



NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT, INC.

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Conseil national pour l'amélioration de l'air et des cours d'eau

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Mr. Allan Hambley
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Dear Al,

I've taken a look at the ISC-PRIME dispersion model outputs for fence-line concentrations following RTO elimination. Only two of the compounds on the list you provided are considered to be carcinogens and for those two, formaldehyde and benzene, I have calculated the associated cancer risk levels. In order to calculate an estimate of increased cancer risk associated with exposure to a substance in ambient air, the estimated annual average ambient air concentration 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/m³ 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.

Formaldehyde

The IRIS listing for formaldehyde is currently being revised and since 1999, US EPA has utilized a unit risk level derived by the CIIT Centers for Health Research. It is anticipated that the revised IRIS listing for formaldehyde will adopt this CIIT unit risk estimate, which is 5.5 x 10⁻⁹/ug/m³.

The ISC-PRIME dispersion model predicts an annual average fence-line formaldehyde concentration of 1.27 ug/m³ following RTO elimination. The risk level associated with this concentration is:

$$1.27 \text{ ug/m}^3 \times 5.5 \times 10^{-9} \text{ /ug/m}^3 = 6.99 \times 10^{-9}$$

This risk level is three orders 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 formaldehyde exposure.

Expected ambient concentrations of formaldehyde 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 formaldehyde emissions. There is no universal consensus as to which exposure limits are most appropriate for these comparisons. The table below lists several exposure limits based on non-cancer endpoints.

Type of exposure limit	Exposure Limit (ug/m ³)
Manitoba 1-hr average ambient	60.0
ATSDR MRL ¹ Acute ²	49.1
ATSDR MRL Intermediate ³	36.8
ATSDR MRL Chronic ⁴	9.82

¹Agency for Toxic Substances and Disease Registry Minimal Risk Level

²Exposure duration = 1-14 days

³Exposure duration = >14-365 days

⁴Exposure duration = >365 days

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of formaldehyde following RTO elimination (56.86 ug/m³) may best be compared to the Manitoba 1-hour average ambient limit. The model prediction for the maximum 24-hour average ambient fenceline concentration (15.4 ug/m³) may best be compared to the ATSDR acute MRL and that for the maximum annual average (1.27 ug/m³) can be compared to the ATSDR intermediate or chronic MRLs. In every case, the predicted formaldehyde concentration is lower than the regulatory limit, therefore the likelihood of non-cancer adverse effects associated with the proposed RTO elimination is negligible.

Benzene

The IRIS unit risk factor for benzene is expressed as a range (2.2 x 10⁻⁶ to 7.8 x 10⁻⁶) rather than a single number. The ISC-PRIME dispersion model predicts an annual average fenceline benzene concentration of 0.029 ug/m³ following RTO elimination. The lower and upper bounds of the range of risk levels associated with this concentration are:

$$0.029 \text{ ug/m}^3 \times 2.2 \times 10^{-6} / \text{ug/m}^3 = 6.38 \times 10^{-8}$$

$$0.029 \text{ ug/m}^3 \times 7.8 \times 10^{-6} / \text{ug/m}^3 = 2.26 \times 10^{-7}$$

These risk levels are well below 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 benzene exposure.

There are a number of exposure limits for benzene that are based on non-cancer endpoints. The ISC-PRIME dispersion model predictions for ambient benzene concentrations 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. There is no universal consensus as to which exposure limits are most appropriate for these comparisons.

Type of Exposure Limit	Exposure Limit (ug/m ³)
IRIS RfC ¹	30
ATSDR MRL ² Acute ³	28.8
ATSDR MRL Intermediate ⁴	19.2
ATSDR MRL Chronic ⁵	9.6
ACGIH TLV ⁶	1,579
ACGIH STEL ⁷	7,987

¹US EPA IRIS Reference Concentration (RfC), the concentration at which a lifetime exposure is expected to have no adverse effect

²Agency for Toxic Substances and Disease Registry Minimal Risk Level

³Exposure duration = 1-14 days

⁴Exposure duration = >14-365 days

⁵Exposure duration = >365 days

⁶American Conference of Governmental Industrial Hygienists Threshold Limit Value, an 8-hour time weighted average occupational exposure limit

⁷American Conference of Governmental Industrial Hygienists Short Term Exposure Limit, a 15-minute average occupational exposure limit

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of benzene following RTO elimination (2.058 ug/m³) might be compared to the ACGIH TLV or STEL. The model prediction for the maximum 24-hour average ambient fenceline concentration (0.592 ug/m³) may best be compared to the ATSDR acute MRL and that for the maximum annual average (0.029 ug/m³) can be compared to the ATSDR intermediate or chronic MRLs or the IRIS RfC. In every case, the predicted benzene concentration is considerably lower than the regulatory limit, therefore the likelihood of non-cancer adverse effects associated with the proposed RTO elimination is essentially non-existent.

