**MID-MICHIGAN ENERGY, LLC**
c/o LS Power Development, LLC
400 Chesterfield Center, Suite 110
St. Louis, Missouri 63017
(636) 532-2200 · Fax (636) 532-2250

*Via Email and Overnight Mail*

August 19, 2008

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AIR QUALITY DIV.

Mr. D. John Vial, Sr. Environmental Engineer
Michigan Department of Environmental Quality, Air Quality Division
Constitution Hall
525 West Allegan Street
3rd Floor, North Tower
Lansing, MI 48933

Re: Permit to Install (PTI) Application Number 297-07
Mid-Michigan Energy Station,
Midland, Michigan

Dear Mr. Vial:

As discussed in a recent meeting, Mid-Michigan Energy, LLC (MME) encloses for your review an addendum to the Human Health Risk Assessment which evaluates the impact of an alternate mercury speciation from the pulverized coal boiler. An electronic copy of this document was transmitted to your attention via electronic mail on August 19, 2008.

Please contact me at (636) 532-2200 or via email at dmulvey@lspower.com if you have questions on this submittal.

Very truly yours,

Douglas Mulvey, P.E.
Senior Environmental Engineer

Cc: Mr. Robert Sills, MDEQ, with enclosures
Mr. William Presson, MDEQ, with enclosures
Ms. Janet Vanderpool, with enclosures
Mr. Bruce Goodman, with enclosures

Enclosures: as noted

# HHRA Addendum

## Introduction

Following submission of the MME Human Health Risk Assessment (HHRA) in November 2007, the MDEQ AQD and MME agreed that the impact of an alternate mercury speciation be evaluated. It is important to note that the November 2007 HHRA evaluated combined emissions from the PC Boiler, Auxiliary Boiler, and Steam Boilers I through III (Table 1). There was no information available on the speciation of mercury emissions from the Auxiliary Boiler and Steam Boilers I through III which are all fueled with natural gas. To avoid underestimating mercury impacts, emissions from these sources were run under the conservative assumption that they existed both in the form of elemental mercury (Hg0) and divalent mercury vapor (Hg2). In contrast to the November 2007 HHRA, the current evaluation focuses only on potential emissions from the PC Boiler.

Table 2 shows that the original partitioning for PC Boiler emissions evaluated in the HHRA was comprised primarily of elemental mercury (98.7-percent) with the remainder comprising divalent mercury vapor (1.3-percent). As described in the HHRA, these partitioning values were based on Department of Energy data (USDOE, 2006) from the Hawthorn Unit 5, which is a PC-fired boiler utilizing PRB coal, low NOx burner/overfire air, selective catalytic reduction, spray dry absorber, activated carbon injection (non-halogenated) and fiber filter baghouse. Mercury speciation from this unit is expected to be representative of the MME facility due to the similar emission control systems and fuel source.

Table 2 shows the alternative speciation pattern evaluated in the current study. It is the generalized partitioning described by USEPA in its Mercury Study Report to Congress (USEPA, 1997) and is comprised of elemental mercury (50-percent), divalent mercury vapor (30-percent) and particle-bound divalent mercury (20-percent). Table 2 also shows the resulting emission rates, expressed as grams per second (g/s), when both partitioning patterns are applied to the anticipated total mercury emissions from the MME PC Boiler.

## Approach

The primary focus of this report is a direct comparison between the results for mercury emissions from the PC Boiler, as determined using the speciation pattern described in the November 2007 HHRA, and those determined in a reevaluation based on the USEPA 50:30:20 speciation pattern. As the HHRA demonstrated that the primary impacts from mercury were mediated through the fish consumption pathway, the current report will focus on mercury impacts on the Fisher and Fisher Child. These receptor groups are assumed to reside at the maximally-impacted residential location and be exposed to mercury through inhalation, incidental ingestion of surface soil, ingestion of homegrown vegetables and ingestion of locally-caught fish. Based on the findings of the HHRA, consumed fish are assumed to have been caught in Kiwassee Lake.

