# Appendix Q

# Human Health Benchmarks

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This appendix presents summaries of the scientific basis of the human health benchmarks used to characterize human health risks in the paint listing risk assessment. For each constituent, an introduction, summary table, and discussions of noncancer and carcinogenic effects are provided. The toxicological studies, calculations, and methods used to derive health benchmarks are reviewed for each constituent. The chronic benchmarks used in this risk assessment fall into the following four categories:

- Reference dose (RfD) (mg/kg-d)
- Reference concentration (RfC) (mg/m$^3$)
- Oral cancer slope factor (CSF) (mg/kg-d)$^{-1}$
- Inhalation CSF (mg/kg-d)$^{-1}$.

The RfD and RfC are the primary benchmarks used to evaluate noncarcinogenic hazards posed by environmental exposures to chemicals. They are based on the "threshold" approach, which is based on the theory that there is a "safe" exposure level (i.e., a threshold) that must be exceeded before a toxic effect occurs. RfDs and RfCs are derived from the highest no observed adverse effects level (NOAEL) for the most sensitive effect identified in human epidemiological studies or from subchronic or chronic studies in laboratory animals. If a NOAEL is not identified in any of the available studies, the lowest observed adverse effects level (LOAEL) is used. If the studies report dose levels as parts per million (ppm) in the diet or water, the dose levels are converted to milligrams per kilogram per day (mg/kg-d) based on the consumption level and body weights of the test animals. It is generally assumed that dose levels expressed on a mg/kg-d basis are equivalent in humans and animals; therefore, dose adjustments are not necessary unless chemical-specific pharmacokinetic data indicate that a dose adjustment is appropriate. NOAELs and LOAELs are adjusted ($NOAEL_{ADJ}$ or $LOAEL_{ADJ}$) for exposure protocols that are not continuous (i.e., less than 7 days per week or 24 hours per day). Differences in respiratory rates and respiratory physiology between humans and laboratory animals are well recognized; therefore, NOAELs and LOAELs identified in animals from inhalation studies are converted to the human equivalent concentration ($NOAEL_{HEC}$ or $LOAEL_{HEC}$) before deriving the RfC. The RfC methodology is described in detail in U.S. EPA (1994).

Once an appropriate NOAEL or LOAEL has been identified, the characteristics and the quality of the database are examined. Uncertainty and variability in the toxicological and epidemiological data from which RfDs and RfCs are derived are accounted for by applying uncertainty factors. Some of these uncertainties include those associated with extrapolation from animals to humans, from LOAELs to NOAELs, and from subchronic to chronic data to account for sensitive subpopulations and to account for database deficiencies. The NOAEL or LOAEL is divided by uncertainty factors and modifying factors to derive the RfD or RfC. Factors of 10 are commonly used as uncertainty factors. An uncertainty factor of 3 may be used if appropriate pharmacokinetic data (or a model) are available, particularly to account for inter- or intraspecies extrapolations. The default value for the modifying factor is 1. All uncertainty factors and modifying factors are multiplied together to derive the total uncertainty factor, with 3,000 being the maximum recommended value (U.S. EPA, 1994).

Measures of carcinogenic potency, the CSFs and URFs, may be derived from a number of statistically and/or biologically based models. Traditionally, the linearized multistage model has been the default model for extrapolating cancer slope factors for low doses; however, other models also have been used. Although several models may provide a good fit to the experimental data, the slope factors at low doses may be different by up to several orders of magnitude depending on which model is used. EPA's proposed cancer risk guidelines propose significant changes to the default methodology (U.S. EPA, 1996b). Although the new methodology has been used to develop some benchmarks listed in the Integrated Risk Information System (IRIS) (e.g., for PCBs), most of the cancer benchmarks used in this risk analysis are based on the linearized multistage model.

CSFs and URFs are used to evaluate cancer risks for ingestion and inhalation exposures, respectively. Unlike RfDs and RfCs, CSFs and URFs do not represent "safe" exposure levels. They are derived mathematically as the 95 percent upper confidence limit of the slope of the linear portion of the dose-response curve; that is, they relate levels of exposure with a probability of effect or risk. The CSF is expressed in units of $(mg/kg\text{-}d)^{-1}$ and the URF is expressed in units of $(\mu g/m^3)^{-1}$.

To assess less than lifetime cancer risks (e.g., child) and address population variability (e.g., body weight differences among adults), inhalation CSFs were used in this risk assessment. Inhalation CSFs were used to account for age-specific differences and population variability in inhalation rate and body weight as well as exposure duration and frequency. Inhalation URFs are not dependent on exposure factors (e.g., inhalation rates) and therefore cannot be used to address population variability or age-specific differences in exposure scenarios. Inhalation CSFs are not available from IRIS, so they were derived from URFs for the purpose of calculating risk.

Human health benchmarks were primarily identified in IRIS (U.S. EPA, 2000a)[1] and the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1997a). IRIS and HEAST are databases maintained by EPA, and values from IRIS and HEAST were used in the analysis whenever available. Provisional EPA benchmarks, Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs), California Environmental Protection Agency (CalEPA) chronic inhalation reference exposure levels (CalEPA, 1997, 1999b), and CalEPA

[1] The IRIS citation reflects the 2000 date it was obtained on-line and not the date that the information was added to (or last updated on) the IRIS database.

cancer potency factors (CalEPA, 1999a) were used to fill in data gaps; the studies and methods used to derive these alternative benchmarks were evaluated prior to use in this risk assessment. The derivation of provisional RfCs for nickel soluble salts and nickel oxide for use in this analysis is also provided.

A glossary of terms used in these summaries is provided in Section Q.41 of this appendix.

## Q.1 Acrylamide

### Q.1.1 Introduction

Acrylamide occurs as an odorless, white crystalline solid at room temperature. Acrylamide is primarily used in the production of polymers and copolymers. Its largest use is as polyacrylamide in sewage and wastewater treatment as a flocculant and as a coagulant aid to treat potable water. Polyacrylamide is also used in the paper and pulp industry to strengthen and improve the quality of paper and related products. Acrylamide monomer is used to produce chemical grouts and soil stabilizers and small quantities are used in the production of resins, in photographic applications, and in the textile industry. The most common routes of exposure to acrylamide is occupational through dermal and inhalation exposures. For the general population, exposure to acrylamide may occur through the consumption of contaminated drinking water (U.S. EPA, 1985a).

| Acrylamide | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-04 mg/kg-d | U.S. EPA, 2000a |
| RfC | 7.0E-04 mg/m$^3$ | CalEPA, 1997 |
| oral CSF | 4.5 (mg/kg-d)$^{-1}$ | U.S. EPA, 2000a |
| inh URF | 1.3E-03 (µg/m$^3$)$^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 4.5 (mg/kg-d)$^{-1}$ | U.S. EPA, 1997a |

### Q.1.2 Noncancer Effects

Limited data are available for human exposures to acrylamide. Numbness of the lower limbs that is accompanied or followed by weakness in the hands and feet and paresthesias (burning or prickling sensation) of the fingers have been reported (U.S. EPA, 1985a). Skin irritation, fatigue, ataxia (incoordination), tingling of the hands, slurred speech, muscular weakness, and sensory and reflex loss in the extremities have also been reported (CalEPA, 1997).

In animals, central nervous system effects are the most common effects resulting from acrylamide exposure. Neurological effects reported in rats following oral exposure to acrylamide include hindlimb and forelimb weakness, incoordination, abnormal gait, peripheral nerve degeneration, decreased performance on neurobehavioral tests, alterations in axonal transport, changes in myelin morphology, alterations in dopamine and serotonin binding affinities, and effects on Purkinje cells (U.S. EPA, 1985a). Reproductive effects (decreased number of live pups per litter, increased early resorptions, increased postimplantation loss, decreased number of live fetuses, decreased maternal weight gain, and decreased fetal body weight) and neurotoxicity (decreased grip strength, hindlimb splaying) in offspring have also been observed in orally exposed rats (CalEPA, 1997).

**Q.1.2.1 Reference Dose.** EPA has established an RfD for acrylamide of 2.0E-04 mg/kg-d based on a NOEL of 0.2 mg/kg-d and a LOAEL of 1 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Groups of rats were administered 0, 0.05, 0.2, 1, 5, or 20 mg/kg-d acrylamide in drinking water for 90 days. Some rats were observed for an additional 144 days to judge recovery (U.S. EPA, 2000a, citing Burek et al., 1980). Nerve damage (a slight but significant increase in peripheral axolemnal invaginations) was observed in rats in the 1 mg/kg-d group. At higher doses, sciatic nerve degeneration was observed though lesions were either partially or completely reversed following the recovery period.

An uncertainty factor of 1,000 was applied based on a tenfold factor to account for interspecies extrapolation, a tenfold factor to account for human variability, and a tenfold factor to account for extrapolation from subchronic to chronic exposure (U.S. EPA, 2000a).

EPA assigns confidence rankings to the noncancer benchmarks contained in IRIS. Confidence rankings are assigned to the study on which the RfD was based, the database supporting the RfD, and to the RfD itself. EPA has

- High confidence in the critical study used as the basis for the RfD because it was well designed. The study used a large number of endpoints, a sensitive measure of the most appropriate endpoints, more than the minimum number of treatment groups, and included a long posttreatment recovery period.

- Medium confidence in the database because it lacks accepted chronic studies.

Therefore, EPA has medium confidence in the RfD (U.S. EPA, 2000a).

**Q.1.2.2 Reference Concentration.** EPA has not established an RfC for acrylamide (U.S. EPA, 2000a). However, CalEPA (1997) derived a chronic inhalation reference exposure level of 7.0E-04 mg/m$^3$ for acrylamide based on the same study, NOAEL, and uncertainty factors that were used to calculate the RfD (Burek et al., 1980). A route-to-route extrapolation of the RfD (2.0E-04 mg/kg-d) was performed, resulting in an RfC of 7.0E-04 mg/m$^3$, by assuming a daily respiration rate of 20 m$^3$ of air and an average body weight of 70 kg (CalEPA, 1997).

### Q.1.3 Cancer Effects

Two available studies of the relationship of occupational exposure to acrylamide and cancer mortality are inadequate to derive an inference of relative risk. The limitations of these studies include small group sizes, underrepresentation of the at-risk worker population, incomplete exposure data, incomplete assessment of cause of death, multiple chemical exposures, limited followup, and varied exposure durations (U.S. EPA, 2000a).

In animal studies, increased incidences of several tumor types have been observed in rats exposed by drinking water. Scrotal, adrenal, and thyroid tumors were observed in male rats. Tumors of the central nervous system, mammary gland, thyroid gland, uterus, and oral cavity were observed in females rats (U.S. EPA, 2000a, citing Johnson et al., 1984, 1986). Additionally, acrylamide initiated skin tumorigenesis and induced lung neoplasms in mice exposed by gavage and intraperitoneal injection (U.S. EPA, 2000a).

EPA has classified acrylamide as a Group B2, Probable Human Carcinogen, based on the observation of an increased incidence of benign and/or malignant tumors at multiple sites in rats and carcinogenic effects in mice by several routes of exposure (U.S. EPA, 2000a).

**Q.1.3.1 Oral Cancer Risk.** EPA used the linearized multistage extrapolation model based on data from a study of rats exposed in drinking water (U.S. EPA, 2000a, citing Johnson et al., 1986) to estimate the oral unit risk estimate for acrylamide. EPA calculated a drinking water unit risk estimate of 1.3E-04 $(\mu g/L)^{-1}$ and an oral CSF of 4.5 $(mg/kg\text{-}d)^{-1}$ based on a combined increased incidence of central nervous system, mammary gland, thyroid gland, uterine, and oral cavity tumors in female rats.

EPA has confidence in the risk estimate because four dose levels over a reasonable range and a sufficient number of animals were tested. Many of the tumors were malignant, including gliomas and astrocytomas of the central nervous system, which rarely occur in rats (U.S. EPA, 2000a).

**Q.1.3.2 Inhalation Cancer Risk.** EPA used the linearized multistage extrapolation model to calculate the inhalation unit risk from the oral data. EPA calculated an inhalation unit risk estimate of 1.3E-03 $(\mu g/m^3)^{-1}$ (U.S. EPA, 2000a). EPA has also calculated an inhalation CSF of 4.5 $(mg/kg\text{-}d)^{-1}$ (U.S. EPA, 1997a).

## Q.2 Acrylonitrile

### Q.2.1 Introduction

Acrylonitrile is primarily used in the manufacture of acrylic and modoacrylic fibers. It is also used as a raw material in the manufacture of plastics (acrylonitrile-butadiene-styrene and styrene-acrylonitrile resins), acrylamide, and nitrile rubbers and barrier resins. Human exposure to acrylonitrile is primarily occupational. Exposure to very low levels of acrylonitrile could occur through contact with consumer products such as acrylic carpeting or ingestion of food stored in acrylic plastic containers (ATSDR, 1990c).

| Acrylonitrile | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-03 mg/kg-d | U.S. EPA, 1997a |
| RfC | 2.0E-03 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | 5.4E-01 (mg/kg-d)$^{-1}$ | U.S. EPA, 2000a |
| inh URF | 6.8E-05 (µg/m$^3$)$^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 2.4E-01 (mg/kg-d)$^{-1}$ | U.S. EPA, 1997a |

### Q.2.2 Noncancer Effects

Workers exposed to high levels of acrylonitrile via inhalation for less than an hour experienced mucous membrane irritation, headaches, nausea, and feelings of irritability. Low-grade anemia, leukocytosis, kidney irritation, and mild jaundice were also observed in the workers, with these effects subsiding after exposure ended. Symptoms associated with acrylonitrile poisoning include limb weakness, labored and irregular breathing, dizziness, impaired judgment, cyanosis, nausea, collapse, and convulsions (ATSDR, 1990c; U.S. EPA, 2000a).

In rats exposed to acrylonitrile by inhalation, degenerative and inflammatory changes in the respiratory epithelium of the nasal turbinates and effects on brain cells have been observed. Neurological effects, including excessive salivation and paralysis of the hind limbs, have been observed in a variety of animal species. Developmental effects, including fetal malformations, have been observed in the offspring of rats exposed to acrylonitrile by inhalation (ATSDR, 1990c).

**Q.2.2.1 Reference Dose.** The provisional RfD for acrylonitrile is 1.0E-03 mg/kg-d based on a NOAEL of 1 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 1997a). The RfD was based on a study in which histological and biochemical evidence of degenerative changes in the testicular tubules were observed in male mice exposed to 10 mg/kg-d of acrylonitrile via gavage for 60 days (U.S. EPA, 1997a, citing Tandon et al., 1988). These changes were accompanied by a 45 percent decrease in sperm count.

**Q.2.2.2 Reference Concentration.** The RfC for acrylonitrile is 2.0E-03 mg/m$^3$ based on the LOAEL of 43 mg/m$^3$, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfC was based on a study in which male and female rats were exposed to 0, 20, or 80 ppm (0, 43, or 174 mg/m$^3$) acrylonitrile for 6 h/d, 5 d/wk for 2 years (U.S. EPA, 2000a, citing Quast et al., 1980). Based on gross and histopathological evaluation of tissues from over 40 different organs, the two tissues that exhibited a treatment-related adverse effect due to acrylonitrile exposure were the nasal respiratory epithelium and the brain. There were significant degenerative and inflammatory changes in the respiratory epithelium of the nasal turbinates at both 20 and 80 ppm. The effects in the 80-ppm group were more severe than in the 20-ppm group and were characterized by suppurative rhinitis, hyperplasia, focal erosions, and squamous metaplasia of the respiratory epithelium.

A LOAEL of 20 ppm (43 mg/m$^3$) for pathological alterations in the respiratory epithelium was selected and adjusted for duration exposure (6 h/d, 5 d/wk), resulting in an adjusted LOAEL (LOAEL$_{ADJ}$) of 7.7 mg/m$^3$. To account for species-specific differences in inhalation dosimetry, a human equivalent concentration LOAEL (LOAEL$_{HEC}$) of 1.9 mg/m$^3$ was calculated by applying a regional gas dose ratio (RGDR) of 0.252 (based on ventilation rates and surface areas of extrathoracic region of rats and humans) for respiratory effects in the extrathoracic region (U.S. EPA, 2000a). The adjustment factor (i.e., RGDR) is used to adjust the observed exposure effect level (i.e., LOAEL) in laboratory animals to estimate a concentration that would be an equivalent exposure in humans (i.e., LOAEL$_{HEC}$) (U.S. EPA, 1994).

An uncertainty factor of 1,000 was applied based on a tenfold factor to protect unusually sensitive individuals, a threefold factor for adjusting from a minimally adverse LOAEL to a NOAEL, a threefold factor for interspecies variability because the use of dosimetric adjustments accounts for part of this area of uncertainty, and a tenfold factor for an incomplete database (U.S. EPA, 2000a).

EPA assigns confidence rankings to the noncancer benchmarks contained in IRIS. Confidence rankings are assigned to the study on which the RfC was based, the database supporting the RfC, and to the RfC itself. For acrylonitrile, EPA has

- Medium confidence in the study on which the RfC was based because, although it was a well-conducted chronic study in an appropriate number of animals, it was performed on only one species, did not identify a NOAEL, was confounded by the early sacrifice of rats with large mammary gland tumors, and the target organ (nasal turbinates) was examined only at the end of the study in relatively few animals

- Medium to low confidence in the database because of the lack of chronic or subchronic inhalation data in a second species, the lack of reproductive data by the inhalation route, and the existence of an oral study showing reproductive effects

Consequently, EPA has assigned a ranking of medium to low confidence in the RfC (U.S. EPA, 2000a).

### Q.2.3 Cancer Effects

A statistically significant increase in the incidence of lung cancer has been reported in several studies of chronically exposed workers. However, some of these studies contain deficiencies such as lack of exposure information, short followup, and confounding factors. In several animal studies, an increased incidence of tumors has been observed in rats exposed by inhalation, drinking water, and gavage. Astrocytomas in the brain and spinal cord and tumors of the Zymbal gland have been reported most frequently, as well as tumors of the stomach, tongue, small intestine, and mammary gland (ATSDR, 1990c; U.S. EPA, 2000a).

EPA has classified acrylonitrile as a Group B1, Probable Human Carcinogen, based on the observation of a statistically significant increase in the incidence of lung cancer in exposed workers and tumors in studies in two rat strains exposed by various routes (U.S. EPA, 2000a).

**Q.2.3.1 Oral Cancer Risk.** EPA used the linearized multistage model (extra risk) based on data from a study of rats exposed to acrylonitrile in drinking water to estimate the oral CSF and unit risk estimate. EPA calculated an oral unit risk estimate of 1.5E-05 $(\mu g/L)^{-1}$ and an oral CSF of 5.4E-01 $(mg/kg\text{-}d)^{-1}$ based on an increase in brain and spinal cord astrocyomas, Zymbal gland carcinomas, and stomach carcinomas in rats exposed to acrylonitrile in drinking water (U.S. EPA, 2000a).

EPA has confidence in the risk estimate because relatively large numbers of animals were treated and observed and a dose-response effect was observed in all studies. The slope factors derived from data on male rats were similar and within a factor of 3. The slope factors based on the three female rat studies were similar to those of the respective male rat studies, as was their geometric mean (U.S. EPA, 2000a).

**Q.2.3.2 Inhalation Cancer Risk.** EPA used a relative risk model (adjusted for smoking) based on data from an occupational study to estimate the inhalation unit risk estimate for acrylonitrile. EPA established an inhalation URF of $6.8 \times 10^{-5}$ $(\mu g/m^3)^{-1}$ based on respiratory cancer in occupationally exposed humans (U.S. EPA, 2000a). EPA has also calculated an inhalation CSF for acrylonitrile of 2.4E-01 $(mg/kg\text{-}d)^{-1}$ (U.S. EPA, 1997a).

EPA has confidence in the risk estimate because the cohort was sufficiently large and was followed for an adequate time period. A dose-response relationship was seen for the increased cancer risk and the increased risk remained after adjustment for smoking. Exposure levels were estimated by company representatives (U.S. EPA, 2000a).

## Q.3 Antimony

### Q.3.1 Introduction

Antimony is found at very low levels throughout the environment. Soil usually contains very low concentrations of antimony (less than 1 ppm). However, higher concentrations have been detected at hazardous waste sites and at antimony processing sites. Food contains small amounts of antimony: the average concentration of antimony in meats, vegetables, and seafood is 0.2 to 1.1 ppb. There are many different antimony compounds that occur naturally or are manufactured chemicals. Antimony trioxide is one example; it is found naturally in the environment and may also be produced by oxidizing antimony sulfide ore or antimony metal in air at 600 to 800°C. The most common industrial use of antimony compounds is to produce antimony trioxide for fire retardation. Persons who work in industries that process antimony ore and metal or manufacture antimony trioxide may be exposed to antimony by breathing dust or by skin contact (ATSDR, 1992a).

### Q.3.2 Noncancer Effects

The primary effects from chronic inhalation exposure to antimony in humans are respiratory effects that include antimony pneumoconiosis (inflammation of the lungs due to irritation caused by the inhalation of dust), alterations in pulmonary function, chronic bronchitis, chronic emphysema, inactive tuberculosis, pleural adhesions, and irritation. Other effects noted in humans chronically exposed to antimony by inhalation are cardiovascular effects (increased blood pressure, altered EKG readings, and heart muscle damage) and gastrointestinal disorders (ATSDR, 1992a).

| Antimony | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 4.0E-04 mg/kg-d | U.S. EPA, 2000a |
| RfC | 2.0E-04 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

Animal studies have reported lung, cardiovascular, liver, and kidney damage from exposure to high levels of antimony by inhalation. Exposure to lower levels has resulted in eye irritation, lung damage, hair loss, and cardiovascular effects (changes in EKGs). Reproductive effects, including failure to conceive, were reported in rats exposed to antimony trioxide by inhalation (ATSDR, 1992a).

**Q.3.2.1 <u>Reference Dose</u>.** The RfD for antimony is 4.0E-04 mg/kg-d, based on a LOAEL of 0.35 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which 50 male and 50 female rats were administered 0 or 5 ppm potassium antimony tartrate in water (U.S. EPA, 2000a, citing Schroeder et al., 1970). Over the period of the study, growth rates of treated animals were not affected, but male and female rats survived 106 and 107 fewer days, respectively, than did controls at median lifespans. Nonfasting blood glucose levels were decreased in treated males, and cholesterol levels were altered in both sexes. A decrease in mean heart weight for the males was noted and no increase in tumors was seen as a result of treatment. Because only one level of antimony was administered, a NOAEL could not be established in the study. The concentration of 5 ppm antimony was expressed as an exposure of 0.35 mg/kg-d by the authors. The critical effects identified for this study are decreased longevity and blood glucose levels and altered cholesterol levels (U.S. EPA, 2000a).

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and an additional tenfold factor for use of a LOAEL (U.S. EPA, 2000a).

EPA assigns confidence rankings to the noncancer benchmarks contained in IRIS. Confidence rankings are assigned to the study on which the RfD was based, the database supporting the RfD, and to the RfD itself. For antimony, EPA has

- Low confidence in the study on which the RfD was based because only one species and one dose level were used, a NOAEL was not determined, and gross pathology and histopathology were not well described

- Low confidence in the database due to lack of adequate oral exposure investigations

Consequently, EPA has assigned a ranking of low confidence to the RfD (U.S. EPA, 2000a).

**Q.3.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for antimony (U.S. EPA, 2000a). However, EPA has established an RfC for antimony trioxide of 2.0E-04 $mg/m^3$ based on a benchmark concentration (BMC) (adjusted) of 0.074 $mg/m^3$, an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 2000a). This RfC was based on a study in which groups of 65 rats/sex/group were exposed to actual concentrations of 0, 0.06, 0.51, or 4.50 $mg/m^3$ antimony trioxide for 6 h/d, 5 d/wk for 1 year (U.S. EPA, 2000a, citing Newton et al., 1994). No significant changes in hematological parameters were observed that were concentration related. An increase in cataracts was noted but a dose-response relationship was not observed. Microscopic lesions of the lungs revealed interstitial inflammation in control and exposure groups at the end of 6, 12, 18, and 24 months. This incidence was analyzed to determine a BMC. The concentrations associated with 1, 5, and 10 percent relative increases in the probability of response were estimated using both the Weibull and linear models. The lower 95 percent confidence limit for the 10 percent relative increase in probability of response was determined to be 0.87 $mg/m^3$ (U.S. EPA, 2000a). Similar analyses indicate that more serious respiratory lesions occur at slightly higher concentrations.

The BMC of 0.87 $mg/m^3$ was adjusted for intermittent exposure (6 h/d, 5 d/wk) ($BMC_{ADJ}$ = 0.16 $mg/m^3$). A regional deposited dose ratio factor was incorporated to account for differences in the deposition pattern of inhaled particles in the respiratory tract of humans and the rat test animals (U.S. EPA, 2000a, citing Jarabek et al., 1990). The RDDR of 0.46 for respiratory effects in the thoracic region was determined based on a mass median aerodynamic diameter (MMAD) of 3.7 µm and a geometric standard deviation of 1.7 (U.S. EPA, 2000a); based on this RDDR, a human equivalent concentration BMC ($BMC_{HEC}$) of 0.074 $mg/m^3$ was calculated.

An uncertainty factor of 300 was applied based on a tenfold factor for the protection of sensitive human subpopulations, a threefold factor for extrapolation from animals to humans because the dosimetric adjustments account for part of this area of uncertainty, a threefold uncertainty factor for lack of reproductive and developmental bioassays, and an additional threefold uncertainty factor to account for less-than-lifetime exposure duration, since there is no evidence that, at the lowest exposure level tested in the Newton et al. study, the levels of antimony in the rat reached a steady-state concentration (U.S. EPA, 2000a, citing Newton et al., 1994).

EPA has

- Medium confidence in the study on which the RfC was based because it was not a chronic, lifetime study

- Medium confidence in the database because adequate developmental or reproductive studies are not available

Consequently, EPA has assigned a ranking of medium confidence to the RfC (U.S. EPA, 2000a).

### Q.3.3 Cancer Effects

Limited data are available on the carcinogenic effects of antimony. One study in humans did not report an increased incidence of cancer in workers exposed to antimony oxide in the workplace for 9 to 31 years. Animal studies have shown conflicting results. Several studies have reported an increase in lung tumors in rats exposed by inhalation to antimony trioxide and antimony trisulfide, while other studies did not report an increase in these tumors (ATSDR, 1992a).

EPA has not classified antimony or antimony trioxide for carcinogenicity and has not calculated an oral CSF or an inhalation unit risk estimate for antimony (U.S. EPA, 2000a).

## Q.4 Barium

### Q.4.1 Introduction

Barium is a naturally occurring element that is found in the earth's crust. Barium enters the environment primarily through the weathering of rocks and minerals. The general population is exposed to barium, usually at low levels, through consumption of drinking water and foods. Barium and its compounds are used in automotive paints, stabilizers for plastics, and jet fuel (ATSDR, 1992b).

| Barium | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 7.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 5.0E-04 $mg/m^3$ | U.S. EPA, 1997a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.4.2 Noncancer Effects

Hypertension has been noted in humans who ingested high doses of barium and workers who inhaled dusts of barium ores and barium carbonate (U.S. EPA, 2000a). Other effects noted in humans from chronic exposure include musculoskeletal effects, such as progressive muscle weakness, and neurological effects, including numbness and tingling around the mouth and neck (ATSDR, 1992b).

Chronic, oral exposure to barium in experimental animals has resulted in increases in blood pressure and kidney effects (ATSDR, 1992b; U.S. EPA, 2000a).

**Q.3.2.1 <u>Reference Dose</u>.** EPA has calculated an RfD for barium of 7.0E-02 mg/kg-d based on a NOAEL (adjusted) of 0.21 mg/kg-d, an uncertainty factor of 3, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on several epidemiological studies that investigated the effects of elevated levels of barium in drinking water (U.S. EPA, 2000a, 1999a, citing Brenniman and Levy, 1984, and Wones et al., 1990). Wones et al. found no increases in systolic or diastolic blood pressure in subjects who consumed drinking water containing barium at levels ranging from 0 to 10 mg/L for 10 weeks. Brenniman and Levy conducted a retrospective epidemiology study that compared mortality and morbidity rates in populations ingesting elevated barium levels (2 to 10 mg/L) in their drinking water to populations ingesting very little or no barium (less than or equal to 0.2 mg/L). Differences in mortality rates from all cardiovascular diseases were significantly higher in the communities with elevated barium. However, these differences were largely in the 65 and over age group and did not account for confounding variables such as population mobility or use of water softeners or medication. No significant differences in mean systolic or diastolic blood pressures, or in rates of hypertension, heart disease, stroke, or kidney disease were found for men or women of the two communities. In addition, several rat studies that reported increased kidney weights in rats exposed to barium in drinking water for 13 weeks or 2 years were considered (U.S. EPA, 2000a, 1999a, citing NTP, 1994). NOAELs of 45 and 65 mg/kg-d, respectively, were selected from these studies (U.S. EPA, 2000a, 1999a). An uncertainty factor of 3 was applied to account for potential differences between adults and children and the existence of adequate developmental toxicity studies (U.S. EPA, 2000a).

For barium, EPA has

- Medium confidence in the principal studies used as the basis for the RfD because LOAELs for cardiovascular and kidney disease were not identified in the human studies; however, the animal studies provided information regarding NOAELs and LOAELs for kidney effects of barium, but cardiovascular effects did not occur in these studies.

- Medium confidence in the database because of the existence of subchronic and chronic human studies, suchronic and chronic animal studies in more than one species, and a reproductive/ developmental study in rats and mice.

EPA has assigned a ranking of medium confidence in the RfD as well (U.S. EPA, 2000a).

**Q.4.2.2 <u>Reference Concentration</u>.** EPA has calculated a provisional RfC of 5.0E-04 mg/m$^3$ for barium (U.S. EPA, 1997a). This was based on a 4-month reproductive study in rats in which a NOAEL of 0.8 mg/m$^3$ was identified (U.S. EPA, 1997a, 2000a, citing Tarasenko et al. 1977). A number of adverse effects were reported in rats exposed to a higher concentration; these included alterations in hematological and serum chemistry parameters, lung lesions, and increases in arterial pressure (U.S. EPA, 1997a, 2000a, citing Tarasenko et al., 1977). An uncertainty factor of 1,000 was applied (U.S. EPA, 1997a).

### Q.4.3 Cancer Effects

Limited human data are available on the carcinogenicity of barium. The only available studies involve a single topical application of barium chloride to the cervix of one woman. These studies reported a number of cell transformations in the cervix; however, 1 to 2 weeks after the application, these cellular alterations were no longer observed (U.S. EPA, 2000a, 1999a).

Two chronic oral animal studies evaluated the carcinogenicity of barium in rats and mice. No statistically significant increases in the incidences of tumors were observed in the barium-exposed rats or mice (U.S. EPA, 2000a, 1999a).

EPA has classified barium as Group D - Not Classifiable as to Human Carcinogenicity. This was based on the availability of adequate chronic oral studies in rats and mice that have not demonstrated carcinogenic effects but a lack of adequate inhalation studies (U.S. EPA, 2000a). EPA has not calculated an oral or an inhalation unit risk estimate for barium (U.S. EPA, 2000a).

## Q.5 Benzene

### Q.5.1 Introduction

Benzene (also called benzol) is a colorless liquid used to make other chemicals such as styrene for styrofoam and plastics, cumen for resins, and cyclohexane for nylon and other synthetic fibers. It is also used in the manufacture of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Benzene is found in crude oil, gasoline, and cigarette smoke. Human exposure to benzene may occur outdoors, in the home, and in the workplace. Exposure to tobacco smoke, motor vehicle exhaust, industrial emissions, and vapors from products containing benzene (e.g., glues and paints), and at gas stations are the primary sources. Exposure may also occur from the consumption of contaminated water (ATSDR, 1997a).

| Benzene | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | NA | |
| RfC | NA | |
| oral CSF | 5.5E-02 $(mg/kg\text{-}d)^{-1}$ | U.S. EPA, 2000a |
| inh URF | 7.8E-06 $(\mu g/m^3)^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 2.7E-02 $(mg/kg\text{-}d)^{-1}$ | calculated |

### Q.5.2 Noncancer Effects

Acute inhalation and ingestion of very high levels of benzene have been reported to cause death in humans. In addition, acute exposure has been reported to cause neurological effects (e.g., drowsiness, dizziness, headaches, and unconsciousness). However, the majority of information on benzene toxicity in humans involves occupational or environmental exposures via inhalation of benzene vapors. The most frequent effects observed in humans following chronic inhalation exposures are on the blood (aplastic anemia) and immunological system (macrocytosis, thrombocytopenia, leukopenia). Respiratory and ocular effects have also been reported but to a lesser extent. Mucous membrane, skin, and eye irritation have been reported following acute and chronic dermal exposures (ATSDR, 1997a).

Animal studies have reported effects on the blood, immunologic, developmental, neurologic, and reproductive systems, and body weight decreases following acute inhalation exposure to benzene. With longer-duration inhalation exposures in animals, blood and immunologic effects were the most widely reported. Body weight decreases and reproductive and respiratory effects have been observed. Acute oral exposure in animals is associated with body weight (decreases), liver, and neurologic effects. The main effects reported following longer-duration oral exposures include body weight (decreases), blood, and immunologic effects. Neurologic and reproductive effects have also been reported (ATSDR, 1997a).

**Q.5.2.1 Reference Dose.** EPA has not established an RfD for benzene (U.S. EPA, 2000a).

**Q.5.2.2 Reference Concentration.** EPA has not established an RfC for benzene (U.S. EPA, 2000a).

### Q.5.3 Cancer Effects

EPA has classified benzene as a Group A, Known Human Carcinogen, based on numerous occupational epidemiologic and case studies indicating that benzene exposure causes acute nonlymphotic leukemia. There is also evidence that it causes chronic nonlymphotic leukemia and chronic lymphotic leukemia. Benzene exposure is also associated with an increased risk for hematologic neoplasms, blood disorders (preleukemia, aplastic anemia), Hodgkin's lymphoma, and myelodysplastic syndrome (U.S. EPA, 2000a).

Experimental animal data indicate that inhalation and oral exposure to benzene increases the risk of cancer in multiple species at multiple organ sites (hematopoietic, oral and nasal, liver, forestomach, preputial gland, lung, ovary, and mammary gland). In rats and mice, chronic inhalation and oral exposures to benzene have been shown to increase the incidence of Zymbal gland carcinoma, hepatomas, hematopoietic neoplasms, myelogenous leukemia, liver tumors, squamous cell papillomas, carcinomas of the oral and nasal cavities, angiosarcoma of the liver, harderian gland adenoma, lymphoma, mammary tumors, and lung tumors (U.S. EPA, 2000a; ATSDR, 1997a).

**Q.5.3.1 Oral Cancer Risk.** EPA estimated the oral CSF by extrapolating from the known inhalation dose-response to the potential oral route of exposure based on data from studies of occupationally exposed workers (U.S. EPA, 2000a). EPA calculated an oral CSF of 1.5E-02 to 5.45E-02 $(mg/kg\text{-}d)^{-1}$ (U.S. EPA, 2000a). In order to be most protective of human health, the upper range of the estimates is used for this risk assessment.

Data on oral exposure of humans are limited. Most human exposure data come from occupational inhalation exposure studies. Extrapolation from route-to-route is justified because similar effects are observed in animals following oral or inhalation exposures. Experimental data support the complete absorption of orally administered benzene in rats and mice and, therefore, complete absorption in humans is a reasonable assumption (U.S. EPA, 2000a).

**Q.5.3.2 Inhalation Cancer Risk.** EPA used a linear extrapolation model applying the low-dose linearity concept to estimate the inhalation unit risk estimate for benzene based on data from studies of humans exposed to benzene via inhalation (U.S. EPA, 2000a). EPA calculated an inhalation unit risk estimate of 2.2E-06 to 7.8E-06 $(\mu g/m^3)^{-1}$ (U.S. EPA, 2000a). In order to be most protective of human health, the upper range of the estimates was used for this risk assessment. An inhalation CSF of 2.7E-02 $(mg/kg\text{-}d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 7.8\text{E}{-}06\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1000\ \mu g/mg = 0.027\ (mg/kg{-}d)^{-1}$$

The data used for the risk estimate had the least number of confounding variables and a wide range of benzene exposure levels. Additionally, EPA is confident in the application of the low-dose linearity concept to the model. To account for the uncertainty in the low-dose exposure and lack of a definitive mode of action, the range of risk estimates was used. This range represents the maximum likelihood values, each of which is equally plausible (U.S. EPA, 2000a).

# Q.6 n-Butyl Alcohol

## Q.6.1 Introduction

n-Butyl alcohol (also called butanol) is used as a solvent for fats, waxes, resins, shellac, varnishes, and gums. It is also used in microscopy for preparing paraffin imbedding materials (Merck, 1989).

| n-Butyl Alcohol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

## Q.6.2 Noncancer Effects

Limited information is available on the noncancer effects of n-butyl alcohol. In one study, occupational exposure to 100 ppm n-butyl alcohol had no impact on worker's health. Several other human inhalation studies have reported irritation of the eyes, nose, and throat and mild headaches; however, these effects were transitory in nature. A rat inhalation study reported reversible blood cholinesterase activity and increased thyroid activity after 4 months' exposure to n-butyl alcohol (U.S. EPA, 2000a).

**Q.6.2.1 Reference Dose.** The RfD for n-butyl alcohol is 1.0E-01 mg/kg-d based on a NOAEL of 125 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which four groups of 30 male and female rats were dosed daily by gavage with 0, 30, 125, and 500 mg/kg-d n-butyl alcohol for 13 weeks (U.S. EPA, 2000a, citing U.S. EPA, 1986). No dose-related differences between control and treated animals were observed in terms of body and organ weight changes, food consumption, moribundity, mortality, and opthalmological, gross, and histopathological examinations. Ataxia and hypoactivity were consistently observed in the high dose (500-mg/kg-d) group. The 125-mg/kg-d dose of n-butyl alcohol was selected as a NOAEL for central nervous system effects in rats.

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and an additional tenfold factor for extrapolating from subchronic to long-term exposure (U.S. EPA, 2000a).

For n-butyl alcohol, EPA has

- High confidence in the study on which the RfD was based because it provided more than adequate toxicologic endpoints and used a well-designed experimental protocol;

- Low confidence in the database because it does not provide pertinent information on oral chronic or reproductive studies.

Consequently, EPA has assigned a ranking of low confidence in the RfD (U.S. EPA, 2000a).

**Q.6.2.2 Reference Concentration.** EPA has not established an RfC for n-butyl alcohol (U.S. EPA, 2000a).

### Q.6.3 Cancer Effects

No information is available on the carcinogenic effects of n-butyl alcohol in humans or animals. EPA has classified n-butyl alcohol as a Group D, Not Classifiable as to Human Carcinogenicity, and has not calculated an oral CSF or inhalation risk estimate for n-butyl alcohol (U.S. EPA, 2000a).

## Q.7 Butyl Benzyl Phthalate

### Q.7.1 Introduction

Butyl benzyl phthalate is a clear, oily liquid with a slight odor. It is a plasticizer added to polymers in the manufacture of plastics, polyvinyl acetate, polysulfides, and polyurethane to add flexibility and softness. It is used extensively in polyvinyl chloride for vinyl floor tile, vinyl foams, carpet backings, and Astroturf. Other uses include synthetic leather, automotive paint and upholstery, and as a dispersant for pesticides, colorants, and solvents. Butyl benzyl phthalate can enter the environment during its manufacture, use, and disposal. Human exposure is primarily occupational through inhalation of dust or dermal exposures. In the general population, exposure to low levels of butyl benzyl phthalate may occur through inhalation of contaminated air, ingestion of contaminated drinking water, or dermal contact with products containing butyl benzyl phthalate (NTP, 1997).

| Butyl Benzyl Phthlate | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.7.2 Noncancer Effects

Butyl benzyl phthalate is a slight skin, eye, and mucous membrane irritant and central nervous system depressant in humans. Occupational exposure of humans to butyl benzyl phthalate has been reported to cause irritation of the eyes, nose, throat, and skin, and numbness and weakness of the extremities (NTP, 1997).

Animal studies have reported decreased body and organ weights (heart, kidney, lungs, seminal vesicles, and testes), blood effects (decreased red blood cell mass, hemoglobin, total red blood cell, and hematocrit, and increased mean corpuscular hemoglobin), male reproductive effects (small or soft testes, testicular lesions, decreased epididmyla spermatozoal concentration, decreased fertility indices), kidney effects, and increased liver weight from oral exposure to high levels of benzyl butyl phthalate. Exposure to lower levels has resulted in increased liver-to-body-weight and liver-to-brain-weight ratios (U.S. EPA, 2000a; NTP, 1997).

**Q.7.2.1 <u>Reference Dose</u>.** The RfD for butyl benzyl phthalate is 2.0E-01 mg/kg-d, based on a LOAEL of 470 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which groups of 15 male rats were administered 0, 0.03, 0.09, 0.28, 0.83, or 2.5 percent butyl benzyl phthalate (0, 17, 51, 159, 470, or 1417 mg/kg-d, respectively) in the diet for 26 weeks (U.S. EPA, 2000a, citing NTP, 1985). The critical effects identified for this study are increased liver-to-body-weight and liver-to-brain-weight ratios, with a LOAEL of 470 mg/kg-d and a NOAEL of 159 mg/kg-d identified (U.S. EPA, 2000a).

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor for intraspecies sensitivity, and an additional tenfold factor for extrapolating from subchronic to chronic NOAELs (U.S. EPA, 2000a).

EPA assigns confidence rankings to the noncancer benchmarks contained in IRIS. Confidence rankings are assigned to the study on which the RfD was based, the database supporting the RfD, and to the RfD itself. For butyl benzyl phthalate, EPA has

- Medium confidence in the study on which the RfD was based because the study is of adequate quality.
- Low confidence in the database because only male rats were used in the critical study and there are no supporting chronic studies.

Consequently, EPA has assigned a ranking of low confidence to the RfD (U.S. EPA, 2000a).

**Q.7.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for butyl benzyl phthalate (U.S. EPA, 2000a).

### Q.7.3 Cancer Effects

No data are available on the carcinogenic effects of butyl benzyl phthalate in humans and limited data are available in animals. Increases in mononuclear cell leukemia has been observed in female rats; however, effects in male rats were inconclusive. This response was not observed in mice (U.S. EPA, 2000a). In a more recent study, acinar cell adenoma or carcinoma of the pancreas was observed in male rats (NTP, 1997)

EPA has classified butyl benzyl phthalate as a Group C, Possible Human Carcinogen. EPA has not calculated an oral CSF or an inhalation unit risk estimate for butyl benzyl phthalate (U.S. EPA, 2000a).

## Q.8 Cadmium

### Q.8.1 Introduction

Cadmium is a soft, silver-white metal that occurs naturally in the earth's crust and is usually found in combination with other elements such as oxygen, chlorine, or sulfur. The major uses of cadmium are in the manufacture of pigments and batteries and in the metal-plating and plastics industries. Most of the cadmium used in this country is obtained as a byproduct from the smelting of zinc, lead, or copper ores (ATSDR, 1999a).

| Cadmium | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 5.0E-04 mg/kg-d (water)<br>1.0E-03 mg/kg-d (food) | U.S. EPA, 2000a |
| RfC | 2.0E-05 mg/m$^3$ | CalEPA, 1999b |
| oral CSF | NA | |
| inh URF | 1.8E-03 (µg/m$^3$)$^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 6.3E+00 (mg/kg-d)$^{-1}$ | Calculated |

### Q.8.2 Noncancer Effects

The kidney appears to be the main target organ in humans following chronic inhalation exposure to cadmium. Abnormal kidney function, indicated by proteinuria and a decrease in glomerular filtration rate, and an increased frequency of kidney stone formation are some of the effects that have been observed. Respiratory effects, such as bronchitis and emphysema, have also been noted in humans chronically exposed to cadmium through inhalation. Oral exposure to cadmium in humans also results in effects on the kidney, with effects similar to those seen following inhalation exposure. In humans, dermal exposure to cadmium does not appear to cause allergic reactions (ATSDR, 1999a).

Animal studies have reported effects on the kidney, liver, lung, and blood from chronic inhalation exposure to cadmium. Chronic oral exposure to cadmium in animals results in effects on the kidney, bone, immune system, blood, and nervous system. No information is available on chronic dermal exposure to cadmium in animals (ATSDR, 1999a).

**Q.8.2.1 Reference Dose.** EPA has established two RfDs for cadmium: one for cadmium ingested in drinking water and one for cadmium ingested in food. The RfD for cadmium in drinking water is 5.0E-04 mg/kg-d and the RfD for dietary exposure to cadmium is 1.0E-03 mg/kg-d (U.S. EPA, 2000a). These RfDs were based on a number of human studies that showed kidney effects (significant proteinuria) from chronic exposure to cadmium. Both RfDs were calculated based on the highest level of cadmium in the human renal cortex (200 µg/g) that was not associated with the critical effect, i.e., significant proteinuria (U.S. EPA, 2000a, citing U.S. EPA, 1985). A toxicokinetic model was then used to determine the NOAEL. This model took into account the difference in absorption between drinking water and food. The NOAELs for water and food were calculated to be 0.005 mg/kg-d and 0.01 mg/kg-d, respectively. The RfDs were calculated by applying an uncertainty factor of 10 and a modifying factor of 1 to each NOAEL (U.S. EPA, 2000a). An uncertainty factor of 10 was applied to account for intrahuman variability to the toxicity of cadmium in the absence of data on sensitive individuals (U.S. EPA, 2000a).

EPA has high confidence in the studies and the database on which the RfDs for cadmium were based. The RfDs were not based on a single study, but rather on data obtained from many studies on the toxicity of cadmium in humans and animals. These data permit calculation of pharmacokinetic parameters of cadmium absorption, distribution, metabolism, and elimination. High confidence in the RfDs results (U.S. EPA, 2000a).

**Q.8.2.2 Reference Concentration.** EPA has not established an RfC for cadmium. However, CalEPA (1999b) derived a chronic inhalation reference exposure level (REL) of 2.0E-05 mg/m$^3$ based on kidney (proteinuria) and respiratory effects (reduction in forced vital capacity and reduction in peak expiratory flow rate) in occupationally exposed humans (CalEPA, 1999b, citing Lauwerys et al., 1974). Workers had been exposed to cadmium for periods of 1 to over 20 years and the exposed group was matched to a control group in terms of age, body size, cigarettes smoked per day, duration of smoking, and duration of employment. A NOAEL of 0.0014 mg/m$^3$ was identified and then adjusted for intermittent exposure (8 h/d, 5 d/wk). An uncertainty factor of 30 was applied: a threefold factor for extrapolation from subchronic to chronic exposure and a tenfold factor for intrahuman variation (CalEPA, 1999b).

### Q.8.3 Cancer Effects

Several occupational studies have reported an excess risk of lung cancer from exposure to inhaled cadmium. However, the evidence is limited rather than conclusive due to confounding factors such as the presence of other carcinogens and smoking. Studies of human ingestion to cadmium are inadequate to assess its carcinogenicity (U.S. EPA, 2000a). Animal studies have reported lung cancer resulting from inhalation exposure to several forms of cadmium, while animal ingestion studies have not reported cancer from exposure to cadmium compounds (U.S. EPA, 2000a).

EPA has classified cadmium as a Group B1, Probable Human Carcinogen, based on human studies showing a possible association between cadmium exposure and lung cancer and animal studies showing an increased incidence of lung cancer (U.S. EPA, 2000a).

**Q.8.3.1 <u>Oral Cancer Risk</u>.** EPA has not calculated an oral unit risk estimate for cadmium (U.S. EPA, 2000a).

**Q.8.3.2 <u>Inhalation Cancer Risk</u>.** EPA used the two-stage extrapolation model based on data from an occupational study of workers exposed to cadmium (U.S. EPA, 2000a, citing Thun et al., 1985) to estimate the inhalation risk estimate for cadmium. EPA calculated an inhalation unit risk estimate of 1.8E-03 $(\mu g/m^3)^{-1}$ (U.S. EPA, 2000a). An inhalation CSF of 6.3 $(mg/kg\text{-}d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 0.0018\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1000\ \mu g/mg = 6.3\ (mg/kg{-}d)^{-1}$$

EPA used human data to develop the risk estimate for cadmium because the data were derived from a relatively large cohort, and the effects of arsenic and smoking were accounted for in the quantitative analysis of cadmium's effects. EPA also calculated an inhalation unit risk of 9.2E-02 $(\mu g/m^3)^{-1}$ for cadmium based on animal data (U.S. EPA, 2000a, citing Takenda et al., 1983). This estimate was higher than that derived from human data and thus more conservative. However, EPA felt that the use of the available human data was more reliable because of species variations in response and the type of exposure (U.S. EPA, 2000a).

## Q.9 Chloroform

### Q.9.1 Introduction

Chloroform is a colorless liquid with a pleasant, sweet smell. A major use of chloroform is in the manufacture of the refrigerant HCFC-22. It is also used as a solvent and a dry cleaning spot remover. In the past, chloroform was used as an anesthetic, but it has been replaced by other materials. Chloroform is released into the environment as a result of its manufacture and use; its formation from the reaction of chlorinated drinking water, wastewater, and swimming pool water with organic chemicals in the water; and from other water treatment processes involving chlorination (ATSDR, 1997b).

| Chloroform | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E-01 $mg/m^3$ | ATSDR, 1997b |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.9.2 Noncancer Effects

The target organs of chloroform toxicity in humans and animals are the central nervous system, liver, and kidneys. Dizziness, vertigo, headache, fatigue, and unconciousness have been observed in acutely exposed humans. Chronic occupational exposure has resulted in dizziness, fatigue, insomnia, lack of concentration, and irritability. Liver effects, including changes in liver enzyme levels, jaundice, liver enlargement and tenderness, toxic hepatitis, and centrilobular necrosis, have been observed in humans acutely and chronically exposed to chloroform via inhalation and ingestion. Kidney damage has been reported in humans exposed to high amounts of chloroform orally (ATSDR, 1997b).

In addition to liver, kidney, and neurological effects, respiratory, reproductive, and developmental effects have been observed in animals exposed to chloroform via inhalation or ingestion. Upper and lower respiratory tract effects, increased resorptions, fetotoxicity, and teratogenicity were reported in rats and mice following inhalation and oral exposures to chloroform (ATSDR, 1997b).

**Q.9.2.1 Reference Dose.** EPA has established an RfD for chloroform of 0.01 mg/kg-d based on a LOAEL of 15 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Fatty cyst formation in the liver was reported in dogs exposed to chloroform in capsules once daily 6 days per week for 7.5 years (U.S. EPA, 2000a, citing Heywood et al., 1979). The LOAEL was adjusted for intermittent exposure (6 d/wk). An uncertainty factor of 1,000 was applied, based on a tenfold factor for interspecies extrapolation, a tenfold factor to protect sensitive individuals, and a tenfold factor to account for extrapolating from a LOAEL to a NOAEL (U.S. EPA, 2000a).

EPA has

- Medium confidence in the study used as the basis of the RfD for chloroform because it was of chronic duration, used a fairly large number of dogs, and measured multiple endpoints but only two dose levels were used and no NOAEL was identified.

- Medium to low confidence in the database because several studies support the choice of a LOAEL, but no NOAELs were found.

Confidence in the RfD is also considered medium to low (U.S. EPA, 2000a).

**Q.9.2.2 Reference Concentration.** EPA has not established an RfC for chloroform. However, ATSDR derived a chronic inhalation MRL of 0.02 ppm (0.1 mg/m$^3$) based on liver effects in humans (ATSDR, 1997b). Hepatomegaly (enlargement of the liver) was reported in occupationally exposed workers (ATSDR, 1997b, citing Bomski et al., 1967). A LOAEL of 2 ppm was reported for liver effects. An uncertainty factor of 100 was applied based on a tenfold factor to account for the use of a LOAEL and a tenfold factor to account for human variability (ATSDR, 1997b).

