
Appendix A4

**Parameterization of Risk
Assessment Model**

PARAMETERIZATION OF RISK ASSESSMENT MODEL

The following bullets detail how each of the variables in the risk assessment model were selected. Values reflect either site specific input from meeting with Laotian team members or Health Canada default values (Health Canada 2004).

- C_S (Soil Concentration used by the accidental soil ingestion, inhalation of contaminated particles and dermal contact with contaminated soil pathways, units = mg/kg dry). The concentration total PCBs and PCDD/F + PCB TEQs measured in sludge collected at the edge of the leachate treatment pond was used for modeling. It was anticipated that employees may be directly exposed to this material while working at the site. Off-site soil concentrations were used to estimate exposure to local residents for PCDD/F + PCBTEQ concentrations. Off-site soil concentrations were not assessed for total PCBs, therefore the more conservative treatment pond sludge concentrations was used in the model by default.
- C_{Food} (Concentration measured in fish tissue, units = mg/kg wet). The concentration of total PCBs measured in fish tissue was estimated by adding the individual homologue groupings of PCBs (i.e., monoPCBs, diPCBs, triPCBs etc...). This data was analyzed by ALS Tetrachem, Malaysia using low resolution GC-MS. The individual homologues had concentrations below the method detection limit and were reported as “<5µg/kg”. For the model, 2.5µg/kg was used as a rough estimate of the concentration of total PCBs in the fish tissue sample. It was assumed that both landfill employees and local residents had equal access to fish exposed to landfill leachate.
- P_{Air} (Concentration of particulates suspended in the air, units = µg/m³). The default Health Canada value for typical conditions was used (0.76 µg/m³, as per USEPA 1992)
- IR_S (mass of soil per day accidentally ingested, units = mg/day). The rate value used was taken directly from the Health Canada default table (0.00002 kg/day). The same rate was used for both children and adults. This means that on a per body weight basis, children accidentally consume about double the amount of soil than an adult (children are 32.9 kg, compared to an adult weight of 60 kg; see Bw below).
- IR_{Food} (mass of contaminated food per day ingested, units = kg/day). The default Canadian values were adopted for the model (0.11 kg/day for adults and 0.09 kg/day for children).
- IR_A (volume of air inhaled each hour, units = m³/hr). This variable is used for the inhalation pathway only. The rate value for adults and children were taken directly from the Health Canada default values. Note that Health Canada default values are presented in units of m³/day and therefore were divided by 24 hrs/day to get units of m³/hr.

- **S_{AW}** (surface area of skin exposed to contaminated soils, units = cm²). Only hands were assumed to be exposed. The surface area of hands were adopted from the Health Canada default values, but adjusted slightly downward (800cm² for adult and 400cm² for a child). Values were developed during meetings with Malaysian team members.
- **SL_H** (Soil loading to exposed skin, indicates the usual surface area coverage per volume of contaminated soil, units = g/cm² - event). The Health Canada default value (0.0001 g/cm² for hands) was adopted.
- **AF_{GIT}** (absorption factor across the gastro intestinal tract, units = unitless). This variable is used both for accidental soil ingestion and food ingestion pathways. There are no readily available AF_{GIT} values for total PCBs or PCDD/F + PCB TEQs. In these cases, Health Canada guidance recommends adopting a conservative estimate of "1". This indicates that 100% of chemical is absorbed across the gastrointestinal tract into the body.
- **AF_{Inh}** (Absorption Factor for the lungs, units = unitless). There are no readily available AF_{GIT} values for total PCBs or PCDD/F + PCB TEQs. In these cases, Health Canada guidance recommends adopting a conservative estimate of "1". This indicates that 100% of chemical is absorbed across the lungs into the body.
- **AF_{Skin}** (Absorption Factor for the skin, units = unitless). For PCBs or PCB & PCDD/F TEQs, an AF_{Skin} of 14% was adopted this is the absorption factor for PCB Aroclor mixtures commonly applied by the USEPA (cited in Mayes et al., 2002). The same factor was used for PCDD/F + PCB TEQs.
- **EF** (number of dermal exposures per day, units = events/day). It was assumed that there would be only one dermal exposure per day. This value was developed during discussions with Malaysian team members.
- **D_{hours}** (number of hours a day that an individual is potentially exposed, units = hrs/day). D_{hours} is used by the accidental ingestion and inhalation of contaminated particle pathways, but the value is slightly different for each exposure pathway. For accidental soil ingestion, it is assumed that individuals may only be exposed while they are near contaminated soils and also awake. The model assumes 16 hours for both the landfill employee and for local residents. For inhalation of contaminated particles it was assumed that individual may be exposed at any time that they are near to the contaminated soils, therefore the model assumes 24 hours for both the landfill employee and for local residents.
- **D_{days}** (number of days per week, or days per year, that an individual is potentially exposed, units = days/week or days/year). D_{days} is used by all the exposure pathways, but the value is slightly different for each. For accidental soil ingestion, inhalation of contaminated particles and dermal contact, it was assumed that the person (either a security guard working at the site or local residents) would be potentially exposed seven days a week. The numbers were based on interviews with security guards and local residents, and were

selected during meetings with Malaysian team members. The food ingestion pathway uses days per year, which indicates the number of days each year that contaminated food items may be ingested. In this risk assessment it was assumed that only fish or other meat sources collected from the site were potentially contaminated.

- **D_{weeks}** (number of weeks per year that an individual is potentially exposed, units = weeks/year). **D_{weeks}** is used by the accidental soil ingestion, inhalation of contaminated particles and dermal contact pathways. It was assumed that the person (either a security guard working at the site or local residents) would be potentially exposed most weeks of the year, but would not be at the site during short periods of holiday or vacation. The numbers were based on interviews with security guards and local residents, and were selected during meetings with Malaysian team members. The **D_{weeks}** used for the inhalation pathway were multiplied by 0.55 which is the proportion of days during the year with no precipitation. Refer to Section 1.2.4 for climatic information. It was assumed that there would be no dust (suspended particulates) on days with rain.
- **D_{years}** (number of years that an individual is potentially exposed, units = years). **D_{years}** is used by all exposure pathways, but only in the non-threshold model (i.e., the carcinogen model). Security guards were assumed to be working at the site for approximately 10 years, while local residents were assumed to be living in the community for 10 years. The numbers were based on interviews with security guards and local residents, and were selected during meetings with Malaysian team members.
- **BW** (Body weight, units = kg). Adults were assumed to weight 69.3 kg. The adult BW was developed during discussions with Malaysian team members. The child body weight was estimated using the same child to adult weight ratio for weights provided by Health Canada. The estimated Malaysian child weight was 32.2 kg.
- **LE** (Life expectancy, the number of year that the person is likely to live. Not used for non-carcinogens, units = years). It was assumed that the average life expectancy was 60 years. The live expectancy value was developed during discussions with Malaysian team members.

References:

Health Canada. 2004. Federal Contaminated Site Risk Assessment in Canada Part I: Guidance on human health Preliminary Quantitative Risk Assessment (PQRA), Cat. H46-2/04-367E, ISBN 0-662-38244-7. Accessed on line at <http://www.hc-sc.gc.ca/ewh-semt/contamsite/risk-risque-eng.php> in July 2008.

Mayes BA, Brown GL, Mondello FJ, Holtzclaw KW, Hamilton SB, Ramsey AA.. 2002. Dermal absorption in rhesus monkeys of polychlorinated biphenyls from soil contaminated with Aroclor 1260, Regul Toxicol Pharmacol., 35:289-95.