**Air Modeling**

The air modeling was once again conducted using AERMOD, however, as agency-validated meteorological data for the year 2007 had become available since the HHRA was submitted in November 2007, meteorological data for the years 2003 through 2007 were used in the current modeling exercise. The HHRA air modeling results were also updated to consider the meteorological data from those same years. Air modeling for particle-bound divalent mercury using AERMOD has to consider the particle size distribution based on particle surface area. The distribution used in the current air modeling is shown in Table 3. It is the same particle size distribution used in the HHRA to model lead, however, the modeling of mercury is based on particle surface area rather than on particle mass.

Table 4 summarizes the air modeling impacts on the selected residential location using the HHRA speciation pattern and the USEPA speciation pattern. For the HHRA pattern, modeled air concentrations of divalent mercury vapor and elemental mercury vapor are shown as well as both dry and wet deposition fluxes for divalent mercury vapor. Deposition fluxes are not shown for elemental mercury, as elemental mercury is only evaluated for direct inhalation under the current USEPA HHRA guidance.

The air modeling impacts for divalent mercury vapor and elemental mercury using the USEPA speciation pattern are similar to those seen using the HHRA pattern, although there is a noticeable shift in the modeled air concentrations from elemental mercury to divalent mercury vapor. Table 4 also shows modeled air concentration and wet and dry deposition flux values for particle-bound divalent mercury.

Table 5 shows the impact of speciation on AERMOD modeled mercury impacts on Kiwassee Lake. This lake was selected from a list of three candidate surface water bodies in the HHRA and was predicted to be the most-impacted of those three water bodies. The results of the current air modeling confirmed the selection of Kiwassee Lake. As described in detail within the HHRA, air modeling results are used to determine average emission impacts over both the surface water body and its watershed. Under the USEPA mercury speciation pattern, Table 5 shows that there are greater mercury impacts from PC Boiler emissions on both the surface water and watershed than seen using the HHRA speciation pattern.

**Exposure Assessment**

The HHRA provides a detailed description of the fate and transport algorithms involved in the modeling of mercury into fish tissue. Although it will not be described in the current report, there were no deviations from the process used in the November 2007 HHRA. However, as the results from the air modeling, described in Table 5, indicate that modifying the mercury speciation does change the impact(s) on Kiwassee Lake and its watershed, it is important to examine the impact on the individual mercury loading components to the lake. Table 6 shows that, under the USEPA speciation pattern, mercury loading is increased for all water body loading components. It is important to note that loading of methylmercury is calculated for both watershed soil erosion ($L_E$) and runoff ($L_R$); this is the result of conversion of divalent mercury to methylmercury which is assumed to occur in watershed soils under current USEPA HHRA guidance.

Although the intermediate steps are not shown in the current report, the November 2007 HHRA describes in some detail the process used to convert total water body loading ($L_T$) into predicted mercury concentrations in the various water body compartments. That same process was used for the current report. Two different approaches have been used to estimate fish tissue mercury concentrations based on concentrations of mercury in surface water. Under the USEPA approach, the uptake into fish tissue is based on the concentration of mercury in the dissolved phase of the water column ($C_{dw}$); under the MDEQ AQD approach, the uptake is based on the modeled concentration of total mercury in the water column ($C_{wctot}$). The impact of speciation on mercury concentrations in fish tissue is shown in Table 7 for both the MDEQ AQD and USEPA approaches. As might be expected based on the modeled differences in water body loading, use of the USEPA mercury speciation pattern results in higher predicted fish mercury concentrations.

As described earlier in this report, the Fisher and Fisher Child can be exposed to mercury through a variety of pathways in addition to fish consumption. Table 8 summarizes the impact of mercury speciation on indirect mercury intake pathways for both the Fisher and Fisher Child. Clearly, these results confirm that fish consumption is the primary pathway for mercury exposure and that the USEPA mercury speciation pattern results in higher total mercury intake ($I_{tot}$) for both receptor groups.

Inhalation (direct) exposure to mercury is also evaluated in the HHRA and the results are presented in Table 9; modeled air concentrations ($C_{air}$) were based on air modeling results presented previously in Table 4. Note that the $C_{air}$ for divalent mercury represents the combined air concentrations for divalent mercury vapor and particle-bound divalent mercury.