### Q.9.3 Cancer Effects

There are no epidemiologic studies available in which exposure to only chloroform occurred. Several ecological and case-control studies of populations consuming chlorinated drinking water in which chloroform was the major chlorinated organic show small significant increases in the risk of bladder or colon cancer on an intermittent basis. However, many other suspected carcinogens were also present in these water supplies (U.S. EPA, 2000a).

Kidney tumors in male rats and liver tumors in mice were observed in animals orally exposed to chloroform (U.S. EPA, 2000a). EPA has classified chloroform as a Group B2, Probable Human Carcinogen based on an increased incidence of several tumor types in rats and mice (U.S. EPA, 2000a).

However, based on an evaluation initiated by EPA's Office of Water (OW), OSW now believes the weight of evidence for the carcinogenic mode of action for chloroform does not support a mutagenic mode of action; therefore, a nonlinear low dose extrapolation is more appropriate for assessing risk from exposure to chloroform. EPA's Science Advisory Board (SAB), the World Health Organization (WHO), the Society of Toxicology, and EPA all strongly endorse the nonlinear approach for assessing risks from chloroform. Although OW conducted its evaluation of chloroform carcinogenicity for oral exposure, a nonlinear approach for low-dose extrapolation would apply to inhalation exposure to chloroform as well, because chloroform's mode of action is understood to be the same for both ingestion and inhalation exposures. Specifically, tumorigenesis for both ingestion and inhalation exposures is induced through cytotoxicity (cell death) produced by the oxidative generation of highly reactive metabolites (phosgene and hydrochloric acid), followed by regenerative cell proliferation (U.S. EPA, 1998a). Chloroform-induced liver tumors in mice have only been seen after bolus corn oil dosing and have not been observed following administration by other routes (i.e., drinking water and inhalation). As explained in EPA OW's March 31, 1998, and December 16, 1998, *Federal Register* notices pertaining to chloroform (U.S. EPA 1998a and 1998b, respectively), EPA now believes that "based on the current evidence for the mode of action by which chloroform may cause tumorigenesis,...a nonlinear approach is more appropriate for extrapolating low dose cancer risk rather than the low dose linear approach..."(U.S. EPA 1998a). OW determined that, given chloroform's mode of carcinogenic action, liver toxicity (a noncancer health effect) actually "is a more sensitive effect of chloroform than the induction of tumors" and that protecting against liver toxicity "should be protective against carcinogenicity given that the putative mode of action understanding for chloroform involves cytotoxicity as a key event preceding tumor development" (U.S. EPA 1998a).

Given the recent evaluations conducted by OW that conclude that protecting against chloroform's noncancer health effects protects against excess cancer risk, EPA now believes that the noncancer health effects resulting from inhalation of chloroform would precede the development of cancer and would occur at lower doses than tumor development. Although EPA has not finalized a noncancer health benchmark for inhalation exposure (i.e., an RfC), ATSDR has developed an inhalation MRL for chloroform. Therefore, ATSDR's chronic inhalation MRL for chloroform (0.1 mg/m$^3$) was used in this risk analysis.

## Q.10 Chromium

### Q.10.1 Introduction

Chromium is a metallic element that occurs in the environment in two major valence states: trivalent chromium (chromium III) and hexavalent chromium (chromium VI). Chromium (VI) compounds are much more toxic than chromium (III) compounds. Chromium (III) is an essential element in humans (it potentiates insulin production and is essential for lipid, protein, and fat metabolism); a daily intake of 50 to 200 µg/d is recommended for an adult. Chromium (VI) is quite toxic; however, the human body can detoxify some amount of chromium (VI) to chromium (III). The metallurgical, refractory, and chemical industries are the fundamental users of chromium. In the chemical industry, chromium is used primarily in pigments (III and VI), metal finishing (VI), leather tanning (III), and wood preservatives (VI) (ATSDR, 1998a).

| Chromium | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 3.0E-03 mg/kg-d (Cr VI)<br>1.5E+00 mg/kg-d (Cr III) | U.S. EPA, 2000a |
| RfC | 1.0E-04 mg/$m^3$ (Cr VI particulates) | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | 1.2E-02 $(\mu g/m^3)^{-1}$ (Cr VI) | U.S. EPA, 2000a |
| inh CSF | 4.1E+01 $(mg/kg\text{-}d)^{-1}$ (Cr VI) | U.S. EPA, 1997a |

### Q.10.2 Noncancer Effects

Chronic inhalation exposure to chromium (VI) in humans results in effects on the respiratory tract, with perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, asthma, and nasal itching and soreness reported. Chronic exposure to high levels of chromium (VI) by inhalation or ingestion may also produce effects on the liver, kidney, gastrointestinal and immune systems, and possibly the blood. Dermal exposure to chromium (VI) may cause contact dermatitis, sensitivity, and ulceration of the skin (ATSDR, 1998a).

Limited information is available on the chronic effects of chromium in animals. The available data indicate that, following inhalation exposure, the lung and kidney have the highest tissue levels of chromium. Respiratory effects have been reported in animals exposed to chromium (VI) by inhalation. No effects were noted in several oral animal studies with chromium (VI) and chromium (III) (ATSDR, 1998a). High levels of chromium (VI) administered orally have resulted in developmental effects in rats and mice (U.S. EPA, 1998c, 2000a).

**Q.10.2.1** **<u>Reference Dose</u>.** EPA has established an RfD for chromium (VI) of 3.0E-03 mg/kg-d, based on a NOAEL (adjusted) of 2.5 mg/kg-d, an uncertainty factor of 300, and a modifying factor of 3 (U.S. EPA, 1998c, 2000a). This was based on a study in rats (MacKenzie et al., 1958, as cited in U.S. EPA, 1998c, 2000a) that reported no adverse effects after exposure to chromium (VI) in the drinking water for 1 year. A study in dogs supports these findings; no significant effects were observed in female dogs given chromium (VI) in the drinking water for 4 years (U.S. EPA, 1998c, 2000a).

An uncertainty factor of 300 was applied based on two tenfold factors to account for both the expected intrahuman and interspecies variability in the toxicity of the chemical in lieu of specific data and an additional threefold factor to compensate for the less-than-lifetime exposure duration of the principal study. The modifying factor of 3 is to account for uncertainties related to reports of gastrointestinal effects following drinking water exposure in a residential population in China (U.S. EPA, 1998c, 2000a).

EPA has assigned a ranking of low confidence in the study on which the RfD for chromium (VI) was based, in the database, and in the RfD. Confidence in the key study was ranked low due to the small number of animals tested, the small number of parameters measured, and the lack of toxic effects at the highest dose tested. Confidence in the database was also ranked low by EPA because the supporting studies are of equally low quality and developmental toxicity endpoints are not well studied, thus a low confidence in the RfD follows (U.S. EPA, 1998c, 2000a).

The RfD for chromium (III) is 1.5E+00 mg/kg-d, based on a NOAEL (adjusted) of 1,468 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 10 (U.S. EPA, 1998d, 2000a). This was based on no effects observed in rats fed chromium (III) in the diet for 2 years (Ivankovic and Preussman, 1975, as cited in U.S. EPA, 1998d, 2000a). In this study, groups of 60 male and female rats were fed chromic oxide in the diet for 600 feedings. All major organs were examined histologically, and no effects due to chromium treatment were observed at any dose level. This study also included a 90-day study, where the only effects observed were reductions in the absolute weights of the livers and spleens in animals in the high-dose group (U.S. EPA, 1998d, 2000a).

An uncertainty factor of 100 was applied based on two tenfold factors to account for both the expected interhuman and interspecies variability in the toxicity of the chemical in lieu of specific data. An additional tenfold modifying factor was applied to reflect database deficiencies including the lack of a study in a nonrodent mammal and uncertainties regarding potential reproductive effects. Additional uncertainties are related to the NOAEL because the effects observed in the 90-day study were not explicitly addressed in the 2-year study, the effect of the vehicle on absorption of chromium is unclear, the animals were allowed to die naturally after feeding stopped (2 years) and only then was histology performed (U.S. EPA, 1998d, 2000a).

EPA has assigned a ranking of low confidence in the study on which the RfD was based, in the database, and in the RfD. The low confidence in the key study was due to the lack of explicit detail on study protocol and results, the low ranking of the database was due to the lack of supporting data, and the low confidence of the RfD was due to the lack of an observed effect level in the key study (U.S. EPA, 1998d, 2000a).

**Q.10.2.2 Reference Concentration.** EPA has established an RfC for chromium (VI) particulates of 1.0E-04 mg/m$^3$, based upon a benchmark dose of 0.016 mg/m$^3$, an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 1998c, 2000a). This was based on lower respiratory effects reported in rats (U.S. EPA, 1998c, 2000a, citing Glaser et al., 1990, and Malsch et al., 1994). Chronic respiratory dyspnea (labored breathing), reduced body weight, increased lung weight, accumulation of macrophages, focal inflammation in the upper airways, and increased albumin and lactate dehydrogenase in bronchioalveolar lavage fluid were observed (U.S. EPA, 1998c, 2000a, citing Glaser et al., 1990).

The dose-effects data were adjusted to account for discontinuous exposure (22 h/d). An RDDR factor was incorporated to account for differences in the deposition pattern of inhaled chromium (VI) dusts in the respiratory tract of humans and the rat test animals (U.S. EPA, 2000a, citing Jarabek et al., 1990). The RDDR of 2.1576 was determined based on a mass median aerodynamic diameter (MMAD) (0.28 µm for dose levels of 0.05-0.1 mg/m$^3$ and 0.39 for dose levels of 0.1-0.4 mg/m$^3$) and a geometric standard deviation (1.63 for dose levels of 0.05-0.1 mg/m$^3$ and 1.72 for dose levels of 0.1-0.4 mg/m$^3$) of the particulates reported by the study (U.S. EPA, 2000a, citing Glaser et al., 1990); based on this RDDR, a $BMC_{HEC}$ of 0.34 mg/m$^3$ was calculated.

An uncertainty factor of 300 was applied based on a threefold factor to account for the pharmacodynamic differences not accounted for by the RDDR, a tenfold uncertainty factor to account for the less-than-lifetime exposure, and a tenfold uncertainty factor to account for variation in the human population (U.S. EPA, 1998c, 2000a).

EPA has medium confidence in the principal study because of uncertainties regarding upper respiratory, reproductive, and renal effects resulting from the exposures. The overall confidence in this RfC assessment for chromium (VI) particulates is medium (U.S. EPA, 1998c, 2000a).

EPA has also established an RfC for chromium (VI) acid mists and dissolved aerosols of 8.0E-06 mg/m$^3$, based on a LOAEL of 0.002 mg/m$^3$, an uncertainty factor of 90, and a modifying factor of 1 (U.S. EPA, 1998c, 2000a). The critical effect was nasal septum atrophy in occupationally exposed humans. The LOAEL was adjusted for intermittent exposure (8 h/d, 5 d/wk). An uncertainty factor of 3 for extrapolation from subchronic to chronic exposure, 3 for extrapolation from a LOAEL to a NOAEL, and 10 for interhuman variation were applied (U.S. EPA, 1998c, 2000a).

There is uncertainty regarding the relevance of occupational exposures to chromic acid mists and dissolved aerosols to exposures to chromium (VI) dusts in the environment (U.S. EPA, 1998c, 2000a). Chromium is present in the atmosphere primarily in particulate form (ATSDR, 1998a). Therefore, the RfC for chromium (VI) particulates is used in this risk assessment.

EPA has not established an RfC for chromium (III) (U.S. EPA, 1998d, 2000a).

### Q.10.3 Cancer Effects

Epidemiological studies of workers have clearly established that inhaled chromium is a human carcinogen, resulting in an increased risk of lung cancer. These studies were not able to differentiate between exposure to chromium (III) and chromium (VI) compounds. No information is available on cancer in humans from oral or dermal exposure to chromium (ATSDR, 1998a; U.S. EPA 1998c, 1998d, 2000a).

Animal studies have shown chromium (VI) to cause lung tumors via inhalation exposure. No studies are available that investigated cancer in animals from oral or dermal exposure to chromium (VI). Chromium (III) has been tested in mice and rats by the oral route, with several studies reporting no increase in tumor incidence. No studies are available on cancer in animals from inhalation or dermal exposure to chromium (III) (ATSDR, 1998a; U.S. EPA, 1998c, 1998d, 2000a).

EPA has classified chromium (VI) as a Group A, Known Human Carcinogen, by the inhalation route of exposure because results of occupational epidemiologic studies show a dose-response relationship for chromium exposure and lung cancer. Because the human studies could not differentiate between chromium (III) and chromium (VI) exposure and only chromium (VI) was found to be carcinogenic in animal studies, EPA concluded that only chromium (VI) should be classified as a human carcinogen (U.S. EPA, 1998c, 2000a). EPA has classified chromium (III) as a Group D, not classifiable as to its human carcinogenicity (U.S. EPA, 1998d, 2000a).

**Q.10.3.1 <u>Oral Cancer Risk</u>.** EPA has not calculated a risk estimate from oral exposure to chromium (VI) or chromium (III) (U.S. EPA, 1998c, 1998d, 2000a).

**Q.10.3.2 <u>Inhalation Cancer Risk</u>.** EPA used the multistage extrapolation model, based on data from an occupational study of chromate production workers (U.S. EPA, 1998c, 2000a, citing Mancuso, 1975) to estimate the unit cancer risk for chromium (VI). EPA calculated an inhalation unit risk estimate of 1.2E-02 $(\mu g/m^3)^{-1}$ (U.S. EPA, 1998c, 2000a). An inhalation CSF of 4.1E+01 $(mg/kg\text{-}d)^{-1}$ was calculated from the URF for chromium (VI) (U.S. EPA, 1997a). EPA has not calculated a risk estimate from inhalation exposure to chromium (III) (U.S. EPA, 1998d, 2000a).

EPA has confidence in the risk estimate for chromium (VI) because results of studies of chromium exposure are consistent across investigators and countries, and a dose-response for lung tumors has been established. However, an overestimation of risk may be due to the implicit assumption that the smoking habits of chromate workers were similar to those of the general white male population, since it is generally accepted that the proportion of smokers is higher for industrial workers than for the general population. An underestimation of risk may result from the assumption that the ratio of chromium (III) to chromium (VI) is 6:1 (U.S. EPA, 2000a).

## Q.11 Cobalt

### Q.11.1 Introduction

Cobalt occurs naturally in the environment in most rocks, soil, water, plants, and animals. Cobalt is used in superalloys, magnetic alloys, and cutting- and water-resistant alloys, as a drier in paint, a catalyst, for porcelain enameling of steel bathroom fixtures and appliances, in pigment manufacture, and as a feed and nutritional additive. Cobalt is an essential element in humans and animals as a component of vitamin $B_{12}$. Cobalt has also been used as a treatment for anemia, because it stimulates red blood cell production (ATSDR, 1992c; NLM, 1999).

| Cobalt | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 6.0E-02 mg/kg-d | U.S. EPA, 1997c |
| RfC | 1.0E-05 mg/m$^3$ | U.S. EPA, 1999b |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.11.2 Noncancer Effects

Acute inhalation exposure to cobalt in humans has been reported to result in cough, dyspnea, decreased pulmonary function, weight loss, diffuse nodular fibrosis, and respiratory hypersensitivity. Contact with cobalt in humans has resulted in dermatitis, with eruptions of the erythematous papular type on the ankles, elbows, and neck (NLM, 1999).

Chronic exposure to cobalt by inhalation in humans also results in effects on the respiratory system, such as respiratory irritation, wheezing, asthma, pneumonia, and fibrosis. Other effects noted from inhalation exposure to cobalt in humans include cardiac effects, such as functional effects on the ventricles and enlargement of the heart; congestion of the liver, kidneys, and conjunctiva; and immunological effects that include cobalt sensitization, which can precipitate an asthmatic attack in sensitized individuals (ATSDR, 1992c).

Cardiovascular effects (cardiomyopathy) were observed in people who consumed large amounts of beer over several years containing cobalt sulfate as a foam stabilizer. The effects were characterized by cardiogenic shock, sinus tachycardia, left ventricular failure, and enlarged hearts. Gastrointestinal effects (nausea, vomiting, and diarrhea), effects on the blood, liver injury, and allergic dermatitis have also been reported in humans from oral exposure to cobalt (ATSDR, 1992c).

Respiratory effects have also been observed in animals exposed to cobalt by inhalation. Animal studies have reported decreased body weight, necrosis of the thymus, and effects on the blood, liver, kidneys, and respiratory, cardiovascular, and central nervous system from inhalation exposure to cobalt (ATSDR, 1992c).

**Q.11.2.1 Reference Dose.** EPA has established a provisional RfD for cobalt of 6.0E-02 mg/kg-d based on the upper range of average intake in children, which is below the levels of cobalt necessary to induce polycythemia in either renally compromised patients or normal patients (U.S. EPA, 1997c).

**Q.11.2.2 Reference Concentration.** A provisional RfC of 1.0E-05 mg/m$^3$ was developed for cobalt in EPA's Air Characteristic Study, based on a LOAEL of 0.11 mg/m$^3$, an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 1999b). This was based on respiratory effects reported in rats (NTP, 1996a). A spectrum of inflammatory, fibrotic, and proliferative lesions in the respiratory tract was observed. Hyperplasia of the lateral wall of the nose and atrophy of the olfactory epithelium were reported in rats exposed to cobalt sulfate heptahydrate for 104 weeks via inhalation; the severity of these lesions increased with increasing exposure concentration (NTP, 1996a).

A LOAEL of 0.11 mg/m$^3$ was identified. The LOAEL was adjusted for intermittent exposure (6 h/d, 5 d/wk). An RDDR factor was incorporated to account for differences in the deposition pattern of inhaled cobalt in the respiratory tract of humans and the rat test animals (U.S. EPA, 2000a, citing Jarabek et al., 1990). A $LOAEL_{HEC}$ of 0.004 mg/m$^3$ was calculated by applying an RDDR of 0.209 for extrathoracic respiratory effects (based on MMAD = 1.5 µm and geometric standard deviation = 2.2).

An uncertainty factor of 300 was applied based on a tenfold factor to account for the use of a LOAEL, a tenfold factor to account for human variability, and a threefold factor to account for extrapolation from animals to humans with the use of a LOAEL adjusted for human equivalent concentration (U.S. EPA, 1999b).

The strengths of the provisional RfC for cobalt are that it was based on a well-designed chronic study from the NTP that involved extensive clinical and pathological examinations in two species and the critical effect noted in the study has been observed in numerous other human and animal studies. Respiratory effects have been reported in workers and animals exposed to a variety of cobalt compounds, including cobalt dust. Similar respiratory effects have been reported across several species exposed to various cobalt compounds at similar exposure levels. The major uncertainty of the RfC is the lack of a NOAEL from this study or other studies (U.S. EPA, 1999b).

### Q.11.3 Cancer Effects

Limited data are available on the carcinogenic effects of cobalt. In one study on workers who refined and processed cobalt and sodium, an increase in deaths due to lung cancer was found for workers exposed only to cobalt. However, when this study was controlled for date of birth, age at death, and smoking habits, the difference in deaths due to lung cancer was found not to be statistically significant. In another study assessing the correlation between cancer deaths and trace metals in water supplies in the United States, no correlation was found between cancer mortality and the level of cobalt in the water (ATSDR, 1992c).

In an animal study, an increased incidence of lung tumors was observed in rats and mice exposed to cobalt sulfate heptahydrate for 2 years (NTP, 1996a). Inhalation of cobalt over a lifetime did not increase the incidence of tumors in hamsters. Cobalt, via direct injection (intramuscular and subcutaneous under the muscles or skin), has been reported to cause tumors at the injection site in rats but not mice (ATSDR, 1992c).

EPA has not classified cobalt for carcinogenicity or calculated a unit risk estimate for cobalt.

## Q.12 Copper

### Q.12.1 Introduction

Copper occurs naturally in rock, soil, water, sediment, and air and is an essential element for humans. It is extensively mined and processed in the United States and is primarily used as the metal or alloy in the manufacture of wire and sheet metal, in agriculture to treat plant diseases, and as a preservative for wood, leather, and fabrics (ATSDR, 1990a).

| Copper | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | NA | |
| MCL | 1.3 mg/L | U.S. EPA, 2000b |
| RfC | 2.0E-05 $mg/m^3$ | CalEPA, 1997 |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.12.2 Noncancer Effects

The majority of information on copper toxicity in humans involves the consumption of water contaminated with high levels of copper or suicide attempts using copper sulfate. Effects observed in humans include gastrointestinal (nausea, vomiting, abdominal pains), hepatic, and renal effects from oral exposure, respiratory irritation from inhalation exposure, and allergic contact dermatitis from dermal exposure. An example of significant (but rare) copper toxicity in humans is Wilson's Disease, an autosomal recessive disorder that affects normal copper homeostasis. The disease is characterized by excessive retention of hepatic copper, decreased concentration of plasma ceruloplasmin, and impaired biliary excretion. The disorder is generally recognized by liver or neurological symptoms; yellow brown deposits in the cornea is a signature symptom (ATSDR, 1990a).

Longer-term or chronic human exposure to copper has been associated with a number of effects including metal fume fever and enlarged livers. Metal fume fever is characterized by chills, fever, aching muscles, dryness in the mouth and throat, and headaches that last for 1 or 2 days. Anorexia, nausea, and occasional diarrhea in factory workers exposed to high concentrations of airborne copper have also been reported (ATSDR, 1990a).

The effects observed in animals from oral exposure to high levels of copper include liver, kidney, hematologic, gastrointestinal, immunologic, and developmental effects. Respiratory effects have been reported in animals following inhalation exposure (ATSDR, 1990a).

Copper is an essential dietary nutrient for which a recommended daily allowance (RDA) has been developed. Copper is essential for incorporation into copper-dependent enzymes. These cuproenzymes are needed for human hemoglobin formation, carbohydrate metabolism, catecholamine biosynthesis, and cross-linking of collagen, elastin, and hair keratin. An RDA of 2 to 3 mg copper/day is recommended by the National Academy of Sciences (ATSDR, 1990a).

**Q.12.2.1 <u>Reference Dose</u>.** EPA has not established an RfD for copper (U.S. EPA, 2000a). A maximum contaminant level (MCL) of 1.3 mg/L in drinking water (U.S. EPA, 2000b) was used in this risk assessment in lieu of an oral human health benchmark (which is not available).

**Q.12.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for copper (U.S. EPA, 2000a). However, CalEPA has established a chronic inhalation reference exposure level for copper of 2.0E-05 mg/m$^3$ based on a NOAEL of 0.008 mg/m$^3$ for respiratory effects in humans (CalEPA, 1997, citing Gleason, 1968) and an uncertainty factor of 100 (CalEPA, 1997). Cold-like symptoms (warmth or chills and head stuffiness), the classic signs of metal fume fever, were reported among workers exposed to copper dust. The NOAEL was adjusted for intermittent exposure (8 h/d, 5 d/wk). An uncertainty factor of 100 was applied based on a tenfold factor to account for human variability and a tenfold factor to account for extrapolation from subchronic to chronic exposure duration (CalEPA, 1997).

### Q.12.3 Cancer Effects

An increased incidence of cancer has not been observed in humans or animals exposed to copper via inhalation, oral, or dermal routes (ATSDR, 1990a). In laboratory animal studies, two strains of mice administered copper for 53 weeks failed to show any evidence of statistically significant increases in tumor incidence (U.S. EPA, 2000a).

EPA has classified copper as Group D - Not Classifiable as to Human Carcinogenicity, based on no human data, inadequate animal data, and equivocal mutagenicity data (U.S. EPA, 2000a).

# Q.13 Cresols

## Q.13.1 Introduction

There are three types of cresols, ortho-cresol (o-cresol), meta-cresol (m-cresol), and para-cresol (p-cresol). Cresols are also found as mixtures. Pure cresols occur as white solids while mixtures tend to be brown in color and in a liquid form. Cresols occur naturally but they are also manmade. Cresols are naturally found in some foods, human and animal urine, wood, tobacco smoke, crude oil, and coal tar. Cresols are used as disinfectants, solvents, preservatives, wood preservatives, chemical intermediates, and in the formulation of antioxidants and resins. The most common routes of exposure to cresols are oral and dermal, though inhalation exposures can also occur. For the general population, exposure to cresols may occur through eating food or drinking water that contains cresols or dermal contact with substances that contain cresol. Ambient air contains low levels of cresols from automobile exhaust, power plants, and refineries (ATSDR, 1992d).

| Cresols | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD (o-cresol) | 5.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfD (m-cresol) | 5.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfD (p-cresol) | 5.0E-03 mg/kg-d | U.S. EPA, 1997a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

## Q.13.2 Noncancer Effects

Human data for cresol exposures are limited. Effects following acute cresol ingestion include gastrointestinal, kidney, neurological, liver, blood, and respiratory effects. Following dermal exposure, neurological, dermal, and ocular effects have been observed. Acute inhalation exposure to cresols has resulted in respiratory tract irritation in humans (ATSDR, 1992d).

In animals, neurological, liver, and kidney effects are the most common effects resulting from acute oral exposure to o-cresol. Following acute oral exposure to p-cresol, body weight decreases, neurological, and respiratory effects have been reported. Similarly, acute oral exposure to m-cresol causes food intake decreases, neurological, and respiratory effects. Longer-duration oral exposure to o-, m-, and p-cresol have also resulted in neurological effects as well as body weight decreases. Systemic (respiratory, liver, kidney, and ocular) and neurological effects have also been reported in animals following inhalation of cresols (ATSDR, 1992d).

**Q.13.2.1 <u>Reference Dose</u>.** EPA has established an RfD for o-cresol of 5.0E-02 mg/kg-d based on a NOAEL of 50 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Groups of rats were administered 0, 50, 175, 450, or 600 mg/kg-d o-cresol by gavage for 90 days. High mortality was observed in the two high-dose-group rats. Additionally, body weight decreases, food consumption reductions, and kidney-to-body weight ratio increases at the end of the study were observed in the high dose group rats. Central nervous system effects (lethargy, ataxia, coma, dyspnea, tremor, and convulsions) in this group appeared within 15 to 30 minutes of exposure, but animals recovered within 1 hour of exposure. Tremors and coma were also observed in animals in the 175-mg/kg-d group (U.S. EPA, 2000a, citing U.S. EPA, 1986, 1987). The RfD is based on body weight decreases and neurotoxicity in rats. An uncertainty factor of 1,000 was applied based on a tenfold factor to account for interspecies extrapolation, a tenfold factor to account for intraspecies variability, and a tenfold factor to account for extrapolation of a subchronic effect level to its chronic equivalent (U.S. EPA, 2000a).

EPA has also established an RfD for m-cresol of 5.0E-02 mg/kg-d based on a NOAEL of 50 mg/kg-d and a LOAEL of 150 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Groups of rats were administered 0, 50, 150, or 450 mg/kg-d m-cresol by gavage for 90 days. Body weight and food intake were decreased in males and females in the 450-mg/kg-d group. Additionally, there was an increased incidence of salivation, tremors, and urination in this group. Decreased weight gain was also observed in males in the 150-mg/kg-d group but not females (U.S. EPA, 2000a, citing U.S. EPA, 1986, 1987). The RfD is based on body weight decreases and neurotoxicity in rats. An uncertainty factor of 1,000 was applied based on a tenfold factor to account for interspecies extrapolation, a tenfold factor to account for intraspecies variability, and a tenfold factor to account for extrapolation of a subchronic effect level to its chronic equivalent (U.S. EPA, 2000a).

EPA has high confidence in the critical studies used as the basis for the RfD for o- and m-cresol because they provide adequate toxicological endpoints including both general toxicity and neurotoxicity. EPA has medium confidence in the database because it lacks chronic and reproductive studies. Therefore, EPA has medium confidence in the RfDs for o- and m-cresol (U.S. EPA, 2000a).

The provisional RfD for p-cresol is 5.0E-03 mg/kg-d based on a NOAEL of 5 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 1997a). The RfD was based on a study in which hypoactivity, respiratory distress, and maternal death were observed in rabbits exposed to p-cresol via gavage on gestation days 6-18 (U.S. EPA, 1997a).

**Q.13.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for o-, p-, or m-cresol (U.S. EPA, 2000a).

### Q.13.3 Cancer Effects

Inadequate human data are available on the carcinogenicity of cresols. The only available data are from anecdotal reports of two cases of multifocal transitional cell carcinomas of the bladder following chronic occupational cresol and creosote exposure and vocal cord squamous cell carcinoma in a worker exposed to cresol, dichlorooctane, and chromic acid (U.S. EPA, 2000a).

Limited data are available on the carcinogenicity of cresols in animals. An increased incidence of skin papillomas was observed in mice exposed to each cresol isomer compared to a benzene control group following exposure to an initiator (dimethylbenzanthracene) (U.S. EPA, 2000a).

EPA has classified o-, m-, and p-cresol as Group C, Possible Human Carcinogens. This was based on the increased incidence of skin papillomas in mice. EPA has not calculated an oral CSF or an inhalation unit risk estimate for any cresol isomer (U.S. EPA, 2000a).

## Q.14 Di(2-ethylhexylphthalate)

### Q.14.1 Introduction

Di(2-ethylhexylphthalate) (DEHP) occurs as a colorless liquid with a slight odor. DEHP is primarily used as a plasticizer in the production of polyvinyl chloride (PVC) and vinyl chloride resins. DEHP has been detected in consumer products stored in plastics, including food and biological fluids used in medical procedures. DEHP leaches from the plastic bags used to store blood products and the tubing used to administer fluids or medication for kidney dialysis and for respirators. Exposure to DEHP may occur from ingesting contaminated food, during certain medical procedures, or in the workplace (ATSDR, 1993).

| Di(2-ethylhexylphthalate) | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E-02 mg/m$^3$ | U.S. EPA, 1996a |
| oral CSF | 1.4E-02 (mg/kg-d)$^{-1}$ | U.S. EPA, 2000a |
| inh URF | 2.4E-06 (µg/m$^3$)$^{-1}$ | CalEPA, 1999a |
| inh CSF | 8.4E-03 (mg/kg-d)$^{-1}$ | Calculated |

### Q.14.2 Noncancer Effects

Data on the health effects of DEHP on humans are limited. One study indicated that exposure to DEHP through dialysis may have an adverse effect on the human kidney (ATSDR, 1993).

Acute, subchronic, and chronic oral and subchronic inhalation exposures to DEHP have resulted in liver effects in animals. Kidney effects have also been reported in animals orally exposed to DEHP. Decreased fertility in males and females, decreased proportion of pups born alive per litter, and damage to the seminiferous tubules were observed in mice exposed to DEHP in the diet. Effects on the male reproductive organs of rats, including testicular damage, have also been reported. Fetotoxicity and teratogenicity have been reported in other studies (ATSDR, 1993; U.S. EPA, 2000a).

**Q.14.2.1 <u>Reference Dose</u>.** EPA has established an RfD for DEHP of 0.02 mg/kg-d based on a LOAEL of 19 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Increased relative liver weight was reported in guinea pigs exposed to DEHP in their diet for 1 year (U.S. EPA, 2000a, citing Carpenter et al., 1953). An uncertainty factor of 1000 was applied, based on a tenfold factor for interspecies extrapolation, a tenfold factor to protect sensitive individuals, and a tenfold factor to account for exposure being longer than subchronic but less than lifetime and extrapolating from a minimal LOAEL to a NOAEL (U.S. EPA, 2000a).

For DEHP, EPA has

- Medium confidence in the study used as the basis for the RfD because sufficient numbers of animals were used and multiple endpoints were measured, but only two dose levels were tested.

- Medium confidence in the database because there are corroborating chronic animal bioassays.

EPA has assigned a ranking of medium confidence in the RfD (U.S. EPA, 2000a).

**Q.14.2.2 <u>Reference Concentration</u>.** A provisional RfC of 1.0E-02 mg/m$^3$ was developed for DEHP by EPA's National Center for Environmental Assessment (NCEA) based on respiratory effects in rats (U.S. EPA, 1996a). Alterations in serum chemistry parameters, increased liver and lung weight, and histopathological alterations in the lung (increased macrophage proliferation and alveolar septal thickening) were observed in rats exposed to DEHP via inhalation for 6 h/d, 5 d/wk, for 4 weeks (U.S. EPA, 1996a, citing Klimisch et al., 1992). A NOAEL of 49 mg/m$^3$ was identified.

The NOAEL of 49 mg/m$^3$ was adjusted for intermittent exposure (6 h/d, 5 d/wk) (NOAEL$_{ADJ}$ = 8.8 mg/m$^3$). To account for species-specific differences in inhalation dosimetry, a NOAEL$_{HEC}$ of 13 mg/m$^3$ was calculated by applying an RDDR of 1.4942 for respiratory effects in the thoracic region (based on MMAD = 1.0 µm and geometric standard deviation = 2.4). An uncertainty factor of 1,000 was applied based on a tenfold factor to account for use of a subchronic study, a threefold factor to account for interspecies extrapolation using dosimetric adjustments, a tenfold factor to account for human variability, and a threefold factor for database deficiencies (U.S. EPA, 1996a). CalEPA (1999b) also derived a chronic inhalation reference exposure level of 1.0E-02 $mg/m^3$ for DEHP based on the same study.

### Q.14.3 Cancer Effects

Human data on the carcinogenic effects of DEHP are inadequate. In one study of DEHP production workers exposed to unknown concentrations of DEHP for 3 months to 24 years, deaths attributable to pancreatic carcinoma and uremia were significantly elevated in workers exposed for more than 15 years when compared to the corresponding age groups in the general population. The study is limited by a short followup period (11.5 years) and unquantified worker exposure (U.S. EPA, 2000a).

A statistically significant increase in the incidence of hepatocellular carcinomas and combined incidence of carcinomas and adenomas was observed in female rats and male and female mice exposed to DEHP in the diet for 103 weeks. A statistically significant increase in the combined incidence of neoplastic nodules and hepatocellular carcinomas was observed in the high-dose male rats. A positive dose response trend was also noted (U.S. EPA, 2000a).

EPA has classified DEHP as a Group B2, Probable Human Carcinogen, based on significant dose-related increases in liver tumors in orally exposed rats and mice of both sexes (U.S. EPA, 2000a).

**Q.14.3.1 <u>Oral Cancer Risk</u>.** EPA used the linearized multistage extrapolation model based on data from a study of orally exposed mice (U.S. EPA, 2000a, citing NTP, 1982) to estimate the oral cancer slope factor and unit risk estimate for DEHP. EPA calculated an oral unit risk estimate of 4.0E-07 $(\mu g/L)^{-1}$ and an oral CSF of 1.4E-02 $(mg/kg\text{-}d)^{-1}$ (U.S. EPA, 2000a).

EPA has confidence in the risk estimate because an adequate number of animals was used and a statistically significant increase in incidence of liver tumors was seen in both sexes and was dose dependent in both sexes of mice and female rats. A potential source of variability in the NTP study is the possibility of feed scattering (U.S. EPA, 2000a).

**Q.14.3.2 <u>Inhalation Cancer Risk</u>.** EPA has not calculated an inhalation unit risk estimate for DEHP (U.S. EPA, 2000a). However, CalEPA (1999a) calculated an inhalation unit risk estimate of 2.4E-06 $(\mu g/m^3)^{-1}$ based on the same data that EPA used (NTP, 1982) to derive an oral cancer risk estimate (see above). An inhalation CSF of 8.4E-03 $(mg/kg/d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 2.4\text{E-6 } (\mu g/m^3)^{-1} \times 70 \text{ kg} \div 20 \text{ m}^3/\text{d} \times 1{,}000 \text{ } \mu g/mg = 8.4\text{E-3 } (mg/kg\text{-}d)^{-1}$$

## Q.15 Dibutyl Phthalate

### Q.15.1 Introduction

Dibutyl phthalate is used as a plasticizer, which is a compound that is added to other substances to make them softer and more flexible. It is used in shower curtains, raincoats, food wraps, car interiors, vinyl fabrics, floor tiles, and other products. It is also used as an antifoam agent, as a fiber lubricant in the textile industry, and as a fragrance fixative (ATSDR, 1999e).

| Dibutyl phthalate | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.15.2 Noncancer Effects

No information is available on the noncancer effects of dibutyl phthalate in humans. In animals, inhalation studies have reported decreased body weight gain and increased brain weight as a percent of body weight, while chronic oral animal studies have reported effects on the liver. Animal studies have also reported developmental effects, such as reduced fetal weight, increased number of resorptions, decreased number of viable litters, and birth defects (e.g., skeletal malformations and neural tube defects) in rats and mice exposed orally to dibutyl phthalate. Reproductive effects, such as testicular atrophy and decreased spermatogenesis and testes weight, have also been reported in oral animal studies (ATSDR, 1999e).

**Q.15.2.1 Reference Dose.** The RfD for dibutyl phthalate is 1.0E-01 mg/kg-d based on a NOAEL of 125 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which groups of 10 male rats were fed diets containing 0, 0.01, 0.05, 0.25, and 1.25 percent dibutyl phthalate for 1 year (U.S. EPA, 2000a, citing Smith, 1953). Values of 125 mg/kg-d for 0.25 percent dibutyl phthalate in the diet and 600 mg/kg-d for 1.25 percent were estimated from a figure depicting daily intake in mg/kg in the reference. One-half of all rats receiving the highest dibutyl phthalate concentration died during the first week of exposure. The remaining animals survived the study with no apparent ill effects. There was no effect of the treatment on gross pathology or hematology. No histopathologic evaluation was reported. The critical effect used as the basis for the RfD was incresed mortality; a LOAEL of 600 mg/kg-d and a NOAEL of 125 mg/kg-d were identified (U.S. EPA, 2000a).

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and an additional tenfold factor to account for both extrapolating from subchronic to long-term exposure and for the deficiencies of the study (e.g., the use of only male animals) (U.S. EPA, 2000a).

EPA has

- Low confidence in the study on which the RfD was based because it used few animals of one sex only, it was not indicated in the paper whether the 50 percent mortality observed early in the study was considered treatment related, nor was the cause of death indicated

- Low confidence in the database because this is the only subchronic bioassay of dibutyl phthalate reported in the literature.

Therefore, EPA has assigned a ranking of low confidence in the RfD (U.S. EPA, 2000a).

**Q.15.2.2 Reference Concentration.** EPA has not established an RfC for dibutyl phthalate (U.S. EPA, 2000a).

### Q.15.3 Cancer Effects

No information is available on the carcinogenic effects of dibutyl phthalate in humans or animals. EPA has classified dibutyl phthalate as a Group D, Not Classifiable as to Human Carcinogenicity, and has not calculated an oral CSF or inhalation risk estimate for dibutyl phthalate (U.S. EPA, 2000a).

## Q.16 Dichloromethane (Methylene Chloride)

### Q.16.1 Introduction

Dichloromethane (also called methylene chloride) is a widely used industrial chemical that occurs as a colorless liquid with a sweet odor. Dichloromethane is used as a solvent in paint strippers and removers; as a propellant in aerosols; as a process solvent in the manufacture of drugs, pharmaceuticals, and film coatings; as a metal cleaning and finishing solvent; in electronics manufacturing; and as an agent in urethane foam blowing. Dichloromethane is also used as an extraction solvent for spice oleoresins, hops, and for the removal of caffeine from coffee. However, due to concern over residual solvent, most decaffeinators no longer use dichloromethane (ATSDR, 1998b).

### Q.16.2 Noncancer Effects

The primary effects from chronic inhalation exposure to dichloromethane in humans are effects on the central nervous system, such as dizziness, nausea, impaired psychomotor function, and decreased visual and auditory function. Animal studies indicate that inhalation of dichloromethane causes effects on the liver, kidney, central nervous system, and cardiovascular system. Animal studies have demonstrated that dichloromethane crosses the placental barrier, and minor skeletal variations and lowered fetal body weights have been noted (ATSDR, 1998b).

| Dichloromethane | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 6.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 3.0E+00 $mg/m^3$ | U.S. EPA, 1997a |
| oral CSF | 7.5E-03 $(mg/kg\text{-}d)^{-1}$ | U.S. EPA, 2000a |
| inh URF | 4.7E-07 $(\mu g/m^3)^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 1.6E-03 $(mg/kg\text{-}d)^{-1}$ | Calculated |

**Q.16.2.1 <u>Reference Dose</u>.** The RfD for dichloromethane is 6.0E-02 mg/kg-d based on a NOAEL of 5.85 and 6.47 mg/kg-d for males and females, respectively, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which 85 rats/sex at each of four dose groups (5, 50, 125, and 250 mg/kg-d) received dichloromethane in the drinking water for 24 months (U.S. EPA, 2000a, citing National Coffee Association, 1982). Treatment-related histological alterations of the liver were evident at doses of 50 mg/kg-d and higher. The low dose of 5 mg/kg-d was selected as a NOAEL. An uncertainty factor of 100 was applied based on a tenfold factor for extrapolation from animals to humans and a tenfold factor to protect sensitive individuals (U.S. EPA, 2000a).

EPA has assigned a ranking of medium confidence in the RfD based on

- High confidence in the study on which the RfD was based because a large number of animals of both sexes were tested in four dose groups, with a large number of controls, many effects were monitored, and a dose-related increase in severity was observed

- Medium to low confidence in the database because only a few studies support he NOAEL (U.S. EPA, 2000a).

**Q.16.2.2 <u>Reference Concentration</u>.** The provisional RfC for dichloromethane is 3.0 $mg/m^3$ based on a LOAEL of 695 $mg/m^3$, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 1997a). The RfC was based on a study in which effects on the liver were observed in rats intermittently exposed to dichloromethane by inhalation for 2 years (U.S. EPA, 1997a, citing Nitschke et al., 1988).

### Q.16.3 Cancer Effects

Several studies did not report a statistically significant increase in deaths from cancer among workers occupationally exposed to dichloromethane. Animal studies have shown an increase in hepatocellular neoplasms, alveolar/bronchiolar neoplasms, and benign mammary gland tumors following inhalation and drinking water exposure to dichloromethane. Dichloromethane administered in the drinking water resulted in an increased incidence of liver tumors in rats and mice (ATSDR, 1998b; U.S. EPA, 2000a).

EPA has classified dichloromethane as a Group B2, Probable Human Carcinogen, based on sufficient evidence of carcinogenicity in animals (U.S. EPA, 2000a).

**Q.16.3.1 Oral Cancer Risk.** EPA used the linearized multistage model (extra risk) based on data from a study of mice exposed to dichloromethane by inhalation and in the drinking water to estimate the oral CSF and unit risk estimate. EPA calculated an oral unit risk estimate of 2.1E-07 $(\mu g/L)^{-1}$ and an oral CSF of 7.5E-03 $(mg/kg\text{-}d)^{-1}$ based on an increase in liver and lung tumors in mice exposed to dichloromethane by inhalation and in the drinking water (U.S. EPA, 2000a).

EPA has confidence in the risk estimate because adequate numbers of animals were used. Risk estimates were based on the more sensitive sex in each study and were within a factor of 5 (U.S. EPA, 2000a).

**Q.16.3.2 Inhalation Cancer Risk.** EPA used a linearized multistage model (extra risk) based on data from an inhalation study in mice to estimate the inhalation unit risk estimate for dichloromethane. EPA calculated an inhalation URF of $4.7 \times 10^{-7}$ $(\mu g/m^3)^{-1}$ based on an increase in liver and lung tumors in mice exposed to dichloromethane by inhalation (U.S. EPA, 2000a). An inhalation CSF of 1.6E-03 $(mg/kg\text{-}d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 4.7\text{E-}7\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1{,}000\ \mu g/mg = 1.6\text{E-}3\ (mg/kg\text{-}d)^{-1}$$

EPA has confidence in the risk estimate because adequate numbers of animals were used and tumor incidences were significantly increased in a dose-dependent fashion. Analysis excluding animals that died before observation of the first tumors produced similar risk estimates, as did time-to-tumor analysis. The use of animal and human metabolism and pharmocokinetic data reduces some of the uncertainty typically associated with dose-risk extrapolation. Important uncertainties remain (U.S. EPA, 2000a).

## Q.17 2,4-Dimethylphenol

### Q.17.1 Introduction

2,4-Dimethylphenol is a colorless liquid. It is used in disinfectants, solvents, pharmaceuticals, insecticides, herbicides, and as a plasticizer, additive, and wetting agent (U.S. EPA, 1989a).

### Q.17.2 Noncancer Effects

Acute exposure to high levels of 2,4-dimethylphenol can cause headache, nausea, fainting, and collapse in humans. The vapors are irritating to the skin, nose, throat, and lungs.

Skin contact can cause scarring and a burning feeling on the skin. Chronic exposure may damage the kidneys, liver, brain, pancreas, and heart (U.S. EPA, 1989a).

| 2,4-Dimethylphenol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

**Q.17.2.1** **<u>Reference Dose</u>.** The RfD for 2,4-dimethylphenol is 2.0E-02 mg/kg-d based on a NOAEL of 50 mg/kg-d, an uncertainty factor of 3,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which 30 rats/sex/group were dosed daily for 90 days with 5, 50, or 250 mg/kg-d 2,4-dimethylphenol by gavage (U.S. EPA, 2000a, citing U.S. EPA, 1989). Effects examined included mortality, clinical signs, body weights, food consumption, opthalmology, hematology and clinical chemistry, organ weights, and gross histopathology. Toxicologically relevant clinical signs observed in the high-dose group included squinting, lethargy, prostration, and ataxia. At interim sacrifice in the female mid- and high-dose groups, blood urea nitrogen levels were significantly below controls, whereas at final sacrifice in the female mid-dose group, blood urea nitrogen levels were significantly higher than controls. Low-dose males at interim sacrifice had significantly higher cholesterol levels. Significant differences were not found in gross necropsy or histopathological evaluations or in organ weights, except for an increase in adrenal weights in low-dose females. The LOAEL and NOAEL for this study were 250 and 50 mg/kg-d, respectively (U.S. EPA, 2000a).

An uncertainty factor of 3,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a thirtyfold factor for lack of chronic toxicity data, data in a second species, and reproductive/developmental studies (U.S. EPA, 2000a).

For 2,4-dimethylphenol, EPA has assigned the following ranking:

- Medium confidence in the study on which the RfD was based because it examined appropriate endpoints, identified both a LOAEL and a NOAEL, and the results of this study are consistent with those of a 14-day gavage study

- Low confidence in both the database and the RfD because the database provides no information on chronic and reproductive studies (U.S. EPA, 2000a).

**Q.17.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for 2,4-dimethylphenol (U.S. EPA, 2000a).

### Q.17.3 Cancer Effects

No information is available on the carcinogenic effects of 2,4-dimethylphenol in humans or animals. EPA has not classified 2,4-dimethylphenol for carcinogenicity and has not calculated an oral CSF or an inhalation unit risk estimate (U.S. EPA, 2000a).

## Q.18 Ethylbenzene

### Q.18.1 Introduction

Ethylbenzene occurs naturally in coal tar and petroleum. It is a colorless liquid with a sweet, gasoline-like odor. Ethylbenzene is used primarily in the production of styrene. It is also used as a solvent, as a constituent of asphalt and naphtha, and in fuels. Other uses are in the manufacture of acetophenone, cellulose acetate, diethylbenzene, and other chemicals (ATSDR, 1999f).

| Ethylbenzene | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E+00 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.18.2 Noncancer Effects

Acute inhalation exposure of humans to ethylbenzene has resulted in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects, such as dizziness. Chronic exposure of ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. In one study of workers occupationally exposed to ethylbenzene, effects on the blood were noted, while in another study, no adverse effects on the blood were seen. Animal studies have reported developmental effects, such as fetal resorptions, retardation of skeletal development, and an increased incidence of extra ribs in animals exposed to ethylbenzene by inhalation. Animal studies have also reported effects on the liver, kidney, blood, and central nervous system (ATSDR, 1999f).

**Q.18.2.1 Reference Dose.** The RfD for ethylbenzene is 1.0E-01 mg/kg-d based on a NOAEL of 136 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which ethylbenzene was given 5 d/wk at doses of 13.6, 136, 408, or 680 mg/kg-d by gavage for 182 days to 10 female rats/dose group (U.S. EPA, 2000a, citing Wolf et al., 1956). The effects measured were growth, mortality, appearance, behavior, hematologic findings, concentration of blood urea nitrogen, final organ and body weights, histopathological findings, and bone marrow counts. A LOAEL of 408 mg/kg-d and a NOAEL of 136 mg/kg-d were selected based on histopathologic changes in the liver and kidneys. The NOAEL was adjusted for duration of exposure as follows: 136 mg/kg-d x 5/7 d = 97.1 mg/kg-d.

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a tenfold factor for extrapolation from subchronic to chronic exposure (U.S. EPA, 2000a).

EPA has assigned a ranking of low confidence in the RfD for ethylbenzene based on:

- Low confidence in the study on which the RfD was based because rats of only one sex were tested and the experiment was not of chronic duration

- Low confidence in the supporting database because other oral toxicity data were not identified (U.S. EPA, 2000a).

**Q.18.2.2 Reference Concentration.** The RfC for ethylbenzene is 1.0 mg/m$^3$ based on a NOAEL of 434 mg/m$^3$, an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 2000a). The RfC was based on a study in which rats and rabbits were exposed 6 to 7 h/d, during days 1-19 and 1-24 of gestation, respectively, to 0, 100, or 1,000 ppm ethylbenzene (434 or 4342 mg/m$^3$) (U.S. EPA, 2000a, citing Andrew et al., 1981, and Hardin et al., 1981). Maternal organs were examined histopathologically and the fetuses were weighed, sexed, measured for crown-to-rump length, and examined for external, internal, and skeletal abnormalities. Ethylbenzene did not elicit embryotoxicity, fetotoxicity, or teratogenicity in rabbits at either dose level. The results of the rabbit study indicated a NOAEL of 100 ppm (434 mg/m$^3$) based on a lack of developmental effects in rabbits. In rats, the principal observation in fetuses was a significantly increased incidence of supernumerary and rudimentary ribs in the high exposure group and an elevated incidence of extra ribs in the high and the 100-ppm groups. A NOAEL of 100 ppm (434 mg/m$^3$) was also determined for rats.

The NOAEL was not adjusted for intermittent exposure because it was determined for developmental effects. To account for species-specific differences in inhalation dosimetry, the $NOAEL_{HEC}$ was calculated based on extrarespiratory effects for a gas and assuming periodicity was attained. A default value of 1.0 was used for the blood gas partition coefficient ratio (values unknown), resulting in a $NOAEL_{HEC}$ of 434 mg/m$^3$. An uncertainty factor of 300 was applied based on a threefold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a tenfold factor to adjust for the absence of multigenerational reproductive and chronic studies (U.S. EPA, 2000a).

EPA has assigned a ranking of low confidence in the RfC for ethylbenzene based on

- Low confidence in the study on which the RfC was based because higher exposure levels may have provided more information on the potential for maternal toxicity and developmental effects

- Low confidence in the database because there are no chronic studies and no multigenerational developmental studies (U.S. EPA, 2000a).

### Q.18.3 Cancer Effects

An epidemiological study monitored the conditions of workers exposed to ethylbenzene for 10 years, with no tumors reported. However, no firm conclusions can be made from this study because exposure information was not provided, and 10 years is insufficient for detecting long latency tumors in humans (ATSDR, 1999f). In a study by the National Toxicology Program (NTP), inhalation exposure to ethylbenzene resulted in a clearly increased incidence of kidney and testicular tumors in male rats and a suggestive increase in kidney tumors in female rats and lung and liver tumors in both sexes of mice (NTP, 1999).

EPA has classified ethylbenzene as a Group D, Not Classifiable as to Human Carcinogenicity. EPA has not calculated an oral CSF or an inhalation unit risk estimate for ethylbenzene (U.S. EPA, 2000a).