Four of the other compounds on the list, hydrogen cyanide, methylene diphenyl diisocyanate (MDI), nitrogen dioxide, and phenol, are not carcinogens, but various regulatory agencies do set health-based exposure or air quality limits for them. The ISC-PRIME dispersion model predictions for ambient concentrations of these compounds 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.

Hydrogen Cyanide

Type of exposure limit	Exposure Limit (ug/m ³)
Manitoba 1-hr average ambient	40
Manitoba annual average ambient	3
IRIS RfC ¹	3
ACGIH STEL ²	5.2 x 10 ³ (Ceiling limit)

¹US EPA IRIS Reference Concentration (RfC), the concentration at which a lifetime exposure is expected to have no adverse effect

²American Conference of Governmental Industrial Hygienists Short Term Exposure Limit, a 15-minute average occupational exposure limit

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of hydrogen cyanide following RTO elimination (3.873 ug/m³) might be compared to the Manitoba 1-hour guideline or the ACGIH STEL. The model prediction for the maximum annual average (0.045 ug/m³) can be compared to the Manitoba annual average guideline or the IRIS RfC. In every case, the predicted hydrogen cyanide concentration is considerably lower than the regulatory limit, meaning that there is virtually no chance of experiencing non-cancer adverse effects associated with the proposed RTO elimination.

MDI

Type of exposure limit	Exposure Limit (ug/m ³)
Manitoba 1-hr average ambient	3
Manitoba annual average ambient	0.5
IRIS RfC ¹	0.6
ACGIH TLV ²	51.2

¹US EPA IRIS Reference Concentration (RfC), the concentration at which a lifetime exposure is expected to have no adverse effect

²American Conference of Governmental Industrial Hygienists Threshold Limit Value, an 8-hour time weighted average occupational exposure limit

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of MDI following RTO elimination (1.895 ug/m³) might be compared to the Manitoba 1-hour guideline or the ACGIH TLV. The model prediction for the maximum annual average (0.068 ug/m³) can be compared to the Manitoba annual average guideline or the IRIS RfC. In every case, the predicted MDI concentration is well below the regulatory limit, which means that the likelihood of non-cancer adverse effects associated with the proposed RTO elimination is negligible.

Nitrogen Dioxide

Type of exposure limit	Exposure Limit (ug/m ³)
Manitoba ¹ 1-hr average ambient	400
Manitoba ¹ 24-hour average ambient	200
Manitoba ¹ annual average ² ambient	100
US EPA NAAQS ³ annual average ²	100
ACGIH TLV ⁴	5,650
ACGIH STEL ⁵	9,410

¹These are “Objectives” rather than “Guidelines”

²Average calculated as arithmetic mean

³US Environmental Protection Agency National Ambient Air Quality Standard

⁴American Conference of Governmental Industrial Hygienists Threshold Limit Value, an 8-hour time weighted average occupational exposure limit

⁵American Conference of Governmental Industrial Hygienists Short Term Exposure Limit, a 15-minute average occupational exposure limit

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of NO₂ following RTO elimination (147.78 ug/m³) might be compared to the Manitoba 1-hour average or the ACGIH TLV or STEL. The model prediction for the maximum 24-hour average ambient fenceline concentration (64.48 ug/m³) may best be compared to the Manitoba 24-hour ambient average objective and that for the annual average (8.54 ug/m³) can be compared to the Manitoba annual ambient objective or the EPA NAAQS. In every case, the predicted nitrogen dioxide concentration is much lower than the regulatory limit, therefore the likelihood of non-cancer adverse effects associated with the proposed RTO elimination is negligible.

Phenol

Type of exposure limit	Exposure Limit (ug/m ³)
Manitoba 1-hr average ambient	63
ACGIH TLV ¹	19,250
ATSDR MRL ² Acute ³	76.98

¹American Conference of Governmental Industrial Hygienists Threshold Limit Value, an 8-hour time weighted average occupational exposure limit

²Agency for Toxic Substances and Disease Registry Minimal Risk Level

³Exposure duration = 1-14 days

The ISC-PRIME dispersion model prediction for the maximum 1-hour average ambient fenceline concentration of phenol following RTO elimination (38.546 ug/m³) might be compared to the Manitoba 1-hour average, the ACGIH TLV, or the ATSDR MRL Acute. In every case, the predicted phenol concentration is much lower than the regulatory limit, so there is little chance that any non-cancer adverse effects will be associated with the elimination of the RTO.

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

Sincerely,



Vickie Tatum, Ph.D.
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