**Risk Characterization**

The key question to be answered by the current activity is the potential impact of speciation on the human health effects of mercury emitted from the PC Boiler. Table 9 presents the impact of speciation on the Hazard Quotients (HQs) resulting from direct inhalation exposure of the Fisher and Fisher Child to mercury emissions. The largest impact of speciation is on the inhalation HQ for divalent mercury which was estimated to increase from 7E-7 to 3E-5. Air concentrations of elemental mercury would be reduced under the USEPA mercury speciation pattern resulting in a decrease in the HQ from 2E-5 to 8E-6.

Table 10 presents the impact of speciation on the Hazard Indices (HIs) resulting from indirect exposure of the Fisher and Fisher Child to mercury emissions. As described earlier, the use of two different methodologies to predict fish tissue concentrations results in two different estimates for total mercury intake ($I_{tot}$). The $I_{tot}$ is then converted to an average daily dose (ADD) which is compared against a reference dose (RfD) to yield an HI. The USEPA mercury speciation pattern results in an increased HI in both the Fisher and Fisher Child for both divalent mercury and methylmercury. A similar pattern was seen when using the MDEQ AQD approach for estimating fish tissue mercury concentrations, although the HIs estimated for methylmercury are still lower than those estimated under the USEPA HHRA approach.

Table 11 summarizes the impact of speciation on cumulative mercury HIs in both the Fisher and Fisher Child. The cumulative HI represents the combined impact of all three mercury species and all exposure pathways (both direct and indirect) in the Fisher and Fisher Child. For the Fisher, the results of this study indicate that the HI could increase from 0.001 to 0.03 under the USEPA mercury speciation pattern; for the Fisher Child, the HI could increase from 0.0008 to 0.02.

**Conclusions**

The results of the current evaluation indicate that although consideration of the generic USEPA mercury speciation did result in higher HIs for the Fisher and Fisher Child, the cumulative HIs are still well below any regulatory level of concern. The combined HI estimates indicate that the incremental mercury impacts should not present a human health concern. Typically, a combined HI ≤ 1 indicates an exposure level that can be tolerated by all individuals, including sensitive subpopulations, throughout a lifetime without any adverse effects. USEPA Region 6 recommends a target HI level of 0.25; this value selected to account for possible contributions from existing background levels. Even though the MDEQ AQD has not endorsed either of these target levels, choosing instead to make case-by-case risk management decisions, consideration of the generic USEPA mercury partitioning pattern has not identified any potential problems.

**References**

United States Department of Energy (USDOE), 2006, Large Scale Testing of Enhanced Mercury Removal at W.A. Parish Unit 8, Hoot lake Unit 3 and Hawthorn Unit 5, US DOE NETL, October 2006.

United States Environmental Protection Agency (USEPA), 1995, Compilation of Air Pollutant Emission factors, Volume I: Stationary Point and Area Sources, Fifth Edition, [Supplement E-September 1999], Office of Air Quality Planning and Standards, Research Triangle Park, NC. [EPA-540-R-93-081]

United States Environmental Protection Agency (USEPA), 1977, Mercury Study Report to Congress, Offices of Air Quality Planning and Standards and Research and Development, Washington, DC. [EPA-452-R-97-005]

United States Environmental Protection Agency (USEPA), 2005, Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Office of Solid Waste and Emergency Response, Washington, DC. [EPA-530-R-05-006]

Table 1.
Source-Specific Mercury Emission Rates Evaluated in the HHRA

| Emission Source | Modeled Mercury Emission Rate[A] (g/s) | | |
|---|---|---|---|
| | Hg0 | Hg2 | HgP |
| PC Boiler | 1.52E-03 | 2.06E-05 | 0.00E+00 |
| Auxiliary Boiler | 1.26E-05 | 1.26E-05 | 0.00E+00 |
| Steam Boiler I | 1.12E-05 | 1.12E-05 | 0.00E+00 |
| Steam Boiler II | 1.12E-05 | 1.12E-05 | 0.00E+00 |
| Steam Boiler III | 1.12E-05 | 1.12E-05 | 0.00E+00 |

[A] As the speciation of mercury emissions from the Auxiliary Boiler and Steam Boilers I through III was unknown, the same emission rates were conservatively evaluated for both Hg0 and Hg2 species.

