MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

November 1, 2000

TO: Toxics Unit Chemical File for Asbestos (CAS #1332-21-4)

FROM: Robert Sills, Toxics Unit

SUBJECT: Asbestos Cancer Risk Assessment, and Screening Level (SL) Derivation

The asbestos initial risk screening level (IRSL) is being set at 2.2 E-5 µg/m^3, with the secondary risk screening level (SRSL) at 2.2 E-4 µg/m^3. The averaging time is annual for both. This document explains the SL derivation basis.

Asbestos is classified by the United States Environmental Protection Agency (EPA) (1993) as a known human carcinogen (Class A), based upon the inhalation exposure route and the increased incidence of lung cancer, mesotheliomas, and gastrointestinal cancer. The unit risk value was derived by EPA (1993) on the basis of additive combined risk of lung cancer and mesothelioma. The unit risk is based on the fiber counts made by phase contrast microscopy (PCM). That unit risk value is 2.3E-1 per (fibers/mL) (from PCM). As derived from that unit risk value, the air concentration associated with a 1 in 1 million cancer risk is 4E-6 fibers/mL (from PCM), or 4 fibers per cubic meter (from PCM) (EPA, 1993). However, this cancer risk estimate needs to be converted to units of ug/m^3, as is standard for IRSLs.

Environmental measurements of asbestos are commonly reported in terms of either mass per volume, or as fiber counts determined by transmission electron microscopy (TEM) (EPA, 1993). The TEM mass units are derived from TEM fiber counts. However, the conversion of PCM fiber counts to mass units is highly uncertain. Available studies provide conversion factors between TEM mass and PCM fiber count which range from 5 to 150 (µg/m^3)/(fibers/mL) (EPA, 1993). The geometric mean of these study results, 30 (µg/m^3)/(fibers/mL), was previously adopted by EPA, with the realization that this value is highly uncertain (EPA, 1993). The correlation between PCM fiber counts and TEM fiber counts (and TEM mass units) is very uncertain and no generally applicable conversion factor exists for these two measurements (EPA, 1993).

The California South Coast Air Quality Management District (SCAQMD, 1999) and California EPA (1997) have utilized a unit risk factor of 1.9E-4 per (100 PCM fibers/mL), which was provided by the California Department of Health Services (CDHS, 1986). This is equivalent to 1.9 per (PCM fibers/mL), which is a substantially higher unit risk than the EPA (1993) unit risk of 2.3E-1 per (fibers/mL). These California agencies then converted their unit risk value to 6.3 E-2 per (µg/m^3), from the EPA (1993) mean conversion factor of 30 (µg/m^3)/(fibers/mL) (although they cite that conversion factor in the equivalent form of 0.003 µg per 100 asbestos fibers). That unit risk value and use of the mean conversion factor would result in a 1 in 1 million cancer risk estimate of 1.6 E-5 µg/m^3.

The derivation of an IRSL requires the selection of a unit risk factor in terms of fiber concentration, and a conversion factor to provide a unit risk in terms of mass per volume (µg/m^3). The EPA (1993) unit risk factor is preferred, because it is still current and provided in the IRIS database with supporting documentation, and it was developed and reviewed more

recently than the CDHS (1986) value. The selection of a conversion factor to put the unit risk in terms of mass per volume would require a policy judgment. The importance of that judgment on the resulting cancer risk estimate can be considered by employing the range and geometric mean conversion factors as provided by EPA (1993). Those would result in the following air concentrations associated with a 1 in one million cancer risk:

High end of potential IRSL range (assuming (150 ug/m3)/(fibers/mL)): 6.5E-4 µg/m³

Potential IRSL (assuming the geo. mean of (30 ug/m3)/(fibers/mL)): 1.3E-4 µg/m³

Low end of potential IRSL range (assuming (5 ug/m3)/(fibers/mL)): 2.2E-5 µg/m³

The IRSL is set according to the more restrictive of these approaches, at 2.2 E-5 µg/m^3. This policy decision is consistent with the concept that screening levels should ensure protectiveness under all reasonably foreseeable situations. However, the listing of the SLs in the SL database will be footnoted with the statement: "The asbestos IRSL (in µg/m^3) is based on a conservative conversion from the EPA's one-in-one million cancer risk estimate of 4E-6 fibers/mL (equivalent to 4 fibers/m^3). Less restrictive IRSLs may be applied a base-by-case basis depending on the fiber density."

References cited:

EPA. 1993. Integrated Risk Information System (IRIS database): Carcinogenicity Assessment for Asbestos (CASRN 1332-21-4). Last revised 7/1/93. Retrieved 8/30/00.

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California EPA. 1997. Air Toxics Hot Spots Program Risk Assessment Guidelines: Technical Support Document for Determining Cancer Potency Factors. Draft for Public Comment.

California Department of Health Services (CDHS, 1986). Report to the Air Resources Board on Asbestos. Part B. Health Effects of Asbestos. Epidemiological Studies Section, Berkeley, CA. As cited in: California EPA, 1997.