## Q.19 Ethylene Glycol

### Q.19.1 Introduction

Ethylene glycol is used to make antifreeze and deicing solutions for cars, aircraft, runways, and taxiways. It is also used as an ingredient in hydraulic brake fluids, as a solvent in the paint and plastics industries, in the formulation of inks, and to produce polyester fibers. The major sources of releases to the environment are from the disposal of used antifreeze and de-icing solutions (ATSDR, 1997c).

| Ethylene Glycol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E+00 mg/kg-d | U.S. EPA, 2000a |
| RfC | 6.0E-01 mg/m$^3$ | U.S. EPA, 1999b |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

## Q.19.2 Noncancer Effects

There are often three stages of toxicity in humans following the accidental or intentional ingestion of large amounts of ethylene glycol. The first stage of ethylene glycol toxicity involves central nervous system depression (ataxia, disorientation, slurred speech), metabolic changes (hyperosmolality and acidosis), and gastrointestinal upset. During the second stage (12-24 h after ingestion), cardiopulmonary symptoms (tachypnea, hyperpnea, and tachycardia) become evident and are largely due to metabolic acidosis. During stage three, renal involvement becomes evident, with flank pain and oliguria/anuria occurring. Renal tubular necrosis has been observed. Other effects reported following acute oral exposures to large amounts of ethylene glycol include hyperventilation and generalized pulmonary edema. Irritation of the respiratory tract and headaches have been observed in humans following inhalation exposure (ATSDR, 1997c).

Kidney, metabolic, respiratory, cardiovascular, liver, reproductive, and developmental effects have been reported in animals orally exposed to ethylene glycol. Liver, reproductive, and developmental effects have been reported in animals exposed via inhalation. Increased pre- and postimplantation losses, reduced litter size and number, abortion, increased incidence of skeletal malformations in offspring and decreased pup body weight were reported in animals orally exposed to ethylene glycol (ATSDR, 1997c; U.S. EPA, 2000a).

**Q.19.2.1 Reference Dose.** EPA has established an RfD for ethylene glycol of 2.0 mg/kg-d based on a NOAEL of 200 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). Kidney toxicity (increased kidney hemoglobin and hematocrit and chronic nephritis) was reported in rats exposed to ethylene glycol in their diet for 2 years (U.S. EPA, 2000a, citing DePass et al., 1986a). An uncertainty factor of 100 was applied, based on a tenfold factor for interspecies extrapolation and a tenfold factor to protect sensitive individuals (U.S. EPA, 2000a).

Therefore, EPA has assigned a ranking of high confidence in the RfD (U.S. EPA, 2000a). EPA has

- High confidence in the study used as the basis for the RfD because it was a well-conducted lifetime study in two species by a relevant route and defined a NOAEL and LOAEL.

- High confidence in the database because it contains another chronic rat study and a monkey study that support the NOAEL and LOAEL from the critical study, as well as indicating that the RfD is protective of teratogenic and reproductive effects.

**Q.19.2.2 Reference Concentration.** EPA developed a provisional RfC for ethylene glycol of 6.0E-01 mg/m$^3$ based on respiratory effects in humans (U.S. EPA, 1999b). Volunteers were exposed to ethylene glycol via inhalation for 20 h/d for 30 days (U.S. EPA, 1999b, citing Wills et al., 1974). A NOAEL of 67 mg/m$^3$ was identified. Throat and upper respiratory tract irritation were observed at higher exposure concentrations. No effects were observed in clinical serum enzyme levels for liver and kidney toxicity, hematotoxicity, or psychological responses.

The NOAEL of 67 $mg/m^3$ was adjusted for intermittent exposure (20 h/d) ($NOAEL_{ADJ}$ = 55.8 $mg/m^3$). An uncertainty factor of 100 was applied based on a tenfold factor to account for use of a subchronic study and a tenfold factor to account for human variability (U.S. EPA, 1999b).

### Q.19.3 Cancer Effects

Studies in humans and animals indicate that there is little carcinogenic risk after ethylene glycol exposure, although the data are limited. No carcinogenic effects were reported in two studies of orally exposed rats and mice (ATSDR, 1997c). EPA has not classified ethylene glycol for carcinogenicity or calculated a unit risk estimate (U.S. EPA, 2000a).

## Q.20 Formaldehyde

### Q.20.1 Introduction

Formaldehyde is used as a chemical intermediate in the production of a large variety of organic compounds. The most common use of formaldehyde is for manufacturing urea-formaldehyde resins; these resins are used in particle board products and foam insulation. Formaldehyde is also used to produce phenolic resins, acetylenic chemicals, polyacetal resins, and methylene diisocyanate. Formaldehyde is used as a tissue preservative and disinfectant in embalming fluid. It is used in consumer goods to deter spoilage caused by microbial contamination, in the agricultural industry as a fumigant to prevent mildew and rot, and as an antimicrobial agent in many cosmetic products (ATSDR, 1999b).

Combustion processes account for most of the formaldehyde entering the environment; combustion sources include power plants, incinerators, refineries, wood stoves, kerosene heaters, and cigarettes. Some other sources of formaldehyde in the environment include vent gas from formaldehyde production, exhaust from diesel and gasoline-powered motor vehicles, emissions from resins in particle board and plywood (particularly indoors), and emissions from the use of formaldehyde as a fumigant, soil disinfectant, embalming fluid, and leather tanning agent (ATSDR, 1999b).

| **Formaldehyde** | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | NA |
| oral CSF | NA | NA |
| inh URF | 1.3E-05 $(\mu g/m^3)^{-1}$ | U.S. EPA, 2000a |
| inh CSF | 4.5E-02 $(mg/kg\text{-}d)^{-1}$ | U.S. EPA, 1997a |

### Q.20.2 Noncancer Effects

Human and animal studies indicate that formaldehyde irritates the upper respiratory tract and eyes from inhalation exposure, the skin from dermal exposure, and the gastrointestinal tract from oral exposure. Mild to moderate eye, nose, and throat irritation and sneezing have been reported following acute and repeated inhalation exposures and histological changes in nasal tissue have been observed in chronically exposed workers. Allergic dermal sensitization to formaldehyde has been observed in humans and is supported by studies in animals (ATSDR, 1999b).

**Q.20.1** **<u>Reference Dose</u>.** EPA has established an RfD for formaldehyde of 0.2 mg/kg-d based on a NOAEL of 15 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). Decreased body weight and histopathological effects (gastrointestinal tract and kidneys) were reported in rats exposed to formaldehyde in drinking water for up to 24 months (U.S. EPA, 2000a, citing Til et al., 1989). An uncertainty factor of 100 was applied, based on a tenfold factor for interspecies extrapolation and a tenfold factor to protect sensitive individuals (U.S. EPA, 2000a).

EPA has

- High confidence in the study used as the basis for the RfD because adequate numbers of animals of both sexes were used, and a thorough examination of toxicological and histological parameters was performed.

- Medium confidence in the database because several additional chronic bioassays and reproductive and developmental studies support the critical effect and study.

Therefore, EPA has assigned a ranking of medium confidence in the RfD for formaldehyde (U.S. EPA, 2000a).

**Q.20.2.2** **<u>Reference Concentration</u>.** EPA has not established an RfC for formaldehyde (U.S. EPA, 2000a).

### Q.20.3 Cancer Effects

Several studies in humans have reported an increased risk for nasopharyngeal, buccal cavity, or lung cancers in workers occupationally exposed to formaldehyde (ATSDR, 1999b; U.S. EPA, 2000a). In several animal studies, squamous cell carcinomas of the nasal cavity were observed in male and female rats and male mice exposed to formaldehyde via inhalation (ATSDR, 1999b; U.S. EPA, 2000a).

EPA has classified formaldehyde as a Group B1, Probable Human Carcinogen, based on statistically significant associations between site-specific respiratory cancers and exposure to formaldehyde or formaldehyde-containing products in humans and an increased incidence of nasal squamous cell carcinomas in rodents (U.S. EPA, 2000a).

**Q.20.3.1 Oral Cancer Risk.** EPA has not calculated a cancer risk estimate from oral exposure (U.S. EPA, 2000a).

**Q.20.3.2 Inhalation Cancer Risk.** EPA used the linearized multistage (additional risk) extrapolation model based on data from a study of rats exposed via inhalation (U.S. EPA, 2000a, citing Kerns et al., 1983) to estimate the inhalation unit risk estimate for formaldehyde. EPA calculated an inhalation unit risk estimate of 1.3E-05 $(\mu g/m^3)^{-1}$ for formaldehyde (U.S. EPA, 2000a). EPA (1997a) calculated the inhalation CSF of 4.5E-02 $(mg/kg\text{-}d)^{-1}$ from the inhalation URF as follows:

$$\text{inh CSF} = 1.3\text{E}{-5}\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1{,}000\ \mu g/mg = 4.5\text{E}{-2}\ (mg/kg{-}d)^{-1}.$$

EPA has confidence in the risk estimate because the experimental range is close to expected human exposures. Estimated lifetime excess risks from six epidemiologic studies are close to upper bound risks based on animal data. Three exposure groups were used in addition to controls in the study on which calculations are based, with a large number of animals per group. Male and female incidences were close throughout the exposure groups (U.S. EPA, 2000a).

## Q.21 Lead

### Q.21.1 Introduction

Lead is a naturally occurring, bluish-gray metal that is found in small quantities in the earth's crust. It is present in a variety of compounds such as lead acetate, lead chloride, lead chromate, lead nitrate, and lead oxide (ATSDR, 1999c).

Exposure to lead can occur through the air, drinking water, food, and soil. Most lead exposure occurs through a combination of the inhalation and oral routes, with inhalation generally contributing a greater proportion of the dose for occupationally exposed groups, and the oral route generally contributing a greater proportion for the general population. The effects of lead are the same regardless of the route of exposure (inhalation or oral) and are correlated with internal exposure as blood lead levels. For this reason, this summary discusses lead exposure in terms of blood lead levels, rather than route (ATSDR, 1999c).

Children are at particular risk to lead exposure because they commonly put hands, toys, and other items that may come in contact with lead-containing dust and dirt in their mouths. In addition, lead-based paints were commonly used for many years and flaking paint, paint chips, and weathered paint powder may be a major source of lead exposure, particularly for children. Lead continues to be used in pigments for paints (ATSDR, 1999c).

| Lead | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | NA | |
| soil screening level | 400 ppm | U.S. EPA, 1998f |
| drinking water action level | 0.015 mg/L | U.S. EPA, 2000b |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.21.2 Noncancer Effects

The primary effects in humans from chronic exposure to lead are to the nervous system. Neurological symptoms have been reported in workers with blood lead levels of 40 to 60 µg/dL, and slowed nerve conduction in peripheral nerves in adults occurs at blood lead levels of 30 to 40 µg/dL. Children are particularly sensitive to the neurotoxic effects of lead. There is evidence that blood lead levels of 10 to 30 µg/dL, or lower, may affect the hearing threshold and growth in children. Neurobehavioral impairment, including IQ deficits, has been been associated with blood lead levels of 50 to 70 µg/dL in children. Chronic exposure to lead in humans can also affect the blood. Anemia has been reported in adults at blood lead levels of 50 to 80 µg/dL and in children at blood lead levels of 40 to 70 µg/dL. Other effects from chronic lead exposure in humans include effects on blood pressure and kidney function, interference with vitamin D metabolism, and reproductive effects (ATSDR, 1999c).

Animal studies have reported effects similar to those found in humans, with effects on the blood, kidneys, and nervous, immune, reproductive, and cardiovascular systems noted (ATSDR, 1999c).

EPA has not established an RfD or RfC for lead. Although, by comparison to most other environmental toxicants, there is a low degree of uncertainty about the health effects of lead, EPA believes that it is inappropriate to develop an RfD for lead. In addition, “it appears that some of these effects, particularly children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold” (U.S. EPA, 2000a).

The Centers for Disease Control and Prevention (CDC) has set an “intervention level” for childhood lead poisoning of 10 $\mu$g/dL. This level was reduced in 1991 from the previous threshold level of 25 $\mu$g/dL based on scientific evidence that adverse health effects can occur at levels as low as 10 $\mu$g/dL (CDC, 1991). However, the CDC does not recommend environmental or medical intervention at 10 $\mu$g/dL. They recommend medical evaluation at or above 20 $\mu$g/dL or if blood lead levels of 15 to 19 $\mu$g/dL persist. Various counseling, monitoring, and communitywide prevention activities are recommended at levels between 10 and 19 $\mu$g/dL (CDC, 1991).

A 400-ppm screening level for lead in soil (U.S. EPA, 1998f) and a 0.015-mg/L action level in drinking water (U.S. EPA, 2000b) were used in this risk assessment in lieu of human health benchmarks (which are not available).

### Q.21.3 Cancer Effects

Human studies are inconclusive regarding lead and an increased cancer risk. Four major human studies of workers exposed to lead have been carried out; two studies did not find an association between lead exposure and cancer, one study found an increased incidence of respiratory tract and kidney cancers, and the fourth study found excesses for lung and stomach cancers. However, all of these studies are limited in usefulness because the levels of lead to which the workers were exposed and information on smoking were not reported. In addition, exposure to other metals probably occurred (U.S. EPA, 2000a).

Animal studies have reported kidney tumors in rats and mice exposed to soluble lead salts via the oral route. No studies are available on cancer in animals exposed to lead via the inhalation or dermal routes (U.S. EPA, 2000a).

EPA has classified lead as a Group B2 - Probable Human Carcinogen. This classification was based on animal studies showing an increased risk of kidney tumors and inadequate human evidence (U.S. EPA, 2000a).

EPA has not calculated a cancer risk estimate for lead due to the number of uncertainties that are unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, EPA believes that "the current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk" (U.S. EPA, 2000a).

## Q.22 Mercury

### Q.22.1 Introduction

Elemental mercury is a shiny, silver-white, odorless liquid. Elemental mercury is released to the air by natural and industrial processes. A major route of exposure to elemental mercury is inhalation in occupational settings, such as chlorine-alkaline manufacturing facilities. Exposure may also occur from dental and medical treatments; dental amalgams may contain between 43 and 54 percent elemental liquid mercury (ATSDR, 1999d).

| Mercury | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | NA | |
| RfC | 3.0E-04 $mg/m^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.22.2 Noncancer Effects

Nervous system effects are the most sensitive toxicologic endpoint observed following exposure to elemental mercury. Symptoms associated with elemental mercury neurological toxicity include tremors, irritability, excessive shyness, nervousness, insomnia, headaches, polyneuropathy, and memory loss. At higher concentrations, kidney and respiratory effects have been observed (U.S. EPA, 1997b).

**Q.22.2.1 Reference Dose.** EPA has not calculated an RfD for elemental mercury; however, RfDs for inorganic and organic mercury are available (U.S. EPA, 2000a).

**Q.22.2.2 Reference Concentration.** EPA has calculated an RfC for elemental mercury of 3.0E-04 $mg/m^3$, based on a LOAEL (adjusted) of 0.009 $mg/m^3$, an uncertainty factor of 30, and a modifying factor of 1. A human occupational study was used as the basis for the RfC and the LOAEL (U.S. EPA, 2000a, citing Fawer et al., 1983) and several other human occupational studies were used to corroborate this LOAEL. These studies investigated neurological effects in humans exposed to elemental mercury in the workplace; hand tremors, increases in memory disturbances, and evidence of autonomic dysfunction were observed and were the basis for the LOAEL (U.S. EPA, 2000a).

An uncertainty factor of 30 was applied based on a tenfold factor for the protection of sensitive human subpopulations and an additional threefold factor for database deficiencies, particularly developmental and reproductive studies. The LOAEL of 0.025 $mg/m^3$ was adjusted to account for occupational ventilation rate ([10 $m^3$/8 h]/[20 $m^3$/24 h]) and intermittent exposure (5/7 d) to result in an adjusted LOAEL of 0.009 $mg/m^3$ (U.S. EPA, 2000a).

EPA has

- Medium confidence in the studies on which the RfC was based because there were a sufficient number of human subjects, an appropriate control group, and the exposure levels in a number of studies had to be extrapolated from blood mercury levels.

- Medium confidence in the database; although the LOAEL is corroborated by several human studies, there are a lack of human or multispecies reproductive/developmental studies and inadequate quantification of exposure levels.

EPA has assigned a ranking of medium confidence in the RfC (U.S. EPA, 2000a).

### Q.22.3 Cancer Effects

There are a number of epidemiological studies that have examined cancer mortality and morbidity among workers occupationally exposed to elemental mercury. All of these studies have limitations, including small sample sizes, probable exposure to other lung carcinogens, failure to consider confounding factors such as smoking, and failure to observe correlations between estimated exposure and cancer incidence (U.S. EPA, 1997b).

One available animal study identified cancer incidence in animals exposed to elemental mercury by injection. Tumors were found at the contact sites; however, the study was incompletely reported as to controls and statistics (U.S. EPA, 1997b).

EPA has classified elemental mercury as Group D, Not Classifiable as to Human Carcinogenicity, based on inadequate human and animal data. EPA has not calculated a unit risk estimate for elemental mercury (U.S. EPA, 2000a).

## Q.23 Inorganic Mercury (Mercuric Chloride; Divalent Mercury)

### Q.23.1 Introduction

Inorganic mercury compounds are usually white powders of crystals. Until 30 years ago, inorganic mercury compounds were used extensively as pharmaceuticals, such as components of antiseptics, diuretics, skin lightening creams, and laxatives. Since then, more effective and less harmful alternatives have replaced most pharmaceutical uses of mercury. Today, most exposure to inorganic mercury compounds occurs through dental treatments (ATSDR, 1999d).

| Inorganic Mercury | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 3.0E-04 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.23.2 Noncancer Effects

The primary effect from chronic exposure to inorganic mercury is kidney damage, primarily due to mercury-induced autoimmune glomerulonephritis (induction of an immune response to the body's kidney tissue). In addition, several animal studies have reported developmental effects from exposure to inorganic mercury (U.S. EPA, 1997b).

**Q.23.2.1 Reference Dose.** EPA has established an RfD of 3.0E-04 mg/kg-d for mercuric chloride. This was based on a consensus decision of a panel of mercury experts who used several LOAELs ranging from 0.23 to 0.63 mg/kg-d (U.S. EPA, 2000a, citing U.S. EPA, 1987), an uncertainty factor of 1,000, and a modifying factor of 1. The LOAELs were derived from several rat feeding, gavage, and subcutaneous injection studies in which autoimmune glomerulonephritis was observed (U.S. EPA, 2000a).

An uncertainty factor of 1,000 was applied based a tenfold factor for use of a LOAEL, a tenfold factor for use of subchronic studies, and an additional tenfold factor for extrapolating from animals to humans and for sensitive human subpopulations (U.S. EPA, 2000a).

The studies on which the RfD was based were not given a confidence ranking; the RfD and database were given a high confidence ranking based on the weight of evidence from several studies using Brown Norway rats and the entirety of the mercuric mercury database (U.S. EPA, 2000a).

**Q.23.2.2 Reference Concentration.** EPA has not established an RfC for inorganic mercury (U.S. EPA, 2000a).

### Q.23.3 Cancer Effects

There are no data concerning the carcinogenic effects of mercuric chloride in humans (U.S. EPA, 1997b). Limited animal data are available on the carcinogenic effects of inorganic mercury. Cancer of the forestomach and thyroid were seen in rats exposed to mercuric chloride by gavage, and evidence of cancer of the forestomach and kidneys was considered equivocal in mice (U.S. EPA, 1997b).

EPA has classified mercuric chloride as Group C - Possible Human Carcinogen, based on the absence of data in humans and limited evidence in rats and mice. EPA has not calculated a unit risk estimate for mercuric chloride (U.S. EPA, 2000a).

## Q.24 Organic Mercury (Methylmercury)

### Q.24.1 Introduction

Organic mercury compounds are white crystalline solids. The most common organic mercury compound in the environment is methylmercury. Most exposure to organic mercury occurs through the diet, with fish and fish products as the dominant source. Sources of past exposure to organic mercury include fungicide-treated grains and meat from animals fed such grain. However, fungicides containing mercury are banned in the United States today and this source of exposure is now negligible (ATSDR, 1999d).

| Methylmercury | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-04 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.24.2 Noncancer Effects

A large number of human studies are available on the systemic effects of methylmercury. This database is the result of two large-scale poisoning episodes in Japan and Iraq, as well as several epidemiologic studies investigating populations that consume large quantities of fish. Methylmercury mainly affects the central nervous system. Early symptoms from chronic exposure to low levels of methylmercury are prickling on the skin, blurred vision, and malaise. At higher doses, deafness, speech difficulties, and constriction of the visual field are seen. The fetus is at particular risk from methylmercury exposure. Offspring born to women exposed to methylmercury during pregnancy have exhibited a number of developmental abnormalities including delayed onset of walking and talking, cerebral palsy, altered muscle tone, and reduced neurological test scores (U.S. EPA, 1997b).

**Q.24.2.1 Reference Dose.** EPA has established an RfD of 1.0E-04 mg/kg-d for methylmercury, based on a benchmark dose of 0.0011 mg/kg-d, an uncertainty factor of 10, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on developmental neurologic abnormalities in infants born to mothers exposed to methylmercury in contaminated grain in Iraq (U.S. EPA, 2000a, citing Marsh et al., 1987, and Seafood Safety, 1991). EPA used a benchmark dose, the lower 95 percent confidence level for a 10 percent incidence rate of neurologic changes, based on modeling of all effects in children. This lower bound was 11 ppm methylmercury in maternal hair. A dose conversion was used to estimate a daily intake of 1.1 µg methylmercury/kg body weight/d that, when ingested by a 60-kg individual, will maintain a concentration of approximately 44 µg/L of blood or a hair concentration of 11 µg mercury/g hair (11 ppm) (U.S. EPA, 1997b, 2000a).

EPA applied an uncertainty factor of 10, based on a threefold factor for variability in the human population and an additional threefold factor for the lack of a two-generation reproductive study and lack of data for the effect of exposure duration on developmental neurotoxicity effects and on adult paresthesia (U.S. EPA, 2000a).

EPA has assigned a ranking of medium confidence in the studies on which the RfD was based, in the database, and in the RfD for methylmercury. These rankings are based on the fact that the benchmark dose approach allowed use of the entire dose-response assessment with a resulting value that is consistent with the traditional NOAEL/LOAEL approach. However, EPA has some concerns related to the applicability of a dose-response estimate based on a grain-consuming population when the actual application is likely to help characterize risk for fish-consuming segments of the population (U.S. EPA, 2000a).

It is also important to consider the fact that the RfD represents a “no-effect” level that is presumed to be without appreciable risk. As discussed above, EPA used an uncertainty factor of 10 to derive the RfD for methylmercury. An uncertainty factor of 100 to 1,000 is usually applied when the RfD is based on animal data; however, because this RfD was based on human data, an uncertainty factor of 10 was deemed appropriate. In addition, the RfD was based on a benchmark dose that itself was derived as the lower 95 percent confidence level for the 10 percent incidence rate of neurologic abnormalities in children. Therefore, there is a margin of safety between the RfD and the level corresponding to the threshold for adverse effects, as indicated by the human data.

Considerable new data on the health effects of methylmercury are becoming available. Large studies of fish- and marine-mammal-consuming populations in the Seychelles and Faroe Islands have been carried out. Smaller-scale studies also describe effects in populations around the U.S. Great Lakes. However, EPA has decided “that it is premature to make a change in the methylmercury RfD at this time” (U.S. EPA, 1997b). In November 1998, EPA and other federal agencies participated in an interagency review of available human neurodevelopmental data on methylmercury, including the most recent studies from the Seychelles and Faroe Islands. Preliminary review of the Seychellois and Faroese data supports the current RfD as scientifically valid and protective of human health. The National Academy of Sciences (NAS) is currently independently assessing EPA’s RfD for methylmercury. Pending the completion of the NAS study, EPA will reevaluate the RfD for methylmercury following careful review of the results of the NAS study.

**Q.24.2.2 Reference Concentration.** EPA has not established an RfC for methylmercury (U.S. EPA, 2000a).

### Q.24.3 Cancer Effects

Three human studies have examined the relationship between methylmercury and cancer incidence. However, these studies were considered extremely limited because of study design or incomplete data reporting (U.S. EPA, 1997b).

Several animal studies have shown an increased incidence of kidney tumors in mice exposed orally to methylmercury. However, these tumors were observed only at a single site (kidney), in a single species (mice), and in a single sex (males) (U.S. EPA, 1997b).

EPA has classified methylmercury as Group C, Possible Human Carcinogen, based on the absence of adequate data in humans and limited evidence in animals. EPA has not calculated a unit risk estimate for methylmercury (U.S. EPA, 2000a).

## Q.25 Methanol

### Q.25.1 Introduction

Methanol is used as a solvent and for the manufacture of other chemicals. It is also added to a variety of commercial and consumer products such as duplicating fluids, paint remover, windshield washing fluid and deicing solution, lacquers, and inks. Methanol is also used as an alternative motor fuel (CalEPA, 1999b).

| Methanol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 5.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.3E+01 mg/m$^3$ | U.S. EPA, 1999b |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.25.2 Noncancer Effects

Effects observed in humans following inhalation exposure to methanol from duplicating fluid include central nervous system and visual disturbances such as headaches, dizziness, nausea, and blurred vision. The effects after chronic exposure to methanol are believed to be similar but less severe than those induced by acute exposure (CalEPA, 1999b).

Exposure to a mixture of methanol and other solvents has been associated with central nervous system birth defects in humans. However, methanol is not considered a known human teratogen because exposure to other solvents occurred. Developmental effects have been reported in rats and mice exposed to methanol by inhalation (CalEPA, 1999b).

**Q.25.2.1 Reference Dose.** EPA has established an RfD for methanol of 0.5 mg/kg-d based on a NOAEL of 500 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Increased liver enzymes (SAP and SGPT) and decreased brain weight were reported in rats exposed to methanol via gavage for 90 days (U.S. EPA, 2000a, citing U.S. EPA, 1986). An uncertainty factor of 1,000 was applied, based on a tenfold factor for interspecies extrapolation, a tenfold factor to protect sensitive individuals, and a tenfold factor to account for extrapolating from subchronic to chronic exposure (U.S. EPA, 2000a).

EPA has

- Medium confidence in the principal study because it was well-designed and provided adequate toxicological endpoints, but the method of administration was not ideal.

- Low confidence in the database because the overall database is weak, lacking data on reproductive, developmental, or other toxicological endpoints,

- Medium confidence in the RfD results because of the strengths of the principal study (U.S. EPA, 2000a).

**Q.25.2.2 <u>Reference Concentration</u>.** EPA derived a provisional RfC for methanol of 13 $mg/m^3$ based on a NOAEL of 1,310 $mg/m^3$ for developmental effects in mice, an uncertainty factor of 100, and a modifying factor of 10 (U.S. EPA, 1999b). Groups of pregnant mice were exposed to 1,000, 2,000, 5,000, 7,500, 10,000, or 15,000 ppm methanol (1,310, 2,620, 6,552, 9,828, 13,104, or 19,656 $mg/m^3$) via inhalation for 7 h/d on days 6 through 15 of gestation (U.S. EPA, 1999b, citing Rogers et al., 1993). Three groups of controls were used. Implantation sites, live and dead fetuses, and resorptions were counted, and fetuses were examined externally and weighed as a litter. Half of each litter were examined for skeletal morphology and the other half of each litter were examined for internal soft tissue anomalies. Developmental malformations (increased cervical ribs, exencephaly, and cleft palate) were reported (U.S. EPA, 1999b, citing Rogers et al., 1993). Significant increases in the incidence of exencephaly and cleft palate were observed at 6,552 $mg/m^3$ and above, increased embryo/fetal death at 9,828 $mg/m^3$ and above (including an increasing incidence of full-litter resorptions), and reduced fetal weight at 13,104 $mg/m^3$ and above. A dose-related increase in cervical ribs (small ossification sites lateral to the seventh cervical vertebra) was significant at 2,620 $mg/m^3$ and above. A NOAEL of 1,310 $mg/m^3$ for developmental toxicity in mice was identified in this study.

To account for species-specific differences in inhalation dosimetry, the NOAEL was converted to a human equivalent concentration NOAEL ($NOAEL_{HEC}$) based on extrarespiratory effects by a category 3 gas, resulting in a $NOAEL_{HEC}$ of 1,310 $mg/m^3$. An uncertainty factor of 100 was applied, based on a tenfold factor to account for extrapolating from animals to humans and a tenfold factor for protection of sensitive human subpopulations (U.S. EPA, 1999b).

The major strengths of the critical study are the identification of a NOAEL and the demonstration of a dose-response relationship. The study was well performed, large numbers of animals were used, and effects at six exposure concentrations were examined. The results are also supported by an additional developmental study. The major uncertainties of the RfC are the lack of human data for chronic inhalation exposure and the lack of comprehensive, long-term muliple dose studies (U.S. EPA, 1999b).

### Q.25.3 Cancer Effects

EPA has not classified methanol for carcinogenicity (U.S. EPA, 2000a).

## Q.26 Methyl Ethyl Ketone

### Q.26.1 Introduction

Methyl ethyl ketone is used as a solvent in processes involving gums, resins, cellulose acetate, and cellulose nitrate. It is also used in the synthetic rubber industry, in the production of paraffin wax, and in household products such as lacquer and varnishes, paint remover, and glues (U.S. EPA, 1989b).

| Methyl Ethyl Ketone | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 6.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E+00 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.26.2 Noncancer Effects

Acute exposure of humans to high concentrations of methyl ethyl ketone produces irritation of the eyes, nose, and throat. Other effects reported from acute inhalation exposure include central nervous system depression, headaches, and nausea. Limited information is available on the chronic effects of methyl ethyl ketone in humans. One study reported nerve damage in individuals who sniffed a glue thinner containing methyl ethyl ketone and other chemicals. Slight neurological, liver, kidney, and respiratory effects have been reported in chronic inhalation studies of methyl ethyl ketone in animals (U.S. EPA, 1989b).

**Q.26.2.1 Reference Dose.** The RfD for methyl ethyl ketone is 6.0E-01 mg/kg-d based on a NOAEL of 1,771 mg/kg-d, an uncertainty factor of 3,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a multigeneration/developmental rat study in which 2-butanol (a metabolite of methyl ethyl ketone) was given in drinking water at 0, 0.3. 1.0, or 3.0 percent solutions (U.S. EPA, 2000a, citing Cox et al., 1975). The average daily intake of 2-butanol for males was 0, 538, 1,644, and 5,089 mg/kg-d, and for females it was 0, 594, 1,771, and 4,571 mg/kg-d for the 0, 0.3 1.0, or 3.0 percent solutions, respectively. After 9 weeks of exposure, parental matings were made with one male and one female from each of the treatment groups. Significant effects were noted in the litters from the 3.0 percent dose group vs. the control group, including the number of pups/litter born alive and the mean body weight/pup. The treatment of all high-dose parents and offspring was reduced to 2.0 percent for the remainder of the experimental protocol; this was equivalent to 3,384 mg/kg-d in males and 3,122 mg/kg-d in females. The F1 generation was mated, and the F1B litters receiving 2.0 percent 2-butanol showed a slight reduction in average fetal weight compared with controls. At the 2.0 percent level of the F2 generation, there were a number of histopathologic changes in the kidneys of the male rats only. A LOAEL of 3,122 mg/kg-d (2.0 percent solution) and a NOAEL of 1,771 mg/kg-d (1.0 percent solution) were identified (U.S. EPA, 2000a).

An uncertainty factor of 3,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, a tenfold factor for extrapolation from subchronic to chronic exposure, and a tenfold factor for the incompleteness of the database. EPA has stated that "as is usual practice, the application of four full areas of uncertainty generally results in a total uncertainty factor of 3,000, given the interrelationship among and overlap between the various areas of uncertainty described above" (U.S. EPA, 2000a).

EPA has low confidence in the study on which the RfD was based because, although the critical effect was corroborated by inhalation data and the study employed an adequate number of animals and examined appropriate endpoints, lowering the high-dose group from 3.0 to 2.0 percent confounded determination of the critical effect, and low confidence in the supporting database because the critical study was based on a compound that is nearly completely converted to methyl ethyl ketone in a short period of time. This compound exhibits similar developmental effects as seen by inhalation exposure to methyl ethyl ketone. However, the lack of oral data for methyl ethyl ketone itself and the absence of data in a second species precludes any higher level for database confidence. Therefore, EPA has assigned a ranking of low confidence in the RfD (U.S. EPA, 2000a).

**Q.26.2.2 <u>Reference Concentration</u>.** The RfC for methyl ethyl ketone is 1.0 mg/m$^3$ based on a NOAEL of 2,978 mg/m$^3$, an uncertainty factor of 1,000, and a modifying factor of 3 (U.S. EPA, 2000a). The RfC was based on a study in which pregnant mice were exposed to 0, 398, 1,010, or 3,020 ppm methyl ethyl ketone (0, 1,174, 2,978, or 8,906 mg/m$^3$, respectively) 7 h/d during gestational days 6 to 15 (U.S. EPA, 2000a, citing Schwetz et al., 1991, and Mast et al., 1989). Neither maternal nor developmental toxicity was observed at exposures at or less than 1,010 ppm (2,978 mg/m$^3$). At 3,020 (8,906 mg/m$^3$), mild developmental effects (decreased fetal body weight and misaligned sternebrae) were observed. Based on the absence of both maternal and developmental effects, a NOAEL of 1,010 ppm (2,978 mg/m$^3$) was established. The NOAEL was not adjusted for exposure duration, since this was a developmental study. To account for species-specific differences in inhalation dosimetry, the NOAEL$_{HEC}$ was calculated based on extrarespiratory effects for a gas and assuming periodicity was attained. A default value of 1 was used for the blood gas partition coefficient ratio, resulting in a NOAEL$_{HEC}$ of 2,978 mg/m$^3$.

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a tenfold factor for an incomplete database including a lack of chronic and reproductive toxicity studies. A modifying factor of 3 was used to address the lack of unequivocal data for respiratory tract (portal-of-entry) effects (U.S. EPA, 2000a).

EPA has assigned a ranking of low confidence in the RfC for methyl ethyl ketone based on

- Medium confidence in the principal study because it and other developmental studies were well designed and tested several exposure concentrations and several endpoints of toxicity,

- Low confidence in the database because there are no multigenerational studies and only one subchronic study and these studies do not adequately address portal-of-entry effects (U.S. EPA, 2000a).

### Q.26.3 Cancer Effects

No information is available on the carcinogenicity of methyl ethyl ketone in humans. No studies are available on the carcinogenicity of methyl ethyl ketone by the oral or inhalation routes in animals. In a dermal carcinogenicity study, skin tumors were not reported from methyl ethyl ketone exposure twice a week for a year (U.S. EPA, 1989b, 2000a).

EPA has classified methyl ethyl ketone as a Group D, Not Classifiable as to Human Carcinogenicity (U.S. EPA, 2000a). EPA has not calculated an oral CSF or an inhalation unit risk estimate for methyl ethyl ketone.

## Q.27 Methyl Isobutyl Ketone

### Q.27.1 Introduction

Methyl isobutyl ketone is used as a solvent for gums, resins, paints, varnishes, lacquers, and nitrocellulose, as an alcohol denaturant, in the extraction of rare metals, and as a synthetic flavoring adjuvant (U.S. EPA, 1987).

| Methyl Isobutyl Ketone | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 8.0E-02 mg/kg-d | U.S. EPA, 1997a |
| RfC | 8.0E-02 $mg/m^3$ | U.S. EPA, 1997a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.27.2 Noncancer Effects

Acute exposure to methyl isobutyl ketone may irritate the eyes and mucous membranes and cause weakness, headache, nausea, lightheadedness, vomiting, dizziness, incoordination, and narcosis in humans. Chronic occupational exposure to methyl isobutyl ketone has been observed to cause nausea, headache, burning in the eyes, weakness, insomnia, intestinal pain, and slight enlargement of the liver in humans. Lethargy and increased kidney and liver weights have been observed in rats chronically exposed by ingestion and inhalation. Maternal toxicity and neurological effects and increased liver and kidney weights in fetuses were observed in rats and mice exposed to methyl isobutyl ketone by inhalation (U.S. EPA, 1987).

**Q.27.2.1 Reference Dose.** The provisional RfD for methyl isobutyl ketone is 8.0E-02 mg/kg-d based on a NOAEL of 250 mg/kg-d, an uncertainty factor of 3,000, and a modifying factor of 1 (U.S. EPA, 1997a). The RfD was based on a 13-week gavage study in rats in which increased relative liver and kidney weights were observed (U.S. EPA, 1997a, citing Microbiological Associates, 1986).

**Q.27.2.2 Reference Concentration.** The provisional RfC for methyl isobutyl ketone is 8.0E-02 $mg/m^3$ based on a NOAEL of 50 ppm, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 1997a). The RfC was based on a 90-day inhalation study in rats in which increased liver and kidney weights were noted (U.S. EPA, 1997a, citing Union Carbide Corp., 1983).

### Q.27.3 Cancer Effects

No information is available on the carcinogenicity of methyl isobutyl ketone in humans or animals. EPA has classified methyl isobutyl ketone as Group D, not classifiable as to human carcinogenicity (U.S. EPA, 1987). EPA has not calculated an oral CSF or an inhalation unit risk estimate for methyl isobutyl ketone (U.S. EPA, 1987, 2000a).

## Q.28 Methyl Methacrylate

### Q.28.1 Introduction

Methyl methacrylate is a colorless, flammable liquid with a strong acrid odor. It is primarily used in the manufacture of methacrylate resins and plastics; uses of these resins and plastics include acrylic sheets and moldings, extrusion powders, surface coating resins, lacquers, and emulsion polymers. It is also used in lighting fixtures, glazing and skylights, building panels and sidings, and plumbing and bathroom fixtures (U.S. EPA, 1998e).

| Methyl Methacrylate | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.4E+00 mg/kg-d | U.S. EPA, 2000a |
| RfC | 7.0E-01 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

## Q.28.2 Noncancer Effects

Methyl methacrylate is irritating to the skin, eyes, and mucous membranes in humans. Respiratory effects in humans include chest tightness, dyspnea, coughing, wheezing, and reduced peak expiratory flow. Neurological symptoms, including headache, lethargy, lightheadedness, and sensation of heaviness in arms and legs have occurred in humans following acute exposure to methyl methacrylate (U.S. EPA, 1998e).

In chronically exposed workers, respiratory and nasal symptoms and reduced lung function were reported. Cases of contact dermatitis have also been reported. In one study, occupational exposure to high doses of methyl methacrylate was associated with cardiovascular disorders. Chronic inhalation of methyl methacrylate in rats has resulted in respiratory effects, including lung congestion and inflammation of the nasal cavity (U.S. EPA, 1998e).

**Q.28.2.1 <u>Reference Dose</u>.** The RfD for methyl methacrylate is 1.4 mg/kg-d based on a NOAEL of 136 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which groups of 25 male and 25 female rats were exposed to methyl methacrylate in drinking water for 104 weeks (U.S. EPA, 1998e, 2000a, citing Borzelleca et al., 1964). The initial exposure concentrations were 6, 60, and 2,000 ppm methyl methacrylate. The low and medium concentrations were increased to 7 and 70 ppm, respectively, at the start of the fifth month, resulting in time-weighted average (TWA) concentrations of 6.85 and 68.46 ppm. Hematological parameters were normal. No abnormalities or lesions related to methyl methacrylate were reported at any dose level. The only effect observed was an increased kidney/body weight ratio in female rats exposed to 2,000 ppm, but the increase was only marginally significant and was not associated with any histopathological findings. The highest exposure level, 2,000 ppm (136 mg/kg-d), was considered a NOAEL for this study (U.S. EPA, 1998e, 2000a). A NOAEL was calculated as follows:

$$136 \text{ mg/kd-d} = 2{,}000 \text{ mg/L} \times 0.0313 \text{ L/day} \div 0.462 \text{ kg}$$

An uncertainty factor of 100 was applied based on a threefold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a threefold factor for database deficiencies (U.S. EPA, 1998e, 2000a).

EPA has

- Low to medium confidence in the study on which the RfD was based because, although the study is well documented, it does not appear to be conducted in accordance with what would now be considered Good Laboratory Practice and did not identify a LOAEL,

- Low to medium confidence in the supporting database because relevant, quantitative human subchronic or chronic studies are not available.

Although repeat exposure inhalation studies, including developmental, reproductive, and chronic studies, bolster the weak and dated oral database, no developmental or reproductive studies are available by the oral route, and no multigenerational studies are available by any route of exposure. EPA has assigned a ranking of low to medium confidence in the RfD for methyl methacrylate (U.S. EPA, 1998e, 2000a).

**Q.28.2.2 Reference Concentration.** The RfC for methyl methacrylate is 7.0E-01 mg/m$^3$ based on a benchmark concentration of 35 ppm (143 mg/m$^3$), an uncertainty factor of 10, and a modifying factor of 1 (U.S. EPA, 2000a). The RfC was based on a study in which 70 male and 70 female rats were exposed to mean concentrations of 0, 25, 99.79, or 396.07 ppm (0, 102.4, 408.6, 1,621.7 mg/m$^3$) for 6 h/d, 5 d/wk (duration adjusted to 0, 18.3, 73, 289.6 mg/m$^3$) for 2 years (U.S. EPA, 1998e, 2000a, citing Hazelton Laboratories, 1979a). No consistent trend with exposure was revealed, but microscopic examination of nasal tissues revealed minimal to slight focal rhinitis in 4 out of 10 females exposed to 396.07 ppm, and an inflammatory exudate was observed in 3 of 4 females. At 52 weeks, livers of 9 out of 10 males and 6 out of 10 females exposed to 396.07 ppm showed minimal nonsuppurative pericholangitis. An increased incidence in lesions of mild rhinitis was observed in the nasal turbinates of exposed animals at week 104.

A reexamination of the nasal tissue block and a rereview of the histopathology of the rat nasal tissues from this study was carried out (U.S. EPA, 1998e, 2000a, citing Lomax, 1992, and Lomax et al., 1997). A polynomial mean response regression model and a Weibull power mean response regression model were used to fit incidence data for observed olfactory lesions in male and female rats from the Lomax and Lomax et al. studies. Data for degeneration/ atrophy of olfactory epithelium in males were used for the derivation of the RfC. A benchmark concentration ($BMC_{10}$), the lower 95 percent confidence bound on the maximum likelihood estimate of the concentration that causes a 10 percent increased incidence of olefactory lesions, was calculated at 35 ppm (143 mg/m$^3$). This value was adjusted for intermittent exposure, resulting in a value of 25.6 mg/m$^3$ as follows: 25.6 mg/m$^3$ = 143 mg/m$^3$ x 6/24 h x 5/7 d. To account for species-specific differences in inhalation dosimetry, a human equivalent $BMC_{10}$ of 7.2 mg/m$^3$ was calculated by applying a regional gas dose ratio (RGDR) of 0.28 (based on ventilation rates and surface areas of extrathoracic region of rats and humans) for gas:respiratory effects in the extrathoracic region as follows: 7.2 mg/m$^3$ = 25.6 mg/m$^3$ x 0.28 (U.S. EPA, 1998e, 2000a).

An uncertainty factor of 10 was applied based on a threefold factor for extrapolation from animals to humans and a threefold factor to protect sensitive individuals (U.S. EPA, 1998e, 2000a).

EPA has assigned a ranking of medium to high confidence in the RfC for methyl methacrylate based on

- High confidence in the principal study on which the RfC was based because it was a long-term study performed with relatively large numbers of animals and in which thorough histopathological analyses were performed on all relevant tissues and a NOAEL and a LOAEL were identified,

- Medium to high confidence in the database because acceptable developmental studies were carried out in two species, rats and mice, with effects only observed in offspring at levels more than tenfold higher than the LOAEL for the chosen critical effect.

Multigenerational reproductive studies are not available for methyl methacrylate. However, protection against portal-of-entry effects observed at low exposure levels across both the oral and inhalation routes of exposure is deemed likely to protect against any possible multigenerational reproductive effects (U.S. EPA, 1998e, 2000a).

### Q.28.3 Cancer Effects

From a retrospective epidemiology study, a causal relationship between occupational exposure to methyl methacrylate and increased incidences of colon and rectal cancers has been suggested; however, the causal relationship could not be established when relative accumulated total exposures and latency were considered. A high background rate was also documented for the location and time of the study. No carcinogenic effects were observed in four well-conducted chronic inhalation studies in three appropriate animal species, and no carcinogenic effects were seen in a chronic animal oral study (U.S. EPA, 1998e, 2000a).

EPA has classified methyl methacrylate as Group E, Evidence of Noncarcinogenicity to Humans. Under the *Proposed Guidelines for Carcinogenic Risk Assessment* (U.S. EPA, 1996b), methyl methacrylate is considered not likely to be carcinogenic to humans by any route of exposure (U.S. EPA, 1998e, 2000a). EPA has not calculated an oral CSF or an inhalation unit risk estimate for methyl methacrylate.

## Q.29 Nickel

### Q.29.1 Introduction

Nickel is a silvery-white metal that is usually found in nature as a component of silicate, sulfide, or arsenide ores. The predominant forms of nickel in the atmosphere are nickel sulfate, nickel oxides, metallic nickel, and the complex oxides of nickel. Each form of nickel exhibits different physical properties. Most nickel is used to make stainless steel; other uses include the manufacture of batteries, electroplating baths, textile dyes, coins, sparkplugs, and machinery parts (ATSDR, 1997d).

| Nickel | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 8.0E-05 mg/m$^3$ (salt)<br>1.5E-04 mg/m$^3$ (oxide) | Developed |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.29.2 Noncancer Effects

Contact dermatitis is the most common effect in humans from exposure to nickel via inhalation, oral, or dermal exposure. Cases of nickel-contact dermatitis have been reported following occupational and nonoccupational exposure, with symptoms of itching of the fingers, wrists, and forearms. Chronic inhalation exposure to nickel in humans also results in respiratory effects. These effects include direct respiratory effects such as asthma due to primary irritation or an allergic response and an increased risk of chronic respiratory tract infections (ATSDR, 1997d).

Animal studies have reported effects on the lungs, kidneys, and immune system from inhalation exposure to nickel and effects on the respiratory and gastrointestinal systems, heart, blood, liver, kidney, and decreased body weight from oral exposure to nickel. Fetotoxicity has been reported in animals orally exposed to nickel (soluble salts). Dermal animal studies have reported effects on the skin (ATSDR, 1997d).

Significant differences in inhalation toxicity among the various forms of nickel have been documented; different mechanisms of action between soluble and insoluble nickel compounds and different dose-response levels have been reported. Soluble nickel compounds are more toxic to the respiratory tract than less soluble compounds (e.g., nickel oxide) (ATSDR, 1997d; CalEPA, 1999b).

**Q.29.2.1 Reference Dose.** EPA has established an RfD for nickel (soluble salts) of 2.0E-02 mg/kg-d, based on a NOAEL of 5 mg/kg-d, an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on a study in rats (U.S. EPA, 2000a, citing Ambrose et al., 1976) that showed decreased body and organ weights from chronic (2-year) exposure to nickel in the diet. Several other studies showed similar results, with decreased body and organ weights after exposure to nickel chloride via gavage and through the drinking water (U.S. EPA, 2000a).

An uncertainty factor of 300 was applied, based on a tenfold factor for interspecies extrapolation, a tenfold factor to protect sensitive subpopulations, and a threefold factor for inadequacies in the reproductive studies (U.S. EPA, 2000a).

EPA has

- Low confidence in the study on which the RfD was based because, although it was properly designed and provided adequate toxicological endpoints, high mortality occurred in the controls.

- Medium confidence in the database because it provided adequate supporting subchronic studies.

EPA assigned a ranking of medium confidence level in the RfD (U.S. EPA, 2000a).

**Q.29.2.2 Reference Concentration.** EPA has not established an RfC for any nickel compound (U.S. EPA, 2000a).

Substantive differences in toxicity warrant the derivation of separate RfCs for soluble nickel salts and nickel oxide. A provisional chronic RfC for nickel soluble salts of 8.0E-05 mg/m$^3$ is based on a NOAEL of 0.03 mg/m$^3$ for respiratory effects in rats (NTP, 1996b) and an uncertainty factor of 30. Groups of male and female rats were exposed via inhalation to 0, 0.03, 0.06, or 0.11 mg Ni/m$^3$ as nickel sulfate hexahydrate for 6 h/d, 5 d/wk for 104 weeks. The incidences of inflammatory lesions in the lung, chronic active inflammation, macrophage hyperplasia, alveolar proteinosis, and fibrosis were markedly increased in rats exposed to 0.06 or 0.11 mg Ni/m$^3$. Increased incidences of bronchial lymph node hyperplasia and olfactory epithelial atrophy were observed in male and female rats exposed to 0.11 mg Ni/m$^3$ (NTP, 1996b). A NOAEL of 0.03 mg/m$^3$ was identified.

The NOAEL was adjusted for intermittent exposure (6 h/d, 5 d/wk), resulting in a $NOAEL_{ADJ}$ of 0.0054 mg/m$^3$. To account for species-specific differences in inhalation dosimetry, a $NOAEL_{HEC}$ of 0.0024 mg/m$^3$ was calculated based on an RDDR of 0.445 (MMAD = 2.5, sigma g = 2.4, male F344 rat default body weight = 380 g). An uncertainty factor of 30 was applied based on a tenfold factor to account for human variability and a threefold factor to account for extrapolation from animals to humans.

A provisional chronic RfC for nickel oxide of 1.5E-04 mg/m$^3$ is based on a LOAEL of 0.5 mg/m$^3$ for respiratory effects in rats (NTP, 1996c) and an uncertainty factor of 300. Groups of male and female rats were exposed via inhalation to 0, 0.5, 1.0, or 2.0 mg Ni/m$^3$ as nickel oxide for 6 h/d, 5 d/wk for 104 weeks. Atypical alveolar hyperplasia and chronic inflammation of the lungs were observed in all exposed groups. The incidence of inflammatory pigmentation in the alveoli was significantly greater in all exposed groups compared to controls. The severity of the lesions increased with increasing exposure. Lymphoid hyperplasia in the bronchial lymph nodes was observed and the incidence generally increased with increasing concentration at the end of the 2-year study. Females had an increased incidence of adrenal medullary hyperplasia at the highest concentration of nickel oxide (NTP, 1996c). A LOAEL of 0.5 mg/m$^3$ was identified.

The LOAEL was adjusted for intermittent exposure (6 h/d, 5 d/wk), resulting in a $LOAEL_{ADJ}$ of 0.0895 mg/m$^3$. To account for species-specific differences in inhalation dosimetry, a $LOAEL_{HEC}$ of 0.0438 mg/m$^3$ was calculated based on an RDDR of 0.489 (MMAD = 2.21, sigma g = 1.97, male F344 rat default body weight = 380 g). An uncertainty factor of 300 was applied based on a tenfold factor for use of a LOAEL, a threefold factor to account for interspecies extrapolation, and a tenfold factor to account for human variability.

### Q.29.3 Cancer Effects

No significant increases in tumor incidences were observed in male or female rats or mice chronically exposed to nickel sulfate hexahydrate (a soluble nickel salt) via inhalation in a study by the NTP; NTP concluded that there was no evidence of carcinogenic activity in rats or mice (NTP, 1996b).

In a chronic inhalation study, NTP concluded that there was some evidence of carcinogenic activity of nickel oxide in male and female rats based on increased incidences of alveolar/ bronchiolar adenoma or carcinoma (combined) and increased incidences of benign or malignant pheochromocytoma of the adrenal medulla, no evidence in male mice, and equivocal evidence in female mice based on marginally increased incidences of alveolar/bronchiolar adenoma or carcinoma (NTP, 1996c).

Neither nickel soluble salts nor nickel oxide has been classified for carcinogenicity by EPA. EPA has not calculated a unit risk estimate for nickel soluble salts or nickel oxide (U.S. EPA, 2000a).