Table 2.
PC Boiler Mercury Emission Rates Evaluated in Current Speciation Study

| Mercury Species | % of Total Hg Emissions | Modeled Emission Rate (g/s) |
|---|---|---|
| Original HHRA Mercury Speciation [A,B] | | |
| Elemental Mercury (Hg0) | 98.7 | 1.52E-03 |
| Divalent Mercury-Vapor Phase (Hg2) | 1.3 | 2.06E-05 |
| Divalent Mercury-Particle-Bound (HgP) | 0.0 | 0.00E+00 |
| Totals | 100.0 | 1.54E-03 |
| 50:30:20 Mercury Speciation [A,C] | | |
| Elemental Mercury (Hg0) | 50.0 | 7.70E-04 |
| Divalent Mercury-Vapor Phase (Hg2) | 30.0 | 4.62E-04 |
| Divalent Mercury-Particle-Bound (HgP) | 20.0 | 3.08E-04 |
| Totals | 100.0 | 1.54E-03 |

[A] Emissions source: PC Boiler

[B] Partitioning source:Large-Scale Testing of Enhanced Mercury Removal at W.A. Parish Unit 8, Hoot Lake Unit 3, and Hawthorn Unit 5[DOE, 2006].

[C] Partitioning source:Mercury Study Report to Congress[USEPA, 1997]

Table 3.
Particle Size Distribution Selected for Air Modeling of Mercury Emissions

| Lower Range of Particle Diameter (µm) | Upper Range of Particle Diameter (µm) | Mean Particle Diameter for Cumulative Range (µm) | Mean Particle Radius(µm) | Cumulative Mass% ≤ Stated Size[A] | Fraction of Mass Within Range[B] | Surface Area/ Volume[C] | Proportion Available Surface Area[C] | Fraction of Total Surface Area[C] |
|---|---|---|---|---|---|---|---|---|
| 15 | 30 | 23.304 | 11.65 | 100% | 0.030 | 0.257 | 0.008 | 0.002 |
| 10 | 15 | 12.664 | 6.33 | 97% | 0.050 | 0.474 | 0.024 | 0.005 |
| 6 | 10 | 8.163 | 4.08 | 92% | 0.150 | 0.735 | 0.110 | 0.025 |
| 2.5 | 6 | 4.478 | 2.24 | 77% | 0.240 | 1.340 | 0.322 | 0.073 |
| 1.25 | 2.5 | 1.942 | 0.97 | 53% | 0.220 | 3.090 | 0.680 | 0.155 |
| 1 | 1.25 | 1.130 | 0.56 | 31% | 0.060 | 5.312 | 0.319 | 0.073 |
| 0.625 | 1 | 0.827 | 0.41 | 25% | 0.110 | 7.258 | 0.798 | 0.182 |
| 0 | 0.625 | 0.394 | 0.20 | 14% | 0.140 | 15.239 | 2.133 | 0.486 |
| Totals | | | | 100% | 1.000 | | 4.393 | 1.000 |

[A] Source: AP-42 Table 1.1-6
[B] Based on AP-42 Table 1.1-6 for Baghouses.
[C] Calculated per Section 3.2.3 of the HHRA guidance [USEPA, 2005]

Table 4.

Impact of Speciation on AERMOD Modeled Mercury Impacts at Selected Residence/Fisher Location

| Mercury Species | Selected Residence/Fisher Location | | |
|---|---|---|---|
| | Air Concentration ($\mu g/m^3$) | Dry Deposition ($g/m^2$-yr) | Wet Deposition ($g/m^2$-yr) |
| Original HHRA Mercury Speciation [A] | | | |
| Divalent Mercury-Vapor Phase (Hg2) | 7.00E-08 | 1.48E-08 | 2.16E-09 |
| Divalent Mercury-Particle-Bound (HgP) | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Elemental Mercury (Hg0) [B] | 5.26E-06 | n/a | n/a |
| 50:30:20 Mercury Speciation [A] | | | |
| Divalent Mercury-Vapor Phase (Hg2) | 1.56E-06 | 2.77E-07 | 4.74E-08 |
| Divalent Mercury-Particle-Bound (HgP) | 1.04E-06 | 5.90E-08 | 1.17E-07 |
| Elemental Mercury (Hg0) [B] | 2.61E-06 | n/a | n/a |

[A] Emissions source: PC Boiler

[B] Hg0 impacts are only evaluated for direct inhalation exposures in HHRA [USEPA, 2005].

