Steps in Risk Assessment:

3. Toxicity Assessment:

   This component of the risk assessment considers the types of adverse health effects associated with chemical exposures and the relationship between the magnitude of exposure and adverse effects. The most current toxicity values will be used in risk assessment. The facility should provide a table clearly showing the toxicity values to be used. The two principal indices of toxicity used in risk assessment are the reference dose (RfD)/reference concentration(RfC) and the cancer slope factor (SF)/inhalation unit risk (IUR).

   A RfD is the intake or dose per unit of body weight (mg/kg-day) that is unlikely to result in toxic (non-carcinogenic) effects to human populations, including sensitive subgroups (e.g., the very young or elderly). The RfD allows for the existence of a threshold dose below which no adverse effects occur. The SF is used to express the cancer risk attributable to a discrete unit of intake; that is, the cancer risk per milligram ingested per kilogram of bodyweight per day ([mg/kg-day]-1). The SF is an estimate of the upper-bound probability of an individual developing cancer as a result of exposure to a particular carcinogen. Unlike the RfD, the SF assumes that there is no threshold dose below which the probability of developing cancer is zero. SFs are only developed for those chemicals which have been shown to be carcinogens in humans or in at least several animal species. A carcinogenic weight of evidence rating is used to describe the strength of the experimental evidence for carcinogenicity.

   A RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime and is expressed as mg/m^3. An IUR is the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu g/m^3$ in air. This means that: if unit risk = 2 × 10-6 per $\mu g/m^3$, 2 excess cancer cases (upper bound estimate) are expected to develop per 1,000,000 people if exposed daily for a lifetime to 1 µg of the chemical per m^3 of air.

   For oral exposures, RfDs and SFs are derived by the U.S. EPA for the most toxic chemicals generally associated with chemical releases to the environment for which adequate toxicological data are available. For inhalation exposure, reference concentration (RfC) and inhalation unit risk (IUR) are provided. If both the carcinogenic and non-carcinogenic effects of a particular compound are significant, both values may be established.

   Chemical specific oral-route absorption values (ABSoral) are used to adjust the oral RfD or SF for use in the dermal exposure pathway. This correction is necessary due to the differences in absorption between the skin and the gastrointestinal tract. By correcting the oral RfD or SF for the fraction expected to be absorbed in the gut, a dermal absorption factor can be used to estimate the correct intake received through the skin.

EPA's recommended hierarchy of references to obtain toxicity values should be consulted prior to conducting risk assessment. The most recent update of EPA Region 3's Regional Screening Table (RSL) may also be consulted to obtain toxicity values and dermal absorption values. The facility should provide a table clearly showing the toxicity values to be used.