Nickel refinery dust and nickel subsulfide (a primary component of refinery dust) have been classified as Class A, known human carcinogens, based on increased risk of lung and nasal cancer in humans and increased lung tumor incidences in animals (U.S. EPA, 2000a). However, nickel refinery dust and nickel subsulfide are not anticipated to be in paint waste streams and will not be used as surrogates for nickel soluble salts or nickel oxide.

## Q.30 Pentachlorophenol

### Q.30.1 Introduction

Pentachlorophenol was once one of the most widely used biocides in the United States. It was registered by EPA as an insecticide, fungicide, herbicide, molluscicide, algicide, disinfectant, and as an ingredient in antifouling paint but is now a restricted-use pesticide. The principal use of pentachlorophenol is as a wood preservative. The treatment of wood for utility poles represents 80 percent of the U.S. consumption of pentachlorophenol (ATSDR, 1999g).

| Pentachlorophenol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 3.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E-01 $mg/m^3$ | CalEPA, 1997 |
| oral CSF | 1.2E-01 $(mg/kg\text{-}d)^{-1}$ | U.S. EPA, 2000a |
| inh URF | 5.1E-06 $(\mu g/m^3)^{-1}$ | CalEPA, 1999a |
| inh CSF | 1.8E-02 $(mg/kg\text{-}d)^{-1}$ | Calculated |

## Q.30.2 Noncancer Effects

Target organs and systems for the toxic effects of pentachlorophenol in humans are the liver, immune system, and central nervous system. Acute inhalation exposure to pentachlorophenol in humans may result in effects on the cardiovascular system, blood, liver, and eyes. Chronic exposure in humans has resulted in inflammation of the upper respiratory tract and bronchitis, effects on the blood (including aplastic anemia, pure red blood cell aplasia, and hemolytic anemia), effects on the kidney and liver, immunological effects, and irritation of the eyes, nose, and skin. One study reported that unexplained infertility or menstrual disorders in women were related to elevated blood levels of pentachlorophenol and/or lindane. However, a direct causal relationship with pentachlorophenol exposure cannot be established from this study due to possible confounding factors. Neurological effects reported following exposure of humans to high levels of pentachlorophenol include lethargy, tachypnea, tachycardia, delirium, and convulsions (ATSDR, 1999g).

Liver, kidney, immune system, central nervous system, hematologic, endocrine, reproductive, and developmental effects have been reported in animals chronically exposed to pentachlorophenol (ATSDR, 1999g).

**Q.30.2.1 <u>Reference Dose</u>.** The RfD for pentachlorophenol is 3.0E-02 mg/kg-d based on a NOAEL of 3 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which 25 male and 25 female rats were administered 0, 3, 10, or 30 mg/kg-d pentachlorophenol in the diet (U.S. EPA, 2000a, citing Schwetz et al., 1978). At the 30 mg/kg-d dose, a reduced rate of body weight gain and increased specific gravity of the urine were observed in females. Pigmentation of the liver and kidneys was observed in females exposed to 10 mg/kg-d or higher and in males exposed to 30 mg/kg-d. The NOAEL was determined to be 3 mg/kg-d. An uncertainty factor of 100 was applied based on a tenfold factor for extrapolation from animals to humans and a tenfold factor to protect sensitive individuals (U.S. EPA, 2000a).

EPA has assigned a ranking of medium confidence in the RfD for pentachlorophenol based on

- High confidence in the study on which the RfD was based because a moderate number of animals/sex were used in each of three doses, a comprehensive analysis of parameters was conducted, and a reproductive study was also performed

- Medium confidence in the database because only one chronic study is available and other subchronic studies provide adequate but weaker supporting data (U.S. EPA, 2000a).

**Q.30.2.2 Reference Concentration.** EPA has not established an RfC for pentachlorophenol. However, CalEPA (1997) derived a draft chronic inhalation reference exposure level of 1.0E-01 mg/m$^3$ for pentachlorophenol based on the same study, NOAEL, and uncertainty factors that were used to calculate the RfD (U.S. EPA, 2000a, citing Schwetz et al., 1978). A route-to-route extrapolation of the RfD (0.03 mg/kg-d) was performed, resulting in an RfC of 1.0E-01 mg/m$^3$, by assuming a daily respiration rate of 20 m$^3$ of air and an average body weight of 70 kg (CalEPA, 1997).

### Q.30.3 Cancer Effects

There is some evidence from epidemiological studies that pentachlorophenol may cause cancer in humans. Case reports suggest a possible association between cancer (Hodgkins's disease, soft tissue sarcoma, and acute leukemia) and occupational exposure to technical-grade pentachlorophenol; however, concurrent exposure to other toxic substances may have contributed to the reported carcinogenic effects (ATSDR, 1999g).

Two studies were performed by the National Toxicology Program (NTP). Technical pentachlorophenol in the diet produced an increase in hepatocellular adenomas/carcinomas, benign and malignant pheochromocytomas of the adrenal medulla, and hemangiomas/ hemangiosarcomas in mice (ATSDR, 1999g, citing NTP, 1989). Pure pentachlorophenol in the diet produced elevated incidences of malignant mesotheliomas and nasal squamous cell carcinomas in male rats (ATSDR, 1999g, citing NTP, 1997).

EPA has classified pentachlorophenol as a Group B2, Probable Human Carcinogen based on statistically significant increases in the incidence of multiple biologically significant tumor types (hepatocellular adenomas and carcinomas, adrenal medulla pheochromocytomas and malignant pheochromocytomas, and/or hemangiosarcomas and hemangiomas) in one or both sexes of mice (U.S. EPA, 2000a).

**Q.30.3.1 Oral Cancer Risk.** EPA used the linearized multistage model based on data from a study of mice exposed to pentachlorophenol in the diet (U.S. EPA, 2000a, citing NTP, 1989) to estimate the oral cancer slope factor. Hepatocellular and hemangiosarcoma tumor incidences in female mice were pooled. EPA calculated an oral unit risk estimate of 3.0E-06 (µg/L)$^{-1}$ and an oral CSF of 1.2E-01 (mg/kg-d)$^{-1}$ for pentachlorophenol (U.S. EPA, 2000a).

EPA has confidence in the risk estimate because similar slope factors can be derived from the incidence of hemangiosarcomas alone (0.05) or from the pooled incidence of liver tumors and pheochromocytomas in male mice (0.5). The carcinogenicity assessment is based on results in a single animal species (U.S. EPA, 2000a).

**Q.30.3.2 __Inhalation Cancer Risk__.** EPA has not calculated an inhalation unit risk estimate for pentachlorophenol (U.S. EPA, 2000a). However, CalEPA used the linearized multistage model based on liver tumor data in male mice exposed to pentachlorophenol in the diet (CalEPA, 1999a, citing NTP, 1989) to estimate an inhalation unit risk estimate of 5.1E-06 $(\mu g/m^3)^{-1}$. An inhalation CSF of 1.8E-02 $(mg/kg/d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 5.1E{-}6\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1{,}000\ \mu g/mg = 1.8E{-}2\ (mg/kg{-}d)^{-1}$$

## Q.31 Phenol

### Q.31.1 Introduction

The major uses of phenol are for the production of bisphenol-A (used as an intermediate for epoxy resins) and phenolic resins. Phenol is also used as a slimicide and as a general disinfectant. It is also used in medicinal preparations. Human exposure to phenol is widespread because it is contained in many medicinal consumer products including mouthwashes, gargles, toothache drops, throat lozenges, analgesic rubs, antisepic lotions, and ointments. Phenol is released to the air and water as a result of its manufacture and use and as a result of wood burning and auto exhaust (ATSDR, 1998c).

| Phenol | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 6.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.31.2 Noncancer Effects

Effects in humans attributed to chronic phenol exposure include anorexia, progressive weight loss, diarrhea, headache, vertigo, salivation, and a dark coloration of the urine. Gastrointestinal irritation (mouth sores, nausea, and diarrhea) were reported in humans exposed to drinking water contaminated with phenol. Methemoglobinemia and hemolytic anemia, as well as liver damage, have also been reported in humans. Direct skin contact with phenol results in irritation and necrosis (ATSDR, 1998c).

Exposure of animals to high doses of phenol results in neurological effects including muscle tremors and loss of coordination. Other effects reported in orally exposed animals include decreased blood cell counts, decreased body weight gain, and kidney effects (ATSDR, 1998c).

**Q.31.2.1** **Reference Dose.** EPA has established an RfD for phenol of 6.0E-01 mg/kg-d based on a NOAEL of 60 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD is based on reduced fetal body weight in rats. Phenol was administered to timed-pregnant rats via gavage on gestation days 6 to 15. No dose-related signs of maternal toxicity were reported (U.S. EPA, 2000a, citing NTP, 1983). EPA applied an uncertainty factor of 100, based on a tenfold factor for interspecies extrapolation and a tenfold factor to protect sensitive human populations (U.S. EPA, 2000a).

EPA has

- Low confidence in the study on which the RfD was based because of the gavage nature of the dose administration.

- Medium confidence in the database because it contains several supporting studies (subchronic, chronic, and reproductive/developmental). Therefore, EPA assigned a ranking of low-to-medium confidence in the RfD (U.S. EPA, 2000a).

**Q.31.2.2** **Reference Concentration.** EPA has not established an RfC for phenol (U.S. EPA, 2000a).

### Q.31.3 Cancer Effects

Small nonsignificant excesses in certain types of cancers were reported in two studies of occupationally exposed workers; however, these effects were not clearly related to phenol exposure (ATSDR, 1998c). No dose-related increases in tumor incidences were reported in one study of rats or mice exposed to phenol in drinking water for 103 weeks (U.S. EPA, 2000a).

EPA has classified phenol as Group D - Not Classifiable as to Carcinogenicity in Humans because of no human data and inadequate animal data. EPA has not calculated a unit risk estimate for phenol (U.S. EPA, 2000a).

## Q.32 Selenium

### Q.32.1 Introduction

Selenium is a naturally occurring substance in the earth’s crust and is commonly found in sedimentary rock combined with other substances, such as sulfide minerals, or with silver, copper, lead, and nickel minerals. Selenium is an essential element for humans and animals and exposure occurs daily through food intake. It is used in the electronics industry; the glass industry; in pigments used in plastics, paints, enamels, inks, and rubber; in pharmaceuticals manufacturing; and as a constituent of fungicides (ATSDR, 1996).

| Selenium | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 5.0E-03 mg/kg-d | U.S. EPA, 2000a |
| RfC | 2.0E-02 $mg/m^3$ | CalEPA, 1999b |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.32.2 Noncancer Effects

No information is available on the chronic effects of selenium in humans from inhalation exposure. Acute inhalation of high concentrations of selenium has resulted in respiratory effects in occupationally exposed workers. Ingestion of high levels of selenium in food and water has led to “selenosis,” which is characterized by discoloration of the skin, deformation and loss of nails, hair loss, excessive tooth decay and discoloration, lack of mental alertness, and listlessness. Dermal exposure has resulted in skin rashes and contact dermatitis (ATSDR, 1996).

No data are available on the chronic effects in animals from inhalation exposure. Livestock exposed through consumption of high levels of selenium develop "alkali disease." (ATSDR, 1996).

**Q.32.2.1** **Reference Dose.** EPA has established an RfD for selenium of 5.0E-03 mg/kg-d based on a NOAEL of 0.015 mg/kg-d, an uncertainty factor of 3, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD is based on an epidemiological study (U.S. EPA, 2000a, citing Yang et al., 1989b), which reported selenosis in a population in China. Clinical signs observed included “garlic odor” of the breath and urine, thickened and brittle nails, hair and nail loss, lowered hemoglobin levels, mottled teeth, skin lesions, and central nervous system abnormalities (U.S. EPA, 2000a).

EPA applied an uncertainty factor of 3 to account for sensitive individuals. A full factor of 10 was not deemed necessary because similar NOAELs were identified in two moderate-sized populations exposed to selenium in excess of the recommended daily allowance without apparent signs of selenosis (U.S. EPA, 2000a).

EPA has medium confidence in the study on which the RfD was based, because, although it was a study in which a sizable population with sensitive subpopulations was studied, there were still several possible interactions that were not fully accounted for. EPA has assigned a ranking of high confidence in the database because many animal studies and epidemiologic studies support the principal study and, consequently, high confidence in the RfD (U.S. EPA, 2000a).

**Q.32.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for selenium (U.S. EPA, 2000a). However, CalEPA has established a chronic inhalation REL for selenium of 2.0E-02 mg/m$^3$; a route-to-route extrapolation of the U.S. EPA RfD (0.005 mg/kg-d) was performed, assuming a body weight of 70 kg and an inhalation rate of 20 m$^3$/d (CalEPA, 1999b).

### Q.32.3 Cancer Effects

Several epidemiological studies have examined the relationship between cancer death rates in humans and selenium levels in forage crops. These studies have reported an increased incidence of colon, gastrointestinal, breast, prostate, and other forms of cancer in areas where selenium is deficient and a lowered cancer incidence in areas with higher selenium concentrations. Other studies have reported that blood serum levels in patients with cancer had significantly lower selenium levels than healthy patients (U.S. EPA, 2000a).

Several animal studies have investigated the carcinogenicity of selenium. However, the data are conflicting and difficult to interpret because of apparent anticarcinogenicity and high toxicity of some selenium compounds (U.S. EPA, 2000a).

EPA has classified selenium as Group D - Not Classifiable as to Carcinogenicity in Humans, because of inadequate human data and inadequate evidence of carcinogenicity in animals (U.S. EPA, 2000a). EPA has not calculated a unit risk estimate for selenium.

## Q.33 Silver

### Q.33.1 Introduction

Silver is a naturally occurring element that is often found deposited as a mineral ore in association with other elements. It is acquired as a byproduct during the retrieval of copper, lead, zinc, and gold ores. It is used in photographic materials, electrical products, silver paints, batteries, sterling ware, and jewelry (ATSDR, 1990b).

| Silver | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 5.0E-03 mg/kg-d | U.S. EPA, 2000a |
| RfC | 2.0E-02 mg/m$^3$ | CalEPA, 1997 |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.33.2 Noncancer Effects

The only clinical condition that is known in humans to be associated with long-term exposure to silver is argyria, a gray or blue-gray discoloring of the skin. Argyria was common around the turn of the century when many pharmacological preparations contained silver. It is much less common now. Today, case reports in humans have reported that repeated dermal contact with silver may in some cases lead to contact dermatitis and a generalized allergic reaction to silver (ATSDR, 1990b).

**Q.33.2.1 Reference Dose.** EPA has established an RfD for silver of 5.0E-03 mg/kg-d based on a LOAEL of 0.014 mg/kg-d, an uncertainty factor of 3, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD is based on a report summarizing 70 cases of argyria following the use of silver medication in humans (U.S. EPA, 2000a, citing Gaul and Staud, 1935).

An uncertainty factor of 3 was applied to account for minimal effects in a subpopulation that has exhibited an increased propensity for the development of argyria. The critical effect is cosmetic, with no associated adverse health effects (U.S. EPA, 2000a).

EPA has

- Medium confidence in the critical study used as the basis for the RfD because it is an old study and only describes patients who developed argyria; no information is presented on patients who received injections of silver and did not develop argyria.

- Low confidence in the database because the studies used to support the RfD were not controlled studies.

EPA has assigned a ranking of low-to-medium confidence in the RfD for silver because the RfD is based on a study using intravenous administration, which necessitated a dose conversion with inherent uncertainties (U.S. EPA, 2000a).

**Q.33.2.2 Reference Concentration.** EPA has not established an RfC for silver (U.S. EPA, 2000a). However, CalEPA has established a chronic inhalation REL for silver of 2.0E-02 mg/m$^3$; a route-to-route extrapolation of the EPA RfD (0.005 mg/kg-d) was performed, assuming a body weight of 70 kg and inhalation rate of 20 m$^3$/d (CalEPA, 1997).

### Q.33.3 Cancer Effects

No evidence of cancer in humans has been reported despite frequent therapeutic use of silver compounds over the years. Animal studies are inadequate and have shown local sarcomas after the subcutaneous implantation of foils and discs of silver (U.S. EPA, 2000a).

EPA has classified silver as Group D - Not Classifiable as to Human Carcinogenicity based on questionable interpretation of the local sarcomas seen in animal studies. Even insoluble solids such as plastics have been shown to result in local sarcomas (U.S. EPA, 2000a).

## Q.34 Styrene

### Q.34.1 Introduction

Styrene is used predominantly in the production of polystyrene plastics and resins. Some of these resins are used for construction purposes such as in insulation or in the fabrication of fiberglass boats. Styrene is also used as an intermediate in the synthesis of materials used for ion exchange resins and to produce copolymers such as styrene-acrylonitrile (ATSDR, 1992e).

| Styrene | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 1.0E+00 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.34.2 Noncancer Effects

Acute exposure to styrene in humans results in respiratory effects, such as mucous membrane irritation, eye irritation, and gastrointestinal effects. Chronic exposure of styrene in humans results in effects on the central nervous system, with symptoms such as headache, fatigue, weakness, depression, impaired balance and coordination, increased reaction time, decrement in concentration, peripheral neuropathy, and minor effects on some kidney enzyme functions and on the blood. Hematological, liver, and kidney effects have been reported in animals (ATSDR, 1992e).

**Q.34.2.1 <u>Reference Dose</u>.** The RfD for styrene is 2.0E-01 mg/kg-d based on a NOAEL of 200 mg/kg-d and a LOAEL of 400 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a study in which four beagle dogs/sex were gavaged with doses of 0, 200, 400, or 600 mg/kg-d in peanut oil for 560 days (U.S, EPA, 2000a, citing Quast et al., 1979). No adverse effects were observed for dogs administered styrene at 200 mg/kg-d. In the higher dose groups, increased numbers of Heinz bodies in the red blood cells, decreased packed cell volume, and sporadic decreases in hemoglobin and red blood cell counts were observed. Increased numbers of Heinz bodies were also found in the liver. A NOAEL of 200 mg/kg-d was selected (U.S. EPA, 2000a).

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a tenfold factor to extrapolate from subchronic effects to chronic effects (U.S. EPA, 2000a).

EPA has assigned a ranking of medium confidence in the RfD for styrene based on

- Medium confidence in the study on which the RfD was based because the study is well done and the effects levels seem reasonable but there were a small number of animals/sex/dose

- Medium confidence in the database because there is no full-term chronic study (U.S. EPA, 2000a).

**Q.34.2.2 <u>Reference Concentration</u>.** The RfC for styrene is 1.0 $mg/m^3$ based on a NOAEL of 94 $mg/m^3$, an uncertainty factor of 30, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on a study in which neuropsychological function was examined in 50 workers whose mean duration of styrene exposure was 8.6 years (U.S. EPA, 2000a, citing Mutti et al., 1984). A clear concentration response in three of eight tests, including block design (measures intellectual function), digit-symbol (memory), and reaction time (visuo-motor speed) was seen. A NOAEL of 25 ppm was selected based on urinary metabolite concentration (i.e., 150 mmol/mol is the NOAEL and corresponds to daily inhalation exposure to 25 ppm or 106 $mg/m^3$). A value of 0.88 (the lower limit of the 95 percent confidence interval for an 8-h exposure to 100 ppm) was applied to the NOAEL, resulting in a NOAEL of 22 ppm (94 $mg/m^3$). The NOAEL was adjusted for intermittent occupational exposure (5 out of 7 d, 10 out of 20 $m^3/d$), resulting in a $NOAEL_{ADJ}$ of 34 $mg/m^3$ (U.S. EPA, 2000a).

An uncertainty factor of 30 was applied based on a threefold factor for database inadequacy, a threefold factor for extrapolation from animals to humans, and a threefold factor for lack of information on chronic studies (U.S. EPA, 2000a).

EPA assigned a ranking of medium confidence in the RfC based on

- Medium confidence in the study on which the RfC was based because this study documents concentration-response relationships of central nervous system effects in a relatively small worker population and the results of this study are consistent with a number of other studies,

- Medium to high confidence in the database because chronic laboratory animal studies are not available (U.S. EPA, 2000a).

### Q.34.3 Cancer Effects

There are several epidemiological studies of styrene workers that suggest an association between occupational exposure and an increased incidence of leukemia and lymphoma. However, these studies are inconclusive because of confounding factors. Animal studies have produced both negative and positive results (ATSDR, 1992e).

EPA has not classified styrene for carcinogenicity and has not calculated an oral CSF or inhalation unit risk estimate for styrene (U.S. EPA, 2000a).

# Q.35 Tetrachloroethylene

## Q.35.1 Introduction

Tetrachloroethylene occurs as a nonflammable liquid at room temperature that evaporates easily into the air. Tetrachloroethylene is used as a solvent and as a chemical intermediate. It is used for metal cleaning, vapor degreasing, dry cleaning, and textile processing. The most common routes of exposure for the general population are the inhalation of ambient air and the ingestion of contaminated drinking water. Indoor air concentrations are generally higher than outdoor air concentrations (ATSDR, 1997e).

| Tetrachloroethylene | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E-02 mg/kg-d | U.S. EPA, 2000a |
| RfC | 3.0E-01 $mg/m^3$ | ATSDR, 1997e |
| oral CSF | 5.2E-02 $(mg/kg\text{-}d)^{-1}$ | U.S. EPA, 1985b |
| inh URF | 5.8E-07 $(\mu g/m^3)^{-1}$ | U.S. EPA, 1986 |
| inh CSF | 2.0E-03 $(mg/kg\text{-}d)^{-1}$ | Calculated |

## Q.35.2 Noncancer Effects

Central nervous system effects are the most common effects resulting from tetrachloroethylene exposure in humans. Acute exposure to high concentrations has caused headache, dizziness, drowsiness, mood changes, slight ataxia, and difficulty in speaking. Other neurobehavioral effects reported following short-term and occupational exposures to tetrachloroethylene include performance deficits for vigilance and eye-hand coordination and increased reaction times. Loss of color vision has been reported among dry cleaning workers. Liver and kidney effects have also been observed in occupationally exposed workers. Limited studies of occupationally exposed women suggest an association with menstrual disorders and spontaneous abortions; other studies have not found a significant association between tetrachloroethylene exposure and birth outcome (ATSDR, 1997e).

Neurological, liver, and kidney effects have also been observed in animals exposed to tetrachloroethylene orally and via inhalation (ATSDR, 1997e; U.S. EPA, 2000a).

**Q.35.2.1 Reference Dose.** EPA has established an RfD for tetrachloroethylene of 1.0E-02 mg/kg-d based on a NOAEL of 20 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). Groups of mice were administered 0, 20, 100, 200, 500, 1,500, and 2,000 mg/kg tetrachloroethylene in corn oil via gavage 5 d/wk for 6 wk (U.S. EPA, 2000a, citing Buben and O'Flaherty, 1985). Increased liver triglycerides and relative liver weights were observed in mice treated with 100 mg/kg. At higher doses, decreased DNA content, increased

SGPT, decreased G6P, hepatocellular necrosis, degeneration, and polyploidy were reported. The RfD is based on hepatotoxicity in mice and decreased weight gain in rats.

The NOAEL of 20 mg/kg-d was adjusted for intermittent exposure (5 d/wk), resulting in a $NOAEL_{ADJ}$ of 14 mg/kg-d. An uncertainty factor of 1,000 was applied based on a tenfold factor to account for human variability, a tenfold factor to account for interspecies extrapolation, and a tenfold factor to account for extrapolation of a subchronic effect level to its chronic equivalent (U.S. EPA, 2000a).

EPA has

- Low confidence in the critical study used as the basis for the RfD because of the lack of a complete histopathological examination
- Medium confidence in the database because it is relatively complete but lacks studies of reproductive and teratology endpoints subsequent to oral exposure.

Therefore, EPA has medium confidence in the RfD results (U.S. EPA, 2000a).

**Q.35.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for tetrachloroethylene (U.S. EPA, 2000a). However, ATSDR has established a chronic inhalation MRL for tetrachloroethylene of 0.3 $mg/m^3$ (0.04 ppm) based on a LOAEL of 15 ppm for neurological effects in humans and an uncertainty factor of 100 (ATSDR, 1997e). Neurobehavioral effects were studied in women exposed to tetrachloroethylene in dry cleaning shops. Increased reaction times were observed in exposed workers (ATSDR, 1997e, citing Ferroni et al., 1992). The LOAEL was adjusted for intermittent exposure (8 h/d, 5 d/wk). An uncertainty factor of 100 was applied based on a tenfold factor to account for the use of a LOAEL and a tenfold factor to account for human variability (ATSDR, 1997e).

### Q.35.3 Cancer Effects

Some epidemiological studies of dry cleaning workers suggest a possible association between chronic tetrachloroethylene exposure and increased cancer risk. The cancer types most consistently showing an increase were esophageal cancer, cervical cancer, and non-Hodgkin's lymphoma. Some of these studies are confounded by concomitant exposure to other solvents, smoking and other lifestyle variables, and methodological limitations (ATSDR, 1997e).

Hepatocellular carcinomas were observed in mice exposed to tetrachloroethylene by inhalation and oral (gavage) routes of exposure. Significantly increased incidences of mononuclear cell leukemia in male and female rats and an increased incidence of renal tumors in male rats were observed following chronic oral exposure to tetrachloroethylene (ATSDR, 1997e).

EPA's Science Advisory Board has recommended that tetrachloroethylene be classified on the C-B2 continuum (C = possible human carcinogen, B2 = probable human carcinogen); EPA has not adopted a final position to date (U.S. EPA, 2000a).

**Q.35.3.1 Oral Cancer Risk.** EPA used the linearized multistage extrapolation model based on data from a study of orally exposed mice (U.S. EPA, 1985b, citing NCI, 1977) to estimate the oral unit risk estimate for tetrachloroethylene. EPA calculated an oral unit risk estimate of 1.5E-06 $(\mu g/L)^{-1}$. An oral CSF of 5.2E-02 $(mg/kg/d)^{-1}$ was calculated from the oral URF as follows:

$$\text{oral CSF} = 1.5E{-}6\ (\mu g/L)^{-1} \times (70\ kg) \div (2\ L/d) \times 1{,}000\ \mu g/mg = 5.2E{-}2\ (mg/kg{-}d)^{-1}$$

**Q.35.3.2 Inhalation Cancer Risk.** EPA used the linearized multistage extrapolation model based on data from a study of rats and mice exposed to tetrachloroethylene via inhalation (U.S. EPA, 1986, citing NTP, 1985) to estimate the inhalation unit risk estimate. EPA calculated an inhalation unit risk estimate ranging from 2.9E-07 to 9.5E-07 $(\mu g/m^3)^{-1}$, with a geometric mean of 5.8E-07 $(\mu g/m^3)^{-1}$ for tetrachloroethylene. An inhalation CSF of 2.0E-03 $(mg/kg\text{-}d)^{-1}$ was calculated from the inhalation URF as follows:

$$\text{inh CSF} = 5.8E{-}7\ (\mu g/m^3)^{-1} \times 70\ kg \div 20\ m^3/d \times 1{,}000\ \mu g/mg = 2.0E{-}3\ (mg/kg{-}d)^{-1}$$

## Q.36 Tin

### Q.36.1 Introduction

Tin is a naturally occurring element found in the earth's crust. The majority of tin used in the United States is imported from other countries, and a smaller percentage is recovered from scrap materials containing tin. The principal use of tin is in the making of containers, including aerosol cans and food and beverage containers. Tin is also used as a reducing agent in chemical processes and in the production of other compounds such as stannous chloride, stannic oxide, and in the production of organotin compounds (ATSDR, 1992f).

| Tin | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 6.0E-01 mg/kg-d | U.S. EPA, 1997a |
| RfC | NA | |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.36.2 Noncancer Effects

Gastrointestinal effects, consisting of irritation of the mucous membranes of the stomach and intestines, have been observed in humans after oral exposure to tin, via eating of foods or drinking liquids from tin containers. Skin and eye irritation and dermatitis have been reported after dermal exposure to tin in humans and animals. Effects on the blood, liver, and kidneys have been observed in animals exposed orally to tin (ATSDR, 1992f).

**Q.36.2.1 Reference Dose.** The provisional RfD for tin is 6.0 E-01 mg/kg-d (U.S. EPA, 1997a), based on a chronic bioassay in which male and female rats were exposed to stannous chloride (tin chloride) at 1,000 or 2,000 ppm in the diet for 2 years (NTP, 1982). A NOAEL of 2,000 ppm was identified, based on liver and kidney lesions. An uncertainty factor of 100 was applied. The RfD was calculated by analogy to stannous chloride by correcting for differences in molecular weight (U.S. EPA, 1997a).

**Q.36.2.2 Reference Concentration.** EPA has not established an RfC for tin.

### Q.36.3 Cancer Effects

No studies are available on the carcinogenic effects of tin in humans. A study by the National Toxicology Program was carried out on stannous chloride (an inorganic tin compound) (NTP, 1982). Rats and mice were fed diets containing stannous chloride for 2 years. The conclusions from the study were that stannous chloride was not carcinogenic for rats and mice under the conditions of the study. EPA has not classified tin for carcinogenicity and has not calculated an oral CSF or inhalation unit risk estimate.

## Q.37 Toluene

### Q.37.1 Introduction

The major use of toluene is as a mixture added to gasoline to improve octane ratings. Toluene is also used to produce benzene and as a solvent in paints, coatings, adhesives, inks, and cleaning agents. Other uses include in the production of polymers used to make nylon, plastic soda bottles, and polyurethanes and for pharmaceuticals, dyes, cosmetic nail products, and the synthesis of organic chemicals (ATSDR, 1998d).

| Toluene | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 4.0E-01 $mg/m^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.37.2 Noncancer Effects

The central nervous system is the primary target for toluene toxicity in humans and animals for acute and chronic exposures. Symptoms including fatigue, narcosis, confusion, incoordination, headaches, dizziness, nausea, and impaired reaction time, perception, and motor control and function have been observed from acute exposure in humans. Ataxia, tremors, and impaired speech, hearing, and vision have occurred from chronic exposure of humans to toluene (ATSDR, 1998d).

Other effects from chronic exposure in humans include irritation of the upper respiratory tract, eye irritation, and difficulty sleeping. Studies have reported developmental effects, including microcephaly, central nervous system dysfunction, and attentional deficits in children exposed to toluene in utero as a result of maternal solvent abuse during pregnancy. Neurological, liver, kidney, respiratory, hematological, and developmental effects have been reported in animals exposed to toluene via gavage and/or inhalation (ATSDR, 1998d).

**Q.37.2.1 Reference Dose.** The RfD for toluene is 2.0E-01 mg/kg-d based on a NOAEL of 312 mg/kg-d, an uncertainty factor of 1,000, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a subchronic gavage study in which groups of 10 rats per sex were administered toluene doses of 0, 312, 625, 1,250, 2,500, or 5,000 mg/kg-d for 5 d/wk for 13 wk (U.S, EPA, 2000a, citing NTP, 1990). Several toxic effects were noted at 2,500 and 5,000 mg/kg-d, including prostration, hypoactivity, ataxia, and body tremors. In males, absolute and relative weights of both the liver and kidney were significantly increased at doses of 625 mg/kg-d and above. In males, absolute and relative weights of the liver, kidney, and heart were significantly increased at 1,250 mg/kg-d and higher. Hepatocellular hypertrophy occurred at 2,500 mg/kg-d and higher. Nephrosis was observed in all rats that died and damage to the tubular epithelia of the kidney occurred in terminally sacrificed rats. Histopathological changes were also noted in the brain and urinary bladder. A NOAEL of 312 mg/kg was selected for liver and kidney weight increases, and the NOAEL was adjusted for intermittent exposure as follows: 312 mg/kg-d × 5/7 d = 223 mg/kg-d (U.S, EPA, 2000a).

An uncertainty factor of 1,000 was applied based on a tenfold factor for extrapolation from animals to humans, a tenfold factor to protect sensitive individuals, and a tenfold factor to extrapolate from subchronic effects to chronic effects and for limited reproductive and developmental toxicity data (U.S. EPA, 2000a).

EPA assigned a ranking of medium confidence in the RfD for toluene based on

- High confidence in the study on which the RfD was based because a sufficient number of animals were tested in each of six dose groups and many parameters were studied,

- Medium confidence in the database because it is supported by a 6-month oral study but there is no reproductive study and all the oral studies are subchronic (U.S. EPA, 2000a).

**Q.37.2.2 __Reference Concentration__.** The RfC for toluene is 4.0E-01 mg/m$^3$ based on a LOAEL of 332 mg/m$^3$ (88 ppm), an uncertainty factor of 300, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on a study in which 30 female workers were exposed to toluene emitted from glue (U.S. EPA, 2000a, citing Foo et al., 1990). Exposed workers breathed toluene at levels of 88 ppm (332 mg/m$^3$) and control workers breathed 13 ppm (49 mg/m$^3$). A battery of eight neurobehavioral tests were administered to all exposed and control workers. Statistically significant differences were seen in six out of eight tests; all tests showed that exposed workers performed poorly compared with the controls. A LOAEL of 332 mg/m$^3$ was selected for this study. This LOAEL is for the extrarespiratory effect of a soluble vapor and was based on an 8-h occupational exposure. It was adjusted for intermittent occupational exposure as follows: 332 mg/m$^3$ x 10 m$^3$/d ÷ 20 m$^3$/d x 5/7 d = 119 mg/m$^3$.

A 2-year inhalation study in rats (U.S. EPA, 2000a, citing NTP, 1990) was used to support the derivation of the RfC. Rats were exposed to 0, 600, or 1,200 ppm (0, 2,261, or 4,523 mg/m$^3$) toluene 6.5 h/d, 5 d/wk (duration adjusted to 0, 437, and 875 mg/m$^3$, respectively) for 103 wk. A significant increase in the incidence of erosion of the olfactory epithelium and of degeneration of the respiratory epithelium was observed in exposed animals. A LOAEL of 600 ppm was identifed. To account for species-specific differences in inhalation dosimetry, a $LOAEL_{HEC}$ of 79 mg/m$^3$ was calculated by applying a regional gas dose ratio (RGDR) of 0.18 (based on ventilation rates and surface areas of extrathoracic region of rats and humans) for respiratory effects in the extrathoracic region (U.S. EPA, 2000a).

An uncertainty factor of 300 was applied based on a tenfold factor to protect sensitive individuals, a tenfold factor for use of a LOAEL, and a threefold factor to account for database inadequacy, including the lack of data and well-characterized laboratory animal exposures evaluating neurotoxicity and respiratory irritation (U.S. EPA, 2000a).

EPA has assigned a ranking of medium confidence in the RfC based on

- Medium confidence in the study on which the RfC was based because the effects seen in this study are consistent with more severe central nervous system effects occurring at abusive concentrations of toluene and could not have been confounded by alcohol but a NOAEL was not identified,

- Medium confidence in the database because, although there is a complement of chronic laboratory animal studies, long-term data in humans are not available for either the neurotoxicity or irritation endpoints (U.S. EPA, 2000a).

### Q.37.3 Cancer Effects

Two epidemiologic studies did not report a statistically significant increased risk of cancer due to inhalation exposure to toluene. However, these studies were limited due to the size of the study population and lack of historical monitoring data. Chronic inhalation exposure of rats did not result in an increased incidence of tumors (ATSDR, 1998d). EPA has classified toluene as Group D, Not Classifiable as to Human Carcinogenicity and has not calculated an oral CSF or inhalation unit risk estimate for toluene (U.S. EPA, 2000a).

# Q.38 Vinyl Acetate

## Q.38.1 Introduction

Vinyl acetate is primarily used as a monomer in the production of polyvinyl acetate and polyvinyl alcohol. It is also used as a raw material in the production of other chemicals, in adhesives, water-based paints, nonwoven textile fibers, textile sizings and finishes, paper coatings, inks, films, and lacquers (ATSDR, 1992g).

## Q.38.2 Noncancer Effects

Acute inhalation exposure of workers to vinyl acetate has resulted in eye irritation and upper respiratory tract irritation. Chronic occupational exposure did not result in any severe adverse effects in workers; some instances of upper respiratory tract irritation, cough, and hoarseness were reported. Nasal epithelial lesions and irritation and inflammation of the respiratory tract were observed in animals chronically exposed by inhalation (ATSDR, 1992g).

| Vinyl Acetate | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 1.0E+00 mg/kg-d | U.S. EPA, 1997a |
| RfC | 2.0E-01 mg/m$^3$ | U.S. EPA, 2000a |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

**Q.38.2.1 Reference Dose.** The provisional RfD for vinyl acetate is 1.0 mg/kg-d based on a NOAEL of 100 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 1997a). The RfD was based on a study in which rats were exposed to vinyl acetate in the drinking water for 2 years and altered body and kidney weights were observed (U.S. EPA, 1997a, citing Shaw, 1988).

**Q.38.2.2 Reference Concentration.** The RfC for vinyl acetate is 2.0E-01 mg/m$^3$ based on a NOAEL of 176 mg/m$^3$ (50 ppm), an uncertainty factor of 30, and a modifying factor of 1 (U.S. EPA, 2000a). This was based on a study in which rats and mice were exposed to 0, 50, 200, or 600 ppm vinyl acetate (0, 176, 704, and 2,113 mg/m$^3$) for 6 h/d, 5 d/wk for 104 wk (U.S. EPA, 2000a, citing Owen, 1988). At 600 ppm, respiratory tract lesions (nasal cavity, bronchi, lungs) were observed. In the nasal cavity of rats exposed to 200 ppm, there was clear evidence of atrophy and metaplasia in the olfactory epithelia. No lesions were observed in the nasal cavities of the rats exposed to 50 ppm.

A NOAEL of 50 ppm (176 $mg/m^3$) was identified and adjusted for duration of exposure as follows: 176 $mg/m^3 \times 6/24$ h $\times$ 5/7 d = 31 $mg/m^3$. To account for species-specific differences in inhalation dosimetry, a $NOAEL_{HEC}$ of 5 $mg/m^3$ was calculated by applying an RGDR of 0.18 (based on ventilation rates and surface areas of extrathoracic region of rats and humans) for gas:respiratory effects in the extrathoracic region (U.S. EPA, 2000a). An uncertainty factor of 30 was applied based on a tenfold factor to protect sensitive individuals and a threefold factor for interspecies variability because the use of dosimetric adjustments accounts for part of this area of uncertainty (U.S. EPA, 2000a).

EPA has assigned a ranking of high confidence in the RfC for vinyl acetate based on:

- High confidence in the study on which the RfC was based because the study identified both a NOAEL and a LOAEL for histopathology of the nasal olfactory epithelia in rats and mice in a chronic 2-year study, used an adequate number of animals, and was thorough in reporting experimental and exposure details,

- High confidence in the database because it provides sufficient supporting data for the RfC (U.S. EPA, 2000a).

### Q.38.3 Cancer Effects

No information is available on the carcinogenic effects of vinyl acetate in humans. In a drinking water study, no treatment-related tumors were observed in rats (ATSDR, 1992g). EPA has not classified vinyl acetate for carcinogenicity and has not calculated an oral CSF or inhalation unit risk estimate for vinyl acetate (U.S. EPA, 2000a).

## Q.39 Xylene

### Q.39.1 Introduction

Xylenes are used as solvents in the printing, rubber, and leather industries. They are also used as cleaning agents, paint thinners and removers, in varnishes, and blended into gasoline. Commercial or mixed xylene generally contains about 40 to 65 percent meta-xylene and up to 20 percent each of ortho-xylene, para-xylene, and ethylbenzene. Xylenes are released into the atmosphere from industrial sources, in automobile exhaust, and through volatilization from their use as solvents. Air concentrations measured in industrial areas and cities in the United States range from 1 to 88 ppb (ATSDR, 1995).

| Xylenes | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 2.0E+00 mg/kg-d | U.S. EPA, 1997a, 2000a |
| RfC | 4.0E-01 mg/$m^3$ | ATSDR, 1995 |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

### Q.39.2 Noncancer Effects

Short- and long-term inhalation exposures to xylene have resulted in a variety of neurological effects that include headache, mental confusion, narcosis, alterations in equilibrium and body balance, impaired short-term memory, dizziness, and tremors in humans. Eye and respiratory tract irritation can occur and pulmonary function may also be affected. At higher concentrations, the liver and kidney may be affected. Animal studies have suggested that the developing fetus may be sensitive to xylene exposure. Human and animal data suggest that mixed xylenes and the individual isomers, meta-, ortho-, and para-xylene, all produce similar health effects (ATSDR, 1995).

**Q.39.2.1 Reference Dose.** EPA has established an RfD for total xylenes of 2.0 mg/kg-d based on a NOAEL of 250 mg/kg-d, an uncertainty factor of 100, and a modifying factor of 1 (U.S. EPA, 2000a). Groups of male and female rats and mice were administered 0, 250, or 500 mg/kg-d (rats) and 0, 500, or 1,000 mg/kg-d (mice) mixed xylenes via gavage 5 d/wk for 103 wk (U.S. EPA, 2000a, citing NTP, 1986). Hyperactivity in mice and decreased body weight and increased mortality in male rats were reported. The NOAEL was adjusted for intermittent exposure (5/7 d). An uncertainty factor of 100 was applied based on a tenfold factor for interspecies extrapolation and a tenfold factor to protect sensitive individuals (U.S. EPA, 2000a).

EPA has

- Medium confidence in the study the RfD was based on because, although it was a well-designed study in which adequately sized groups of two species were tested over a substantial portion of their lifespan, comprehensive histology was performed, and a NOAEL was identified, clinical chemistries, blood enzymes, and urinalysis were not performed.

- Medium confidence in the database because, although supporting data exist for mice and teratogenicity and fetotoxicity data are available with positive results at high oral doses, a LOAEL for chronic oral exposure was not defined.

EPA has assigned a ranking of medium confidence in the RfD (U.S. EPA, 2000a).

Provisional RfDs of 2.0 mg/kg-d for meta- and ortho-xylene were derived using the same data as for the derivation of the RfD for total xylenes (U.S. EPA, 1997a). Likewise, a provisional RfD of 2.0 mg/kg-d for para-xylene based on the RfD for total xylenes is used in this risk assessment.

**Q.39.2.2 <u>Reference Concentration</u>.** EPA has not established an RfC for xylenes (U.S. EPA, 2000a). However, ATSDR derived a chronic inhalation MRL of 0.4 mg/$m^3$ (0.1 ppm) for mixed xylenes based on a LOAEL of 14 ppm and an uncertainty factor of 100 (ATSDR, 1995). Neurological effects, including increased prevalance of anxiety, forgetfulness, inability to concentrate, and dizziness, were reported in workers occupationally exposed to mixed xylenes for an average of 7 years (ATSDR, 1995, citing Uchida et al., 1993). An uncertainty factor of 100 was applied, based on a tenfold factor to account for the use of a LOAEL and a tenfold factor to account for human variability (ATSDR, 1995).

Although the chronic RfC was derived from data for mixed xylenes, the human health benchmark was also used for the individual isomers in the risk assessment because similar health effects are expected.

### Q.39.3 Cancer Effects

Very limited data are available regarding the carcinogenicity of xylenes (ATSDR, 1995). EPA has classified mixed xylenes as Group D - Not Classifiable as to Human Carcinogenicity. No significant increases in tumor response were observed in orally exposed rats or mice of both sexes (U.S. EPA, 2000a).

## Q.40 Zinc

### Q.40.1 Introduction

Zinc is an element commonly found in the earth's crust. It is mined in the United States and secondary zinc metal is produced at plants from scrap metal. Zinc is used most commonly as a protective coating of other metals. It is also used in alloys such as bronze and brass, for the electrical apparatus in many common goods, and in organic chemical extractions and reductions (ATSDR, 1994). The primary uses of zinc oxide are in paint pigments, cosmetics, and cements (CalEPA, 1997).

| Zinc | | |
|---|---|---|
| **Benchmark** | **Value** | **Source** |
| RfD | 3.0E-01 mg/kg-d | U.S. EPA, 2000a |
| RfC | 9.0E-04 mg/m$^3$ | CalEPA, 1997 |
| oral CSF | NA | |
| inh URF | NA | |
| inh CSF | NA | |

## Q.40.2 Noncancer Effects

Zinc is an essential element in humans, with a Recommended Daily Allowance (RDA) of 15 mg/d for men and 12 mg/d for women (U.S. EPA, 2000a, citing NRC, 1989). Acute inhalation exposure to high levels of zinc has resulted in metal fume fever, a disease characterized by dryness of the throat, coughing, chest pain, cough, and dyspnea. The respiratory symptoms generally disappear within a few days. Respiratory effects (changes in pulmonary function and morphological changes) have also been reported in guinea pigs exposed to zinc oxide via inhalation. Acute oral exposure to high concentrations of zinc has resulted in gastrointestinal irritation and pancreatic damage in humans. Chronic oral exposure has resulted in effects on the blood, including decreased levels of hemoglobin and hematocrit, which is believed to be the result of zinc-induced copper deficiency (ATSDR, 1994).

**Q.40.2.1 Reference Dose.** The RfD for zinc is 3.0E-01 mg/kg-d based on a LOAEL of 59.72 mg/d (1.0 mg/kg-d), an uncertainty factor of 3, and a modifying factor of 1 (U.S. EPA, 2000a). The RfD was based on a clinical study in which 18 healthy women were given zinc gluconate supplements twice daily (50 mg/d or 1.0 mg/kg-d) for 10 wk (U.S. EPA, 2000a, citing Yadrick et al., 1989). Erythrocyte superoxide dismutase (ESOD) levels declined over the 10-wk supplementation period and at 10 wk were significantly different from values during the pretreatment period. By 10 wk, ESOD levels had declined to 53 percent of pretreatment levels (U.S, EPA, 2000a). ESOD combats free radicals. It is an antioxidant that keeps cell membranes from breaking down; it helps protect cells against a highly toxic free radical (i.e., superoxide). A LOAEL of 1.0 mg/kg-d was calculated from estimations of the FDA Total Diet Study for 1982-1986, plus the reported supplemental dose, divided by the assumed body weight (60 kg), as follows:

$$50 \text{ mg/d} + 9.72 \text{ mg/d} = 60 \text{ mg/d} \div 60 \text{ kg} = 1.0 \text{ mg/kg-d}$$

An uncertainty factor of 3 was applied based on the use of a minimal LOAEL from a moderate duration study of the most sensitive humans and consideration of a substance that is an essential dietary nutrient (U.S. EPA, 2000a).

The RfD is expected to be without adverse health effects when consumed on a daily basis over an extended period of time. It neither induces a nutritional deficiency in healthy, nonpregnant, adult women consuming the average American diet nor causes undesirable inhibition of normal lipid transport. EPA assigned a ranking of medium confidence in the RfD based on:

- Medium confidence in the studies since they are well-conducted clinical studies with many parameters investigated but only a few humans were tested,

- Medium confidence in the database since the studies were all of short duration (U.S. EPA, 2000a).

**Q.40.2.2 Reference Concentration.** EPA has not established an RfC for zinc. However, CalEPA (1997) derived a chronic inhalation reference exposure level of 9.0E-04 $mg/m^3$ based on a LOAEL of 0.26 $mg/m^3$ and an uncertainty factor of 100. The RfC was based on a case report in which development of occupational asthma was seen in a worker exposed to zinc from galvanization processes over a 2-year period (CalEPA, 1997, citing Malo et al., 1993). Environmental monitoring resulted in estimated exposure levels of 0.26 to 0.29 $mg/m^3$ zinc. The worker experienced increasing shortness of breath, chest tightness, wheezing, sneezing, and burning of the eyes. Symptoms disappeared when he left work for 7 months, but reappeared when he returned to work (CalEPA, 1997).

The worker's exposure was determined to be 7 h/d (assumed inhalation rate of 10 $m^3/d$), 5 d/wk. The LOAEL was adjusted for intermittent occupational exposure and resulted in a $LOAEL_{ADJ}$ of 0.093 $mg/m^3$ (0.26 $mg/m^3 \times 10/20\ m^3/d \times 5/7$ d). An uncertainty factor of 100 was applied based on a tenfold factor to account for the use of a LOAEL and a tenfold factor to account for extrapolating from subchronic to chronic exposure duration (CalEPA, 1997).

### Q.40.3 Cancer Effects

Inadequate human carcinogenicity data are available for zinc. In a study in mice, no statistically significant increase in tumor incidence was observed in animals exposed to zinc sulfate in drinking water for 1 year (ATSDR, 1994). EPA has classified zinc as Group D, Not Classifiable as to Human Carcinogenicity, and has not calculated an oral CSF or inhalation unit risk estimate for zinc (U.S. EPA, 2000a).

## Q.41 Glossary

Adenoma: A benign tumor of a glandular structure.

Adenocarcinoma: A malignant tumor originating in glandular epithelium.

Anemia: A condition in which the blood is deficient in red blood cells, hemoglobin, or in total volume.

Ataxia: Failure of muscular coordination.

Benign tumor: A tumor that does not spread to a secondary localization, but may impair normal biological function through obstruction or may progress to malignancy later.

Bronchitis: Acute or chronic inflammation of the bronchial tubes.

Carcinogen: An agent capable of inducing cancer.

Carcinoma: A malignant tumor of epithelial origin.

Cardiovascular: Relating to the heart and blood vessels.

CSF (cancer slope factor): An upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-d, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.

Dermal: Relating to the skin.

Dermatitis: Inflammation of the skin.

Developmental Toxicity: Adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally until the time of sexual maturation. The major manifestations of developmental toxicity include death of the developing organism, structural abnormality, altered growth, and functional deficiency.

Dyspnea: Labored breathing.

Epidemiology: The study of disease patterns in human populations.

Epithelium: A membranous cellular tissue that covers a surface or lines a tube or cavity of the body and serves to enclose and protect.

Hematological: Relating to the blood.

Hepatic: Relating to the liver.

Histopathological: The tissue changes that accompany a disease.

Hyperplasia: An abnormal increase in tissue cells.

Ingestion: To take in for digestion (e.g., eating).

Inhalation: The act of breathing.

LOAEL (lowest-observed-adverse-effect level): The lowest dose of a chemical in a study or group of studies that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control.

MMAD (Mass Median Aerodynamic Diameter): Median of the distribution of airborne particle mass with respect to the aerodynamic diameter. MMADs are usually accompanied by the geometric standard deviation (g or sigma g), which characterizes the variability of the particle size distribution.

Neoplasm: An abnormal growth of tissue that may be benign or malignant.

NOAEL (no-observed-adverse-effect level): That dose of chemical at which there are no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be produced at this dose, but they are not considered to be adverse.

Ocular: Relating to the eyes.

Papilloma: A benign tumor due to overgrowth of epithelial tissue on papillae of vascular connective tissue.

Pulmonary: Relating to the lungs.

RDDR (Regional Deposited Dose Ratio): The ratio of the regional deposited dose calculated for a given exposure in the animal species of interest to the regional deposited dose of the same exposure in a human. This ratio is used to adjust the exposure effect level for interspecies dosimetric differences to derive a human equivalent concentration for particles.

Renal: Relating to the kidneys.

RfC (inhalation reference concentration): An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure of a chemical to the human population through inhalation (including sensitive subpopulations) that is likely to be without risk of deleterious noncancer effects during a lifetime.

RfD (oral reference dose): An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure of a chemical to the human population (including sensitive subpopulations) that is likely to be without risk of deleterious noncancer effects during a lifetime.

RGDR (Regional Gas Dose Ratio): The ratio of the regional gas dose calculated for a given exposure in the animal species of interest to the regional gas dose of the same exposure in humans. This ratio is used to adjust the exposure effect level for interspecies dosimetric differences to derive a human equivalent concentration for gases with respiratory effects.

Target Organ: The biological organ(s) most adversely effected by exposure to a chemical substance.

Tumor: An abnormal, uncontrolled growth of cells.

URF (Unit Risk Factor): The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 µg/L in water, or 1 µg/$m^3$ in air. The interpretation of unit risk would be as follows: if unit risk = 1.5 x 10-6 µg/L, 1.5 excess tumors are expected to develop per 1,000,000 people if exposed daily for a lifetime to 1 µg of the chemical in 1 liter of drinking water.