Table 5.
Impact of Speciation on AERMOD Modeled Mercury Impacts on Kiwassee Lake

| Mercury Species | Water Body | | Watershed | |
|---|---|---|---|---|
| | Air Concentration ($\mu g/m^3$) | Total Deposition ($g/m^2$-yr) | Air Concentration ($\mu g/m^3$) | Total Deposition ($g/m^2$-yr) |
| Original HHRA Mercury Speciation [A] | | | | |
| Divalent Mercury-Vapor Phase (Hg2) | 4.20E-08 | 7.32E-09 | n/a | 7.35E-09 |
| Divalent Mercury-Particle-Bound (HgP) [B] | n/a | 0.00E+00 | n/a | 0.00E+00 |
| Elemental Mercury (Hg0) [C] | n/a | n/a | n/a | n/a |
| 50:30:20 Mercury Speciation [A] | | | | |
| Divalent Mercury-Vapor Phase (Hg2) | 9.47E-08 | 1.45E-07 | n/a | 1.35E-07 |
| Divalent Mercury-Particle-Bound (HgP) [B] | n/a | 3.98E-08 | n/a | 3.88E-08 |
| Elemental Mercury (Hg0) [C] | n/a | n/a | n/a | n/a |

[A] Emissions source: PC Boiler

[B] Airborne HgP is not directly involved in surface water impacts in HHRA [USEPA, 2005].

[C] Hg0 impacts are only evaluated for direct inhalation exposures in HHRA [USEPA, 2005].

Table 6.
Impact of Speciation on Mercury Loading to Kiwassee Lake

| Mercury Species | Water Body Loading (g/yr) | | | | | |
|---|---|---|---|---|---|---|
| | Deposition ($L_{dep}$) | Impervious Runoff ($L_{RI}$) | Diffusion ($L_{Dif}$) | Runoff ($L_R$) | Erosion ($L_E$) | Total ($L_T$) |
| Original HHRA Mercury Speciation [A] | | | | | | |
| Divalent Mercury (Hg2) | 3.6E-04 | 3.5E-05 | 5.2E-04 | 1.6E-06 | 2.8E-04 | 1.2E-03 |
| Methylmercury (MeHg) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 1.9E-07 | 1.2E-05 | 1.2E-05 |
| Elemental Mercury (Hg0) | n/a | n/a | n/a | n/a | n/a | n/a |
| 50:30:20 Mercury Speciation [A] | | | | | | |
| Divalent Mercury (Hg2) | 9.1E-03 | 8.7E-04 | 1.2E-02 | 4.2E-05 | 7.1E-03 | 2.9E-02 |
| Methylmercury (MeHg) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 4.9E-06 | 3.0E-04 | 3.1E-04 |
| Elemental Mercury (Hg0) | n/a | n/a | n/a | n/a | n/a | n/a |

[A] Emissions source: PC Boiler

Table 7.
Impact of Speciation on Mercury Concentrations in Fish Tissue

| Mercury Species | USEPA Approach | | | MDEQ Approach | | | |
|---|---|---|---|---|---|---|---|
| | $C_{dw}$ (mg/L) | BAF (L/kg) | $C_{fish}$ (mg/kg) | $C_{wctot}$ (mg/L) | $C_{wctot}$ [Combined] (mg/L) | BAF (L/kg) | $C_{fish}$ (mg/kg) |
| Original HHRA Mercury Speciation[A] | | | | | | | |
| Divalent Mercury (Hg2) | 4.2E-10 | 1.0E+00 | 4.2E-10 | 9.8E-10 | | | |
| Methylmercury (MeHg) | 1.0E-10 | 5.6E+06 | 5.6E-04 | 5.5E-11 | 1.0E-09 | 1.1E+05 | 1.2E-04 |
| Elemental Mercury (Hg0)[B] | n/a | | | | | | |
| 50:30:20 Mercury Speciation[A] | | | | | | | |
| Divalent Mercury (Hg2) | 1.0E-08 | 1.0E+00 | 1.0E-08 | 2.4E-08 | | | |
| Methylmercury (MeHg) | 2.5E-09 | 5.6E+06 | 1.4E-02 | 1.4E-09 | 2.5E-08 | 1.1E+05 | 2.8E-03 |
| Elemental Mercury (Hg0)[B] | n/a | | | | | | |

[A] Emissions source: PC Boiler

[B] Hg0 impacts are only evaluated for direct inhalation exposures in HHRA [USEPA, 2005].

