



8.0 HUMAN HEALTH RISK ASSESSMENT SUMMARY AND CONCLUSIONS

The MDEQ requested that a human health risk assessment (HHRA) be conducted as part of the permitting process for the new boiler. The ASCPC boiler HHRA focuses on lead and mercury emissions and evaluates potential human health impacts associated with operation of the new unit. The HHRA has been based on current federal risk assessment guidance, titled Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 2005), although it has also incorporated several requirements from the MDEQ. The migration of lead and mercury emissions into the atmosphere from the ASCPC facility up to their ultimate interaction with receptors involves a series of complex modeling processes. USEPA's AERMOD was used to evaluate the atmospheric movement of lead and mercury, resulting in air concentration and deposition flux estimates at over 9,000 predefined grid locations.

At the request of AQD, a subset of USEPA default receptor scenarios was evaluated in the HHRA for both direct and indirect exposures to lead and mercury. The default receptor scenarios included:

- Resident;
- Resident Child;
- Recreational Fisher; and
- Fisher Child.

Consistent with current USEPA guidance, all four receptors were assumed to live at the same residential location, identified as the residential area of highest incremental impact through evaluation of air modeling outputs, consideration of existing zoning and examination of digitized aerial photographs. Potential exposure to emitted lead and mercury through inhalation, incidental ingestion of surface soil and ingestion of homegrown plants/vegetables was evaluated for all four default receptor scenarios at the identified residential location. In addition, the Recreational Fisher and Fisher Child were evaluated for exposure to lead and mercury through the ingestion of fish caught in the Kawkawlin River.



The terrestrial and aquatic fate-and-transport of lead and mercury involve a complex series of linked algorithms developed by USEPA in the HHRA guidance. The first step involved estimating the concentration of lead and mercury in various exposure media, including: air, soil (both tilled and untilled), homegrown plants, surface water and fish. The second step involved estimating the daily intake of lead and mercury through exposure to those media. Once an exposure level had been estimated, USEPA methods were used to determine if that exposure was sufficiently high to pose a threat to human health. Potential impacts from the various mercury species are evaluated through comparison of exposure levels against either a reference dose (RfD) for ingestion or a reference concentration (RfC) for inhalation.

Potential impacts from lead exposure were evaluated in a different manner. In contrast to the various forms of mercury, lead is not believed to exhibit threshold behavior; as a consequence, USEPA has not developed an RfD or RfC. The AQD recommended that the potential health impacts from lead be evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) model which focuses on potential impacts on children during the first seven years of life. IEUBK integrates lead intake from multiple exposure pathways and then estimates a blood lead level. The Centers for Disease Control (CDC) have established a blood lead level of 10 µg/dL as the level of concern. Although the CDCs' overall goal is to reduce children's blood lead levels below 10 µg/dL, children with blood lead concentrations less than that are "not considered to be lead poisoned".

Potential impacts from the various mercury species were quantified through generation of a hazard index (HI); direct and indirect exposure levels were compared against the appropriate toxicity criterion (RfD or RfC) and the resulting ratio values were summed across pathways and chemicals of potential concern (COPCs) for each receptor group. The highest combined HI was associated with the Recreational Fisher (0.02) followed by the Fisher Child (0.01), Resident Child (0.00005) and Resident (0.00002). Typically, a combined $HI \leq 1$ indicates an exposure level that can be tolerated by all individuals, including sensitive subpopulations, throughout a lifetime without any adverse effects. As mercury exposures unrelated to operation of the ASCPC boiler can occur, the MDEQ recommended an alternate target level (i.e., combined $HI \leq 0.25$). For all four receptor scenarios, the combined HI was well below that target level. Therefore, the HHRA



results indicate that incremental exposure to mercury emitted from the ASCPC unit will not result in adverse health effects.

The incremental increases in media lead levels resulting from operation of the planned ASCPC boiler were added to region-specific background lead levels in those media. The resulting media lead concentrations were evaluated using USEPA's IEUBK model, which integrates multiple exposure pathways and predicts blood lead levels in children. As there was uncertainty associated with the potential contribution of lead-based paint to dust levels in area homes, two different residential scenarios were evaluated. In the first, the assumption was made that no lead-based paint was present; all lead in household dust was assumed to result from the tracking of soil into the homes and the deposition of airborne lead. The IEUBK-modeled geometric mean blood lead level under that background scenario was 2.905 $\mu\text{g}/\text{dL}$.

Under the second scenario, the assumption was made that lead-based paint was present in area homes; however, the paint was in good condition. USEPA believes that dust lead levels under that scenario could be as high as 200 mg/kg. The IEUBK-modeled geometric mean blood lead level under the second background scenario was 3.975 $\mu\text{g}/\text{dL}$. When the incremental impact of the ASCPC boiler emissions was evaluated using the IEUBK model, the resulting geometric mean blood lead concentrations under both scenarios were unchanged. Under both scenarios, background lead levels would not be predicted to result in blood lead levels of concern in area children and the incremental impact of the ASCPC boiler emissions above those background levels would not be significant.

The conservative estimates of the incremental impacts of the proposed ASCPC boiler emissions on the lead levels in the various media and blood lead via the IEUBK modeling indicate that the impacts do not exceed or approach relevant regulatory benchmarks or contribute to exceedances of health effect levels of concern.

Furthermore, all of the conservative assumptions applied in the emissions characterization, fate-and-transport modeling, exposure assessment, and toxicity assessment are compounded in the derivation of a numerical estimate of risk and the projected risks associated with the ASCPC



boiler's emissions are likely to be overestimated. Even though application of the HHRA process indicates that the impact of the ASCPC boiler will be accomplished without appreciable additional risk to the surrounding community, actual risks should be even lower than demonstrated in the HHRA.

The HHRAs for both Pb and Hg demonstrate that the additional impact from the new unit will not result in adverse health effects. The complete HHRA report is included in Appendix H.