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# Appendix R

# Screening Ecological Risk Assessment Inputs and Calculations

## Table R-1a. Benchmarks for Birds

| Constituent | CAS | Benchmark (mg/kg-d) [a] | Test Species | Body Weight (kg) | Toxicity Endpoint | Reference |
|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | | | |
| Acrylonitrile | 107-13-1 | ID | | | | |
| Antimony | 7440-36-0 | ID | | | | |
| Barium | 7440-39-3 | 30 | Chicken | 0.121 | Developmental effects | Johnson et al., 1960 |
| Benzene | 71-43-2 | ID | | | | |
| Butylbenzylphthalate | 85-68-7 | ID | | | | |
| Cadmium | 7440-43-9 | 4.4 | Mallard | 1.153 | Reproduction | White and Finley, 1978 |
| Chloroform | 67-66-3 | ID | | | | |
| Chromium (III) | 16065-83-1 | 2.2 | Duck | 1.25 | Reproduction | Sample et al., 1996 |
| Chromium (VI) | 18540-29-9 | ID | | | | |
| Cobalt | 7440-48-4 | ID | | | | |
| Copper | 7440-50-8 | 53.85 | Chicks | 0.534 | Growth, mortality | Sample et al., 1996 |
| Cresol, m- | 108-39-4 | ID | | | | |
| Cresol, o- | 95-48-7 | ID | | | | |
| Cresol, p- | 106-44-5 | ID | | | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | 1.1 | Ringed dove | 0.155 | Reproduction | Sample et al., 1996 |
| Dibutylphthalate | 84-74-2 | 0.347 | Ringed dove | 0.155 | Reproduction | Sample et al., 1996 |
| Dichloromethane | 75-09-2 | ID | | | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | | | |
| Divalent mercury | 7439-97-6(d) | 0.64 | Japanese quail | 0.15 | Reproduction | Sample et al., 1996 |
| Ethylbenzene | 100-41-4 | ID | | | | |
| Ethylene glycol | 107-21-1 | ID | | | | |
| Formaldehyde | 50-00-0 | ID | | | | |
| Lead | 7439-92-1 | 0.066 | Quail | 0.15 | Reproduction | Edens and Garlich, 1983 |
| Methanol | 67-56-1 | ID | | | | |
| Methyl ethyl ketone | 78-93-3 | ID | | | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | | | |
| Methyl methacrylate | 80-62-6 | ID | | | | |
| Methylmercury | 22967-92-6 | 0.025 | Mallard | 1.162 | Reproduction | U.S. EPA, 1997a |
| n-Butyl alcohol | 71-36-3 | ID | | | | |
| Nickel | 7440-02-0 | 91 | Mallard | 0.782 | Mortality, growth, behavior | Sample et al., 1996 |
| Pentachlorophenol | 87-86-5 | 62 | Chicks | 1.245 | Growth | Prescott et al., 1982 |
| Phenol | 108-95-2 | ID | | | | |
| Selenium | 7782-49-2 | 1.6 | Mallard | 1.055 | Reproduction | Heinz et al., 1987 |
| Silver | 7440-22-4 | ID | | | | |
| Styrene | 100-42-5 | ID | | | | |
| Tetrachloroethylene | 127-18-4 | ID | | | | |
| Tin | 7440-31-5 | ID | | | | |
| Toluene | 108-88-3 | ID | | | | |

## Table R-1a. Benchmarks for Birds

| Constituent | CAS | Benchmark (mg/kg-d) [a] | Test Species | Body Weight (kg) | Toxicity Endpoint | Reference |
|---|---|---|---|---|---|---|
| Vinyl acetate | 108-05-4 | ID | | | | |
| Xylene (mixed isomers) | 1330-20-7 | ID | | | | |
| Zinc | 7440-66-6 | 32 | Chicken | 1.935 | Reproduction | Sample et al., 1996 |

ID = Insufficient data.

[a] Measure of effect for benchmarks is a geomean of the no observed adverse effects level (NOAEL) and the lowest observed adverse effects level (LOAEL).

## Table R-1b. Benchmarks for Mammals

| Constituent | CAS | Benchmark (mg/kg-d) [a] | Test Species | Body Weight (kg) | Toxicity Endpoint | Reference |
|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | | | |
| Acrylonitrile | 107-13-1 | ID | | | | |
| Antimony | 7440-36-0 | 0.45 | Rat | 0.255 | Reproduction | Rossi et al., 1987 |
| Barium | 7440-39-3 | ID | | | | |
| Benzene | 71-43-2 | 83.4 | Mosue | 0.03 | Reproduction | U.S. EPA, 1999a |
| Butylbenzylphthalate | 85-68-7 | 1909.81 | Rat | 0.4 | Reproduction | U.S. EPA, 1995 |
| Cadmium | 7440-43-9 | 3.16 | Rat | 0.46 | Reproduction | Sutou et al., 1980 |
| Chloroform | 67-66-3 | 24.8 | Rat | 0.35 | Liver, kidney, gonad condition | Sample et al., 1996 |
| Chromium (III) | 16065-83-1 | 2737 | Rat | 0.35 | Reproduction, longevity | Sample et al., 1996 |
| Chromium (VI) | 18540-29-9 | 10.4 | Mouse | 0.023 | Growth | Zahid et al., 1990 |
| Cobalt | 7440-48-4 | ID | | | | |
| Copper | 7440-50-8 | ID | Mink | 0.75 | Development | Aulerich et al., 1982 |
| Cresol, m- | 108-39-4 | ID | | | | |
| Cresol, o- | 95-48-7 | ID | | | | |
| Cresol, p- | 106-44-5 | ID | | | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | 115 | Mouse | 0.03026 | Reproduction | Shiota and Nishimura, 1982 |
| Dibutylphthalate | 84-74-2 | ID | | | | |
| Dichloromethane | 75-09-2 | ID | | | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | | | |
| Divalent mercury | 7439-97-6(d) | 1 | Mink | 1 | Reproduction | Sample et al., 1996 |
| Ethylbenzene | 100-41-4 | ID | | | | |
| Ethylene glycol | 107-21-1 | ID | | | | |
| Formaldehyde | 50-00-0 | ID | | | | |
| Lead | 7439-92-1 | 0.016 | Rat | 0.47 | Reproduction | Krasovskii et al., 1979 |
| Methanol | 67-56-1 | ID | | | | |
| Methyl ethyl ketone | 78-93-3 | 2845 | Rat | 0.35 | Reproduction | Sample et al., 1996 |
| Methyl isobutyl ketone | 108-10-1 | ID | | | | |
| Methyl methacrylate | 80-62-6 | ID | | | | |
| Methylmercury | 22967-92-6 | 0.099 | Mink | 0.8 | Reproduction | U.S. EPA, 1997a |
| n-Butyl alcohol | 71-36-3 | ID | | | | |
| Nickel | 7440-02-0 | 75.7 | Rat | 0.148 | Reproduction | Ambrose et al., 1976 |
| Pentachlorophenol | 87-86-5 | 7.2 | Rat | 0.33 | Reproduction | Welsh et al., 1987 |
| Phenol | 108-95-2 | ID | | | | |
| Selenium | 7782-49-2 | 0.26 | Rat | 0.32 | Reproduction | Rosenfeld and Beath, 1954 |
| Silver | 7440-22-4 | ID | | | | |
| Styrene | 100-42-5 | ID | | | | |
| Tetrachloroethylene | 127-18-4 | ID | | | | |
| Tin | 7440-31-5 | ID | | | | |
| Toluene | 108-88-3 | 82.2 | Mouse | 0.03 | Reproduction | Sample et al., 1996 |

## Table R-1b. Benchmarks for Mammals

| Constituent | CAS | Benchmark (mg/kg-d) [a] | Test Species | Body Weight (kg) | Toxicity Endpoint | Reference |
|---|---|---|---|---|---|---|
| Vinyl acetate | 108-05-4 | ID | | | | |
| Xylene (mixed isomers) | 1330-20-7 | ID | | | | |
| Zinc | 7440-66-6 | 290 | Rat | 0.174 | Reproduction | Schlicker and Cox, 1968 |

ID = Insufficient data.

[a] Measure of effects for all benchmarks is a geomean of the no-oberved-adverse-effects level (NOAEL) and the lowest-observed-adverse effects level (LOAEL).

## Table R-1c. Benchmarks for Aquatic Plants

| Constituent | CAS | Benchmark (mg/L) | Measure of Effects[a] | Reference |
|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | |
| Acrylonitrile | 107-13-1 | ID | | |
| Antimony | 7440-36-0 | 0.61 | LCV-EC50 | Suter and Tsao, 1996 |
| Barium | 7440-39-3 | ID | | |
| Benzene | 71-43-2 | 530 | LCV-EC50 | U.S. EPA, 1999b |
| Butylbenzylphthalate | 85-68-7 | ID | | |
| Cadmium | 7440-43-9 | 0.002 | LCV-EC50 | Suter and Tsao, 1996 |
| Chloroform | 67-66-3 | ID | | |
| Chromium (III) | 16065-83-1 | 0.397 | LCV-EC50 | Suter and Tsao, 1996 |
| Chromium (VI) | 18540-29-9 | 0.002 | LCV-EC50 | Suter and Tsao, 1996 |
| Cobalt | 7440-48-4 | ID | | |
| Copper | 7440-50-8 | 0.001 | LCV-EC50 | Suter and Tsao, 1996 |
| Cresol, m- | 108-39-4 | ID | | |
| Cresol, o- | 95-48-7 | ID | | |
| Cresol, p- | 106-44-5 | ID | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | ID | | |
| Dibutylphthalate | 84-74-2 | ID | | |
| Dichloromethane | 75-09-2 | ID | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | |
| Ethylbenzene | 100-41-4 | ID | | |
| Ethylene glycol | 107-21-1 | ID | | |
| Formaldehyde | 50-00-0 | ID | | |
| Lead | 7439-92-1 | 0.5 | LCV-EC50 | Suter and Tsao, 1996 |
| Methanol | 67-56-1 | ID | | |
| Methyl ethyl ketone | 78-93-3 | ID | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | |
| Methyl methacrylate | 80-62-6 | ID | | |
| Methylmercury | 22967-92-6 | 0.0008 | LCV-EC50 | Suter and Tsao, 1996 |
| n-Butyl alcohol | 71-36-3 | ID | | |
| Nickel | 7440-02-0 | 0.005 | LCV-EC50 | Suter and Tsao, 1996 |
| Pentachlorophenol | 87-86-5 | ID | | |
| Phenol | 108-95-2 | 20 | LCV-EC50 | Suter and Tsao, 1996 |
| Selenium | 7782-49-2 | 0.1 | LCV-EC50 | Suter and Tsao, 1996 |
| Silver | 7440-22-4 | 0.03 | LCV-EC50 | Suter and Tsao, 1996 |
| Styrene | 100-42-5 | ID | | |
| Tetrachloroethylene | 127-18-4 | ID | | |
| Tin | 7440-31-5 | ID | | |
| Toluene | 108-88-3 | 245 | LCV-EC50 | Suter and Tsao, 1996 |
| Vinyl acetate | 108-05-4 | ID | | |
| Xylene (mixed isomers) | 1330-20-7 | ID | | |
| Zinc | 7440-66-6 | 0.03 | LCV-EC50 | Suter and Tsao, 1996 |

## Table R-1c. Benchmarks for Aquatic Plants

| Constituent | CAS | Benchmark (mg/L) | Measure of Effects[a] | Reference |
|---|---|---|---|---|

EC50 = Effective concentration for 50% of the organisms.

ID = Insufficient data.

LCV = Lowest chronic value.

[a] Endpoints include growth, deformities, reporoductive success, and lethality.

## Table R-1d. Benchmarks for Terrestrial Plants

| Constituent | CAS | Benchmark (mg/kg soil) | Measure of Effects[a] | Reference |
|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | |
| Acrylonitrile | 107-13-1 | ID | | |
| Antimony | 7440-36-0 | 5 | ER-L | Efroymson et al., 1997b |
| Barium | 7440-39-3 | 500 | ER-L | Efroymson et al., 1997b |
| Benzene | 71-43-2 | ID | | |
| Butylbenzylphthalate | 85-68-7 | ID | | |
| Cadmium | 7440-43-9 | 4 | ER-L | Efroymson et al., 1997b |
| Chloroform | 67-66-3 | ID | | |
| Chromium (III) | 16065-83-1 | ID | | |
| Chromium (VI) | 18540-29-9 | 1 | ER-L | Efroymson et al., 1997b |
| Cobalt | 7440-48-4 | 20 | ER-L | Efroymson et al., 1997b |
| Copper | 7440-50-8 | 100 | ER-L | Efroymson et al., 1997b |
| Cresol, m- | 108-39-4 | ID | | |
| Cresol, o- | 95-48-7 | ID | | |
| Cresol, p- | 106-44-5 | ID | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | ID | | |
| Dibutylphthalate | 84-74-2 | ID | | |
| Dichloromethane | 75-09-2 | ID | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | |
| Divalent mercury | 7439-97-6(d) | ID | | |
| Ethylbenzene | 100-41-4 | ID | | |
| Ethylene glycol | 107-21-1 | ID | | |
| Formaldehyde | 50-00-0 | ID | | |
| Lead | 7439-92-1 | 50 | ER-L | Efroymson et al., 1997b |
| Methanol | 67-56-1 | ID | | |
| Methyl ethyl ketone | 78-93-3 | ID | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | |
| Methyl methacrylate | 80-62-6 | ID | | |
| n-Butyl alcohol | 71-36-3 | ID | | |
| Nickel | 7440-02-0 | 30 | ER-L | Efroymson et al., 1997b |
| Pentachlorophenol | 87-86-5 | 3 | ER-L | Efroymson et al., 1997b |
| Phenol | 108-95-2 | 70 | ER-L | Efroymson et al., 1997b |
| Selenium | 7782-49-2 | 1 | ER-L | Efroymson et al., 1997b |
| Silver | 7440-22-4 | 2 | ER-L | Efroymson et al., 1997b |
| Styrene | 100-42-5 | 300 | ER-L | Efroymson et al., 1997b |
| Tetrachloroethylene | 127-18-4 | ID | | |
| Tin | 7440-31-5 | 50 | ER-L | Efroymson et al., 1997b |
| Toluene | 108-88-3 | 200 | ER-L | Efroymson et al., 1997b |
| Vinyl acetate | 108-05-4 | ID | | |
| Xylene (mixed isomers) | 1330-20-7 | ID | | |
| Zinc | 7440-66-6 | 50 | ER-L | Efroymson et al., 1997b |

## Table R-1d. Benchmarks for Terrestrial Plants

| Constituent | CAS | Benchmark (mg/kg soil) | Measure of Effects[a] | Reference |
|---|---|---|---|---|

ID = Insufficient data.

[a] Endpoints are plant growth and yield.

## Table R-1e. Benchmarks for the Soil Community

| Constituent | CAS | Benchmark (mg/kg soil) | Test Species | Measured Effect[a] | Reference |
|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | | |
| Acrylonitrile | 107-13-1 | 1000 | microbial | ER-L | Efroymson et al., 1997a |
| Antimony | 7440-36-0 | ID | | | |
| Barium | 7440-39-3 | 3000 | microbial | ER-L | Efroymson et al., 1997a |
| Benzene | 71-43-2 | ID | | | |
| Butylbenzylphthalate | 85-68-7 | ID | | | |
| Cadmium | 7440-43-9 | 1 | combination | Community-based CSCL | U.S. EPA, 1999d |
| Chloroform | 67-66-3 | ID | | | |
| Chromium (III) | 16065-83-1 | ID | | | |
| Chromium (VI) | 18540-29-9 | 0.4 | combination | | CCME, 1997 |
| Cobalt | 7440-48-4 | 1000 | microbial | ER-L | Efroymson et al., 1997a |
| Copper | 7440-50-8 | 50 | earthworms | ER-L | Efroymson et al., 1997a |
| Cresol, m- | 108-39-4 | ID | | | |
| Cresol, o- | 95-48-7 | ID | | | |
| Cresol, p- | 106-44-5 | ID | | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | ID | | | |
| Dibutylphthalate | 84-74-2 | ID | | | |
| Dichloromethane | 75-09-2 | ID | | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | | |
| Divalent mercury | 7439-97-6(d) | ID | | | |
| Ethylbenzene | 100-41-4 | 0.1 | combination | ER-L | CCME, 1997 |
| Ethylene glycol | 107-21-1 | 97 | combination | | CCME, 1997 |
| Formaldehyde | 50-00-0 | ID | | | |
| Lead | 7439-92-1 | 28 | combination | Community-based CSCL | U.S. EPA, 1999d |
| Methanol | 67-56-1 | ID | | | |
| Methyl ethyl ketone | 78-93-3 | ID | | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | | |
| Methyl methacrylate | 80-62-6 | ID | | | |
| n-Butyl alcohol | 71-36-3 | ID | | | |
| Nickel | 7440-02-0 | 90 | microbial | ER-L | Efroymson et al., 1997a |
| Pentachlorophenol | 87-86-5 | 6 | earthworms | ER-L | Efroymson et al., 1997a |
| Phenol | 108-95-2 | 30 | earthworms | ER-L | Efroymson et al., 1997a |
| Selenium | 7782-49-2 | 70 | earthworms | ER-L | Efroymson et al., 1997a |
| Silver | 7440-22-4 | 50 | microbial | ER-L | Efroymson et al., 1997a |
| Styrene | 100-42-5 | ID | | | |
| Tetrachloroethylene | 127-18-4 | 0.1 | combination | | CCME, 1997 |
| Tin | 7440-31-5 | 2000 | microbial | ER-L | Efroymson et al., 1997a |
| Toluene | 108-88-3 | 0.1 | combination | | CCME, 1997 |
| Vinyl acetate | 108-05-4 | ID | | | |

## Table R-1e. Benchmarks for the Soil Community

| Constituent | CAS | Benchmark (mg/kg soil) | Test Species | Measured Effect[a] | Reference |
|---|---|---|---|---|---|
| Xylene (mixed isomers) | 1330-20-7 | 0.1 | combination | | CCME, 1997 |
| Zinc | 7440-66-6 | 100 | microbials | ER-L | Efroymson et al., 1997a |

CSCL = Chemical stressor concentration limits.

ID = Insufficient data.

ER-L = Effects range low.

[a]Endpoints include survivorship, growth, respiration, reproduction, substrate transformation, and enzyme activity.

## Table R-1f. Benchmarks for the Sediment Community

| Constituent | CAS | Benchmark (mg/kg sediment) | Measure of Effects [a] | Reference |
|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | |
| Acrylonitrile | 107-13-1 | ID | | |
| Antimony | 7440-36-0 | 2.00E+00 | ER-L | Long and Morgan, 1991 |
| Barium | 7440-39-3 | ID | | |
| Benzene | 71-43-2 | 1.60E-01 | EqP | U.S. EPA, 1999b |
| Butylbenzylphthalate | 85-68-7 | 1.74E+01 | EqP | U.S. EPA, 1995 |
| Cadmium | 7440-43-9 | 6.76E-01 | TEL | MacDonald, 1994 |
| Chloroform | 67-66-3 | 1.06E-02 | EqP | Jones et al., 1997 |
| Chromium (III) | 16065-83-1 | ID | | |
| Chromium (VI) | 18540-29-9 | ID | | |
| Cobalt | 7440-48-4 | ID | | |
| Copper | 7440-50-8 | 1.87E+01 | TEL | MacDonald, 1994 |
| Cresol, m- | 108-39-4 | ID | | |
| Cresol, o- | 95-48-7 | ID | | |
| Cresol, p- | 106-44-5 | ID | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | 1.82E-01 | TEL | MacDonald, 1994 |
| Dibutylphthalate | 84-74-2 | ID | | |
| Dichloromethane | 75-09-2 | 1.87E-01 | EqP | Jones et al., 1997 |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | |
| Divalent mercury | 7439-97-6(d) | 1.30E-01 | TEL | MacDonald, 1994 |
| Ethylbenzene | 100-41-4 | 7.30E-02 | EqP | Jones et al., 1997 |
| Ethylene glycol | 107-21-1 | ID | | |
| Formaldehyde | 50-00-0 | ID | | |
| Lead | 7439-92-1 | 3.02E+01 | TEL | MacDonald, 1994 |
| Methanol | 67-56-1 | ID | | |
| Methyl ethyl ketone | 78-93-3 | ID | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | |
| Methyl methacrylate | 80-62-6 | ID | | |
| n-Butyl alcohol | 71-36-3 | ID | | |
| Nickel | 7440-02-0 | 1.59E+01 | TEL | MacDonald, 1994 |
| Pentachlorophenol | 87-86-5 | 3.74E-02 | EqP | Jones et al., 1997 |
| Phenol | 108-95-2 | 1.87E-02 | EqP | Jones et al., 1997 |
| Selenium | 7782-49-2 | ID | | |
| Silver | 7440-22-4 | 7.33E-01 | TEL | MacDonald, 1994 |
| Styrene | 100-42-5 | ID | | |
| Tetrachloroethylene | 127-18-4 | 1.59E-01 | EqP | Jones et al., 1997 |
| Tin | 7440-31-5 | ID | | |
| Toluene | 108-88-3 | 2.64E-02 | EqP | Jones et al., 1997 |
| Vinyl acetate | 108-05-4 | 4.11E-04 | Eqp | Jones et al., 1997 |
| Xylene (mixed isomers) | 1330-20-7 | 1.56E-01 | EqP | Jones et al., 1997 |
| Zinc | 7440-66-6 | 1.24E+02 | TEL | MacDonald, 1994 |

## Table R-1f. Benchmarks for the Sediment Community

| Constituent | CAS | Benchmark (mg/kg sediment) | Measure of Effects [a] | Reference |
|---|---|---|---|---|

ER-L = Effects range low.

EqP = Equilibrium partitioning.

TEL = Threshold effects level.

[a]Endpoints include survival, species diversity, and abundance.

## Table R-1g. Benchmarks for the Aquatic Community

| Constituent | CAS | Benchmark (mg/L) Total | Benchmark (mg/L) Dissolved | Methodology[a] | Reference |
|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | ID | | |
| Acrylonitrile | 107-13-1 | ID | NA | | |
| Antimony | 7440-36-0 | 0.03 | ID | Draft FCV | U.S. EPA, 1988 |
| Barium | 7440-39-3 | 0.004 | ID | SCV - Tier II | Suter and Tsao, 1996 |
| Benzene | 71-43-2 | 0.13 | ID | SCV - Tier II | U.S. EPA, 1999b |
| Butylbenzylphthalate | 85-68-7 | 16 | ID | SCV - Tier II | U.S. EPA, 1995 |
| Cadmium | 7440-43-9 | 0.0025 | 0.0023 | CCC - NAWQC | U.S. EPA, 1996a |
| Chloroform | 67-66-3 | 0.028 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Chromium (III) | 16065-83-1 | 0.086 | 0.074 | CCC - NAWQC | U.S. EPA, 1996a |
| Chromium (VI) | 18540-29-9 | 0.011 | 0.011 | CCC - NAWQC | U.S. EPA, 1996a |
| Cobalt | 7440-48-4 | 0.023 | ID | SCV - Tier II | Suter and Tsao, 1996 |
| Copper | 7440-50-8 | 0.0093 | 0.0089 | CCC - NAWQC | U.S. EPA, 1996a |
| Cresol, m- | 108-39-4 | ID | ID | | |
| Cresol, o- | 95-48-7 | ID | ID | | |
| Cresol, p- | 106-44-5 | ID | ID | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | 0.003 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Dibutylphthalate | 84-74-2 | ID | NA | | |
| Dichloromethane | 75-09-2 | 2.2 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Dimethylphenol, 2,4- | 105-67-9 | ID | NA | | |
| Ethylbenzene | 100-41-4 | 0.0073 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Ethylene glycol | 107-21-1 | ID | NA | | |
| Formaldehyde | 50-00-0 | ID | NA | | |
| Lead | 7439-92-1 | 0.0032 | 0.0025 | FCV - NAWQC | U.S. EPA, 1985 |
| Methanol | 67-56-1 | ID | NA | | |
| Methyl ethyl ketone | 78-93-3 | ID | NA | | |
| Methyl isobutyl ketone | 108-10-1 | ID | NA | | |
| Methyl methacrylate | 80-62-6 | ID | NA | | |
| Methylmercury | 22967-92-6 | 0.0000028 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| n-Butyl alcohol | 71-36-3 | ID | NA | | |
| Nickel | 7440-02-0 | 0.052 | 0.052 | CCC - NAWQC | U.S. EPA, 1996a |
| Pentachlorophenol | 87-86-5 | 0.0024 | NA | CCC - NAWQC | U.S. EPA, 1996a |
| Phenol | 108-95-2 | 0.11 | NA | FCV - chronic NAWQC | U.S. EPA, 1999 |
| Selenium | 7782-49-2 | 0.005 | ID | CCC - NAWQC | U.S. EPA, 1996a |
| Silver | 7440-22-4 | 0.00036 | ID | SCV - NAWQC FAV | Suter and Tsao, 1996 |
| Styrene | 100-42-5 | ID | NA | | |
| Tetrachloroethylene | 127-18-4 | 0.098 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Tin | 7440-31-5 | 0.073 | ID | SCV - Tier II | Suter and Tsao, 1996 |
| Toluene | 108-88-3 | 0.0098 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Vinyl acetate | 108-05-4 | 0.016 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Xylene (mixed isomers) | 1330-20-7 | 0.013 | NA | SCV - Tier II | Suter and Tsao, 1996 |
| Zinc | 7440-66-6 | 0.12 | 0.12 | CCC - NAWQC | U.S. EPA, 1996a |

**Table R-1g. Benchmarks for the Aquatic Community**

| Constituent | CAS | Benchmark (mg/L) Total | Dissolved | Methodology[a] | Reference |
|---|---|---|---|---|---|

CCC = Criterion continuous concentration.
FCV = Final chronic value.
ID = Insufficient data.
NA = Not applicable.
NAWQC = National ambient water quality criteria.
SCV = Secondary chronic value.
[a] Endpoints include growth, deformities, reproductive success, and lethality.

## Table R-1h. Benchmarks for Amphibians

| Constituent | CAS | Benchmark (mg/L) | Methodology[a] | Reference |
|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | | |
| Acrylonitrile | 107-13-1 | ID | | |
| Antimony | 7440-36-0 | 0.3 | Geomean of LC50s | U.S. EPA, 1996b |
| Barium | 7440-39-3 | ID | | |
| Benzene | 71-43-2 | ID | | |
| Butylbenzylphthalate | 85-68-7 | ID | | |
| Cadmium | 7440-43-9 | 1.2172 | Geomean of LC50s | Power et al., 1989; U.S. EPA, 1996b |
| Chloroform | 67-66-3 | 8.878 | Geomean of LC50s | Devillers and Exbrayat, 1992; U.S. EPA, 1996b |
| Chromium (III) | 16065-83-1 | ID | | |
| Chromium (VI) | 18540-29-9 | 9.4733 | Geomean of LC50s | Power et al., 1989; U.S. EPA, 1996b |
| Cobalt | 7440-48-4 | 0.05 | Geomean of LC50s | Power et al., 1989 |
| Copper | 7440-50-8 | 0.11 | Geomean of LC50s | U.S. EPA, 1996b |
| Cresol, m- | 108-39-4 | ID | | |
| Cresol, o- | 95-48-7 | ID | | |
| Cresol, p- | 106-44-5 | ID | | |
| Di(2-ethylhexylphthalate) | 117-81-7 | ID | | |
| Dibutylphthalate | 84-74-2 | ID | | |
| Dichloromethane | 75-09-2 | ID | | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | | |
| Ethylbenzene | 100-41-4 | ID | | |
| Ethylene glycol | 107-21-1 | 326 | Geomean of LC50s | Devillers and Exbrayat, 1992 |
| Formaldehyde | 50-00-0 | ID | | |
| Lead | 7439-92-1 | ID | | |
| Methanol | 67-56-1 | ID | | |
| Methyl ethyl ketone | 78-93-3 | ID | | |
| Methyl isobutyl ketone | 108-10-1 | ID | | |
| Methyl methacrylate | 80-62-6 | ID | | |
| Methylmercury | 22967-92-6 | 0.058 | Geomean of LC50s | U.S. EPA, 1996b |
| n-Butyl alcohol | 71-36-3 | 1200 | Geomean of LC50s | Devillers and Exbrayat, 1992 |
| Nickel | 7440-02-0 | 1.7493 | Geomean of LC50s | U.S. EPA, 1996b |
| Pentachlorophenol | 87-86-5 | 0.2527 | Geomean of LC50s | Devillers and Exbrayat, 1992 |
| Phenol | 108-95-2 | 1.1131 | Geomean of LC50s | Devillers and Exbrayat, 1992; U.S. EPA, 1996b |
| Selenium | 7782-49-2 | 1.7321 | Geomean of LC50s | U.S. EPA, 1996b |
| Silver | 7440-22-4 | ID | | |
| Styrene | 100-42-5 | ID | | |
| Tetrachloroethylene | 127-18-4 | ID | | |
| Tin | 7440-31-5 | 0.09 | Geomean of LC50s | U.S. EPA, 1996c |
| Toluene | 108-88-3 | 0.39 | Geomean of LC50s | Devillers and Exbrayat, 1992 |
| Vinyl acetate | 108-05-4 | ID | | |

## Table R-1h. Benchmarks for Amphibians

| Constituent | CAS | Benchmark (mg/L) | Methodology[a] | Reference |
|---|---|---|---|---|
| Xylene (mixed isomers) | 1330-20-7 | 73 | Geomean of LC50s | Devillers and Exbrayat, 1992 |
| Zinc | 7440-66-6 | 1.3 | Geomean of LC50s | U.S. EPA, 1996b |

ID = Insufficient data.

[a]Endpoint is lethality.

# Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Antimony (7440-36-0)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.00E+00 | Default value |
| Trophic level 4 fish (whole) | 1.00E+00 | Default value |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 2.00E-01 | Baes et al., 1984 |
| Exposed vegetables | 2.00E-01 | Baes et al., 1984 |
| Forage | 2.00E-01 | Baes et al., 1984 |
| Grains | 3.00E-02 | Baes et al., 1984 |
| Roots | 3.00E-02 | Baes et al., 1984 |
| Silage | 2.00E-01 | Baes et al., 1984 |

## Barium (7440-39-3)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 2.91E+00 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 1.00E+00 | Default value |
| Trophic level 4 fish (whole) | 1.00E+00 | Default value |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 9.10E-02 | Sample et al., 1998a |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 5.66E-02 | Sample et al., 1998b |
| Small birds | 5.66E-02 | Sample et al., 1998b |
| Small herpetofauna | 1.86E+00 | Rowe et al., 1996 |
| Herbivores | 5.66E-02 | Sample et al., 1998b |
| Omnivores | 5.66E-02 | Sample et al., 1998b |
| Exposed fruit | 1.50E-01 | Baes et al., 1984 |
| Exposed vegetables | 1.50E-01 | Baes et al., 1984 |
| Forage | 1.50E-01 | Baes et al., 1984 |
| Grains | 1.50E-02 | Baes et al., 1984 |
| Roots | 1.50E-02 | Baes et al., 1984 |
| Silage | 1.50E-01 | Baes et al., 1984 |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

# Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Benzene (71-43-2)**

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.20E+01 | U.S. EPA, 1998 |
| Trophic level 4 fish (whole) | 1.78E+01 | U.S. EPA, 1998 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 2.27E+00 | U.S. EPA, 1998 |
| Exposed vegetables | 2.27E+00 | U.S. EPA, 1998 |
| Forage | 2.27E+00 | U.S. EPA, 1998 |
| Grains | 2.27E+00 | U.S. EPA, 1998 |
| Roots | 1.65E-01 | U.S. EPA, 1997b |
| Silage | 2.27E+00 | U.S. EPA, 1998 |

**Butylbenzylphthalate (85-68-7)**

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.40E+03 | U.S. EPA, 1995 |
| Trophic level 4 fish (whole) | 1.40E+03 | U.S. EPA, 1995 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 6.17E-02 | U.S. EPA, 1998 |
| Exposed vegetables | 6.17E-02 | U.S. EPA, 1998 |
| Forage | 6.17E-02 | U.S. EPA, 1998 |
| Grains | 6.17E-02 | U.S. EPA, 1998 |
| Roots | 7.47E-02 | U.S. EPA, 1997b |
| Silage | 6.17E-02 | U.S. EPA, 1998 |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

# Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Cadmium (7440-43-9)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 6.69E+03 | U.S. EPA, 1999d |
| Aquatic plants | 1.70E+01 | U.S. EPA, 1999d |
| Small herpetofauna | 6.05E+00 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 2.65E+02 | Barrows et al., 1980 |
| Trophic level 4 fish (whole) | 2.65E+02 | Barrows et al., 1980 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 7.71E+00 | Sample et al., 1998a |
| Invertebrates | 7.99E+00 | U.S. DOE, 1998 |
| Small mammals | 3.33E-01 | Sample et al., 1998b |
| Small birds | 3.33E-01 | Sample et al., 1998b |
| Small herpetofauna | 3.87E+00 | Rowe et al., 1996 |
| Herbivores | 3.33E-01 | Sample et al., 1998b |
| Omnivores | 3.33E-01 | Sample et al., 1998b |
| Exposed fruit | 5.50E-01 | U.S. EPA, 1999d |
| Exposed vegetables | 6.00E-01 | Baes et al., 1984 |
| Forage | 3.10E-01 | U.S. EPA, 1999d |
| Grains | 5.50E-02 | U.S. EPA, 1999d |
| Roots | 4.00E-01 | U.S. EPA, 1999d |
| Silage | 2.10E-01 | Baes et al., 1984 |

## Chloroform (67-66-3)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 8.63E+00 | U.S. EPA, 1998 |
| Trophic level 4 fish (whole) | 1.26E+01 | U.S. EPA, 1998 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 3.01E+00 | U.S. EPA, 1998 |
| Exposed vegetables | 3.01E+00 | U.S. EPA, 1998 |
| Forage | 3.01E+00 | U.S. EPA, 1998 |
| Grains | 3.01E+00 | U.S. EPA, 1998 |
| Roots | 1.25E+00 | U.S. EPA, 1997b |
| Silage | 3.01E+00 | U.S. EPA, 1998 |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Chromium (III) (16065-83-1)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 4.00E+01 | U.S. EPA, 1999d |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 3.80E-01 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 8.70E+01 | U.S. EPA, 1999e |
| Trophic level 4 fish (whole) | 8.70E+01 | U.S. EPA, 1999e |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 3.06E-01 | Sample et al., 1998a |
| Invertebrates | 4.68E-01 | U.S. DOE, 1998 |
| Small mammals | 8.46E-02 | Sample et al., 1998b |
| Small birds | 8.46E-02 | Sample et al., 1998b |
| Small herpetofauna | 2.43E-01 | Rowe et al., 1996 |
| Herbivores | 8.46E-02 | Sample et al., 1998b |
| Omnivores | 8.46E-02 | Sample et al., 1998b |
| Exposed fruit | 7.50E-03 | U.S. EPA, 1999d |
| Exposed vegetables | 5.70E-04 | Baes et al., 1984 |
| Forage | 1.90E-03 | U.S. EPA, 1999d |
| Grains | 8.50E-05 | U.S. EPA, 1999d |
| Roots | 6.60E-04 | U.S. EPA, 1999d |
| Silage | 9.30E-03 | Baes et al., 1984 |

### Chromium (VI) (18540-29-9)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 4.00E+01 | U.S. EPA, 1999d |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 3.80E-01 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 8.70E+01 | U.S. EPA, 1999e |
| Trophic level 4 fish (whole) | 8.70E+01 | U.S. EPA, 1999e |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 3.06E-01 | Sample et al., 1998a |
| Invertebrates | 4.68E-01 | U.S. DOE, 1998 |
| Small mammals | 8.46E-02 | Sample et al., 1998b |
| Small birds | 8.46E-02 | Sample et al., 1998b |
| Small herpetofauna | 2.43E-01 | Rowe et al., 1996 |
| Herbivores | 8.46E-02 | Sample et al., 1998b |
| Omnivores | 8.46E-02 | Sample et al., 1998b |
| Exposed fruit | 7.50E-03 | U.S. EPA, 1999d |
| Exposed vegetables | 5.70E-04 | Baes et al., 1984 |
| Forage | 1.90E-03 | U.S. EPA, 1999d |
| Grains | 8.50E-05 | U.S. EPA, 1999d |
| Roots | 6.60E-04 | U.S. EPA, 1999d |
| Silage | 9.30E-03 | U.S. EPA, 1999d |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

# Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Copper (7440-50-8)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 6.83E-01 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 0.00E+00 | Stephan, 1993 |
| Trophic level 4 fish (whole) | 0.00E+00 | Stephan, 1993 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 5.15E-01 | Sample et al., 1998a |
| Invertebrates | 5.25E+00 | U.S. DOE, 1998 |
| Small mammals | 1.96E-01 | Sample et al., 1998b |
| Small birds | 1.96E-01 | Sample et al., 1998b |
| Small herpetofauna | 4.37E-01 | Rowe et al., 1996 |
| Herbivores | 1.96E-01 | Sample et al., 1998b |
| Omnivores | 1.96E-01 | Sample et al., 1998b |
| Exposed fruit | 4.00E-01 | U.S. EPA, 1999d |
| Exposed vegetables | 7.80E-02 | Baes et al., 1984 |
| Forage | 1.30E-01 | U.S. EPA, 1999d |
| Grains | 5.90E-02 | U.S. EPA, 1999d |
| Roots | 1.50E-01 | U.S. EPA, 1999d |
| Silage | 3.20E-01 | Baes et al., 1984 |

## Di(2-ethylhexylphthalate) (117-81-7)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 3.40E-01 | U.S. EPA, 1999d |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 3.60E+00 | Sample et al., 1996 |
| Trophic level 4 fish (whole) | 1.50E+01 | Sample et al., 1996 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 2.34E-03 | U.S. EPA, 1998 |
| Exposed vegetables | 2.34E-03 | U.S. EPA, 1998 |
| Forage | 2.34E-03 | U.S. EPA, 1998 |
| Grains | 2.34E-03 | U.S. EPA, 1998 |
| Roots | 7.37E-03 | U.S. EPA, 1997b |
| Silage | 2.34E-03 | U.S. EPA, 1998 |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Dibutylphthalate (84-74-2)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.50E+03 | U.S. EPA, 1999d |
| Trophic level 4 fish (whole) | 1.50E+03 | U.S. EPA, 1999d |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 8.38E-02 | U.S. EPA, 1998 |
| Exposed vegetables | 8.38E-02 | U.S. EPA, 1998 |
| Forage | 8.38E-02 | U.S. EPA, 1998 |
| Grains | 8.38E-02 | U.S. EPA, 1998 |
| Roots | 3.61E-02 | U.S. EPA, 1997b |
| Silage | 8.38E-02 | U.S. EPA, 1998 |

### Divalent mercury (7439-97-6(d))

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | | |
| Aquatic plants | | |
| Small herpetofauna | | |
| Trophic level 3 fish (whole) | | |
| Trophic level 4 fish (whole) | | |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.69E+00 | Sample et al., 1998a |
| Invertebrates | 2.87E+00 | U.S. DOE, 1998 |
| Small mammals | 5.43E-02 | Sample et al., 1998b |
| Small birds | 2.10E+00 | U.S. EPA, 1999d |
| Small herpetofauna | 2.10E+00 | U.S. EPA, 1999d |
| Herbivores | 2.10E+00 | U.S. EPA, 1999d |
| Omnivores | 2.10E+00 | U.S. EPA, 1999d |
| Exposed fruit | 1.80E-02 | U.S. EPA, 1999d |
| Exposed vegetables | 1.00E-01 | U.S. EPA, 1997b |
| Forage | 2.50E-01 | U.S. EPA, 1999d |
| Grains | 8.90E-02 | U.S. EPA, 1999d |
| Roots | 3.50E-02 | U.S. EPA, 1999d |
| Silage | 7.80E-01 | U.S. EPA, 1999d |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Lead (7439-92-1)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 4.20E+01 | U.S. EPA, 1999d |
| Small herpetofauna | 1.76E+00 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 4.60E+01 | Stephan, 1993 |
| Trophic level 4 fish (whole) | 4.60E+01 | Stephan, 1993 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 2.66E-01 | Sample et al., 1998a |
| Invertebrates | 6.07E-01 | U.S. DOE, 1998 |
| Small mammals | 1.05E-01 | Sample et al., 1998b |
| Small birds | 2.70E-01 | U.S. EPA, 1999d |
| Small herpetofauna | 1.13E+00 | Rowe et al., 1996 |
| Herbivores | 2.70E-01 | U.S. EPA, 1999d |
| Omnivores | 2.70E-01 | U.S. EPA, 1999d |
| Exposed fruit | 4.50E-02 | U.S. EPA, 1999d |
| Exposed vegetables | 3.80E-02 | Baes et al., 1984 |
| Forage | 8.30E-02 | U.S. EPA, 1999d |
| Grains | 7.40E-03 | U.S. EPA, 1999d |
| Roots | 3.00E-02 | U.S. EPA, 1999d |
| Silage | 6.70E-02 | U.S. EPA, 1998 |

### Methyl ethyl ketone (78-93-3)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.23E+00 | U.S. EPA, 1998 |
| Trophic level 4 fish (whole) | 1.48E+00 | U.S. EPA, 1998 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 2.67E+01 | U.S. EPA, 1998 |
| Exposed vegetables | 2.67E+01 | U.S. EPA, 1998 |
| Forage | 2.67E+01 | U.S. EPA, 1998 |
| Grains | 2.67E+01 | U.S. EPA, 1998 |
| Roots | 2.77E+00 | U.S. EPA, 1997b |
| Silage | 2.67E+01 | U.S. EPA, 1998 |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

# Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Methylmercury (22967-92-6)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 3.28E+00 | U.S. EPA, 1999d |
| Trophic level 3 fish (whole) | 1.60E+06 | U.S. EPA, 1997a |
| Trophic level 4 fish (whole) | 6.80E+06 | U.S. EPA, 1997a |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | | |
| Invertebrates | | |
| Small mammals | | |
| Small birds | | |
| Small herpetofauna | | |
| Herbivores | | |
| Omnivores | | |
| Exposed fruit | | |
| Exposed vegetables | | |
| Forage | | |
| Grains | | |
| Roots | | |
| Silage | | |

## Nickel (7440-02-0)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 3.20E+02 | U.S. EPA, 1999d |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 3.89E-01 | Sample et al., 1998b |
| Trophic level 3 fish (whole) | 8.00E-01 | Stephan, 1993 |
| Trophic level 4 fish (whole) | 8.00E-01 | Stephan, 1993 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.06E+00 | Sample et al., 1998a |
| Invertebrates | 2.32E+00 | U.S. DOE, 1998 |
| Small mammals | 2.49E-01 | Sample et al., 1998b |
| Small birds | 2.49E-01 | Sample et al., 1998b |
| Small herpetofauna | 2.49E-01 | Sample et al., 1998b |
| Herbivores | 2.49E-01 | Sample et al., 1998b |
| Omnivores | 2.49E-01 | Sample et al., 1998b |
| Exposed fruit | 6.00E-02 | U.S. EPA, 1999d |
| Exposed vegetables | 5.10E-02 | Baes et al., 1984 |
| Forage | 4.30E-02 | U.S. EPA, 1999d |
| Grains | 7.00E-02 | U.S. EPA, 1999d |
| Roots | 2.70E-02 | U.S. EPA, 1999d |
| Silage | 1.70E-01 | U.S. EPA, 1999d |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Pentachlorophenol (87-86-5)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.50E+02 | U.S. EPA, 1999d |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 1.00E+00 | Default value |
| Trophic level 4 fish (whole) | 1.00E+00 | Default value |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 4.66E+00 | van Gestel and Ma, 1988 |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 4.43E-02 | U.S. EPA, 1998 |
| Exposed vegetables | 4.43E-02 | U.S. EPA, 1998 |
| Forage | 4.43E-02 | U.S. EPA, 1998 |
| Grains | 4.43E-02 | U.S. EPA, 1998 |
| Roots | 1.27E+00 | U.S. EPA, 1997b |
| Silage | 4.43E-02 | U.S. EPA, 1998 |

### Selenium (7782-49-2)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+00 | Default value |
| Small herpetofauna | 8.60E+00 | Rowe et al., 1996 |
| Trophic level 3 fish (whole) | 4.85E+02 | Lemly, 1985 |
| Trophic level 4 fish (whole) | 1.69E+03 | Lemly, 1985 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 9.85E-01 | Sample et al., 1998a |
| Invertebrates | 1.50E+00 | Wu et al., 1995 |
| Small mammals | 1.62E-01 | Sample et al., 1998b |
| Small birds | 1.62E-01 | Sample et al., 1998b |
| Small herpetofauna | 5.51E+00 | Rowe et al., 1996 |
| Herbivores | 1.62E-01 | Sample et al., 1998b |
| Omnivores | 1.62E-01 | Sample et al., 1998b |
| Exposed fruit | 2.50E-02 | Baes et al., 1984 |
| Exposed vegetables | 2.50E-02 | Baes et al., 1984 |
| Forage | 2.50E-02 | Baes et al., 1984 |
| Grains | 2.50E-02 | Baes et al., 1984 |
| Roots | 2.50E-02 | Baes et al., 1984 |
| Silage | 2.50E-02 | U.S. EPA, 1999d |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-2. Bioaccumulation Factors (BAFs) for Calculating Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Toluene (108-88-3)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 1.00E+00 | Default value |
| Aquatic plants | 1.00E+04 | U.S. EPA, 1999d |
| Small herpetofauna | 1.00E+00 | Default value |
| Trophic level 3 fish (whole) | 3.32E+01 | U.S. EPA, 1998 |
| Trophic level 4 fish (whole) | 4.97E+01 | U.S. EPA, 1998 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 1.00E+00 | Default value |
| Invertebrates | 1.00E+00 | Default value |
| Small mammals | 1.00E+00 | Default value |
| Small birds | 1.00E+00 | Default value |
| Small herpetofauna | 1.00E+00 | Default value |
| Herbivores | 1.00E+00 | Default value |
| Omnivores | 1.00E+00 | Default value |
| Exposed fruit | 9.97E-01 | U.S. EPA, 1998 |
| Exposed vegetables | 9.97E-01 | U.S. EPA, 1998 |
| Forage | 9.97E-01 | U.S. EPA, 1998 |
| Grains | 9.97E-01 | U.S. EPA, 1998 |
| Roots | 2.54E-02 | U.S. EPA, 1997b |
| Silage | 9.97E-01 | U.S. EPA, 1998 |

### Zinc (7440-66-6)

| Prey Items | Value | Reference |
|---|---|---|
| *Aquatic Bioaccumulation Factors* | | |
| Benthic filter feeders | 2.52E+03 | U.S. EPA, 1999d |
| Aquatic plants | 5.10E+02 | U.S. EPA, 1999d |
| Small herpetofauna | 1.21E+00 | Sample et al., 1998b |
| Trophic level 3 fish (whole) | 4.40E+00 | Stephan, 1993 |
| Trophic level 4 fish (whole) | 4.40E+00 | Stephan, 1993 |
| *Terrestrial Bioaccumulation Factors* | | |
| Worms | 3.20E+00 | Sample et al., 1998a |
| Invertebrates | 7.53E+00 | U.S. DOE, 1998 |
| Small mammals | 7.72E-01 | Sample et al., 1998b |
| Small birds | 7.72E-01 | Sample et al., 1998b |
| Small herpetofauna | 7.72E-01 | Sample et al., 1998b |
| Herbivores | 7.72E-01 | Sample et al., 1998b |
| Omnivores | 7.72E-01 | Sample et al., 1998b |
| Exposed fruit | 1.50E+00 | U.S. EPA, 1999d |
| Exposed vegetables | 3.70E-01 | Baes et al., 1984 |
| Forage | 2.90E-01 | U.S. EPA, 1999d |
| Grains | 1.80E-01 | U.S. EPA, 1999d |
| Roots | 2.30E-01 | U.S. EPA, 1999d |
| Silage | 1.60E+00 | U.S. EPA, 1999d |

Note: The values for small herpetofauna for the aquatic BAFs are in wet weight while the values for the terrestrial BAFs are in dry weigh

## Table R-3. Exposure Factors for Calculating CSCLs for Receptor Populations

| Species Name | Species Type | Body Weight (kg) | Intake of food[a] (kg - DW/d) | Intake of water (L/d) | Intake of soil (kg/d) |
|---|---|---|---|---|---|
| American Kestrel | Bird | 1.19E-01 | 1.44E-02 | 1.42E-02 | 1.44E-04 |
| American Robin | Bird | 7.73E-02 | 1.08E-02 | 1.06E-02 | 1.08E-04 |
| American Woodcock | Bird | 1.77E-01 | 1.86E-02 | 1.85E-02 | 1.94E-03 |
| Bald Eagle | Bird | 3.75E+00 | 1.36E-01 | 1.43E-01 | 0.00E+00 |
| Beaver | Mammal | 1.93E+01 | 7.67E-01 | 1.42E+00 | 0.00E+00 |
| Belted Kingfisher | Bird | 1.47E-01 | 1.65E-02 | 1.63E-02 | 0.00E+00 |
| Black Bear | Mammal | 1.29E+02 | 3.65E+00 | 7.85E+00 | 1.02E-01 |
| Black-Tailed Jackrabbit | Mammal | 2.42E+00 | 1.39E-01 | 2.19E-01 | 8.75E-03 |
| Burrowing Owl | Bird | 1.52E-01 | 1.68E-02 | 1.67E-02 | 1.68E-04 |
| Canada Goose | Bird | 3.00E+00 | 1.17E-01 | 1.23E-01 | 9.62E-03 |
| Cerulean Warbler | Bird | 9.00E-03 | 2.68E-03 | 2.51E-03 | 0.00E+00 |
| Cooper's Hawk | Bird | 4.05E-01 | 3.19E-02 | 3.22E-02 | 3.19E-04 |
| Coyote | Mammal | 1.31E+01 | 5.58E-01 | 1.00E+00 | 1.56E-02 |
| Deer Mouse | Mammal | 1.96E-02 | 2.65E-03 | 2.88E-03 | 5.31E-05 |
| Eastern Cottontail | Mammal | 1.23E+00 | 7.95E-02 | 1.19E-01 | 5.01E-03 |
| Great Basin Pocket Mouse | Mammal | 1.77E-02 | 2.44E-03 | 2.63E-03 | 4.89E-05 |
| Great Blue Heron | Bird | 2.23E+00 | 9.68E-02 | 1.01E-01 | 0.00E+00 |
| Green Heron | Bird | 2.26E-01 | 2.18E-02 | 2.18E-02 | 0.00E+00 |
| Herring Gull | Bird | 1.09E+00 | 6.08E-02 | 6.26E-02 | 0.00E+00 |
| Kit Fox | Mammal | 1.80E+00 | 1.09E-01 | 1.68E-01 | 3.05E-03 |
| Least Weasel | Mammal | 4.08E-02 | 4.85E-03 | 5.57E-03 | 4.85E-05 |
| Lesser Scaup | Bird | 7.92E-01 | 4.94E-02 | 5.05E-02 | 0.00E+00 |
| Little Brown Bat | Mammal | 8.79E-03 | 1.37E-03 | 1.40E-03 | 0.00E+00 |
| Loggerhead Shrike | Bird | 4.70E-02 | 7.85E-03 | 7.61E-03 | 7.85E-05 |
| Long-Tailed Weasel | Mammal | 1.89E-01 | 1.71E-02 | 2.21E-02 | 4.78E-04 |
| Mallard Duck | Bird | 1.17E+00 | 6.36E-02 | 6.56E-02 | 0.00E+00 |
| Marsh Wren | Bird | 1.06E-02 | 2.98E-03 | 2.81E-03 | 0.00E+00 |
| Meadow Vole | Mammal | 2.08E-02 | 2.79E-03 | 3.04E-03 | 6.70E-05 |
| Mink | Mammal | 9.92E-01 | 6.68E-02 | 9.83E-02 | 0.00E+00 |
| Mule Deer | Mammal | 7.55E+01 | 2.35E+00 | 4.85E+00 | 1.60E-01 |
| Muskrat | Mammal | 8.73E-01 | 6.02E-02 | 8.76E-02 | 0.00E+00 |
| Northern Bobwhite | Bird | 1.91E-01 | 1.96E-02 | 1.95E-02 | 1.82E-03 |
| Osprey | Bird | 1.60E+00 | 7.80E-02 | 8.09E-02 | 0.00E+00 |
| Pine Vole | Mammal | 2.53E-02 | 3.27E-03 | 3.62E-03 | 7.85E-05 |
| Prairie Vole | Mammal | 4.16E-02 | 4.92E-03 | 5.66E-03 | 1.18E-04 |
| Raccoon | Mammal | 5.69E+00 | 2.81E-01 | 4.74E-01 | 0.00E+00 |
| Red Fox | Mammal | 4.53E+00 | 2.33E-01 | 3.86E-01 | 6.52E-03 |
| Red-Tailed Hawk | Bird | 1.13E+00 | 6.22E-02 | 6.41E-02 | 6.22E-04 |
| River Otter | Mammal | 8.66E+00 | 3.97E-01 | 6.91E-01 | 0.00E+00 |
| Short-Tailed Shrew | Mammal | 1.50E-02 | 2.13E-03 | 2.26E-03 | 2.13E-05 |
| Short-Tailed Weasel | Mammal | 2.02E-01 | 1.80E-02 | 2.34E-02 | 5.05E-04 |
| Spotted Sandpiper | Bird | 4.25E-02 | 7.35E-03 | 7.11E-03 | 0.00E+00 |
| Tree Swallow | Bird | 2.10E-02 | 4.64E-03 | 4.43E-03 | 4.64E-05 |
| Western Meadowlark | Bird | 1.06E-01 | 1.34E-02 | 1.32E-02 | 0.00E+00 |
| White-tailed Deer | Mammal | 6.94E+01 | 2.19E+00 | 4.50E+00 | 1.49E-01 |

The exposures factor values were taken from U.S. EPA, 1999c.