Table 8.

Impact of Speciation on Indirect Mercury Intake by the Fisher and Fisher Child

| Mercury Species | $I_{soil}$ (mg/d) | $I_{veg}$ (mg/d) | $I_{fish-EPA}$ (mg/d) | $I_{fish\_MDEQ}$ (mg/d) | $I_{dw}$ (mg/d) | $I_{tot-EPA}$ (mg/d) | $I_{tot-MDEQ}$ (mg/d) |
|---|---|---|---|---|---|---|---|
| **Fisher** | | | | | | | |
| Original HHRA Mercury Speciation [A] | | | | | | | |
| Divalent Mercury (Hg2) | 1.7E-09 | 4.0E-09 | 6.2E-12 | 0.0E+00 | 0.0E+00 | 5.7E-09 | 5.6E-09 |
| Methylmercury (MeHg) | 3.3E-11 | 6.2E-10 | 8.4E-06 | 1.8E-06 | 0.0E+00 | 8.4E-06 | 1.8E-06 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 50:30:20 Mercury Speciation [A] | | | | | | | |
| Divalent Mercury (Hg2) | 4.9E-08 | 1.3E-07 | 1.5E-10 | 0.0E+00 | 0.0E+00 | 1.7E-07 | 1.7E-07 |
| Methylmercury (MeHg) | 9.6E-10 | 2.0E-08 | 2.1E-04 | 4.3E-05 | 0.0E+00 | 2.1E-04 | 4.3E-05 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| **Fisher Child** | | | | | | | |
| Original HHRA Mercury Speciation [A] | | | | | | | |
| Divalent Mercury (Hg2) | 3.3E-09 | 2.0E-09 | 9.6E-13 | 0.0E+00 | 0.0E+00 | 5.3E-09 | 5.3E-09 |
| Methylmercury (MeHg) | 6.5E-11 | 3.1E-10 | 1.3E-06 | 2.7E-07 | 0.0E+00 | 1.3E-06 | 2.7E-07 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 50:30:20 Mercury Speciation [A] | | | | | | | |
| Divalent Mercury (Hg2) | 9.8E-08 | 6.2E-08 | 2.3E-11 | 0.0E+00 | 0.0E+00 | 1.6E-07 | 1.6E-07 |
| Methylmercury (MeHg) | 1.9E-09 | 1.0E-08 | 3.2E-05 | 6.5E-06 | 0.0E+00 | 3.2E-05 | 6.5E-06 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | n/a | n/a | n/a | n/a | n/a |

[A] Emissions source: PC Boiler

[B] Hg0 impacts are only evaluated for direct inhalation exposures in HHRA [USEPA, 2005].

Table 9.

Impact of Mercury Speciation on Direct Hazard Quotients in the Fisher and Fisher Child

| Mercury Species | $C_{air}$ (μg/m$^3$) | EC (μg/m$^3$) | RfC (mg/m$^3$) | $HQ_i$ ( ) |
|---|---|---|---|---|
| Original HHRA Mercury Speciation [A] | | | | |
| Divalent Mercury (Hg2) | 7.0E-08 | 6.7E-08 | 9.0E-05 | 7E-07 |
| Methylmercury (MeHg) | 0.0E+00 | 0.0E+00 | n/a | |
| Elemental Mercury (Hg0) | 5.3E-06 | 5.0E-06 | 3.0E-04 | 2E-05 |
| 50:30:20 Mercury Speciation [A] | | | | |
| Divalent Mercury (Hg2) | 2.6E-06 | 2.5E-06 | 9.0E-05 | 3E-05 |
| Methylmercury (MeHg) | 0.0E+00 | 0.0E+00 | n/a | |
| Elemental Mercury (Hg0) | 2.6E-06 | 2.5E-06 | 3.0E-04 | 8E-06 |

[A] Emissions source: PC Boiler

Table 10.

