|---|---|---|
| Manitoba 24-hr average ambient | 50 | 32.29 |
| Ontario 24-hr average ambient | 50 | 32.29 |
| US EPA NAAQS[2] 24-hr average | 150 | 32.29 |

[1] ISC3 dispersion model prediction for max GLC is 32.29 ug/m$^3$ (24-hour)
[2]US Environmental Protection Agency National Ambient Air Quality Standard

The predicted max GLC is well below both the Manitoba and Ontario 24-hr average ambient limits of 50 ug/m$^3$, thus the likelihood of non-cancer adverse effects is negligible.

**$PM_{2.5}$**

| Type of exposure limit | Exposure Limit (ug/m$^3$) | Max GLC[1] (ug/m$^3$) |
|---|---|---|
| Canada-wide Standard 24-hr average ambient[2] | 30 | 14.596[3] |
| US EPA NAAQS[4] 24-hr average | 35 | 22.26 |

[1] ISC3 dispersion model prediction for max GLC is 22.26 ug/m$^3$ (24-hour)
[2] A 3-year average of the 98$^{th}$ percentile of 24-hr concentrations
[3] The modeled 98$^{th}$ percentile of 24-hr max GLCs
[4]US Environmental Protection Agency National Ambient Air Quality Standard

The ISC3 dispersion model predictions for the 24-hr max GLC and the 98$^{th}$ percentile of 24-hr max GLCs are below the 24-hr standards established by both Canada and the US, thus the likelihood of non-cancer adverse effects is negligible.

**Propionaldehyde**

There are few available ambient air guidelines or standards established for propionaldehyde.

| **Type of exposure limit** | **Exposure Limit (ug/m$^3$)** | **Max GLC[1] (ug/m$^3$)** |
|---|---|---|
| Ontario AAQC 10-minute average ambient[2] | 10 | 2.41 |
| IRIS RfC[3] | 8 | 0.03 |

[1] ISC3 dispersion model predictions for max GLC are 2.41 ug/m$^3$ (1-hour), 0.74 ug/m$^3$ (24-hour), and 0.03 ug/m$^3$ (annual)
[2] Based on odour
[3]US EPA IRIS Reference Concentration (RfC), the concentration at which a lifetime exposure is expected to have no adverse effect

The ISC3 dispersion model predictions for the 1-hour, 24-hour, and annual max GLCs are all lower than the Ontario 10-minute and US EPA lifetime exposure limits thus the likelihood of non-cancer adverse effects is negligible.

If you have any questions about this or if I can be of further assistance, please let me know.

Sincerely,

Vickie Tatum

Vickie Tatum, Ph.D.
Project Leader

Attachment