[a] The intake of food in wet weight is determined by using a moisture adjustment factor of 85%.

# Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Antimony (7440-36-0)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.00 | 0.10 | 0.10 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.61 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.22 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raccoon | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Barium (7440-39-3)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 0.84 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.27 | 0.53 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.00 | 0.10 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.61 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.10 | 0.80 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.10 | 0.11 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Long-Tailed Weasel | 0.00 | 0.10 | 0.82 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.61 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

**Benzene (71-43-2)**

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coyote | 0.00 | 0.00 | 0.73 | 0.07 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.65 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.85 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.06 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.81 | 0.09 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.92 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Butylbenzylphthalate (85-68-7)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.22 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

**Cadmium (7440-43-9)**

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.27 | 0.53 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.00 | 0.10 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.10 | 0.38 | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.10 | 0.80 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.21 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.10 | 0.10 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 0.40 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.10 | 0.25 | 0.40 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Chloroform (67-66-3)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.07 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.65 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Great Basin Pocket Mouse | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.85 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.06 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.81 | 0.09 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.92 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

**Chromium (III) (16065-83-1)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.34 | 0.53 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.07 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.25 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.61 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.10 | 0.11 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | 0.00 | 0.00 | 0.25 |
| Mink | 0.00 | 0.63 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.00 | 0.09 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 |
| **Chromium (VI) (18540-29-9)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.34 | 0.53 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.07 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.25 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.61 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.10 | 0.11 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | 0.00 | 0.00 | 0.25 |
| Mink | 0.00 | 0.63 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.00 | 0.09 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 |
| **Copper (7440-50-8)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 0.84 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.34 | 0.53 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Least Weasel | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.00 | 0.09 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 |

**Di(2-ethylhexylphthalate) (117-81-7)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.53 | 0.00 | 0.37 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.22 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.61 | 0.00 | 0.34 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.00 | 0.09 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.50 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Dibutylphthalate (84-74-2)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.22 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

**Divalent mercury (7439-97-6(d))**

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.53 | 0.00 | 0.34 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.12 | 0.28 | 0.10 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.01 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.10 | 0.38 | 0.22 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.10 | 0.80 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loggerhead Shrike | 0.00 | 0.96 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.10 | 0.10 | 0.05 | 0.25 | 0.00 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.09 | 0.46 | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.00 | 0.25 | 0.00 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.78 |

**Lead (7439-92-1)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.53 | 0.10 | 0.34 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.17 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.41 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.61 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.21 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.61 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.14 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.29 | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

**Methyl ethyl ketone (78-93-3)**

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.10 | 0.30 | 0.00 | 0.00 | 0.05 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.07 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.65 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.85 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.81 | 0.09 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.92 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Nickel (7440-02-0)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.34 | 0.53 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |

# Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.09 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.78 |
| **Pentachlorophenol (87-86-5)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.27 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.53 | 0.00 | 0.37 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.10 | 0.12 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.10 | 0.00 | 0.82 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.10 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.61 | 0.00 | 0.34 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.80 | 0.00 | 0.10 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.50 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.25 | 0.00 |
| Raccoon | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.10 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Selenium (7782-49-2)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.00 | 0.00 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.07 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bald Eagle | 0.00 | 0.10 | 0.27 | 0.53 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.07 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.61 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.75 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Short-Tailed Weasel | 0.00 | 0.25 | 0.50 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Toluene (108-88-3)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.00 | 0.34 | 0.53 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.00 | 0.73 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.65 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Basin Pocket Mouse | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.85 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.22 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Kit Fox | 0.00 | 0.00 | 0.94 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.00 | 0.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.20 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| **Zinc (7440-66-6)** | | | | | | | | | | | | | |
| American Kestrel | 0.00 | 0.51 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Robin | 0.00 | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| American Woodcock | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bald Eagle | 0.00 | 0.10 | 0.34 | 0.53 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Beaver | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Black Bear | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Black-Tailed Jack Rabbit | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Burrowing Owl | 0.00 | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Canada Goose | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Cerulean Warbler | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cooper's Hawk | 0.00 | 0.00 | 0.15 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coyote | 0.00 | 0.10 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Deer Mouse | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Eastern Cottontail | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 | 0.25 |
| Great Basin Pocket Mouse | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.00 | 0.00 |
| Herring Gull | 0.00 | 0.38 | 0.62 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Table R-4. Dietary Fractions for CSCLs for Receptor Populations - Terrestrial Diet Items

| Receptor | Worms | Invertebrates | Small Mammals | Small Birds | Small Herpetofauna | Herbivores | Omnivores | Exposed Fruit | Exposed Vegetables | Forage | Grains | Roots | Silage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kit Fox | 0.00 | 0.10 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Least Weasel | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lesser Scaup | 0.00 | 0.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| Little Brown Bat | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Loggerhead Shrike | 0.00 | 0.96 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Long-Tailed Weasel | 0.08 | 0.10 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 |
| Marsh Wren | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Meadow Vole | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.50 | 0.00 | 0.00 | 0.25 |
| Mink | 0.00 | 0.63 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Mule Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 |
| Muskrat | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.81 | 0.00 | 0.00 | 0.00 |
| Northern Bobwhite | 0.00 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 |
| Pine Vole | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| Prairie Vole | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 |
| Raccoon | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red Fox | 0.00 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Red-Tailed Hawk | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| River Otter | 0.00 | 0.25 | 0.25 | 0.25 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Shrew | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Short-Tailed Weasel | 0.00 | 0.25 | 0.75 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Spotted Sandpiper | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tree Swallow | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Western Meadow Lark | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| White-Tailed Deer | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Antimony** | **7440-36-0** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.09 | 0.91 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.25 | 0.23 | 0.22 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Barium** | **7440-39-3** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.09 | 0.91 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.25 | 0.23 | 0.22 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Benzene** | **71-43-2** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.00 | 0.91 | 0.00 | 0.09 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Butylbenzylphthalate** | **85-68-7** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Cadmium** | **7440-43-9** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.09 | 0.00 | 0.00 | 0.91 | 0.00 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.38 | 0.00 | 0.00 | 0.62 | 0.00 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.40 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| **Chloroform** | **67-66-3** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.00 | 0.91 | 0.00 | 0.09 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Chromium (III)** | **16065-83-1** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.40 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Chromium (VI)** | **18540-29-9** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.40 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Copper** | **7440-50-8** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.10 | 0.74 | 0.16 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.10 | 0.00 | 0.27 | 0.63 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.09 | 0.33 | 0.23 | 0.35 | 0.00 |
| Green Heron | 0.00 | 0.03 | 0.10 | 0.87 | 0.00 |
| Herring Gull | 0.38 | 0.16 | 0.02 | 0.44 | 0.00 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.00 | 0.39 | 0.61 | 0.00 |
| Muskrat | 0.09 | 0.91 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.05 | 0.95 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.25 | 0.23 | 0.22 |
| River Otter | 0.10 | 0.00 | 0.25 | 0.65 | 0.00 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Di(2-ethylhexylphthalate)** | **117-81-7** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.50 | 0.40 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |
| **Dibutylphthalate** | **84-74-2** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |
| **Lead** | **7439-92-1** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.73 | 0.27 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.80 | 0.10 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.00 | 0.91 | 0.00 | 0.09 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.94 | 0.06 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Methyl ethyl ketone** | **78-93-3** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.09 | 0.91 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |
| **Methylmercury** | **22967-92-6** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.29 | 0.00 | 0.25 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |
| **Nickel** | **7440-02-0** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.09 | 0.00 | 0.00 | 0.91 | 0.00 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.38 | 0.00 | 0.00 | 0.62 | 0.00 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Pentachlorophenol** | **87-86-5** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.09 | 0.00 | 0.00 | 0.91 | 0.00 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.38 | 0.00 | 0.00 | 0.62 | 0.00 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.25 | 0.23 | 0.22 |
| River Otter | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| **Selenium** | **7782-49-2** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 |
| Green Heron | 0.00 | 0.00 | 0.10 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.00 | 0.00 | 0.27 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.00 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.00 | 0.90 | 0.00 | 0.10 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.29 | 0.00 | 0.25 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |
| **Toluene** | **108-88-3** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.26 | 0.74 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.00 | 0.33 | 0.00 | 0.00 | 0.67 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.00 | 0.16 | 0.00 | 0.11 | 0.73 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.80 | 0.10 | 0.00 | 0.10 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.10 | 0.90 |
| Muskrat | 0.00 | 0.91 | 0.00 | 0.09 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.00 | 0.00 | 0.00 | 0.06 | 0.94 |

## Table R-5. Dietary Fractions Calculating CSCLs for Receptor Populations - Aquatic Diet Items

| Receptor | Benthic Filter Feeders | Aquatic Plants | Small Herpetofauna | Trophic Level 3 Fish | Trophic Level 4 Fish |
|---|---|---|---|---|---|
| **Zinc** | **7440-66-6** | | | | |
| Bald Eagle | 0.00 | 0.00 | 0.00 | 0.74 | 0.26 |
| Beaver | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Belted Kingfisher | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |
| Canada Goose | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| Great Blue Heron | 0.09 | 0.33 | 0.00 | 0.58 | 0.00 |
| Green Heron | 0.00 | 0.03 | 0.07 | 0.90 | 0.00 |
| Herring Gull | 0.38 | 0.16 | 0.00 | 0.46 | 0.00 |
| Lesser Scaup | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mallard Duck | 0.90 | 0.10 | 0.00 | 0.00 | 0.00 |
| Mink | 0.00 | 0.00 | 0.00 | 0.90 | 0.10 |
| Muskrat | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 |
| Osprey | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 |
| Raccoon | 0.30 | 0.00 | 0.24 | 0.23 | 0.23 |
| River Otter | 0.10 | 0.00 | 0.00 | 0.90 | 0.00 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Sediment

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| **Antimony (7440-36-0)** | | | |
| Beaver | Mammal | 1.65E-01 | 1.26E+02 |
| Mink | Mammal | 3.47E-01 | 5.48E+01 |
| Muskrat | Mammal | 3.58E-01 | 1.57E+02 |
| Raccoon | Mammal | 2.24E-01 | 4.83E+01 |
| River Otter | Mammal | 2.02E-01 | 4.69E+01 |
| **Barium (7440-39-3)** | | | |
| Bald Eagle | Bird | 3.00E+01 | 1.40E+04 |
| Belted Kingfisher | Bird | 3.00E+01 | 4.53E+03 |
| Great Blue Heron | Bird | 3.00E+01 | 7.35E+03 |
| Green Heron | Bird | 3.00E+01 | 3.31E+03 |
| Herring Gull | Bird | 3.00E+01 | 9.13E+03 |
| Lesser Scaup | Bird | 3.00E+01 | 1.46E+04 |
| Mallard Duck | Bird | 3.00E+01 | 1.67E+04 |
| Osprey | Bird | 3.00E+01 | 1.04E+04 |
| **Benzene (71-43-2)** | | | |
| Beaver | Mammal | 1.66E+01 | 1.26E+04 |
| Mink | Mammal | 3.48E+01 | 5.49E+03 |
| Muskrat | Mammal | 3.59E+01 | 1.58E+04 |
| Raccoon | Mammal | 2.25E+01 | 4.84E+03 |
| River Otter | Mammal | 2.02E+01 | 4.70E+03 |
| **Butylbenzylphthalate (85-68-7)** | | | |
| Beaver | Mammal | 7.25E+02 | 5.53E+05 |
| Mink | Mammal | 1.52E+03 | 2.40E+05 |
| Muskrat | Mammal | 1.57E+03 | 6.91E+05 |
| Raccoon | Mammal | 9.83E+02 | 2.12E+05 |
| River Otter | Mammal | 8.85E+02 | 2.06E+05 |
| **Cadmium (7440-43-9)** | | | |
| Bald Eagle | Bird | 4.40E+00 | 2.06E+03 |
| Beaver | Mammal | 1.24E+00 | 9.47E+02 |
| Belted Kingfisher | Bird | 4.40E+00 | 6.65E+02 |
| Great Blue Heron | Bird | 4.40E+00 | 1.08E+03 |
| Green Heron | Bird | 4.40E+00 | 4.85E+02 |
| Herring Gull | Bird | 4.40E+00 | 1.34E+03 |
| Lesser Scaup | Bird | 4.40E+00 | 2.14E+03 |
| Mallard Duck | Bird | 4.40E+00 | 2.45E+03 |
| Mink | Mammal | 2.61E+00 | 4.12E+02 |
| Muskrat | Mammal | 2.69E+00 | 1.18E+03 |
| Osprey | Bird | 4.40E+00 | 1.53E+03 |
| Raccoon | Mammal | 1.68E+00 | 3.63E+02 |
| River Otter | Mammal | 1.52E+00 | 3.52E+02 |
| **Chloroform (67-66-3)** | | | |
| Beaver | Mammal | 9.10E+00 | 6.94E+03 |
| Mink | Mammal | 1.91E+01 | 3.02E+03 |
| Muskrat | Mammal | 1.97E+01 | 8.68E+03 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Sediment**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Raccoon | Mammal | 1.23E+01 | 2.66E+03 |
| River Otter | Mammal | 1.11E+01 | 2.58E+03 |

**Chromium (III) (16065-83-1)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 2.20E+00 | 1.03E+03 |
| Beaver | Mammal | 1.00E+03 | 7.66E+05 |
| Belted Kingfisher | Bird | 2.20E+00 | 3.33E+02 |
| Great Blue Heron | Bird | 2.20E+00 | 5.39E+02 |
| Green Heron | Bird | 2.20E+00 | 2.43E+02 |
| Herring Gull | Bird | 2.20E+00 | 6.69E+02 |
| Lesser Scaup | Bird | 2.20E+00 | 1.07E+03 |
| Mallard Duck | Bird | 2.20E+00 | 1.23E+03 |
| Mink | Mammal | 2.11E+03 | 3.33E+05 |
| Muskrat | Mammal | 2.18E+03 | 9.58E+05 |
| Osprey | Bird | 2.20E+00 | 7.65E+02 |
| Raccoon | Mammal | 1.36E+03 | 2.94E+05 |
| River Otter | Mammal | 1.23E+03 | 2.85E+05 |

**Chromium (VI) (18540-29-9)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Beaver | Mammal | 1.93E+00 | 1.47E+03 |
| Mink | Mammal | 4.06E+00 | 6.41E+02 |
| Muskrat | Mammal | 4.19E+00 | 1.84E+03 |
| Raccoon | Mammal | 2.62E+00 | 5.65E+02 |
| River Otter | Mammal | 2.36E+00 | 5.48E+02 |

**Copper (7440-50-8)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 5.39E+01 | 2.52E+04 |
| Beaver | Mammal | 2.75E+00 | 2.10E+03 |
| Belted Kingfisher | Bird | 5.39E+01 | 8.14E+03 |
| Great Blue Heron | Bird | 5.39E+01 | 1.32E+04 |
| Green Heron | Bird | 5.39E+01 | 5.94E+03 |
| Herring Gull | Bird | 5.39E+01 | 1.64E+04 |
| Lesser Scaup | Bird | 5.39E+01 | 2.62E+04 |
| Mallard Duck | Bird | 5.39E+01 | 3.00E+04 |
| Mink | Mammal | 5.78E+00 | 9.13E+02 |
| Muskrat | Mammal | 5.97E+00 | 2.63E+03 |
| Osprey | Bird | 5.39E+01 | 1.87E+04 |
| Raccoon | Mammal | 3.74E+00 | 8.05E+02 |
| River Otter | Mammal | 3.36E+00 | 7.81E+02 |

**Di(2-ethylhexylphthalate) (117-81-7)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 1.10E+00 | 5.15E+02 |
| Beaver | Mammal | 2.29E+01 | 1.75E+04 |
| Belted Kingfisher | Bird | 1.10E+00 | 1.66E+02 |
| Great Blue Heron | Bird | 1.10E+00 | 2.70E+02 |
| Green Heron | Bird | 1.10E+00 | 1.21E+02 |
| Herring Gull | Bird | 1.10E+00 | 3.35E+02 |
| Lesser Scaup | Bird | 1.10E+00 | 5.35E+02 |
| Mallard Duck | Bird | 1.10E+00 | 6.13E+02 |
| Mink | Mammal | 4.81E+01 | 7.59E+03 |
| Muskrat | Mammal | 4.96E+01 | 2.18E+04 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Sediment

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Osprey | Bird | 1.10E+00 | 3.83E+02 |
| Raccoon | Mammal | 3.11E+01 | 6.69E+03 |
| River Otter | Mammal | 2.80E+01 | 6.49E+03 |

**Dibutylphthalate (84-74-2)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 3.47E-01 | 1.62E+02 |
| Belted Kingfisher | Bird | 3.47E-01 | 5.25E+01 |
| Great Blue Heron | Bird | 3.47E-01 | 8.50E+01 |
| Green Heron | Bird | 3.47E-01 | 3.82E+01 |
| Herring Gull | Bird | 3.47E-01 | 1.06E+02 |
| Lesser Scaup | Bird | 3.47E-01 | 1.69E+02 |
| Mallard Duck | Bird | 3.47E-01 | 1.93E+02 |
| Osprey | Bird | 3.47E-01 | 1.21E+02 |

**Divalent mercury (7439-97-6(d))**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 6.40E-01 | 3.00E+02 |
| Beaver | Mammal | 4.77E-01 | 3.64E+02 |
| Belted Kingfisher | Bird | 6.40E-01 | 9.67E+01 |
| Great Blue Heron | Bird | 6.40E-01 | 1.57E+02 |
| Green Heron | Bird | 6.40E-01 | 7.05E+01 |
| Herring Gull | Bird | 6.40E-01 | 1.95E+02 |
| Lesser Scaup | Bird | 6.40E-01 | 3.11E+02 |
| Mallard Duck | Bird | 6.40E-01 | 3.57E+02 |
| Mink | Mammal | 1.00E+00 | 1.58E+02 |
| Muskrat | Mammal | 1.03E+00 | 4.55E+02 |
| Osprey | Bird | 6.40E-01 | 2.23E+02 |
| Raccoon | Mammal | 6.47E-01 | 1.40E+02 |
| River Otter | Mammal | 5.83E-01 | 1.35E+02 |

**Lead (7439-92-1)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 6.60E-02 | 3.09E+01 |
| Beaver | Mammal | 6.32E-03 | 4.82E+00 |
| Belted Kingfisher | Bird | 6.60E-02 | 9.98E+00 |
| Great Blue Heron | Bird | 6.60E-02 | 1.62E+01 |
| Green Heron | Bird | 6.60E-02 | 7.28E+00 |
| Herring Gull | Bird | 6.60E-02 | 2.01E+01 |
| Lesser Scaup | Bird | 6.60E-02 | 3.21E+01 |
| Mallard Duck | Bird | 6.60E-02 | 3.68E+01 |
| Mink | Mammal | 1.33E-02 | 2.10E+00 |
| Muskrat | Mammal | 1.37E-02 | 6.03E+00 |
| Osprey | Bird | 6.60E-02 | 2.30E+01 |
| Raccoon | Mammal | 8.58E-03 | 1.85E+00 |
| River Otter | Mammal | 7.72E-03 | 1.79E+00 |

**Methyl ethyl ketone (78-93-3)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Beaver | Mammal | 1.04E+03 | 7.97E+05 |
| Mink | Mammal | 2.19E+03 | 3.46E+05 |
| Muskrat | Mammal | 2.26E+03 | 9.96E+05 |
| Raccoon | Mammal | 1.42E+03 | 3.05E+05 |
| River Otter | Mammal | 1.28E+03 | 2.96E+05 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Sediment**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| **Nickel (7440-02-0)** | | | |
| Bald Eagle | Bird | 9.10E+01 | 4.26E+04 |
| Beaver | Mammal | 2.24E+01 | 1.71E+04 |
| Belted Kingfisher | Bird | 9.10E+01 | 1.38E+04 |
| Great Blue Heron | Bird | 9.10E+01 | 2.23E+04 |
| Green Heron | Bird | 9.10E+01 | 1.00E+04 |
| Herring Gull | Bird | 9.10E+01 | 2.77E+04 |
| Lesser Scaup | Bird | 9.10E+01 | 4.43E+04 |
| Mallard Duck | Bird | 9.10E+01 | 5.07E+04 |
| Mink | Mammal | 4.70E+01 | 7.43E+03 |
| Muskrat | Mammal | 4.86E+01 | 2.14E+04 |
| Osprey | Bird | 9.10E+01 | 3.17E+04 |
| Raccoon | Mammal | 3.04E+01 | 6.55E+03 |
| River Otter | Mammal | 2.74E+01 | 6.36E+03 |
| **Pentachlorophenol (87-86-5)** | | | |
| Bald Eagle | Bird | 6.20E+01 | 2.90E+04 |
| Beaver | Mammal | 2.60E+00 | 1.99E+03 |
| Belted Kingfisher | Bird | 6.20E+01 | 9.37E+03 |
| Great Blue Heron | Bird | 6.20E+01 | 1.52E+04 |
| Green Heron | Bird | 6.20E+01 | 6.83E+03 |
| Herring Gull | Bird | 6.20E+01 | 1.89E+04 |
| Lesser Scaup | Bird | 6.20E+01 | 3.02E+04 |
| Mallard Duck | Bird | 6.20E+01 | 3.46E+04 |
| Mink | Mammal | 5.47E+00 | 8.64E+02 |
| Muskrat | Mammal | 5.65E+00 | 2.48E+03 |
| Osprey | Bird | 6.20E+01 | 2.16E+04 |
| Raccoon | Mammal | 3.53E+00 | 7.62E+02 |
| River Otter | Mammal | 3.18E+00 | 7.39E+02 |
| **Selenium (7782-49-2)** | | | |
| Bald Eagle | Bird | 1.60E+00 | 7.49E+02 |
| Beaver | Mammal | 9.33E-02 | 7.12E+01 |
| Belted Kingfisher | Bird | 1.60E+00 | 2.42E+02 |
| Great Blue Heron | Bird | 1.60E+00 | 3.92E+02 |
| Green Heron | Bird | 1.60E+00 | 1.76E+02 |
| Herring Gull | Bird | 1.60E+00 | 4.87E+02 |
| Lesser Scaup | Bird | 1.60E+00 | 7.78E+02 |
| Mallard Duck | Bird | 1.60E+00 | 8.92E+02 |
| Mink | Mammal | 1.96E-01 | 3.09E+01 |
| Muskrat | Mammal | 2.02E-01 | 8.90E+01 |
| Osprey | Bird | 1.60E+00 | 5.56E+02 |
| Raccoon | Mammal | 1.27E-01 | 2.73E+01 |
| River Otter | Mammal | 1.14E-01 | 2.65E+01 |
| **Toluene (108-88-3)** | | | |
| Beaver | Mammal | 1.63E+01 | 1.25E+04 |
| Mink | Mammal | 3.43E+01 | 5.41E+03 |
| Muskrat | Mammal | 3.54E+01 | 1.56E+04 |
| Raccoon | Mammal | 2.21E+01 | 4.77E+03 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Sediment**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| River Otter | Mammal | 1.99E+01 | 4.63E+03 |

**Zinc (7440-66-6)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 3.20E+01 | 1.50E+04 |
| Beaver | Mammal | 8.94E+01 | 6.82E+04 |
| Belted Kingfisher | Bird | 3.20E+01 | 4.84E+03 |
| Great Blue Heron | Bird | 3.20E+01 | 7.84E+03 |
| Green Heron | Bird | 3.20E+01 | 3.53E+03 |
| Herring Gull | Bird | 3.20E+01 | 9.74E+03 |
| Lesser Scaup | Bird | 3.20E+01 | 1.56E+04 |
| Mallard Duck | Bird | 3.20E+01 | 1.78E+04 |
| Mink | Mammal | 1.88E+02 | 2.96E+04 |
| Muskrat | Mammal | 1.94E+02 | 8.52E+04 |
| Osprey | Bird | 3.20E+01 | 1.11E+04 |
| Raccoon | Mammal | 1.21E+02 | 2.61E+04 |
| River Otter | Mammal | 1.09E+02 | 2.54E+04 |

# Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Soil

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| **Antimony (7440-36-0)** | | | |
| Beaver | Mammal | 1.65E-01 | 2.27E+01 |
| Black Bear | Mammal | 1.03E-01 | 4.18E+00 |
| Black-Tailed Jackrabbit | Mammal | 2.78E-01 | 1.84E+01 |
| Coyote | Mammal | 1.82E-01 | 4.16E+00 |
| Deer Mouse | Mammal | 9.25E-01 | 9.99E+00 |
| Eastern Cottontail | Mammal | 3.29E-01 | 1.93E+01 |
| Great Basin Pocket Mous | Mammal | 9.48E-01 | 2.18E+01 |
| Kit Fox | Mammal | 2.99E-01 | 4.80E+00 |
| Least Weasel | Mammal | 7.70E-01 | 6.41E+00 |
| Little Brown Bat | Mammal | 1.13E+00 | 7.24E+00 |
| Long-Tailed Weasel | Mammal | 5.25E-01 | 5.64E+00 |
| Meadow Vole | Mammal | 9.11E-01 | 3.04E+01 |
| Mink | Mammal | 3.47E-01 | 5.15E+00 |
| Mule Deer | Mammal | 1.17E-01 | 1.41E+01 |
| Muskrat | Mammal | 3.58E-01 | 1.86E+01 |
| Pine Vole | Mammal | 8.68E-01 | 2.62E+01 |
| Prairie Vole | Mammal | 7.67E-01 | 1.53E+01 |
| Raccoon | Mammal | 2.24E-01 | 4.54E+00 |
| Red Fox | Mammal | 2.37E-01 | 4.49E+00 |
| River Otter | Mammal | 2.02E-01 | 4.41E+00 |
| Short-Tailed Shrew | Mammal | 9.89E-01 | 6.89E+00 |
| Short-Tailed Weasel | Mammal | 5.17E-01 | 5.62E+00 |
| White-tailed Deer | Mammal | 1.20E-01 | 1.42E+01 |
| **Barium (7440-39-3)** | | | |
| American Kestrel | Bird | 3.00E+01 | 1.73E+02 |
| American Robin | Bird | 3.00E+01 | 2.25E+02 |
| American Woodcock | Bird | 3.00E+01 | 8.39E+02 |
| Bald Eagle | Bird | 3.00E+01 | 2.50E+03 |
| Burrowing Owl | Bird | 3.00E+01 | 2.47E+02 |
| Canada Goose | Bird | 3.00E+01 | 3.30E+03 |
| Cerulean Warbler | Bird | 3.00E+01 | 1.01E+02 |
| Cooper's Hawk | Bird | 3.00E+01 | 5.72E+03 |
| Herring Gull | Bird | 3.00E+01 | 1.30E+03 |
| Lesser Scaup | Bird | 3.00E+01 | 6.67E+02 |
| Loggerhead Shrike | Bird | 3.00E+01 | 1.72E+02 |
| Mallard Duck | Bird | 3.00E+01 | 8.36E+02 |
| Marsh Wren | Bird | 3.00E+01 | 1.07E+02 |
| Northern Bobwhite | Bird | 3.00E+01 | 5.53E+02 |
| Red-Tailed Hawk | Bird | 3.00E+01 | 7.23E+02 |
| Spotted Sandpiper | Bird | 3.00E+01 | 1.73E+02 |
| Tree Swallow | Bird | 3.00E+01 | 1.65E+02 |
| Western Meadowlark | Bird | 3.00E+01 | 2.39E+02 |
| **Benzene (71-43-2)** | | | |
| Beaver | Mammal | 1.66E+01 | 2.02E+02 |
| Black Bear | Mammal | 1.03E+01 | 1.78E+02 |
| Black-Tailed Jackrabbit | Mammal | 2.78E+01 | 2.07E+02 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Coyote | Mammal | 1.82E+01 | 3.34E+02 |
| Deer Mouse | Mammal | 9.28E+01 | 2.99E+02 |
| Eastern Cottontail | Mammal | 3.30E+01 | 2.18E+02 |
| Great Basin Pocket Mous | Mammal | 9.51E+01 | 3.02E+02 |
| Kit Fox | Mammal | 3.00E+01 | 4.81E+02 |
| Least Weasel | Mammal | 7.72E+01 | 6.43E+02 |
| Little Brown Bat | Mammal | 1.13E+02 | 7.26E+02 |
| Long-Tailed Weasel | Mammal | 5.27E+01 | 5.66E+02 |
| Meadow Vole | Mammal | 9.14E+01 | 2.97E+02 |
| Mink | Mammal | 3.48E+01 | 5.16E+02 |
| Mule Deer | Mammal | 1.18E+01 | 1.61E+02 |
| Muskrat | Mammal | 3.59E+01 | 2.29E+02 |
| Pine Vole | Mammal | 8.70E+01 | 2.93E+02 |
| Prairie Vole | Mammal | 7.69E+01 | 2.82E+02 |
| Raccoon | Mammal | 2.25E+01 | 2.00E+02 |
| Red Fox | Mammal | 2.38E+01 | 2.78E+02 |
| River Otter | Mammal | 2.02E+01 | 4.42E+02 |
| Short-Tailed Shrew | Mammal | 9.92E+01 | 5.26E+02 |
| Short-Tailed Weasel | Mammal | 5.18E+01 | 5.63E+02 |
| White-tailed Deer | Mammal | 1.20E+01 | 1.62E+02 |
| **Butylbenzylphthalate (85-68-7)** | | | |
| Beaver | Mammal | 7.25E+02 | 2.90E+05 |
| Black Bear | Mammal | 4.51E+02 | 1.70E+04 |
| Black-Tailed Jackrabbit | Mammal | 1.22E+03 | 1.70E+05 |
| Coyote | Mammal | 7.98E+02 | 1.83E+04 |
| Deer Mouse | Mammal | 4.06E+03 | 4.79E+04 |
| Eastern Cottontail | Mammal | 1.44E+03 | 1.78E+05 |
| Great Basin Pocket Mous | Mammal | 4.16E+03 | 9.54E+04 |
| Kit Fox | Mammal | 1.31E+03 | 2.11E+04 |
| Least Weasel | Mammal | 3.38E+03 | 2.81E+04 |
| Little Brown Bat | Mammal | 4.96E+03 | 3.18E+04 |
| Long-Tailed Weasel | Mammal | 2.30E+03 | 2.48E+04 |
| Meadow Vole | Mammal | 4.00E+03 | 3.48E+05 |
| Mink | Mammal | 1.52E+03 | 2.26E+04 |
| Mule Deer | Mammal | 5.15E+02 | 1.28E+05 |
| Muskrat | Mammal | 1.57E+03 | 1.47E+05 |
| Pine Vole | Mammal | 3.81E+03 | 1.64E+05 |
| Prairie Vole | Mammal | 3.36E+03 | 8.86E+04 |
| Raccoon | Mammal | 9.83E+02 | 1.99E+04 |
| Red Fox | Mammal | 1.04E+03 | 1.97E+04 |
| River Otter | Mammal | 8.85E+02 | 1.93E+04 |
| Short-Tailed Shrew | Mammal | 4.34E+03 | 3.03E+04 |
| Short-Tailed Weasel | Mammal | 2.27E+03 | 2.47E+04 |
| White-tailed Deer | Mammal | 5.26E+02 | 1.28E+05 |
| **Cadmium (7440-43-9)** | | | |
| American Kestrel | Bird | 4.40E+00 | 6.09E+00 |
| American Robin | Bird | 4.40E+00 | 3.93E+00 |
| American Woodcock | Bird | 4.40E+00 | 5.36E+00 |

# Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Bald Eagle | Bird | 4.40E+00 | 8.36E+01 |
| Beaver | Mammal | 1.24E+00 | 9.80E+01 |
| Black Bear | Mammal | 7.72E-01 | 5.89E+00 |
| Black-Tailed Jackrabbit | Mammal | 2.09E+00 | 9.74E+01 |
| Burrowing Owl | Bird | 4.40E+00 | 5.23E+00 |
| Canada Goose | Bird | 4.40E+00 | 9.69E+01 |
| Cerulean Warbler | Bird | 4.40E+00 | 1.85E+00 |
| Cooper's Hawk | Bird | 4.40E+00 | 1.63E+02 |
| Coyote | Mammal | 1.37E+00 | 2.15E+01 |
| Deer Mouse | Mammal | 6.96E+00 | 1.05E+01 |
| Eastern Cottontail | Mammal | 2.47E+00 | 1.02E+02 |
| Great Basin Pocket Mous | Mammal | 7.13E+00 | 2.51E+01 |
| Herring Gull | Bird | 4.40E+00 | 1.98E+01 |
| Kit Fox | Mammal | 2.25E+00 | 2.50E+01 |
| Least Weasel | Mammal | 5.79E+00 | 4.39E+01 |
| Lesser Scaup | Bird | 4.40E+00 | 1.27E+01 |
| Little Brown Bat | Mammal | 8.50E+00 | 6.81E+00 |
| Loggerhead Shrike | Bird | 4.40E+00 | 3.36E+00 |
| Long-Tailed Weasel | Mammal | 3.95E+00 | 2.34E+01 |
| Mallard Duck | Bird | 4.40E+00 | 1.64E+01 |
| Marsh Wren | Bird | 4.40E+00 | 1.96E+00 |
| Meadow Vole | Mammal | 6.85E+00 | 7.12E+01 |
| Mink | Mammal | 2.61E+00 | 5.99E+00 |
| Mule Deer | Mammal | 8.83E-01 | 5.13E+01 |
| Muskrat | Mammal | 2.69E+00 | 5.64E+01 |
| Northern Bobwhite | Bird | 4.40E+00 | 1.35E+01 |
| Pine Vole | Mammal | 6.53E+00 | 4.58E+01 |
| Prairie Vole | Mammal | 5.76E+00 | 2.16E+01 |
| Raccoon | Mammal | 1.68E+00 | 4.51E+00 |
| Red Fox | Mammal | 1.78E+00 | 1.53E+01 |
| Red-Tailed Hawk | Bird | 4.40E+00 | 2.06E+01 |
| River Otter | Mammal | 1.52E+00 | 1.06E+01 |
| Short-Tailed Shrew | Mammal | 7.44E+00 | 6.66E+00 |
| Short-Tailed Weasel | Mammal | 3.88E+00 | 1.37E+01 |
| Spotted Sandpiper | Bird | 4.40E+00 | 3.18E+00 |
| Tree Swallow | Bird | 4.40E+00 | 3.12E+00 |
| Western Meadowlark | Bird | 4.40E+00 | 4.39E+00 |
| White-tailed Deer | Mammal | 9.02E-01 | 7.54E+01 |

**Chloroform (67-66-3)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Beaver | Mammal | 9.10E+00 | 8.09E+01 |
| Black Bear | Mammal | 5.66E+00 | 7.59E+01 |
| Black-Tailed Jackrabbit | Mammal | 1.53E+01 | 8.67E+01 |
| Coyote | Mammal | 1.00E+01 | 1.65E+02 |
| Deer Mouse | Mammal | 5.10E+01 | 1.24E+02 |
| Eastern Cottontail | Mammal | 1.81E+01 | 9.10E+01 |
| Great Basin Pocket Mous | Mammal | 5.23E+01 | 1.26E+02 |
| Kit Fox | Mammal | 1.65E+01 | 2.64E+02 |
| Least Weasel | Mammal | 4.24E+01 | 3.54E+02 |
| Little Brown Bat | Mammal | 6.23E+01 | 3.99E+02 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Long-Tailed Weasel | Mammal | 2.89E+01 | 3.11E+02 |
| Meadow Vole | Mammal | 5.02E+01 | 1.24E+02 |
| Mink | Mammal | 1.91E+01 | 2.84E+02 |
| Mule Deer | Mammal | 6.47E+00 | 6.75E+01 |
| Muskrat | Mammal | 1.97E+01 | 9.52E+01 |
| Pine Vole | Mammal | 4.78E+01 | 1.22E+02 |
| Prairie Vole | Mammal | 4.22E+01 | 1.18E+02 |
| Raccoon | Mammal | 1.23E+01 | 8.32E+01 |
| Red Fox | Mammal | 1.31E+01 | 1.25E+02 |
| River Otter | Mammal | 1.11E+01 | 2.43E+02 |
| Short-Tailed Shrew | Mammal | 5.45E+01 | 2.54E+02 |
| Short-Tailed Weasel | Mammal | 2.85E+01 | 3.10E+02 |
| White-tailed Deer | Mammal | 6.61E+00 | 6.80E+01 |

**Chromium (III) (16065-83-1)**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| American Kestrel | Bird | 2.20E+00 | 4.95E+01 |
| American Robin | Bird | 2.20E+00 | 3.36E+01 |
| American Woodcock | Bird | 2.20E+00 | 5.11E+01 |
| Bald Eagle | Bird | 2.20E+00 | 4.94E+02 |
| Beaver | Mammal | 1.00E+03 | 1.42E+07 |
| Black Bear | Mammal | 6.25E+02 | 7.06E+04 |
| Black-Tailed Jackrabbit | Mammal | 1.69E+03 | 4.53E+05 |
| Burrowing Owl | Bird | 2.20E+00 | 4.51E+01 |
| Canada Goose | Bird | 2.20E+00 | 4.10E+02 |
| Cerulean Warbler | Bird | 2.20E+00 | 1.58E+01 |
| Cooper's Hawk | Bird | 2.20E+00 | 2.95E+02 |
| Coyote | Mammal | 1.11E+03 | 1.56E+05 |
| Deer Mouse | Mammal | 5.63E+03 | 1.41E+05 |
| Eastern Cottontail | Mammal | 2.00E+03 | 4.62E+05 |
| Great Basin Pocket Mous | Mammal | 5.77E+03 | 3.05E+05 |
| Herring Gull | Bird | 2.20E+00 | 1.71E+02 |
| Kit Fox | Mammal | 1.82E+03 | 2.66E+05 |
| Least Weasel | Mammal | 4.68E+03 | 4.17E+05 |
| Lesser Scaup | Bird | 2.20E+00 | 1.09E+02 |
| Little Brown Bat | Mammal | 6.88E+03 | 9.40E+04 |
| Loggerhead Shrike | Bird | 2.20E+00 | 2.85E+01 |
| Long-Tailed Weasel | Mammal | 3.19E+03 | 2.09E+05 |
| Mallard Duck | Bird | 2.20E+00 | 1.42E+02 |
| Marsh Wren | Bird | 2.20E+00 | 1.67E+01 |
| Meadow Vole | Mammal | 5.54E+03 | 8.10E+05 |
| Mink | Mammal | 2.11E+03 | 8.14E+04 |
| Mule Deer | Mammal | 7.14E+02 | 3.22E+05 |
| Muskrat | Mammal | 2.18E+03 | 1.22E+06 |
| Northern Bobwhite | Bird | 2.20E+00 | 8.15E+01 |
| Pine Vole | Mammal | 5.28E+03 | 5.63E+05 |
| Prairie Vole | Mammal | 4.66E+03 | 2.76E+05 |
| Raccoon | Mammal | 1.36E+03 | 6.20E+04 |
| Red Fox | Mammal | 1.44E+03 | 1.35E+05 |
| Red-Tailed Hawk | Bird | 2.20E+00 | 2.10E+02 |
| River Otter | Mammal | 1.23E+03 | 1.22E+05 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Short-Tailed Shrew | Mammal | 6.02E+03 | 1.07E+05 |
| Short-Tailed Weasel | Mammal | 3.14E+03 | 1.69E+05 |
| Spotted Sandpiper | Bird | 2.20E+00 | 2.72E+01 |
| Tree Swallow | Bird | 2.20E+00 | 2.64E+01 |
| Western Meadowlark | Bird | 2.20E+00 | 3.75E+01 |
| White-tailed Deer | Mammal | 7.29E+02 | 3.00E+05 |
| **Chromium (VI) (18540-29-9)** | | | |
| Beaver | Mammal | 1.93E+00 | 2.74E+04 |
| Black Bear | Mammal | 1.20E+00 | 1.36E+02 |
| Black-Tailed Jackrabbit | Mammal | 3.25E+00 | 8.71E+02 |
| Coyote | Mammal | 2.13E+00 | 3.00E+02 |
| Deer Mouse | Mammal | 1.08E+01 | 2.71E+02 |
| Eastern Cottontail | Mammal | 3.85E+00 | 8.89E+02 |
| Great Basin Pocket Mous | Mammal | 1.11E+01 | 5.86E+02 |
| Kit Fox | Mammal | 3.50E+00 | 5.13E+02 |
| Least Weasel | Mammal | 9.01E+00 | 8.01E+02 |
| Little Brown Bat | Mammal | 1.32E+01 | 1.81E+02 |
| Long-Tailed Weasel | Mammal | 6.15E+00 | 4.03E+02 |
| Meadow Vole | Mammal | 1.07E+01 | 1.56E+03 |
| Mink | Mammal | 4.06E+00 | 1.57E+02 |
| Mule Deer | Mammal | 1.37E+00 | 6.19E+02 |
| Muskrat | Mammal | 4.19E+00 | 2.35E+03 |
| Pine Vole | Mammal | 1.02E+01 | 1.08E+03 |
| Prairie Vole | Mammal | 8.97E+00 | 5.32E+02 |
| Raccoon | Mammal | 2.62E+00 | 1.19E+02 |
| Red Fox | Mammal | 2.78E+00 | 2.59E+02 |
| River Otter | Mammal | 2.36E+00 | 2.34E+02 |
| Short-Tailed Shrew | Mammal | 1.16E+01 | 2.05E+02 |
| Short-Tailed Weasel | Mammal | 6.04E+00 | 3.24E+02 |
| White-tailed Deer | Mammal | 1.40E+00 | 5.77E+02 |
| **Copper (7440-50-8)** | | | |
| American Kestrel | Bird | 5.39E+01 | 1.54E+02 |
| American Robin | Bird | 5.39E+01 | 7.80E+01 |
| American Woodcock | Bird | 5.39E+01 | 3.73E+02 |
| Bald Eagle | Bird | 5.39E+01 | 2.12E+03 |
| Beaver | Mammal | 2.75E+00 | 5.25E+02 |
| Black Bear | Mammal | 1.71E+00 | 2.12E+01 |
| Black-Tailed Jackrabbit | Mammal | 4.63E+00 | 4.17E+02 |
| Burrowing Owl | Bird | 5.39E+01 | 1.02E+02 |
| Canada Goose | Bird | 5.39E+01 | 1.54E+03 |
| Cerulean Warbler | Bird | 5.39E+01 | 3.45E+01 |
| Cooper's Hawk | Bird | 5.39E+01 | 3.31E+03 |
| Coyote | Mammal | 3.03E+00 | 9.33E+01 |
| Deer Mouse | Mammal | 1.54E+01 | 3.52E+01 |
| Eastern Cottontail | Mammal | 5.48E+00 | 4.38E+02 |
| Great Basin Pocket Mous | Mammal | 1.58E+01 | 8.33E+01 |
| Herring Gull | Bird | 5.39E+01 | 4.57E+02 |
| Kit Fox | Mammal | 4.98E+00 | 1.13E+02 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Least Weasel | Mammal | 1.28E+01 | 1.52E+02 |
| Lesser Scaup | Bird | 5.39E+01 | 2.37E+02 |
| Little Brown Bat | Mammal | 1.88E+01 | 2.30E+01 |
| Loggerhead Shrike | Bird | 5.39E+01 | 6.38E+01 |
| Long-Tailed Weasel | Mammal | 8.75E+00 | 1.28E+02 |
| Mallard Duck | Bird | 5.39E+01 | 3.00E+02 |
| Marsh Wren | Bird | 5.39E+01 | 3.65E+01 |
| Meadow Vole | Mammal | 1.52E+01 | 2.77E+02 |
| Mink | Mammal | 5.78E+00 | 2.47E+01 |
| Mule Deer | Mammal | 1.96E+00 | 2.93E+02 |
| Muskrat | Mammal | 5.97E+00 | 5.33E+02 |
| Northern Bobwhite | Bird | 5.39E+01 | 2.50E+02 |
| Pine Vole | Mammal | 1.45E+01 | 1.68E+02 |
| Prairie Vole | Mammal | 1.28E+01 | 7.52E+01 |
| Raccoon | Mammal | 3.74E+00 | 1.59E+01 |
| Red Fox | Mammal | 3.95E+00 | 4.84E+01 |
| Red-Tailed Hawk | Bird | 5.39E+01 | 6.66E+02 |
| River Otter | Mammal | 3.36E+00 | 4.83E+01 |
| Short-Tailed Shrew | Mammal | 1.65E+01 | 4.01E+01 |
| Short-Tailed Weasel | Mammal | 8.61E+00 | 6.47E+01 |
| Spotted Sandpiper | Bird | 5.39E+01 | 5.93E+01 |
| Tree Swallow | Bird | 5.39E+01 | 5.80E+01 |
| Western Meadowlark | Bird | 5.39E+01 | 8.17E+01 |
| White-tailed Deer | Mammal | 2.00E+00 | 1.56E+02 |
| **Di(2-ethylhexylphthalate) (117-81-7)** | | | |
| American Kestrel | Bird | 1.10E+00 | 9.02E+00 |
| American Robin | Bird | 1.10E+00 | 7.76E+00 |
| American Woodcock | Bird | 1.10E+00 | 9.49E+00 |
| Bald Eagle | Bird | 1.10E+00 | 3.04E+01 |
| Beaver | Mammal | 2.29E+01 | 2.03E+05 |
| Black Bear | Mammal | 1.42E+01 | 5.41E+02 |
| Black-Tailed Jackrabbit | Mammal | 3.85E+01 | 1.02E+04 |
| Burrowing Owl | Bird | 1.10E+00 | 9.82E+00 |
| Canada Goose | Bird | 1.10E+00 | 1.51E+02 |
| Cerulean Warbler | Bird | 1.10E+00 | 3.70E+00 |
| Cooper's Hawk | Bird | 1.10E+00 | 1.38E+01 |
| Coyote | Mammal | 2.52E+01 | 5.76E+02 |
| Deer Mouse | Mammal | 1.28E+02 | 1.58E+03 |
| Eastern Cottontail | Mammal | 4.56E+01 | 1.08E+04 |
| Great Basin Pocket Mous | Mammal | 1.31E+02 | 3.51E+03 |
| Herring Gull | Bird | 1.10E+00 | 1.97E+01 |
| Kit Fox | Mammal | 4.14E+01 | 6.65E+02 |
| Least Weasel | Mammal | 1.07E+02 | 8.89E+02 |
| Lesser Scaup | Bird | 1.10E+00 | 2.56E+01 |
| Little Brown Bat | Mammal | 1.57E+02 | 1.00E+03 |
| Loggerhead Shrike | Bird | 1.10E+00 | 6.52E+00 |
| Long-Tailed Weasel | Mammal | 7.28E+01 | 7.82E+02 |
| Mallard Duck | Bird | 1.10E+00 | 3.37E+01 |
| Marsh Wren | Bird | 1.10E+00 | 3.92E+00 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Meadow Vole | Mammal | 1.26E+02 | 1.21E+04 |
| Mink | Mammal | 4.81E+01 | 7.14E+02 |
| Mule Deer | Mammal | 1.63E+01 | 7.43E+03 |
| Muskrat | Mammal | 4.96E+01 | 7.02E+03 |
| Northern Bobwhite | Bird | 1.10E+00 | 2.37E+01 |
| Pine Vole | Mammal | 1.20E+02 | 7.23E+03 |
| Prairie Vole | Mammal | 1.06E+02 | 3.25E+03 |
| Raccoon | Mammal | 3.11E+01 | 6.29E+02 |
| Red Fox | Mammal | 3.29E+01 | 6.22E+02 |
| Red-Tailed Hawk | Bird | 1.10E+00 | 1.98E+01 |
| River Otter | Mammal | 2.80E+01 | 6.10E+02 |
| Short-Tailed Shrew | Mammal | 1.37E+02 | 9.55E+02 |
| Short-Tailed Weasel | Mammal | 7.16E+01 | 7.79E+02 |
| Spotted Sandpiper | Bird | 1.10E+00 | 6.36E+00 |
| Tree Swallow | Bird | 1.10E+00 | 6.29E+00 |
| Western Meadowlark | Bird | 1.10E+00 | 8.76E+00 |
| White-tailed Deer | Mammal | 1.66E+01 | 7.47E+03 |
| **Dibutylphthalate (84-74-2)** | | | |
| American Kestrel | Bird | 3.47E-01 | 2.85E+00 |
| American Robin | Bird | 3.47E-01 | 2.45E+00 |
| American Woodcock | Bird | 3.47E-01 | 2.99E+00 |
| Bald Eagle | Bird | 3.47E-01 | 9.58E+00 |
| Burrowing Owl | Bird | 3.47E-01 | 3.10E+00 |
| Canada Goose | Bird | 3.47E-01 | 3.44E+01 |
| Cerulean Warbler | Bird | 3.47E-01 | 1.17E+00 |
| Cooper's Hawk | Bird | 3.47E-01 | 4.36E+00 |
| Herring Gull | Bird | 3.47E-01 | 6.23E+00 |
| Lesser Scaup | Bird | 3.47E-01 | 7.78E+00 |
| Loggerhead Shrike | Bird | 3.47E-01 | 2.06E+00 |
| Mallard Duck | Bird | 3.47E-01 | 1.01E+01 |
| Marsh Wren | Bird | 3.47E-01 | 1.24E+00 |
| Northern Bobwhite | Bird | 3.47E-01 | 6.69E+00 |
| Red-Tailed Hawk | Bird | 3.47E-01 | 6.24E+00 |
| Spotted Sandpiper | Bird | 3.47E-01 | 2.01E+00 |
| Tree Swallow | Bird | 3.47E-01 | 1.94E+00 |
| Western Meadowlark | Bird | 3.47E-01 | 2.76E+00 |
| **Divalent mercury (7439-97-6(d))** | | | |
| American Kestrel | Bird | 6.40E-01 | 2.12E+00 |
| American Robin | Bird | 6.40E-01 | 1.63E+00 |
| American Woodcock | Bird | 6.40E-01 | 3.39E+00 |
| Bald Eagle | Bird | 6.40E-01 | 8.42E+00 |
| Beaver | Mammal | 4.77E-01 | 5.26E+01 |
| Black Bear | Mammal | 2.97E-01 | 4.89E+00 |
| Black-Tailed Jackrabbit | Mammal | 8.02E-01 | 4.46E+01 |
| Burrowing Owl | Bird | 6.40E-01 | 2.06E+00 |
| Canada Goose | Bird | 6.40E-01 | 1.90E+01 |
| Cerulean Warbler | Bird | 6.40E-01 | 7.51E-01 |
| Cooper's Hawk | Bird | 6.40E-01 | 4.51E+00 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Coyote | Mammal | 5.25E-01 | 6.30E+00 |
| Deer Mouse | Mammal | 2.67E+00 | 1.10E+01 |
| Eastern Cottontail | Mammal | 9.50E-01 | 4.68E+01 |
| Great Basin Pocket Mous | Mammal | 2.74E+00 | 2.47E+01 |
| Herring Gull | Bird | 6.40E-01 | 6.04E+00 |
| Kit Fox | Mammal | 8.63E-01 | 6.70E+00 |
| Least Weasel | Mammal | 2.22E+00 | 3.40E+01 |
| Lesser Scaup | Bird | 6.40E-01 | 5.12E+00 |
| Little Brown Bat | Mammal | 3.27E+00 | 7.29E+00 |
| Loggerhead Shrike | Bird | 6.40E-01 | 1.35E+00 |
| Long-Tailed Weasel | Mammal | 1.52E+00 | 8.13E+00 |
| Mallard Duck | Bird | 6.40E-01 | 6.10E+00 |
| Marsh Wren | Bird | 6.40E-01 | 7.95E-01 |
| Meadow Vole | Mammal | 2.63E+00 | 7.17E+01 |
| Mink | Mammal | 1.00E+00 | 5.76E+00 |
| Mule Deer | Mammal | 3.39E-01 | 3.11E+01 |
| Muskrat | Mammal | 1.03E+00 | 3.56E+01 |
| Northern Bobwhite | Bird | 6.40E-01 | 5.29E+00 |
| Pine Vole | Mammal | 2.51E+00 | 3.62E+01 |
| Prairie Vole | Mammal | 2.21E+00 | 2.01E+01 |
| Raccoon | Mammal | 6.47E-01 | 4.70E+00 |
| Red Fox | Mammal | 6.85E-01 | 6.24E+00 |
| Red-Tailed Hawk | Bird | 6.40E-01 | 5.05E+00 |
| River Otter | Mammal | 5.83E-01 | 7.15E+00 |
| Short-Tailed Shrew | Mammal | 2.86E+00 | 8.78E+00 |
| Short-Tailed Weasel | Mammal | 1.49E+00 | 9.23E+00 |
| Spotted Sandpiper | Bird | 6.40E-01 | 1.29E+00 |
| Tree Swallow | Bird | 6.40E-01 | 1.26E+00 |
| Western Meadowlark | Bird | 6.40E-01 | 1.78E+00 |
| White-tailed Deer | Mammal | 3.46E-01 | 1.50E+01 |
| **Lead (7439-92-1)** | | | |
| American Kestrel | Bird | 6.60E-02 | 6.27E-01 |
| American Robin | Bird | 6.60E-02 | 7.93E-01 |
| American Woodcock | Bird | 6.60E-02 | 1.70E+00 |
| Bald Eagle | Bird | 6.60E-02 | 5.12E+00 |
| Beaver | Mammal | 6.32E-03 | 2.05E+00 |
| Black Bear | Mammal | 3.93E-03 | 2.70E-01 |
| Black-Tailed Jackrabbit | Mammal | 1.06E-02 | 1.27E+00 |
| Burrowing Owl | Bird | 6.60E-02 | 8.89E-01 |
| Canada Goose | Bird | 6.60E-02 | 1.02E+01 |
| Cerulean Warbler | Bird | 6.60E-02 | 3.66E-01 |
| Cooper's Hawk | Bird | 6.60E-02 | 3.28E+00 |
| Coyote | Mammal | 6.96E-03 | 6.21E-01 |
| Deer Mouse | Mammal | 3.54E-02 | 6.43E-01 |
| Eastern Cottontail | Mammal | 1.26E-02 | 1.33E+00 |
| Great Basin Pocket Mous | Mammal | 3.63E-02 | 1.40E+00 |
| Herring Gull | Bird | 6.60E-02 | 4.00E+00 |
| Kit Fox | Mammal | 1.14E-02 | 6.34E-01 |
| Least Weasel | Mammal | 2.95E-02 | 2.15E+00 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Lesser Scaup | Bird | 6.60E-02 | 2.47E+00 |
| Little Brown Bat | Mammal | 4.33E-02 | 4.56E-01 |
| Loggerhead Shrike | Bird | 6.60E-02 | 6.20E-01 |
| Long-Tailed Weasel | Mammal | 2.01E-02 | 1.36E+00 |
| Mallard Duck | Bird | 6.60E-02 | 3.13E+00 |
| Marsh Wren | Bird | 6.60E-02 | 3.87E-01 |
| Meadow Vole | Mammal | 3.49E-02 | 2.43E+00 |
| Mink | Mammal | 1.33E-02 | 2.43E-01 |
| Mule Deer | Mammal | 4.49E-03 | 9.73E-01 |
| Muskrat | Mammal | 1.37E-02 | 1.08E+00 |
| Northern Bobwhite | Bird | 6.60E-02 | 1.87E+00 |
| Pine Vole | Mammal | 3.32E-02 | 2.01E+00 |
| Prairie Vole | Mammal | 2.93E-02 | 1.04E+00 |
| Raccoon | Mammal | 8.58E-03 | 2.64E-01 |
| Red Fox | Mammal | 9.08E-03 | 5.28E-01 |
| Red-Tailed Hawk | Bird | 6.60E-02 | 2.42E+00 |
| River Otter | Mammal | 7.72E-03 | 3.20E-01 |
| Short-Tailed Shrew | Mammal | 3.79E-02 | 5.97E-01 |
| Short-Tailed Weasel | Mammal | 1.98E-02 | 4.30E-01 |
| Spotted Sandpiper | Bird | 6.60E-02 | 6.29E-01 |
| Tree Swallow | Bird | 6.60E-02 | 5.94E-01 |
| Western Meadowlark | Bird | 6.60E-02 | 8.66E-01 |
| White-tailed Deer | Mammal | 4.59E-03 | 9.61E-01 |
| **Methyl ethyl ketone (78-93-3)** | | | |
| Beaver | Mammal | 1.04E+03 | 1.08E+03 |
| Black Bear | Mammal | 6.49E+02 | 9.02E+02 |
| Black-Tailed Jackrabbit | Mammal | 1.76E+03 | 1.14E+03 |
| Coyote | Mammal | 1.15E+03 | 4.39E+03 |
| Deer Mouse | Mammal | 5.85E+03 | 1.62E+03 |
| Eastern Cottontail | Mammal | 2.08E+03 | 1.20E+03 |
| Great Basin Pocket Mous | Mammal | 6.00E+03 | 1.65E+03 |
| Kit Fox | Mammal | 1.89E+03 | 5.06E+03 |
| Least Weasel | Mammal | 4.87E+03 | 4.06E+04 |
| Little Brown Bat | Mammal | 7.15E+03 | 4.58E+04 |
| Long-Tailed Weasel | Mammal | 3.32E+03 | 3.57E+04 |
| Meadow Vole | Mammal | 5.76E+03 | 1.61E+03 |
| Mink | Mammal | 2.19E+03 | 3.26E+04 |
| Mule Deer | Mammal | 7.42E+02 | 8.91E+02 |
| Muskrat | Mammal | 2.26E+03 | 1.23E+03 |
| Pine Vole | Mammal | 5.49E+03 | 1.59E+03 |
| Prairie Vole | Mammal | 4.85E+03 | 1.53E+03 |
| Raccoon | Mammal | 1.42E+03 | 1.08E+03 |
| Red Fox | Mammal | 1.50E+03 | 1.78E+03 |
| River Otter | Mammal | 1.28E+03 | 2.79E+04 |
| Short-Tailed Shrew | Mammal | 6.25E+03 | 4.40E+03 |
| Short-Tailed Weasel | Mammal | 3.27E+03 | 3.55E+04 |
| White-tailed Deer | Mammal | 7.58E+02 | 8.96E+02 |

# Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

## Soil

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| **Nickel (7440-02-0)** | | | |
| American Kestrel | Bird | 9.10E+01 | 5.73E+02 |
| American Robin | Bird | 9.10E+01 | 2.89E+02 |
| American Woodcock | Bird | 9.10E+01 | 7.45E+02 |
| Bald Eagle | Bird | 9.10E+01 | 5.51E+03 |
| Beaver | Mammal | 2.24E+01 | 1.36E+04 |
| Black Bear | Mammal | 1.39E+01 | 4.04E+02 |
| Black-Tailed Jackrabbit | Mammal | 3.77E+01 | 6.18E+03 |
| Burrowing Owl | Bird | 9.10E+01 | 3.86E+02 |
| Canada Goose | Bird | 9.10E+01 | 4.98E+03 |
| Cerulean Warbler | Bird | 9.10E+01 | 1.32E+02 |
| Cooper's Hawk | Bird | 9.10E+01 | 4.47E+03 |
| Coyote | Mammal | 2.47E+01 | 1.20E+03 |
| Deer Mouse | Mammal | 1.25E+02 | 6.64E+02 |
| Eastern Cottontail | Mammal | 4.46E+01 | 6.49E+03 |
| Great Basin Pocket Mous | Mammal | 1.29E+02 | 1.43E+03 |
| Herring Gull | Bird | 9.10E+01 | 1.58E+03 |
| Kit Fox | Mammal | 4.05E+01 | 2.42E+03 |
| Least Weasel | Mammal | 1.04E+02 | 3.40E+03 |
| Lesser Scaup | Bird | 9.10E+01 | 9.00E+02 |
| Little Brown Bat | Mammal | 1.53E+02 | 4.23E+02 |
| Loggerhead Shrike | Bird | 9.10E+01 | 2.43E+02 |
| Long-Tailed Weasel | Mammal | 7.12E+01 | 1.43E+03 |
| Mallard Duck | Bird | 9.10E+01 | 1.18E+03 |
| Marsh Wren | Bird | 9.10E+01 | 1.40E+02 |
| Meadow Vole | Mammal | 1.24E+02 | 5.10E+03 |
| Mink | Mammal | 4.70E+01 | 4.50E+02 |
| Mule Deer | Mammal | 1.59E+01 | 4.59E+03 |
| Muskrat | Mammal | 4.86E+01 | 1.07E+04 |
| Northern Bobwhite | Bird | 9.10E+01 | 9.14E+02 |
| Pine Vole | Mammal | 1.18E+02 | 3.09E+03 |
| Prairie Vole | Mammal | 1.04E+02 | 1.38E+03 |
| Raccoon | Mammal | 3.04E+01 | 2.81E+02 |
| Red Fox | Mammal | 3.22E+01 | 7.88E+02 |
| Red-Tailed Hawk | Bird | 9.10E+01 | 2.13E+03 |
| River Otter | Mammal | 2.74E+01 | 7.80E+02 |
| Short-Tailed Shrew | Mammal | 1.34E+02 | 5.56E+02 |
| Short-Tailed Weasel | Mammal | 7.01E+01 | 9.86E+02 |
| Spotted Sandpiper | Bird | 9.10E+01 | 2.27E+02 |
| Tree Swallow | Bird | 9.10E+01 | 2.24E+02 |
| Western Meadowlark | Bird | 9.10E+01 | 3.12E+02 |
| White-tailed Deer | Mammal | 1.63E+01 | 2.38E+03 |
| **Pentachlorophenol (87-86-5)** | | | |
| American Kestrel | Bird | 6.20E+01 | 5.08E+02 |
| American Robin | Bird | 6.20E+01 | 2.21E+02 |
| American Woodcock | Bird | 6.20E+01 | 1.24E+02 |
| Bald Eagle | Bird | 6.20E+01 | 1.71E+03 |
| Beaver | Mammal | 2.60E+00 | 3.93E+02 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Soil

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Black Bear | Mammal | 1.62E+00 | 5.76E+01 |
| Black-Tailed Jackrabbit | Mammal | 4.38E+00 | 7.10E+02 |
| Burrowing Owl | Bird | 6.20E+01 | 5.53E+02 |
| Canada Goose | Bird | 6.20E+01 | 2.35E+03 |
| Cerulean Warbler | Bird | 6.20E+01 | 2.09E+02 |
| Cooper's Hawk | Bird | 6.20E+01 | 7.80E+02 |
| Coyote | Mammal | 2.87E+00 | 6.56E+01 |
| Deer Mouse | Mammal | 1.46E+01 | 1.74E+02 |
| Eastern Cottontail | Mammal | 5.19E+00 | 7.45E+02 |
| Great Basin Pocket Mous | Mammal | 1.50E+01 | 3.58E+02 |
| Herring Gull | Bird | 6.20E+01 | 8.15E+02 |
| Kit Fox | Mammal | 4.71E+00 | 7.57E+01 |
| Least Weasel | Mammal | 1.21E+01 | 1.01E+02 |
| Lesser Scaup | Bird | 6.20E+01 | 1.41E+03 |
| Little Brown Bat | Mammal | 1.78E+01 | 1.14E+02 |
| Loggerhead Shrike | Bird | 6.20E+01 | 3.68E+02 |
| Long-Tailed Weasel | Mammal | 8.28E+00 | 6.56E+01 |
| Mallard Duck | Bird | 6.20E+01 | 1.54E+03 |
| Marsh Wren | Bird | 6.20E+01 | 2.21E+02 |
| Meadow Vole | Mammal | 1.44E+01 | 2.01E+02 |
| Mink | Mammal | 5.47E+00 | 8.12E+01 |
| Mule Deer | Mammal | 1.85E+00 | 5.29E+02 |
| Muskrat | Mammal | 5.65E+00 | 3.12E+02 |
| Northern Bobwhite | Bird | 6.20E+01 | 1.26E+03 |
| Pine Vole | Mammal | 1.37E+01 | 1.36E+02 |
| Prairie Vole | Mammal | 1.21E+01 | 1.66E+02 |
| Raccoon | Mammal | 3.53E+00 | 5.24E+01 |
| Red Fox | Mammal | 3.74E+00 | 7.08E+01 |
| Red-Tailed Hawk | Bird | 6.20E+01 | 8.19E+02 |
| River Otter | Mammal | 3.18E+00 | 6.95E+01 |
| Short-Tailed Shrew | Mammal | 1.56E+01 | 3.87E+01 |
| Short-Tailed Weasel | Mammal | 8.14E+00 | 8.86E+01 |
| Spotted Sandpiper | Bird | 6.20E+01 | 3.59E+02 |
| Tree Swallow | Bird | 6.20E+01 | 3.50E+02 |
| Western Meadowlark | Bird | 6.20E+01 | 4.94E+02 |
| White-tailed Deer | Mammal | 1.89E+00 | 5.33E+02 |

### Selenium (7782-49-2)

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| American Kestrel | Bird | 1.60E+00 | 3.82E+00 |
| American Robin | Bird | 1.60E+00 | 7.73E+00 |
| American Woodcock | Bird | 1.60E+00 | 1.40E+01 |
| Bald Eagle | Bird | 1.60E+00 | 5.32E+01 |
| Beaver | Mammal | 9.33E-02 | 9.40E+01 |
| Black Bear | Mammal | 5.80E-02 | 1.49E+00 |
| Black-Tailed Jackrabbit | Mammal | 1.57E-01 | 3.10E+01 |
| Burrowing Owl | Bird | 1.60E+00 | 7.55E+00 |
| Canada Goose | Bird | 1.60E+00 | 1.61E+02 |
| Cerulean Warbler | Bird | 1.60E+00 | 3.59E+00 |
| Cooper's Hawk | Bird | 1.60E+00 | 1.18E+02 |
| Coyote | Mammal | 1.03E-01 | 2.81E+00 |

# Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Deer Mouse | Mammal | 5.23E-01 | 4.29E+00 |
| Eastern Cottontail | Mammal | 1.86E-01 | 3.26E+01 |
| Great Basin Pocket Mous | Mammal | 5.36E-01 | 9.39E+00 |
| Herring Gull | Bird | 1.60E+00 | 4.28E+01 |
| Kit Fox | Mammal | 1.69E-01 | 3.85E+00 |
| Least Weasel | Mammal | 4.35E-01 | 2.13E+01 |
| Lesser Scaup | Bird | 1.60E+00 | 2.46E+01 |
| Little Brown Bat | Mammal | 6.39E-01 | 2.73E+00 |
| Loggerhead Shrike | Bird | 1.60E+00 | 5.74E+00 |
| Long-Tailed Weasel | Mammal | 2.97E-01 | 8.42E+00 |
| Mallard Duck | Bird | 1.60E+00 | 3.23E+01 |
| Marsh Wren | Bird | 1.60E+00 | 3.80E+00 |
| Meadow Vole | Mammal | 5.15E-01 | 3.13E+01 |
| Mink | Mammal | 1.96E-01 | 9.50E-01 |
| Mule Deer | Mammal | 6.63E-02 | 2.29E+01 |
| Muskrat | Mammal | 2.02E-01 | 5.12E+00 |
| Northern Bobwhite | Bird | 1.60E+00 | 2.41E+01 |
| Pine Vole | Mammal | 4.90E-01 | 1.93E+01 |
| Prairie Vole | Mammal | 4.33E-01 | 8.75E+00 |
| Raccoon | Mammal | 1.27E-01 | 1.03E+00 |
| Red Fox | Mammal | 1.34E-01 | 4.97E+00 |
| Red-Tailed Hawk | Bird | 1.60E+00 | 1.58E+01 |
| River Otter | Mammal | 1.14E-01 | 1.36E+00 |
| Short-Tailed Shrew | Mammal | 5.59E-01 | 3.14E+00 |
| Short-Tailed Weasel | Mammal | 2.92E-01 | 1.75E+00 |
| Spotted Sandpiper | Bird | 1.60E+00 | 6.17E+00 |
| Tree Swallow | Bird | 1.60E+00 | 6.10E+00 |
| Western Meadowlark | Bird | 1.60E+00 | 8.50E+00 |
| White-tailed Deer | Mammal | 6.77E-02 | 2.30E+01 |

**Toluene (108-88-3)**

| | | | |
|---|---|---|---|
| Beaver | Mammal | 1.63E+01 | 4.57E+02 |
| Black Bear | Mammal | 1.02E+01 | 3.49E+02 |
| Black-Tailed Jackrabbit | Mammal | 2.74E+01 | 4.51E+02 |
| Coyote | Mammal | 1.80E+01 | 4.11E+02 |
| Deer Mouse | Mammal | 9.14E+01 | 6.63E+02 |
| Eastern Cottontail | Mammal | 3.25E+01 | 4.73E+02 |
| Great Basin Pocket Mous | Mammal | 9.37E+01 | 6.69E+02 |
| Kit Fox | Mammal | 2.95E+01 | 4.74E+02 |
| Least Weasel | Mammal | 7.61E+01 | 6.34E+02 |
| Little Brown Bat | Mammal | 1.12E+02 | 7.15E+02 |
| Long-Tailed Weasel | Mammal | 5.19E+01 | 5.58E+02 |
| Meadow Vole | Mammal | 9.01E+01 | 6.59E+02 |
| Mink | Mammal | 3.43E+01 | 5.09E+02 |
| Mule Deer | Mammal | 1.16E+01 | 3.50E+02 |
| Muskrat | Mammal | 3.54E+01 | 5.15E+02 |
| Pine Vole | Mammal | 8.58E+01 | 6.50E+02 |
| Prairie Vole | Mammal | 7.58E+01 | 6.27E+02 |
| Raccoon | Mammal | 2.21E+01 | 4.49E+02 |
| Red Fox | Mammal | 2.34E+01 | 4.44E+02 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Soil**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| River Otter | Mammal | 1.99E+01 | 4.35E+02 |
| Short-Tailed Shrew | Mammal | 9.78E+01 | 6.81E+02 |
| Short-Tailed Weasel | Mammal | 5.11E+01 | 5.55E+02 |
| White-tailed Deer | Mammal | 1.19E+01 | 3.52E+02 |
| **Zinc (7440-66-6)** | | | |
| American Kestrel | Bird | 3.20E+01 | 6.27E+01 |
| American Robin | Bird | 3.20E+01 | 3.20E+01 |
| American Woodcock | Bird | 3.20E+01 | 9.22E+01 |
| Bald Eagle | Bird | 3.20E+01 | 6.11E+02 |
| Beaver | Mammal | 8.94E+01 | 7.92E+03 |
| Black Bear | Mammal | 5.56E+01 | 4.32E+02 |
| Black-Tailed Jackrabbit | Mammal | 1.50E+02 | 7.40E+03 |
| Burrowing Owl | Bird | 3.20E+01 | 4.20E+01 |
| Canada Goose | Bird | 3.20E+01 | 4.86E+02 |
| Cerulean Warbler | Bird | 3.20E+01 | 1.43E+01 |
| Cooper's Hawk | Bird | 3.20E+01 | 5.20E+02 |
| Coyote | Mammal | 9.84E+01 | 1.45E+03 |
| Deer Mouse | Mammal | 5.01E+02 | 7.37E+02 |
| Eastern Cottontail | Mammal | 1.78E+02 | 4.03E+03 |
| Great Basin Pocket Mous | Mammal | 5.13E+02 | 1.83E+03 |
| Herring Gull | Bird | 3.20E+01 | 1.72E+02 |
| Kit Fox | Mammal | 1.62E+02 | 1.81E+03 |
| Least Weasel | Mammal | 4.17E+02 | 4.49E+03 |
| Lesser Scaup | Bird | 3.20E+01 | 9.79E+01 |
| Little Brown Bat | Mammal | 6.12E+02 | 5.20E+02 |
| Loggerhead Shrike | Bird | 3.20E+01 | 2.64E+01 |
| Long-Tailed Weasel | Mammal | 2.84E+02 | 1.88E+03 |
| Mallard Duck | Bird | 3.20E+01 | 1.14E+02 |
| Marsh Wren | Bird | 3.20E+01 | 1.51E+01 |
| Meadow Vole | Mammal | 4.93E+02 | 2.96E+03 |
| Mink | Mammal | 1.88E+02 | 5.54E+02 |
| Mule Deer | Mammal | 6.35E+01 | 3.09E+03 |
| Muskrat | Mammal | 1.94E+02 | 8.14E+03 |
| Northern Bobwhite | Bird | 3.20E+01 | 9.63E+01 |
| Pine Vole | Mammal | 4.70E+02 | 3.50E+03 |
| Prairie Vole | Mammal | 4.15E+02 | 1.44E+03 |
| Raccoon | Mammal | 1.21E+02 | 3.55E+02 |
| Red Fox | Mammal | 1.28E+02 | 8.76E+02 |
| Red-Tailed Hawk | Bird | 3.20E+01 | 2.35E+02 |
| River Otter | Mammal | 1.09E+02 | 9.69E+02 |
| Short-Tailed Shrew | Mammal | 5.35E+02 | 7.01E+02 |
| Short-Tailed Weasel | Mammal | 2.80E+02 | 1.26E+03 |
| Spotted Sandpiper | Bird | 3.20E+01 | 2.46E+01 |
| Tree Swallow | Bird | 3.20E+01 | 2.33E+01 |
| Western Meadowlark | Bird | 3.20E+01 | 3.39E+01 |
| White-tailed Deer | Mammal | 6.49E+01 | 1.25E+03 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Water**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| **Antimony (7440-36-0)** | | | |
| Beaver | Mammal | 1.65E-01 | 4.88E-01 |
| Mink | Mammal | 3.47E-01 | 6.33E-01 |
| Muskrat | Mammal | 3.58E-01 | 6.40E-01 |
| Raccoon | Mammal | 2.24E-01 | 5.44E-01 |
| River Otter | Mammal | 2.02E-01 | 5.24E-01 |
| **Barium (7440-39-3)** | | | |
| Bald Eagle | Bird | 3.00E+01 | 1.07E+02 |
| Belted Kingfisher | Bird | 3.00E+01 | 3.49E+01 |
| Canada Goose | Bird | 3.00E+01 | 9.93E+01 |
| Great Blue Heron | Bird | 3.00E+01 | 8.96E+01 |
| Green Heron | Bird | 3.00E+01 | 4.41E+01 |
| Herring Gull | Bird | 3.00E+01 | 7.00E+01 |
| Lesser Scaup | Bird | 3.00E+01 | 6.26E+01 |
| Mallard Duck | Bird | 3.00E+01 | 7.17E+01 |
| Osprey | Bird | 3.00E+01 | 7.99E+01 |
| **Benzene (71-43-2)** | | | |
| Beaver | Mammal | 1.66E+01 | 4.89E+01 |
| Mink | Mammal | 3.48E+01 | 4.45E+00 |
| Muskrat | Mammal | 3.59E+01 | 3.54E+01 |
| Raccoon | Mammal | 2.25E+01 | 8.94E+00 |
| River Otter | Mammal | 2.02E+01 | 3.75E+00 |
| **Butylbenzylphthalate (85-68-7)** | | | |
| Beaver | Mammal | 7.25E+02 | 2.14E+03 |
| Mink | Mammal | 1.52E+03 | 2.42E+00 |
| Muskrat | Mammal | 1.57E+03 | 2.42E+01 |
| Raccoon | Mammal | 9.83E+02 | 4.64E+00 |
| River Otter | Mammal | 8.85E+02 | 2.07E+00 |
| **Cadmium (7440-43-9)** | | | |
| Bald Eagle | Bird | 4.40E+00 | 6.87E-02 |
| Beaver | Mammal | 1.24E+00 | 2.71E-01 |
| Belted Kingfisher | Bird | 4.40E+00 | 6.48E-03 |
| Canada Goose | Bird | 4.40E+00 | 9.82E-01 |
| Great Blue Heron | Bird | 4.40E+00 | 1.80E-02 |
| Green Heron | Bird | 4.40E+00 | 2.86E-02 |
| Herring Gull | Bird | 4.40E+00 | 4.38E-03 |
| Lesser Scaup | Bird | 4.40E+00 | 1.76E-03 |
| Mallard Duck | Bird | 4.40E+00 | 2.01E-03 |
| Mink | Mammal | 2.61E+00 | 2.19E-02 |
| Muskrat | Mammal | 2.69E+00 | 1.73E-03 |
| Osprey | Bird | 4.40E+00 | 5.11E-02 |
| Raccoon | Mammal | 1.68E+00 | 2.41E-03 |
| River Otter | Mammal | 1.52E+00 | 5.47E-03 |
| **Chloroform (67-66-3)** | | | |
| Beaver | Mammal | 9.10E+00 | 2.69E+01 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

### Water

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Mink | Mammal | 1.91E+01 | 3.42E+00 |
| Muskrat | Mammal | 1.97E+01 | 2.25E+01 |
| Raccoon | Mammal | 1.23E+01 | 6.60E+00 |
| River Otter | Mammal | 1.11E+01 | 2.88E+00 |
| **Chromium (III) (16065-83-1)** | | | |
| Bald Eagle | Bird | 2.20E+00 | 1.05E-01 |
| Beaver | Mammal | 1.00E+03 | 2.97E+03 |
| Belted Kingfisher | Bird | 2.20E+00 | 3.38E-02 |
| Canada Goose | Bird | 2.20E+00 | 7.28E+00 |
| Great Blue Heron | Bird | 2.20E+00 | 8.72E-02 |
| Green Heron | Bird | 2.20E+00 | 4.35E-02 |
| Herring Gull | Bird | 2.20E+00 | 6.80E-02 |
| Lesser Scaup | Bird | 2.20E+00 | 1.46E-01 |
| Mallard Duck | Bird | 2.20E+00 | 1.35E-01 |
| Mink | Mammal | 2.11E+03 | 5.39E+01 |
| Muskrat | Mammal | 2.18E+03 | 1.62E+02 |
| Osprey | Bird | 2.20E+00 | 7.77E-02 |
| Raccoon | Mammal | 1.36E+03 | 7.90E+01 |
| River Otter | Mammal | 1.23E+03 | 4.61E+01 |
| **Chromium (VI) (18540-29-9)** | | | |
| Beaver | Mammal | 1.93E+00 | 5.71E+00 |
| Mink | Mammal | 4.06E+00 | 1.04E-01 |
| Muskrat | Mammal | 4.19E+00 | 3.11E-01 |
| Raccoon | Mammal | 2.62E+00 | 1.52E-01 |
| River Otter | Mammal | 2.36E+00 | 8.86E-02 |
| **Copper (7440-50-8)** | | | |
| Bald Eagle | Bird | 5.39E+01 | 1.16E+03 |
| Beaver | Mammal | 2.75E+00 | 8.14E+00 |
| Belted Kingfisher | Bird | 5.39E+01 | 2.11E+02 |
| Canada Goose | Bird | 5.39E+01 | 1.78E+02 |
| Great Blue Heron | Bird | 5.39E+01 | 2.84E+02 |
| Green Heron | Bird | 5.39E+01 | 3.91E+02 |
| Herring Gull | Bird | 5.39E+01 | 2.07E+02 |
| Lesser Scaup | Bird | 5.39E+01 | 1.12E+02 |
| Mallard Duck | Bird | 5.39E+01 | 1.29E+02 |
| Mink | Mammal | 5.78E+00 | 3.63E+01 |
| Muskrat | Mammal | 5.97E+00 | 1.07E+01 |
| Osprey | Bird | 5.39E+01 | 9.60E+02 |
| Raccoon | Mammal | 3.74E+00 | 1.78E+01 |
| River Otter | Mammal | 3.36E+00 | 2.46E+01 |
| **Di(2-ethylhexylphthalate) (117-81-7)** | | | |
| Bald Eagle | Bird | 1.10E+00 | 3.74E-01 |
| Beaver | Mammal | 2.29E+01 | 1.40E+02 |
| Belted Kingfisher | Bird | 1.10E+00 | 3.93E-01 |
| Canada Goose | Bird | 1.10E+00 | 8.47E+00 |
| Great Blue Heron | Bird | 1.10E+00 | 2.55E-01 |
| Green Heron | Bird | 1.10E+00 | 4.90E-01 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Water**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Herring Gull | Bird | 1.10E+00 | 2.45E-01 |
| Lesser Scaup | Bird | 1.10E+00 | 2.44E+00 |
| Mallard Duck | Bird | 1.10E+00 | 2.15E+00 |
| Mink | Mammal | 4.81E+01 | 7.60E+00 |
| Muskrat | Mammal | 4.96E+01 | 8.89E+01 |
| Osprey | Bird | 1.10E+00 | 2.23E-01 |
| Raccoon | Mammal | 3.11E+01 | 1.86E+01 |
| River Otter | Mammal | 2.80E+01 | 6.28E+00 |
| **Dibutylphthalate (84-74-2)** | | | |
| Bald Eagle | Bird | 3.47E-01 | 9.58E-04 |
| Belted Kingfisher | Bird | 3.47E-01 | 3.09E-04 |
| Canada Goose | Bird | 3.47E-01 | 1.15E+00 |
| Great Blue Heron | Bird | 3.47E-01 | 7.99E-04 |
| Green Heron | Bird | 3.47E-01 | 3.99E-04 |
| Herring Gull | Bird | 3.47E-01 | 6.23E-04 |
| Lesser Scaup | Bird | 3.47E-01 | 7.24E-01 |
| Mallard Duck | Bird | 3.47E-01 | 6.34E-03 |
| Osprey | Bird | 3.47E-01 | 7.12E-04 |
| **Lead (7439-92-1)** | | | |
| Bald Eagle | Bird | 6.60E-02 | 5.92E-03 |
| Beaver | Mammal | 6.32E-03 | 5.65E-04 |
| Belted Kingfisher | Bird | 6.60E-02 | 1.91E-03 |
| Canada Goose | Bird | 6.60E-02 | 6.00E-03 |
| Great Blue Heron | Bird | 6.60E-02 | 4.94E-03 |
| Green Heron | Bird | 6.60E-02 | 2.40E-03 |
| Herring Gull | Bird | 6.60E-02 | 3.85E-03 |
| Lesser Scaup | Bird | 6.60E-02 | 3.03E-02 |
| Mallard Duck | Bird | 6.60E-02 | 1.87E-02 |
| Mink | Mammal | 1.33E-02 | 6.40E-04 |
| Muskrat | Mammal | 1.37E-02 | 7.01E-04 |
| Osprey | Bird | 6.60E-02 | 4.40E-03 |
| Raccoon | Mammal | 8.58E-03 | 1.20E-03 |
| River Otter | Mammal | 7.72E-03 | 5.47E-04 |
| **Methyl ethyl ketone (78-93-3)** | | | |
| Beaver | Mammal | 1.04E+03 | 3.09E+03 |
| Mink | Mammal | 2.19E+03 | 2.92E+03 |
| Muskrat | Mammal | 2.26E+03 | 4.04E+03 |
| Raccoon | Mammal | 1.42E+03 | 3.04E+03 |
| River Otter | Mammal | 1.28E+03 | 2.42E+03 |
| **Methylmercury (22967-92-6)** | | | |
| Bald Eagle | Bird | 2.50E-02 | 1.90E-08 |
| Beaver | Mammal | 4.47E-02 | 1.32E-01 |
| Belted Kingfisher | Bird | 2.50E-02 | 2.09E-08 |
| Canada Goose | Bird | 2.50E-02 | 8.27E-02 |
| Great Blue Heron | Bird | 2.50E-02 | 1.29E-08 |
| Green Heron | Bird | 2.50E-02 | 2.70E-08 |
| Herring Gull | Bird | 2.50E-02 | 1.25E-08 |

## Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Water**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Lesser Scaup | Bird | 2.50E-02 | 5.22E-02 |
| Mallard Duck | Bird | 2.50E-02 | 4.31E-07 |
| Mink | Mammal | 9.38E-02 | 3.33E-08 |
| Muskrat | Mammal | 9.69E-02 | 1.32E-06 |
| Osprey | Bird | 2.50E-02 | 1.13E-08 |
| Raccoon | Mammal | 6.06E-02 | 9.54E-08 |
| River Otter | Mammal | 5.46E-02 | 2.76E-08 |
| **Nickel (7440-02-0)** | | | |
| Bald Eagle | Bird | 9.10E+01 | 3.93E+02 |
| Beaver | Mammal | 2.24E+01 | 6.62E+01 |
| Belted Kingfisher | Bird | 9.10E+01 | 3.70E+00 |
| Canada Goose | Bird | 9.10E+01 | 3.01E+02 |
| Great Blue Heron | Bird | 9.10E+01 | 1.06E+01 |
| Green Heron | Bird | 9.10E+01 | 1.50E+02 |
| Herring Gull | Bird | 9.10E+01 | 2.00E+00 |
| Lesser Scaup | Bird | 9.10E+01 | 7.60E-01 |
| Mallard Duck | Bird | 9.10E+01 | 8.71E-01 |
| Mink | Mammal | 4.70E+01 | 1.03E+02 |
| Muskrat | Mammal | 4.86E+01 | 6.58E-01 |
| Osprey | Bird | 9.10E+01 | 2.93E+02 |
| Raccoon | Mammal | 3.04E+01 | 9.55E-01 |
| River Otter | Mammal | 2.74E+01 | 2.72E+00 |
| **Pentachlorophenol (87-86-5)** | | | |
| Bald Eagle | Bird | 6.20E+01 | 2.22E+02 |
| Beaver | Mammal | 2.60E+00 | 7.69E+00 |
| Belted Kingfisher | Bird | 6.20E+01 | 5.17E+00 |
| Canada Goose | Bird | 6.20E+01 | 2.05E+02 |
| Great Blue Heron | Bird | 6.20E+01 | 1.47E+01 |
| Green Heron | Bird | 6.20E+01 | 8.38E+01 |
| Herring Gull | Bird | 6.20E+01 | 2.89E+00 |
| Lesser Scaup | Bird | 6.20E+01 | 1.10E+00 |
| Mallard Duck | Bird | 6.20E+01 | 1.26E+00 |
| Mink | Mammal | 5.47E+00 | 9.98E+00 |
| Muskrat | Mammal | 5.65E+00 | 1.62E-01 |
| Osprey | Bird | 6.20E+01 | 1.65E+02 |
| Raccoon | Mammal | 3.53E+00 | 2.34E-01 |
| River Otter | Mammal | 3.18E+00 | 6.45E-01 |
| **Selenium (7782-49-2)** | | | |
| Bald Eagle | Bird | 1.60E+00 | 4.81E-03 |
| Beaver | Mammal | 9.33E-02 | 2.76E-01 |
| Belted Kingfisher | Bird | 1.60E+00 | 4.41E-03 |
| Canada Goose | Bird | 1.60E+00 | 5.30E+00 |
| Great Blue Heron | Bird | 1.60E+00 | 3.32E-03 |
| Green Heron | Bird | 1.60E+00 | 5.70E-03 |
| Herring Gull | Bird | 1.60E+00 | 3.16E-03 |
| Lesser Scaup | Bird | 1.60E+00 | 3.34E+00 |
| Mallard Duck | Bird | 1.60E+00 | 8.91E-02 |

# Table R-6. Chemical Stressor Concentration Limits (CSCLs) for Receptor Populations

**Water**

| Species Name | Species Type | Scaled Benchmark | CSCL |
|---|---|---|---|
| Mink | Mammal | 1.96E-01 | 2.78E-04 |
| Muskrat | Mammal | 2.02E-01 | 8.88E-03 |
| Osprey | Bird | 1.60E+00 | 2.91E-03 |
| Raccoon | Mammal | 1.27E-01 | 7.68E-04 |
| River Otter | Mammal | 1.14E-01 | 2.31E-04 |
| **Toluene (108-88-3)** | | | |
| Beaver | Mammal | 1.63E+01 | 6.16E-03 |
| Mink | Mammal | 3.43E+01 | 1.58E+00 |
| Muskrat | Mammal | 3.54E+01 | 8.46E-03 |
| Raccoon | Mammal | 2.21E+01 | 3.39E+00 |
| River Otter | Mammal | 1.99E+01 | 1.33E+00 |
| **Zinc (7440-66-6)** | | | |
| Bald Eagle | Bird | 3.20E+01 | 2.91E+01 |
| Beaver | Mammal | 8.94E+01 | 6.61E-01 |
| Belted Kingfisher | Bird | 3.20E+01 | 1.67E-01 |
| Canada Goose | Bird | 3.20E+01 | 2.40E-01 |
| Great Blue Heron | Bird | 3.20E+01 | 2.78E-01 |
| Green Heron | Bird | 3.20E+01 | 2.56E+00 |
| Herring Gull | Bird | 3.20E+01 | 8.27E-02 |
| Lesser Scaup | Bird | 3.20E+01 | 3.32E-02 |
| Mallard Duck | Bird | 3.20E+01 | 3.81E-02 |
| Mink | Mammal | 1.88E+02 | 9.05E+01 |
| Muskrat | Mammal | 1.94E+02 | 2.78E-01 |
| Osprey | Bird | 3.20E+01 | 2.16E+01 |
| Raccoon | Mammal | 1.21E+02 | 4.86E-01 |
| River Otter | Mammal | 1.09E+02 | 1.40E+00 |

## Table R-7a. Water Chemical Stressor Concentration Limits (CSCLs)

| | | | Aquatic Community | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Constituent**[a] | **CAS** | **Aquatic Plants** | **Total** | **Dissolved** | **Amphibian** | **Bird**[b] | | **Mammal**[c] | |
| Acrylamide | 79-06-1 | ID | ID | NA | ID | ID | | ID | |
| Acrylonitrile | 107-13-1 | ID | ID | NA | ID | ID | | ID | |
| Antimony | 7440-36-0 | 0.61 | 0.03 | ID | 0.3 | ID | | 4.88E-01 | Beaver |
| Barium | 7440-39-3 | ID | 0.004 | ID | ID | 3.48E+01 | Green Heron | ID | |
| Benzene | 71-43-2 | 530 | 0.13 | NA | ID | ID | | 3.75E+00 | River Otter |
| Butylbenzylphthalate | 85-68-7 | ID | 16 | NA | ID | ID | | 2.07E+00 | River Otter |
| Cadmium | 7440-43-9 | 0.002 | 0.0025 | 0.0023 | 1.2172 | 1.76E-03 | Lesser Scaup | 1.73E-03 | Muskrat |
| Chloroform | 67-66-3 | ID | 0.028 | NA | 8.878 | ID | | 2.88E+00 | River Otter |
| Chromium (III) | 16065-83-1 | 0.397 | 0.086 | 0.074 | ID | 3.38E-02 | Belted Kingfisher | 4.61E+01 | River Otter |
| Chromium (VI) | 18540-29-9 | 0.002 | 0.011 | 0.011 | 9.4733 | ID | | 8.86E-02 | River Otter |
| Cobalt | 7440-48-4 | ID | 0.023 | ID | 0.05 | ID | | ID | |
| Copper | 7440-50-8 | 0.001 | 0.0093 | 0.0089 | 0.11 | 1.12E+02 | Lesser Scaup | 8.14E+00 | Beaver |
| Cresol, m- | 108-39-4 | ID | ID | NA | ID | ID | | ID | |
| Cresol, o- | 95-48-7 | ID | ID | NA | ID | ID | | ID | |
| Cresol, p- | 106-44-5 | ID | ID | NA | ID | ID | | ID | |
| Di(2-ethylhexylphthalate) | 117-81-7 | ID | 0.003 | NA | ID | 2.23E-01 | Osprey | 6.28E+00 | River Otter |
| Dibutylphthalate | 84-74-2 | ID | ID | NA | ID | 3.09E-04 | Belted Kingfisher | ID | |
| Dichloromethane | 75-09-2 | ID | 2.2 | NA | ID | ID | | ID | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | ID | NA | ID | ID | | ID | |
| Divalent mercury | 7439-97-6(d) | 0.0008 | 0.0000028 | NA | 0.058 | 1.13E-08 | Osprey | 2.76E-08 | River Otter |
| Ethylbenzene | 100-41-4 | ID | 0.0073 | NA | ID | ID | | ID | |
| Ethylene glycol | 107-21-1 | ID | ID | NA | 326 | ID | | ID | |
| Formaldehyde | 50-00-0 | ID | ID | NA | ID | ID | | ID | |
| Lead | 7439-92-1 | 0.5 | 0.0032 | 0.0025 | ID | 1.91E-03 | Belted Kingfisher | 5.47E-04 | River Otter |
| Methanol | 67-56-1 | ID | ID | NA | ID | ID | | ID | |
| Methyl ethyl ketone | 78-93-3 | ID | ID | NA | ID | ID | | 2.42E+03 | River Otter |
| Methyl isobutyl ketone | 108-10-1 | ID | ID | NA | ID | ID | | ID | |
| Methyl methacrylate | 80-62-6 | ID | ID | NA | ID | ID | | ID | |
| n-Butyl alcohol | 71-36-3 | ID | ID | NA | 1200 | ID | | ID | |
| Nickel | 7440-02-0 | 0.005 | 0.052 | 0.052 | 1.7493 | 7.60E-01 | Lesser Scaup | 6.58E-01 | Muskrat |
| Pentachlorophenol | 87-86-5 | ID | 0.0024 | NA | 0.2527 | 1.10E+00 | Lesser Scaup | 1.62E-01 | Muskrat |
| Phenol | 108-95-2 | 20 | 0.11 | NA | 1.1131 | ID | | ID | |

## Table R-7a. Water Chemical Stressor Concentration Limits (CSCLs)

| Constituent[a] | CAS | Aquatic Plants | Aquatic Community | | Amphibian | Bird[b] | | Mammal[c] | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Total | Dissolved | | | | | |
| Selenium | 7782-49-2 | 0.1 | 0.005 | ID | 1.7321 | 2.91E-03 | Osprey | 2.31E-04 | River Otter |
| Silver | 7440-22-4 | 0.03 | 0.00036 | ID | ID | ID | | ID | |
| Styrene | 100-42-5 | ID | ID | NA | ID | ID | | ID | |
| Tetrachloroethylene | 127-18-4 | ID | 0.098 | NA | ID | ID | | ID | |
| Tin | 7440-31-5 | ID | 0.073 | ID | 0.09 | ID | | ID | |
| Toluene | 108-88-3 | 245 | 0.0098 | NA | 0.39 | ID | | 6.16E-03 | Beaver |
| Vinyl acetate | 108-05-4 | ID | 0.016 | NA | ID | ID | | ID | |
| Xylene (mixed isomers) | 1330-20-7 | ID | 0.013 | NA | 73 | ID | | ID | |
| Zinc | 7440-66-6 | 0.03 | 0.12 | 0.12 | 1.3 | 3.32E-02 | Lesser Scaup | 2.78E-01 | Muskrat |

ID = Insufficient data.

[a]Number based on the transformation of divalent mercury to methylmercury in the waterbody.

[b]Lowest CSCL for birds.

[c]Lowest CSCL for mammals.

## Table R-7b. Sediment Chemical Stressor Concentration Limits (CSCLs)

| Constituent | CAS | Sediment Community | Bird [a] | | Mammal [b] | |
|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | ID | | ID | |
| Acrylonitrile | 107-13-1 | ID | ID | | ID | |
| Antimony | 7440-36-0 | 2.00E+00 | ID | | 4.69E+01 | River Otter |
| Barium | 7440-39-3 | ID | 3.31E+03 | Green Heron | ID | |
| Benzene | 71-43-2 | 1.60E-01 | ID | | 4.70E+03 | River Otter |
| Butylbenzylphthalate | 85-68-7 | 1.74E+01 | ID | | 2.06E+05 | River Otter |
| Cadmium | 7440-43-9 | 6.76E-01 | 4.85E+02 | Green Heron | 3.52E+02 | River Otter |
| Chloroform | 67-66-3 | 1.06E-02 | ID | | 2.58E+03 | River Otter |
| Chromium (III) | 16065-83-1 | ID | 2.43E+02 | Green Heron | 2.85E+05 | River Otter |
| Chromium (VI) | 18540-29-9 | ID | ID | | 5.48E+02 | River Otter |
| Cobalt | 7440-48-4 | ID | ID | | ID | |
| Copper | 7440-50-8 | 1.87E+01 | 5.94E+03 | Green Heron | 7.81E+02 | River Otter |
| Cresol, m- | 108-39-4 | ID | ID | | ID | |
| Cresol, o- | 95-48-7 | ID | ID | | ID | |
| Cresol, p- | 106-44-5 | ID | ID | | ID | |
| Di(2-ethylhexylphthalate) | 117-81-7 | 1.82E-01 | 1.21E+02 | Green Heron | 6.49E+03 | River Otter |
| Dibutylphthalate | 84-74-2 | ID | 3.82E+01 | Green Heron | ID | |
| Dichloromethane | 75-09-2 | 1.87E-01 | ID | | ID | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | ID | | ID | |
| Divalent mercury | 7439-97-6(d) | 1.30E-01 | 7.05E+01 | Green Heron | 1.35E+02 | River Otter |
| Ethylbenzene | 100-41-4 | 7.30E-02 | ID | | ID | |
| Ethylene glycol | 107-21-1 | ID | ID | | ID | |
| Formaldehyde | 50-00-0 | ID | ID | | ID | |
| Lead | 7439-92-1 | 3.02E+01 | 7.28E+00 | Green Heron | 1.79E+00 | River Otter |
| Mercury | 7439-97-6(e) | ID | ID | | ID | |
| Methanol | 67-56-1 | ID | ID | | ID | |
| Methyl ethyl ketone | 78-93-3 | ID | ID | | 2.96E+05 | River Otter |
| Methyl isobutyl ketone | 108-10-1 | ID | ID | | ID | |
| Methyl methacrylate | 80-62-6 | ID | ID | | ID | |
| n-Butyl alcohol | 71-36-3 | ID | ID | | ID | |
| Nickel | 7440-02-0 | 1.59E+01 | 1.00E+04 | Green Heron | 6.36E+03 | River Otter |
| Pentachlorophenol | 87-86-5 | 3.74E-02 | 6.83E+03 | Green Heron | 7.39E+02 | River Otter |
| Phenol | 108-95-2 | 1.87E-02 | ID | | ID | |
| Selenium | 7782-49-2 | ID | 1.76E+02 | Green Heron | 2.65E+01 | River Otter |
| Silver | 7440-22-4 | 7.33E-01 | ID | | ID | |
| Styrene | 100-42-5 | ID | ID | | ID | |
| Tetrachloroethylene | 127-18-4 | 1.59E-01 | ID | | ID | |
| Tin | 7440-31-5 | ID | ID | | ID | |
| Toluene | 108-88-3 | 2.64E-02 | ID | | 4.63E+03 | River Otter |
| Vinyl acetate | 108-05-4 | 4.11E-04 | ID | | ID | |
| Xylene (mixed isomers) | 1330-20-7 | 1.56E-01 | ID | | ID | |
| Zinc | 7440-66-6 | 1.24E+02 | 3.53E+03 | Green Heron | 2.54E+04 | River Otter |

ID = Insufficient data.

[a]Lowest CSCL for birds.

[b]Lowest CSCL for mammals.

## Table R-7c. Soil Chemical Stressor Concentration Limits (CSCLs)

| Constituent | CAS | Soil Community | Terrestrial Plants | Bird [a] | | Mammal [b] | |
|---|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | ID | ID | ID | | ID | |
| Acrylonitrile | 107-13-1 | 1000 | ID | ID | | ID | |
| Antimony | 7440-36-0 | ID | 5 | ID | | 4.16E+00 | Coyote |
| Barium | 7440-39-3 | 3000 | 500 | 1.01E+02 | Cerulean Warbler | ID | |
| Benzene | 71-43-2 | ID | ID | ID | | 1.61E+02 | Mule Deer |
| Butylbenzylphthalate | 85-68-7 | ID | ID | ID | | 1.70E+04 | Black Bear |
| Cadmium | 7440-43-9 | 1 | 4 | 1.85E+00 | Cerulean Warbler | 4.51E+00 | Raccoon |
| Chloroform | 67-66-3 | ID | ID | ID | | 6.75E+01 | Mule Deer |
| Chromium (III) | 16065-83-1 | ID | ID | 1.58E+01 | Cerulean Warbler | 6.20E+04 | Raccoon |
| Chromium (VI) | 18540-29-9 | 0.4 | 1 | ID | | 1.19E+02 | Raccoon |
| Cobalt | 7440-48-4 | 1000 | 20 | ID | | ID | |
| Copper | 7440-50-8 | 50 | 100 | 3.45E+01 | Cerulean Warbler | 1.59E+01 | Raccoon |
| Cresol, m- | 108-39-4 | ID | ID | ID | | ID | |
| Cresol, o- | 95-48-7 | ID | ID | ID | | ID | |
| Cresol, p- | 106-44-5 | ID | ID | ID | | ID | |
| Di(2-ethylhexylphthalate | 117-81-7 | ID | ID | 3.70E+00 | Cerulean Warbler | 5.41E+02 | Black Bear |
| Dibutylphthalate | 84-74-2 | ID | ID | 1.17E+00 | Cerulean Warbler | ID | |
| Dichloromethane | 75-09-2 | ID | ID | ID | | ID | |
| Dimethylphenol, 2,4- | 105-67-9 | ID | ID | ID | | ID | |
| Divalent mercury | 7439-97-6(d) | ID | ID | 7.51E-01 | Cerulean Warbler | 4.70E+00 | Raccoon |
| Ethylbenzene | 100-41-4 | 0.1 | ID | ID | | ID | |
| Ethylene glycol | 107-21-1 | 97 | ID | ID | | ID | |
| Formaldehyde | 50-00-0 | ID | ID | ID | | ID | |
| Lead | 7439-92-1 | 28 | 50 | 3.66E-01 | Cerulean Warbler | 2.43E-01 | Mink |
| Mercury | 7439-97-6(e) | 0.1 | 0.3 | ID | | ID | |
| Methanol | 67-56-1 | ID | ID | ID | | ID | |
| Methyl ethyl ketone | 78-93-3 | ID | ID | ID | | 8.91E+02 | Mule Deer |
| Methyl isobutyl ketone | 108-10-1 | ID | ID | ID | | ID | |
| Methyl methacrylate | 80-62-6 | ID | ID | ID | | ID | |
| n-Butyl alcohol | 71-36-3 | ID | ID | ID | | ID | |
| Nickel | 7440-02-0 | 90 | 30 | 1.32E+02 | Cerulean Warbler | 2.81E+02 | Raccoon |
| Pentachlorophenol | 87-86-5 | 6 | 3 | 1.24E+02 | American Woodcoc | 3.87E+01 | Short-Tailed Shrev |
| Phenol | 108-95-2 | 30 | 70 | ID | | ID | |
| Selenium | 7782-49-2 | 70 | 1 | 3.59E+00 | Cerulean Warbler | 9.50E-01 | Mink |
| Silver | 7440-22-4 | 50 | 2 | ID | | ID | |
| Styrene | 100-42-5 | ID | 300 | ID | | ID | |
| Tetrachloroethylene | 127-18-4 | 0.1 | ID | ID | | ID | |
| Tin | 7440-31-5 | 2000 | 50 | ID | | ID | |
| Toluene | 108-88-3 | 0.1 | 200 | ID | | 3.49E+02 | Black Bear |
| Vinyl acetate | 108-05-4 | ID | ID | ID | | ID | |
| Xylene (mixed isomers) | 1330-20-7 | 0.1 | ID | ID | | ID | |
| Zinc | 7440-66-6 | 100 | 50 | 1.43E+01 | Cerulean Warbler | 3.55E+02 | Raccoon |

ID = Insufficient data.