Impact of Mercury Speciation on Indirect Hazard Indices in the Fisher and Fisher Child

| Mercury Species | $I_{tot\text{-}EPA}$ (mg/d) | $I_{tot\text{-}MDEQ}$ (mg/d) | EF (d/yr) | BW (kg) | UCF (d/yr) | $ADD_{EPA}$ (mg/kg-d) | $ADD_{MDEQ}$ (mg/kg-d) | RfD (mg/kg-d) | $HI_{ind\_EPA}$ ( ) | $HI_{ind\_MDEQ}$ ( ) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Fisher** | | | | | | | | | | |
| Original HHRA Mercury Speciation [A] | | | | | | | | | | |
| Divalent Mercury (Hg2) | 5.7E-09 | 5.6E-09 | 350 | 70 | 365 | 7.7E-11 | 7.7E-11 | 3.0E-04 | 3E-07 | 3E-07 |
| Methylmercury (MeHg) | 8.4E-06 | 1.8E-06 | 350 | 70 | 365 | 1.2E-07 | 2.4E-08 | 1.0E-04 | 1E-03 | 2E-04 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | 350 | 70 | 365 | n/a | n/a | n/a | | |
| 50:30:20 Mercury Speciation [A] | | | | | | | | | | |
| Divalent Mercury (Hg2) | 1.7E-07 | 1.7E-07 | 350 | 70 | 365 | 2.4E-09 | 2.4E-09 | 3.0E-04 | 8E-06 | 8E-06 |
| Methylmercury (MeHg) | 2.1E-04 | 4.3E-05 | 350 | 70 | 365 | 2.8E-06 | 5.8E-07 | 1.0E-04 | 3E-02 | 6E-03 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | 350 | 70 | 365 | n/a | n/a | n/a | | |
| **Fisher Child** | | | | | | | | | | |
| Original HHRA Mercury Speciation [A] | | | | | | | | | | |
| Divalent Mercury (Hg2) | 5.3E-09 | 5.3E-09 | 350 | 15 | 365 | 3.4E-10 | 3.4E-10 | 3.0E-04 | 1E-06 | 1E-06 |
| Methylmercury (MeHg) | 1.3E-06 | 2.7E-07 | 350 | 15 | 365 | 8.3E-08 | 1.7E-08 | 1.0E-04 | 8E-04 | 2E-04 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | 350 | 15 | 365 | n/a | n/a | n/a | | |
| 50:30:20 Mercury Speciation [A] | | | | | | | | | | |
| Divalent Mercury (Hg2) | 1.6E-07 | 1.6E-07 | 350 | 15 | 365 | 1.0E-08 | 1.0E-08 | 3.0E-04 | 3E-05 | 3E-05 |
| Methylmercury (MeHg) | 3.2E-05 | 6.5E-06 | 350 | 15 | 365 | 2.0E-06 | 4.2E-07 | 1.0E-04 | 2E-02 | 4E-03 |
| Elemental Mercury (Hg0) [B] | n/a | n/a | 350 | 15 | 365 | n/a | n/a | n/a | | |

[A] Emissions source: PC Boiler

[B] Hg0 impacts are only evaluated for direct inhalation exposures in HHRA [USEPA, 2005].

Table 11.

Impact of Speciation on Cumulative Mercury Hazard Indices in the Fisher and Fisher Child

| Risk Component | Fisher | | Fisher Child | |
|---|---|---|---|---|
| | Direct HI | Indirect HI [A] | Direct HI | Indirect HI [A] |
| Original HHRA Mercury Speciation [B] | | | | |
| Direct/Indirect HI | 2E-05 | 1E-03 | 2E-05 | 8E-04 |
| Cumulative HI | 1E-03 | | 8E-04 | |
| 50:30:20 Mercury Speciation [B] | | | | |
| Direct/Indirect HI | 4E-05 | 3E-02 | 4E-05 | 2E-02 |
| Cumulative HI | 3E-02 | | 2E-02 | |

[A] Based on fish mercury concentrations estimated using HHRA guidance [USEPA, 2005]

[B] Emissions source: PC Boiler