[a]Lowest CSCL for birds.

[b]Lowest CSCL for mammals.

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# Appendix S

# Waste Stream Data

# Appendix S

# Waste Stream Data

Following completion of the initial risk assessment in April 2000, EPA received survey data on waste volumes produced by the Paints industry (i.e., the 3007 survey). These data were provided to RTI to be used in revising the target waste concentrations calculated in the initial risk assessment. The information contained in this appendix details how the waste volume data were used to derive the distribution of 10,000 records required for the risk assessment.

Waste volume distributions were provided by EPA for aqueous waste, emission control dust, and mixed solids. For each waste type, a discrete distribution of waste volumes was provided along with corresponding weighting factors as given in Tables S-1, S-2, and S-3. For comparison purposes, the weighting factors were converted to a percent basis by dividing the weighting factor for an individual volume by the sum for each waste type.

Using the weighting factors, Crystal Ball was used to generate a distribution of 10,000 volumes, corresponding to the number of iterations in the risk assessment's Monte Carlo simulation. Tables S-4, S-5, and S-6 summarize the output from Crystal Ball. Each of these tables presents the distribution of waste volumes along with the number of times an individual waste volume was selected. The waste volumes were converted to cubic meters per year since these units are required for the risk assessment. The number of times selected was converted to a percent weight to allow for comparison of the output from Crystal Ball and the original distributions.

The initial risk assessment was also conducted in a deterministic mode. To update the target waste concentrations from the deterministic assessment, central tendency and high-end waste volumes are needed. The central tendency waste volumes were based on the 50$^{th}$ percentile and the high-end waste volumes were based on the 90$^{th}$ percentile. Both of these percentiles were derived from the distribution of 10,000 records discussed above and are presented in Table S-7 for each waste type.

**Table S-1. Waste Volume Distribution for Aqueous Waste**

| Weighting Factor | Volume (gal/yr) | Percent Weight (%) |
|---|---|---|
| 1.0417 | 151 | 2.98 |
| 1.1951 | 165 | 3.42 |
| 4.0476 | 300 | 11.57 |
| 1.0417 | 1,300 | 2.98 |
| 1.1951 | 1,500 | 3.42 |
| 1.1951 | 2,400 | 3.42 |
| 1 | 3,700 | 2.86 |
| 1 | 4,600 | 2.86 |
| 1 | 5,000 | 2.86 |
| 1 | 11,165 | 2.86 |
| 8.8571 | 12,000 | 25.32 |
| 1 | 12,900 | 2.86 |
| 1 | 14,870 | 2.86 |
| 1.0417 | 17,000 | 2.98 |
| 1.8571 | 19,330 | 5.31 |
| 2.25 | 20,334 | 6.43 |
| 1 | 20,812 | 2.86 |
| 1.0417 | 26,750 | 2.98 |
| 1 | 27,634 | 2.86 |
| 1 | 46,761 | 2.86 |
| 1.2143 | 104,225 | 3.47 |
| **Total** | | |
| 34.9782 | | 100.00 |

**Table S-2. Waste Volume and Bulk Density Distribution for Emission Control Dust**

| Weighting Factor | Volume (gal/yr) | Density (lb/gal) | Percent Weight (%) |
|---|---|---|---|
| 1.1951 | 40.00 | 30 | 2.36 |
| 1.05 | 45.00 | 27 | 2.08 |
| 1 | 55.00 | 18.68 | 1.98 |
| 1.0417 | 82.29 | 12 | 2.06 |
| 1.0417 | 100.00 | 18.68 | 2.06 |
| 3.629 | 172.00 | 11.66 | 7.18 |
| 1.1951 | 214.13 | 18.68 | 2.36 |
| 2.1667 | 220.00 | 3 | 4.28 |
| 1.1951 | 224.42 | 26.7 | 2.36 |
| 1 | 297.00 | 18.68 | 1.98 |
| 1.2143 | 300.00 | 2 | 2.40 |
| 2.25 | 330.00 | 10 | 4.45 |
| 1 | 330.00 | 18.68 | 1.98 |
| 1.1951 | 400.00 | 15 | 2.36 |
| 2.25 | 450.00 | 5 | 4.45 |
| 1 | 550.00 | 10 | 1.98 |
| 1.1951 | 600.00 | 18.7 | 2.36 |
| 1.1951 | 643.32 | 3.6 | 2.36 |
| 1.05 | 668.00 | 2 | 2.08 |
| 1 | 907.00 | 22.1 | 1.98 |
| 1.1951 | 1,560.00 | 22.5 | 2.36 |
| 4.0476 | 1,920.00 | 22 | 8.00 |
| 1 | 1,980.00 | 5.45 | 1.98 |
| 1.0417 | 2,053.33 | 6 | 2.06 |
| 1.1951 | 2,289.93 | 10.78 | 2.36 |
| 1.1951 | 2,857.14 | 1.82 | 2.36 |
| 2.1667 | 3,211.99 | 18.68 | 4.28 |
| 1 | 5,000.00 | 18.68 | 1.98 |
| 1.05 | 8,196.72 | 2.44 | 2.08 |
| 7.6154 | 58,333.33 | 3 | 15.06 |
| 1.1951 | 78,650.00 | 25 | 2.36 |
| **Total** | | | |
| 50.5658 | | | 100.00 |

**Table S-3. Waste Volume and Bulk Density Distribution for Combined Solids**

| Weighting Factor | Volume (gal/yr) | Density (lb/gal) | Percent Weight (%) |
|---|---|---|---|
| 3.629 | 5.00 | 12 | 2.71 |
| 8.8571 | 5.00 | 12.34 | 6.62 |
| 1.1951 | 40.00 | 30 | 0.89 |
| 1.05 | 45.00 | 27 | 0.78 |
| 1 | 55.00 | 18.68 | 0.75 |
| 4.0476 | 69.79 | 8.32 | 3.02 |
| 7.6154 | 74.81 | 20 | 5.69 |
| 1.0417 | 100.00 | 18.68 | 0.78 |
| 1.1951 | 110.00 | 7.6 | 0.89 |
| 8.8571 | 126.00 | 9.5 | 6.62 |
| 3.629 | 172.00 | 11.66 | 2.71 |
| 1.1951 | 214.13 | 18.68 | 0.89 |
| 2.1667 | 220.00 | 3 | 1.62 |
| 1.1951 | 224.42 | 26.7 | 0.89 |
| 1.8571 | 225.00 | 20 | 1.39 |
| 3.629 | 269.27 | 14.85 | 2.71 |
| 1 | 297.00 | 18.68 | 0.75 |
| 1.2143 | 300.00 | 2 | 0.91 |
| 1 | 330.00 | 18.68 | 0.75 |
| 4.0476 | 330.00 | 20 | 3.02 |
| 2.25 | 330.00 | 10 | 1.68 |
| 1.2143 | 374.03 | 2.77 | 0.91 |
| 8.8571 | 374.03 | 0.51 | 6.62 |
| 1 | 448.00 | 9 | 0.75 |
| 2.25 | 450.00 | 5 | 1.68 |

*(continued)*

**Table S-3. (continued)**

| Weighting Factor | Volume (gal/yr) | Density (lb/gal) | Percent Weight (%) |
|---|---|---|---|
| 1.0417 | 470.00 | 13 | 0.78 |
| 4.0476 | 500.00 | 12 | 3.02 |
| 1 | 550.00 | 10 | 0.75 |
| 1.1951 | 600.00 | 18.7 | 0.89 |
| 1.05 | 668.00 | 2 | 0.78 |
| 1.0417 | 805.00 | 13 | 0.78 |
| 8.8571 | 917.00 | 9.11 | 6.62 |
| 2.1667 | 1,100.00 | 10.9 | 1.62 |
| 1 | 1,543.00 | 19.18 | 0.75 |
| 1.1951 | 1,560.00 | 22.5 | 0.89 |
| 1.1951 | 1,660.00 | 10.06 | 0.89 |
| 1 | 1,980.00 | 5.45 | 0.75 |
| 1.0417 | 2,053.33 | 6 | 0.78 |
| 1.1951 | 2,066.67 | 15 | 0.89 |
| 1.1951 | 2,236.67 | 18.63 | 0.89 |
| 1.1951 | 2,289.93 | 10.78 | 0.89 |
| 1.1951 | 2,857.14 | 1.82 | 0.89 |
| 1.2143 | 3,545.23 | 8.18 | 0.91 |
| 1 | 4,039.00 | 9.5 | 0.75 |
| 1.0417 | 4,076.88 | 14.94 | 0.78 |
| 1.1951 | 4,523.31 | 14.37 | 0.89 |
| 1.1951 | 5,260.00 | 10.02 | 0.89 |
| 2.1667 | 7,180.25 | 13.93 | 1.62 |
| 1.0417 | 7,650.00 | 9 | 0.78 |
| 1.05 | 13,459.88 | 5.2 | 0.78 |

*(continued)*

**Table S-3. (continued)**

| Weighting Factor | Volume (gal/yr) | Density (lb/gal) | Percent Weight (%) |
|---|---|---|---|
| 2.25 | 15,072.00 | 11 | 1.68 |
| 1.0417 | 15,935.50 | 12 | 0.78 |
| 1.1951 | 19,099.00 | 9.8 | 0.89 |
| 4.0476 | 43,266.00 | 20.15 | 3.02 |
| 7.6154 | 67,000.00 | 3 | 5.69 |
| 1.1951 | 128,150.00 | 19.59 | 0.89 |
| 1 | 426,738.53 | 12.16 | 0.75 |
| **Total** | | | |
| 133.8551 | | | 100.00 |

**Table S-4. Summary of Crystal Ball Results for Aqueous Waste**

| Waste Volume (gal/yr) | Waste Volume ($m^3$/yr) | Number of Times Selected | Percent Weight Based on Crystal Ball Results | Percent Weight Based on Survey Data (%) |
|---|---|---|---|---|
| 151 | 0.57 | 296 | 2.96 | 2.98 |
| 165 | 0.62 | 363 | 3.63 | 3.42 |
| 300 | 1.14 | 1151 | 11.51 | 11.57 |
| 1,300 | 4.92 | 299 | 2.99 | 2.98 |
| 1,500 | 5.68 | 335 | 3.35 | 3.42 |
| 2,400 | 9.08 | 402 | 4.02 | 3.42 |
| 3,700 | 14.01 | 273 | 2.73 | 2.86 |
| 4,600 | 17.41 | 297 | 2.97 | 2.86 |
| 5,000 | 18.93 | 305 | 3.05 | 2.86 |
| 11,165 | 42.26 | 315 | 3.15 | 2.86 |
| 12,000 | 45.42 | 2543 | 25.43 | 25.32 |
| 12,900 | 48.83 | 256 | 2.56 | 2.86 |
| 14,870 | 56.29 | 287 | 2.87 | 2.86 |
| 17,000 | 64.35 | 289 | 2.89 | 2.98 |
| 19,330 | 73.17 | 528 | 5.28 | 5.31 |
| 20,334 | 76.97 | 590 | 5.90 | 6.43 |
| 20,812 | 78.78 | 294 | 2.94 | 2.86 |
| 26,750 | 101.26 | 284 | 2.84 | 2.98 |
| 27,634 | 104.61 | 261 | 2.61 | 2.86 |
| 104,225 | 177.01 | 291 | 2.91 | 2.86 |
| 104,225 | 394.53 | 341 | 3.41 | 3.47 |
| **Total** | | | | |
| | | 10,000 | 100.00 | 100.00 |

**Table S-5. Summary of Crystal Ball Results for Emission Control Dust**

| Waste Volume (gal/yr) | Waste Volume (m3/yr) | Bulk Density (g/cm3) | Number of Times Selected | Percent Weight Based on Crystal Ball Iterations (%) |
|---|---|---|---|---|
| 40 | 0.15141644 | 3.594793 | 224 | 2.24 |
| 45 | 0.1703435 | 3.235314 | 207 | 2.07 |
| 55 | 0.20819761 | 2.238358 | 207 | 2.07 |
| 82.29 | 0.31150148 | 1.437917 | 214 | 2.14 |
| 100 | 0.37854111 | 2.238358 | 202 | 2.02 |
| 172 | 0.65109071 | 1.397176 | 670 | 6.70 |
| 214.13 | 0.81057008 | 2.238358 | 247 | 2.47 |
| 220 | 0.83279044 | 0.359479 | 463 | 4.63 |
| 224.42 | 0.84952196 | 3.199366 | 254 | 2.54 |
| 297 | 1.1242671 | 2.238358 | 198 | 1.98 |
| 300 | 1.13562333 | 0.239653 | 219 | 2.19 |
| 330 | 1.24918566 | 1.198264 | 438 | 4.38 |
| 330 | 1.24918566 | 2.238358 | 183 | 1.83 |
| 400 | 1.51416444 | 1.797396 | 242 | 2.42 |
| 450 | 1.703435 | 0.599132 | 432 | 4.32 |
| 550 | 2.08197611 | 1.198264 | 228 | 2.28 |
| 600 | 2.27124666 | 2.240754 | 236 | 2.36 |
| 643.32 | 2.43523067 | 0.431375 | 240 | 2.40 |
| 668 | 2.52865462 | 0.239653 | 197 | 1.97 |
| 907 | 3.43336787 | 2.648164 | 217 | 2.17 |
| 1560 | 5.90524132 | 2.696095 | 235 | 2.35 |
| 1920 | 7.26798931 | 2.636181 | 838 | 8.38 |
| 1980 | 7.49511398 | 0.653054 | 207 | 2.07 |
| 2,053.33 | 7.77269818 | 0.718959 | 214 | 2.14 |
| 2,289.93 | 8.66832644 | 1.291729 | 206 | 2.06 |
| 2,857.14 | 10.8154495 | 0.218084 | 211 | 2.11 |
| 3,211.99 | 12.1587026 | 2.238358 | 416 | 4.16 |
| 5000 | 18.9270555 | 2.238358 | 197 | 1.97 |
| 8,196.72 | 31.0279549 | 0.292376 | 234 | 2.34 |
| 58,333.33 | 220.815635 | 0.359479 | 1494 | 14.94 |
| 7,8650 | 297.722583 | 2.995661 | 230 | 2.30 |
| **Total** | | | | |
| | | | 10,000 | 100.00 |

**Table S-6. Summary of Crystal Ball Results for Mixed Solids**

| Waste Volume (gal/yr) | Waste Volume (m3/yr) | Bulk Density (g/cm3) | Number of Times Selected | Percent Weight Based on Crystal Ball Iterations (%) |
|---|---|---|---|---|
| 5 | 0.018927 | 1.437917 | 284 | 2.84 |
| 5 | 0.018927 | 1.478658 | 705 | 7.05 |
| 40 | 0.151416 | 3.594793 | 100 | 1.00 |
| 45 | 0.170343 | 3.235314 | 82 | 0.82 |
| 55 | 0.208198 | 2.238358 | 67 | 0.67 |
| 69.79 | 0.264184 | 0.996956 | 282 | 2.82 |
| 74.81 | 0.283187 | 2.396529 | 552 | 5.52 |
| 100 | 0.378541 | 2.238358 | 70 | 0.70 |
| 110 | 0.416395 | 0.910681 | 67 | 0.67 |
| 126 | 0.476962 | 1.138351 | 648 | 6.48 |
| 172 | 0.651091 | 1.397176 | 244 | 2.44 |
| 214.13 | 0.81057 | 2.238358 | 99 | 0.99 |
| 220 | 0.83279 | 0.359479 | 181 | 1.81 |
| 224.42 | 0.849522 | 3.199366 | 78 | 0.78 |
| 225 | 0.851717 | 2.396529 | 145 | 1.45 |
| 269.27 | 1.019298 | 1.779422 | 268 | 2.68 |
| 297 | 1.124267 | 2.238358 | 81 | 0.81 |
| 300 | 1.135623 | 0.239653 | 93 | 0.93 |
| 330 | 1.249186 | 1.198264 | 189 | 1.89 |
| 330 | 1.249186 | 2.238358 | 66 | 0.66 |
| 330 | 1.249186 | 2.396529 | 321 | 3.21 |
| 374.03 | 1.415857 | 0.061111 | 644 | 6.44 |
| 374.03 | 1.415857 | 0.331919 | 77 | 0.77 |
| 448 | 1.695864 | 1.078438 | 85 | 0.85 |
| 450 | 1.703435 | 0.599132 | 165 | 1.65 |

*(continued)*

**Table S-6. (continued)**

| Waste Volume (gal/yr) | Waste Volume (m3/yr) | Bulk Density (g/cm3) | Number of Times Selected | Percent Weight Based on Crystal Ball Iterations (%) |
|---|---|---|---|---|
| 470 | 1.779143 | 1.557744 | 87 | 0.87 |
| 500 | 1.892706 | 1.437917 | 280 | 2.80 |
| 550 | 2.081976 | 1.198264 | 77 | 0.77 |
| 600 | 2.271247 | 2.240754 | 83 | 0.83 |
| 668 | 2.528655 | 0.239653 | 84 | 0.84 |
| 805 | 3.047256 | 1.557744 | 82 | 0.82 |
| 917 | 3.471222 | 1.091619 | 676 | 6.76 |
| 1100 | 4.163952 | 1.306108 | 172 | 1.72 |
| 1543 | 5.840889 | 2.298271 | 74 | 0.74 |
| 1560 | 5.905241 | 2.696095 | 93 | 0.93 |
| 1660 | 6.283782 | 1.205454 | 91 | 0.91 |
| 1980 | 7.495114 | 0.653054 | 71 | 0.71 |
| 2,053.33 | 7.772698 | 0.718959 | 71 | 0.71 |
| 2,066.67 | 7.823196 | 1.797396 | 89 | 0.89 |
| 2,236.67 | 8.466715 | 2.232366 | 94 | 0.94 |
| 2,289.93 | 8.668326 | 1.291729 | 91 | 0.91 |
| 2,857.14 | 10.81545 | 0.218084 | 91 | 0.91 |
| 3,545.23 | 13.42015 | 0.98018 | 97 | 0.97 |
| 4039 | 15.28928 | 1.138351 | 73 | 0.73 |
| 4,076.88 | 15.43267 | 1.790207 | 73 | 0.73 |
| 4,523.31 | 17.12259 | 1.721906 | 93 | 0.93 |
| 5260 | 19.91126 | 1.200661 | 79 | 0.79 |
| 7,180.25 | 27.1802 | 1.669182 | 161 | 1.61 |
| 7650 | 28.95839 | 1.078438 | 78 | 0.78 |

*(continued)*

**Table S-6. (continued)**

| Waste Volume (gal/yr) | Waste Volume (m3/yr) | Bulk Density (g/cm3) | Number of Times Selected | Percent Weight Based on Crystal Ball Iterations (%) |
|---|---|---|---|---|
| 13,459.88 | 50.95118 | 0.623097 | 79 | 0.79 |
| 15,072 | 57.05372 | 1.318091 | 171 | 1.71 |
| 15,935.5 | 60.32242 | 1.437917 | 62 | 0.62 |
| 19,099 | 72.29757 | 1.174299 | 100 | 1.00 |
| 43,266 | 163.7796 | 2.414503 | 307 | 3.07 |
| 67,000 | 253.6225 | 0.359479 | 574 | 5.74 |
| 128,150 | 485.1004 | 2.3474 | 77 | 0.77 |
| 426,738.5 | 1615.381 | 1.457089 | 77 | 0.77 |
| **Total** | | | | |
| | | | 10,000 | 100.00 |

**Table S-7. Waste Volumes and Bulk Density for the Deterministic Analysis**

| | 50% | 90% |
|---|---|---|
| **Waste Stream Volumes from 3007 Survey ($m^3$/yr)** | | |
| Dust | 2.44 | 220.8 |
| Combined solids | 1.42 | 163.8 |
| Aqueous waste | 45.42 | 101.3 |
| **Bulk Density (g/cms)** | | |
| Dust | 1.40 | 2.70 |
| Combined solid | 1.32 | 2.40 |

# Appendix T

# Screening Analysis of Groundwater Daughter Products

# Appendix T

# Screening Analysis of Groundwater Daughter Products

## T.1 Degradation Products

The effect of degradation products on chemical concentrations was evaluated in a screening analysis. The purpose of the screening analysis was to determine if daughter products needed to be considered in the risk assessment. For the analysis, two sets of deterministic runs were conducted for three pairs of surrogate chemicals consisting of parent-daughter products. One set of runs included hydrolysis reactions and calculated their resultant impact on the concentration of the parent chemical. The second set of runs did not include hydrolysis reactions (i.e., hydrolysis was set equal to zero) in order to demonstrate the loss of the parent chemical due to dilution and attenuation only. The difference between the two sets of runs reflects the concentration of the chemical that is lost due to hydrolysis.

Hydrolysis reactions are being considered in this screening analysis because a fraction of the chemical lost due to hydrolysis transforms into the parent chemical's daughter products. In reality, only a fraction of daughter product would be expected to reach the receptor well. However, for purposes of this analysis, it was assumed that 100 percent of the difference between the two sets of deterministic model runs is an indicator of the amount of daughter product reaching the receptor well. Thus, if the loss due to hydrolysis is small, then the amount of daughter product formed would be small as well.

It should be noted that a scenario could occur in which the daughter product is characterized by greater toxicity than the parent chemical. However, for the parent-daughter pairs considered in this analysis, the daughter products were either less toxic than the parent or of similar toxicity.

The surrogate chemical groups included in this analysis are as follows:

- Methylene chloride to formaldehyde
- Methyl methacrylate to methanol
- Acrylonitrile to acrylamide.

The selection of the three surrogate groups was based on chemical reaction and toxicity data. Potential for hydrolysis to occur, half-life of the reaction, and availability of toxicity data were all considered in the selection. If the half-life exceeded 10,000 years or if toxicity were unavailable, the parent-daughter pairs were not considered in the analysis. Table T-1 lists chemicals that were evaluated as part of the selection process.

The results of the screening analysis are presented in Tables T-2 and T-3. For each model run for the landfill and the surface impoundment scenarios, the ratios of the concentration of daughter product to the average parent concentration at the receptor well without hydrolysis were calculated. If the percent difference in concentrations for each of set of runs was generally less than 5 percent, it was assumed that daughter products need not be considered in the risk analysis.

As shown in the tabulated data, the percent difference is generally less than 5 percent. Hence, daughter products due to hydrolysis were not considered in the risk analysis.

**Table T-1. Evaluation of Potential Surrogate Pairs**

| Chemical Name | Half-Life (years) | Toxic Daughter Products from Hydrolysis |
|---|---|---|
| Formaldehyde | | None |
| Methanol | | None |
| Chloroform | 9,310 | Degrades to carbon monoxide and hydrochloric acid; not considered due to lack of toxicological benchmarks |
| n-Butyl alcohol | | None |
| Benzene | | None |
| Dichloromethane (methylene chloride) | 2,389 | Degrades to formaldehyde and hydrochloric acid |
| Methyl ethyl ketone (MEK) | | None |
| Acrylamide | 133 | Degrades to acrylic acid and ammonia; ammonia not considered due to lack of toxicological benchmarks; acrylic acid not considered due to data that it is itself readily hydrolyzed (HSDB internet) |
| Methyl methacrylate | 20 | Degrades to methacrylate and methanol |
| Dibutylphthalate | 20,569 | ***Does degrade, but at a very slow rate*** |
| Phthalic anhydride | 4.88E-06 | Degrades to o-phthalic acid; not considered due to lack of toxicological benchmarks |
| Butyl benzyl phthalate | 14,988 | ***Does degrade, but at a very slow rate*** |
| Pentachlorophenol | | None |
| o-Xylene | | None |
| Cresol (o) | | None |
| Ethylbenzene | | None |
| Styrene | | None |
| Cresol (m) | | None |
| 2,4 Dimethylphenol | | None |
| p-Xylene | | None |
| Cresol (p) | | None |

*(continued)*

**Table T-1. (continued)**

| Chemical Name | Half-Life (years) | Toxic Daughter Products from Hydrolysis |
|---|---|---|
| Acrylonitrile | 5,852 | Degrades to acrylamide then to acrylic acid and ammonia |
| Ethylene glycol | | None |
| Vinyl acetate | 7.3 days | Degrades to acetaldehyde and acetate; not considered due to data that the daughter products are also readily hydrolyzed (HSDB internet) |
| Methyl isobutyl ketone (MIBK) | | None |
| m-Xylene | | None |
| Toluene | | None |
| Phenol | | None |
| Di(2-ethylhexylphthalate) | 9.99E+08 | ***Does degrade, but at a very slow rate*** |
| Tetrachloroethylene | | None |
| Cresol (mixed isomers) | | None |
| Xylene (mixed isomers) | | None |

Source: Kollig, Heinz P. 1993. *Environmental Fate Constants for Organic Chemicals Under Consideration for EPA's Hazardous Waste Identification Projects*. EPA/600/R-93/132. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, GA.

**Table T-2. Percent Daughter Product in Landfill Scenario**

| Model Run | Acrylonitrile-Acrylamide (%) | Methylene Chloride-Formaldehyde (%) | Methyl Methacrylate-Methanol (%) |
|---|---|---|---|
| 1 | 0.00 | 0.18 | 5.45 |
| 2 | 0.00 | 0.12 | 4.07 |
| 3 | 0.00 | 0.08 | 2.54 |
| 4 | 0.10 | 0.10 | 2.82 |
| 5 | 0.16 | 0.10 | 3.97 |
| 6 | 0.14 | 0.12 | 3.86 |
| 7 | 0.16 | 0.11 | 3.69 |
| 8 | 0.16 | 0.17 | 5.46 |
| 9 | 0.09 | 0.06 | 1.96 |
| 10 | 0.13 | 0.12 | 3.85 |
| 11 | 0.13 | 0.12 | 3.66 |

**Table T- 3. Percent Daughter Product in Surface Impoundment Scenario**

| Model Run | Acrylonitrile-Acrylamide (%) | Methylene Chloride-Formaldehyde (%) | Methyl Methacrylate-Methanol (%) |
|---|---|---|---|
| 1 | 0.00 | 0.00 | 3.25 |
| 2 | 0.00 | 4.54 | 1.44 |
| 3 | 0.00 | 0.95 | 2.22 |
| 4 | 0.00 | 0.05 | 2.67 |
| 5 | 0.00 | 0.03 | 1.00 |
| 6 | 0.00 | 0.00 | 1.66 |
| 7 | 0.00 | 0.05 | 2.52 |

# Appendix U

# Analysis of Groundwater Constituent Time to Impact

# Appendix U

# Analysis of Groundwater Constituent Time to Impact

## U.1 Calculation of Time to Impact for Deterministic Analysis

An analysis was conducted to estimate the "time to impact" for the reported groundwater concentrations predicted by EPA's groundwater fate and transport model, EPACMTP, in the deterministic groundwater pathway analysis conducted for the risk assessment for the Paints Listing Determination. Although the EPACMTP model currently outputs a value labeled as "time to peak," these data were not used for the Paints Listing Determination because this time to peak value may not necessarily correspond to the first arrival time of the peak concentration. The constituents of concern and the scenarios of interest for this analysis commonly result in long source durations, leading in turn to breakthrough curves at the groundwater receptor well that consist of a gradual increase to a concentration plateau with a long duration. As such, these plateau-like breakthrough curves do not have a unique time value associated with the peak groundwater concentration. At the time that the EPACMTP model was being developed, the primary goal for the model was to be able to conduct Monte Carlo groundwater modeling analyses in a computationally efficient manner. The computationally efficient peak-finding routine that is used in the EPACMTP model estimates the time value associated with the reported peak concentration. But for the case of a plateau-like breakthrough curve, the reported time-to-peak value is most likely somewhere in the middle of this plateau, rather than the first arrival time of this plateau. Thus, in this case, the time-to-peak value reported by EPACMTP would be too great. For this reason, the spreadsheet analysis described below was conducted to more accurately estimate the time to impact for the deterministic groundwater pathway results reported for this project.

Time-to-impact calculations were not conducted if (1) leachate was not estimated to originate from the WMU or (2) zero concentrations were estimated to reach the groundwater well. In addition, any time-to-impact values that exceeded 10,000 years were capped at 10,000 years because this was the maximum amount of time considered in the groundwater model.

The time to impact at a receptor well consists of two major components: travel time in the vadose zone and travel time in the saturated zone required for the maximum concentration of the contaminant plume to reach the receptor well.

## U.1.1 Travel Time in the Vadose Zone

Assuming that hydrodynamic dispersion in the vadose zone is negligibly small, the travel time through the vadose zone may be calculated using Darcy's law, given the following information: thickness of the vadose zone, water content (product of porosity and water saturation), retardation factor, and infiltration rate.

Based on Darcy's law, groundwater velocity in the vadose zone is given by (Bear, 1972; de Marsily, 1986):

$$v_{zi} = -\frac{k_r \, K_{sat}}{S_w \, \theta_v \, R_{vi}} \frac{\partial H}{\partial z} \tag{U-1}$$

where

$v_{zi}$ = velocity in the z direction of chemical i (m/yr)
z = Cartesian coordinate in the vertical direction, positive upward (m)
$k_r$ = relative permeability of the material in the vadose zone ($m^2$)
$K_{sat}$ = saturated hydraulic conductivity of the material in the vadose zone (m/yr)
$S_w$ = water saturation in the vadose zone (dimensionless)
$\theta_v$ = porosity of the vadose zone material (dimensionless)
$R_{vi}$ = retardation factor for chemical i in the vadose zone (dimensionless)
H = potentiometric head (m).

The vadose zone retardation factor for chemical i is determined from:

$$R_{vi} = 1 + \frac{K_{di} \, \rho_{vb}}{S_w \, \theta_v} \tag{U-2}$$

where

$K_{di}$ = distribution coefficient for chemical i ($cm^3/g$)
$\rho_{vb}$ = bulk density of the vadose zone material ($g/cm^3$).

Using Equations U-1 and U-2 and the depth of the vadose zone, $D_{vz}$, the travel time of chemical i, $T_{vzi}$, in the vadose zone may be calculated from:

$$T_{vzi} = \frac{D_{vz}}{v_{zi}} \tag{U-3}$$

where

$D_{vz}$ = depth of the vadose zone (m).

## U.1.2 Travel Time in the Saturated Zone

**U.1.2.1 <u>Travel Time for the Advective Front</u>.** Assuming that degradation has no effect on the travel time in the subsurface, the travel time in the saturated zone can be calculated using the local flow regime. It is also assumed that a receptor well located at a general location (x, y) experiences the maximum concentration at the same time as does another receptor well located at x, 0, or along the plume centerline, where x is the distance along the major flow direction from the downgradient edge of a waste management unit (WMU), and y is the distance normal to x from the plume centerline. The travel time of an advective front in the saturated zone can be calculated from the Darcy's-law-based local flow regime, given the following: recharge rate outside the WMU, infiltration rate within the WMU, thickness of the saturated zone, ambient flow gradient, hydraulic conductivity of the saturated zone, the dimension of the WMU, retardation factor, and the distance x. The travel time is based on the effective groundwater velocity near the midpoint between the WMU and the receptor well.

Similar to calculation of the travel time in the vadose zone, the travel time in the saturated zone, based on the advective front location, is given by

$$T_{szai} = \frac{\frac{1}{2}(X_W + X_{well})}{\overline{v_{szxi}}} \qquad \text{(U-4)}$$

where

$T_{szai}$ = saturated zone travel time due to advective front for chemical i (yr)

$\overline{v_{szxi}}$ = average apparent groundwater velocity in the x direction for chemical i, obtained from Equation U-8 or Equation U-10 (m/yr)

$X_{well}$ = distance in the x-direction from the downgradient edge of the WMU (m)

$X_W$ = WMU dimension (assumed to be a square) (m).

The average apparent groundwater velocity at $X_{well}$ $\left(\overline{v_{szxi}}\right)$ is dependent on the approximated condition of the source. There are two possible approximated source conditions: fully penetrating and partially penetrating; the criteria for distinguishing these two source conditions is given in Equation U-7. These two conditions and the corresponding equations used to calculate $\overline{v_{szxi}}$ for each condition are described below.

**Fully Penetrating Source.** In this case, it is assumed that the infiltration rate is so large that the whole saturated thickness of the aquifer underneath the waste management unit is contaminated by the leachate emanating from the waste management unit and that the source may be approximated by a line source (in the vertical direction) at the centroid of the WMU footprint:

$$Q' = \frac{I\ X_W^2}{Z_B} \tag{U-5}$$

where

| | | |
|---|---|---|
| $Q'$ | = | source strength per unit depth ($m^3$/yr-m) |
| I | = | infiltration rate (m/yr) |
| $Z_B$ | = | saturated zone thickness (m). |

Half-plume width $W(0.5\ X_W + X_{well})$ generated by the point source at $0.5\ X_W + X_{well}$ is given by the following nonlinear equation (Bear, 1972):

$$X_{well} = -\frac{|W(0.5 X_W + X_{well})|}{\tan\left(\dfrac{2\ \pi\ q_0\ |W(0.5 X_W + X_{well})|}{Q'}\right)} \tag{U-6}$$

where

| | | |
|---|---|---|
| $q_0$ | = | $K_{xx}$ I (m/yr) |
| $K_{xx}$ | = | hydraulic conductivity along the flow direction (x)(m/yr) |
| I | = | ambient hydraulic gradient (m/m). |

Whether or not the source is considered fully penetrating is approximated by the following condition:

$$\frac{1}{2} X_W \quad < \quad W(\infty)\ ,\ fully\ \ penetrating \tag{U-7}$$

where

| | | |
|---|---|---|
| $W(\infty)$ | = | asymptotic half-plume width at an infinite distance from the waste management unit. |

Otherwise, the partially penetrating source condition applies (see Equation U-10).

For the fully penetrating source condition, the average apparent velocity in the x direction determined at $0.5\ X_W + 0.5\ X_{well}$ from the line source is approximated by:

$$v_{szxi} = \frac{1}{Z_B \theta_s R_{si}} \left( q_0 Z_B + \frac{Q \ Z_B}{\pi \cdot (X_W + X_{well})} + R \ \frac{1}{2} X_{well} \right) \tag{U-8}$$

where

$Z_B$ = aquifer saturated thickness (m)
$\theta_s$ = aquifer porosity (m/yr)

$R_{si}$ = retardation factor in the aquifer for chemical i (dimensionless)
R = recharge rate beyond the WMU boundary (dimensionless).

The aquifer retardation factor for chemical i is determined from:

$$R_{si} = 1 + \frac{K_{di} \ \rho_{sb}}{\theta_s} \tag{U-9}$$

where

$\rho_{sb}$ = bulk density of the aquifer material (g/cm$^3$).

**Partially Penetrating Source.** When the infiltration rate is normally small compared with the ambient regional groundwater flow, the chemical influent condition at the waste management unit may be considered equivalent to a partially penetrating source. In this case, groundwater velocity at $X_{well}$ is given by:

$$v_{szxi} = \frac{1}{Z_B \theta_s K_{di}} \left( q_0 Z_B + R \ \frac{1}{2} X_{well} \right) \tag{U-10}$$

**U.1.2.2 <u>Lag Time Due to Dispersion</u>.** Assuming that the contaminant source pulse is adequately long, a plateau concentration is always observed at a receptor well. The time to reach this plateau concentration always lags behind the arrival time of the advective front due to hydrodynamic dispersion. Assuming that the distribution of contaminant concentration about the advective front is Gaussian, the lag time is approximated by four standard deviations from the arrival time of the advective front. A standard deviation is a function of the longitudinal dispersivity and the distance x.

Based on the above description, the dispersion-induced lag time is approximated from

$$T_{szdi} = \frac{4}{v_{szxi}} \sqrt{2 \ \alpha_L \ v_{szxi} \ T_{szai}} \tag{U-11}$$

where

$\alpha_L$ = longitudinal dispersivity (m).

**Table U-1. Time to Impact for Landfills**

| Constituent | CAS Number | Minimum Time of Impact (years) | Maximum Time of Impact (years) |
|---|---|---|---|
| Formaldehyde | 50-00-0 | 10 | 27 |
| Methanol | 67-56-1 | 10 | 27 |
| Chloroform | 67-66-3 | 12 | 34 |
| n-Butyl alcohol | 71-36-3 | 10 | 27 |
| Benzene | 71-43-2 | 10 | 27 |
| Dichloromethane | 75-09-2 | 10 | 27 |
| Methyl ethyl ketone | 78-93-3 | 10 | 27 |
| Acrylamide | 79-06-1 | 10 | 27 |
| Methyl methacrylate | 80-62-6 | 10 | 27 |
| Pentachlorophenol | 87-86-5 | 66 | 218 |
| Cresol, o- | 95-48-7 | 10 | 27 |
| Divalent mercury | 7439-97-6(d) | 57 | 10,000 |
| Styrene | 100-42-5 | 19 | 59 |
| Dimethylphenol, 2,4- | 105-67-9 | 19 | 59 |
| Cresol, p- | 106-44-5 | 10 | 27 |
| Acrylonitrile | 107-13-1 | 10 | 27 |
| Ethylene glycol | 107-21-1 | 10 | 27 |
| Vinyl acetate | 108-05-4 | 10 | 27 |
| Methyl isobutyl ketone | 108-10-1 | 10 | 27 |
| Cresol, m- | 108-39-4 | 10 | 27 |
| Toluene | 108-88-3 | 19 | 59 |
| Phenol | 108-95-2 | 10 | 27 |
| Tetrachloroethylene | 127-18-4 | 19 | 59 |
| Lead | 7439-92-1 | 2,755 | 10,000 |

*(continued)*

**Table U-1. (continued)**

| Constituent | CAS Number | Minimum Time of Impact (years) | Maximum Time of Impact (years) |
|---|---|---|---|
| Mercury | 7439-97-6(e) | 10,000 | 10,000 |
| Nickel | 7440-02-0 | 2,482 | 10,000 |
| Silver | 7440-22-4 | 3,680 | 10,000 |
| Tin | 7440-31-5 | 10,000 | 10,000 |
| Antimony | 7440-36-0 | 133 | 1,721 |
| Barium | 7440-39-3 | 2,094 | 10,000 |
| Cadmium | 7440-43-9 | 1,937 | 10,000 |
| Cobalt | 7440-48-4 | 5,628 | 10,000 |
| Copper | 7440-50-8 | 4,898 | 10,000 |
| Zinc | 7440-66-6 | 4,643 | 10,000 |
| Selenium | 7782-49-2 | 805 | 3,414 |
| Chromium (III) | 16065-83-1 | 10,000 | 10,000 |
| Chromium (VI) | 18540-29-9 | 109 | 3,708 |

**Table U-2. Time to Impact for Surface Impoundments**

| Constituent | CAS Number | Minimum Time of Impact (years) | Maximum Time of Impact (years) |
|---|---|---|---|
| Chloroform | 67-66-3 | 6 | 18 |
| Acrylamide | 79-06-1 | 5 | 15 |
| Di(2-ethylhexylphthalate) | 117-81-7 | 573 | 1,919 |
| Dibutylphthalate | 84-74-2 | 573 | 1,919 |
| Butylbenzylphthalate | 85-68-7 | 413 | 1,392 |
| Pentachlorophenol | 87-86-5 | 28 | 92 |
| Divalent mercury | 7439-97-6(d) | 34 | 10,000 |
| Ethylbenzene | 100-41-4 | 29 | 96 |
| Xylene (mixed isomers) | 1330-20-7 | 29 | 96 |
| Methyl methacrylate | 80-62-6 | 5 | 15 |
| Acrylonitrile | 107-13-1 | 5 | 15 |
| Dichloromethane | 75-09-2 | 5 | 15 |
| Phenol | 108-95-2 | 5 | 15 |
| Methyl isobutyl ketone | 108-10-1 | 5 | 15 |
| Methanol | 67-56-1 | 5 | 15 |
| Cresol, p- | 106-44-5 | 5 | 15 |
| Cresol, m- | 108-39-4 | 5 | 15 |
| n-Butyl alcohol | 71-36-3 | 5 | 15 |
| Formaldehyde | 50-00-0 | 5 | 15 |
| Ethylene glycol | 107-21-1 | 5 | 15 |
| Methyl ethyl ketone | 78-93-3 | 5 | 15 |
| Cresol, o- | 95-48-7 | 5 | 15 |
| Vinyl acetate | 108-05-4 | 5 | 15 |
| Benzene | 71-43-2 | 5 | 15 |

*(continued)*

**Table U-2. (continued)**

| Constituent | CAS Number | Minimum Time of Impact (years) | Maximum Time of Impact (years) |
|---|---|---|---|
| Dimethylphenol, 2,4- | 105-67-9 | 9 | 28 |
| Styrene | 100-42-5 | 9 | 28 |
| Toluene | 108-88-3 | 9 | 28 |
| Tetrachloroethylene | 127-18-4 | 9 | 28 |
| Lead | 7439-92-1 | 1,777 | 10,000 |
| Mercury | 7439-97-6(e) | 10,000 | 10,000 |
| Nickel | 7440-02-0 | 1,606 | 10,000 |
| Silver | 7440-22-4 | 2,370 | 10,000 |
| Tin | 7440-31-5 | 10,000 | 10,000 |
| Antimony | 7440-36-0 | 84 | 1,105 |
| Barium | 7440-39-3 | 1,356 | 10,000 |
| Cadmium | 7440-43-9 | 1,248 | 10,000 |
| Cobalt | 7440-48-4 | 3,632 | 10,000 |
| Copper | 7440-50-8 | 3,159 | 10,000 |
| Zinc | 7440-66-6 | 2,988 | 10,000 |
| Selenium | 7782-49-2 | 441 | 2198 |
| Chromium (III) | 16065-83-1 | 10,000 | 10,000 |
| Chromium (VI) | 18540-29-9 | 68 | 2383 |

### U.1.3 Total Time to Impact

The total time to impact is given by:

Total time to impact = Travel time in the vadose zone + Travel time of the advective front in the saturated zone + Lag time of the plateau behind the advective front.

Thus, from Equations U-3, U-4, and U-11, we obtain:

$$T_{total} = T_{vzi} + T_{szai} + T_{szdi} \tag{U-12}$$

The results of this analysis for landfills and surface impoundments are presented in Tables U-1 and U-2, respectively. Results are reported for all organic constituents and metals. Note that although results are reported for all organic constituents, for those represented by surrogates, the results are reported based on their surrogates.

**References**

Bear, Jacob. 1972. *Dynamics of Fluids in Porous Media*. Mineola, NY: Dover Publications, Inc.

de Marsily, Ghislain. 1986. *Quantitative Hydrogeology: Groundwater Hydrology for Engineers*, Orlando, FL: Academic Press, Inc.

# Appendix V

# On-Site Tank Bounding Analysis

# Appendix V

# On-Site Tank Bounding Analysis

A bounding analysis was conducted to determine if there is a need to consider an on-site tank scenario in the paints listing risk assessment. The source model and the exposure/risk model were run for the tank waste management unit using the same values from the deterministic analysis (see Section 3.2). Modeling parameters for the bounding analysis are presented in Table V-1. These data correspond to the largest on-site tank reported by a facility in EPA's 3007 survey. At this facility, a nonhazardous wash water is sent to a 9,000-gallon tank. The paint wastewater volumes ranged from ~175 gal/yr to 600,000 gal/yr. For the bounding analysis, the tank is assumed to manage 600,000 gallons of paint waste per year in addition to wastewater from other sources (i.e., storm water catches). The treatment method in the tank was assumed to be flocculation, which uses agitation and some chemical addition to increase the sizes of particles and settle them out. This tank was modeled with low aeration and no biodegradation.

The source model and exposure/risk model were executed in a deterministic mode (i.e., parameters were based on point estimates rather than distributions). As shown in Table V-2, the waste volume parameter was set as a high-end parameter for all runs. To understand which parameters were the most sensitive in determining risk levels, three parameters, in addition to the waste volume parameter, were chosen and varied over several runs. The additional parameters—location of source, distance from source, and exposure duration—were varied between central tendency (e.g., 50 percent) and high-end values (e.g., 90 percent). Table V-2 shows that waste volume was kept as a high-end parameter for all three runs. The other three parameters were alternately chosen to be high-end.

For the bounding analysis, all volatile and semivolatile chemicals were modeled. Most parameter inputs were set to the same central tendency values used in the deterministic analysis. As noted, the tank modeled has a known volume of 9,000 gallons. The shape of the tank is columnar with a conical bottom. The surface area (7.30 $m^2$) was determined from the radius (5 ft). This surface area and volume was used to calculate the depth of the tank at 4.67 m. The facility reported a retention time of 12 hours. With this retention time, the flow rate was calculated to be 7.72E-4 $m^3$/s. From the flow rate, the fraction of paint waste was calculated to be 9.33 percent. Table V-3 lists the source model and fate and transport model input parameters and assumptions.

**Table V-1. Bounding Analysis Assumptions**

| Parameter | Assumption |
|---|---|
| Tank volume | 9,000 gal |
| Tank radius | 5 ft |
| Retention time | 12 h |
| Chemicals | All volatile and semivolatiles analyzed in the initial risk assessment |
| Receptors and location from source | Farmer and child of a farmer at maximum point of exposure; 75 m and 300 m from the site |
| Meteorological stations (location of source) | Hartford, Connecticut: identified as the HE met station<br>Indianapolis, Indiana; identified as a CT met station |
| Exposure duration | Farmer (10 and 48.3 yr) |
| Other exposure factors | All at central tendency |
| Target risk levels | Carcinogens: risk = 1 x $10^{-5}$<br>Noncarcinogens: HQ = 1 |

CT = Central tendency.
HE = High-end.

**Table V-2. Parameters Set to Central Tendency and High-End Values by Run Number**

| Run Number | Waste Volume | Location of Source | Distance from Source | Exposure Duration |
|---|---|---|---|---|
| 1 | HE | CT | CT | HE |
| 2 | HE | CT | HE | CT |
| 3 | HE | HE | CT | CT |

**Table V-3. Model Input Parameters and Assumptions**

| Input Parameter | Assumptions |
|---|---|
| Aeration characteristics | Low |
| Depth of source | 4.67 m; calculated based on the volume and surface area |
| Area of source | 7.30 $m^2$; calculated based on a radius of 5 ft |
| Volumetric influent flow rate | 7.72E-4 $m^3$/s; calculated based on retention time |
| Number of impellers/aerators | 1 |
| Biologically active solids/total solids | 0.001; value used to zero out biodegradation |
| All other source parameters | Set to appropriate central tendency values from the distributions used in the initial risk assessment |

Target waste concentrations were determined for the constituents modeled in the tank bounding analysis. Table V-4 presents the minimum target waste concentration for each chemical. Constituents that exceeded 1,000,000 ppm paint waste were screened out and are noted with an E. In addition, constituents with a higher target waste concentration than the solubility limit were screened out and are noted with an S. All but one constituent screened out of the three scenarios considered. Acrylonitrile screened out of one of the scenarios.

## Reference

WPCF and ASCE (Water Pollution Control Federation; American Society of Civil Engineers). 1977. *Wastewater Treatment Plant Design*. Lancaster Press, Inc., Lancaster, PA. p.208.

## Table V-4. Target Waste Concentrations for Tank Bounding Analysis

| Constituent | CAS | Solubility (mg/L) | Run 1 Cw (mg/L) WMU | Run 1 Cw (mg/L) Waste Stream | Run 1 Basis | Run 2 Cw (mg/L) WMU | Run 2 Cw (mg/L) Waste Stream | Run 2 Basis | Run 3 Cw (mg/L) WMU | Run 3 Cw (mg/L) Waste Stream | Run 3 Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | 640000 | 5.2E+06 E | 5.6E+07 E | CF 2 | 4.2E+05 | 4.5E+06 E | CF 1 | 5.4E+06 E | 5.7E+07 E | CF 2 |
| Acrylonitrile | 107-13-1 | 74000 | 2.6E+02 | 2.8E+03 | CF 1 | 1.4E+02 | 1.5E+03 | CF 1 | 9.7E+02 | 1.0E+04 | CF 1 |
| Benzene | 71-43-2 | 1750 | 2.0E+02 | 2.2E+03 S | CF 1 | 1.1E+02 | 1.1E+03 | CF 1 | 6.0E+02 | 6.4E+03 S | CF 1 |
| Butylbenzylphthalate | 85-68-7 | 2.69 | 5.0E+10 E | 5.4E+11 E | CF 2 | 2.8E+10 E | 3.1E+11 E | CF 2 | 5.8E+10 E | 6.3E+11 E | CF 2 |
| Chloroform | 67-66-3 | 7920 | 9.1E+03 S | 9.8E+04 S | NA 3 | 1.4E+03 | 1.5E+04 S | NA 3 | 8.0E+03 S | 8.5E+04 S | NA 3 |
| Cresol, m- | 108-39-4 | 22700 | 2.5E+13 E | 2.6E+14 E | CF 2 | 4.5E+13 E | 4.8E+14 E | CF 2 | 3.0E+14 E | 3.2E+15 E | CF 2 |
| Cresol, o- | 95-48-7 | 26000 | 1.2E+10 E | 1.2E+11 E | CF 2 | 1.0E+10 E | 1.1E+11 E | CF 2 | 3.2E+10 E | 3.5E+11 E | CF 2 |
| Cresol, p- | 106-44-5 | 21500 | 1.2E+11 E | 1.3E+12 E | CF 2 | 5.7E+10 E | 6.1E+11 E | CF 2 | 4.8E+11 E | 5.2E+12 E | CF 2 |
| Di(2-ethylhexylphthalate) | 117-81-7 | 0.34 | 3.8E+09 E | 4.1E+10 E | CF 2 | 1.7E+09 E | 1.9E+10 E | CF 2 | 4.8E+09 E | 5.1E+10 E | CF 2 |
| Dibutylphthalate | 84-74-2 | 11.2 | 3.4E+28 E | 3.7E+29 E | CF 2 | 3.8E+28 E | 4.0E+29 E | CF 2 | 3.0E+28 E | 3.2E+29 E | CF 2 |
| Dichloromethane | 75-09-2 | 13000 | 1.1E+05 S | 1.2E+06 E | CF 2 | 1.6E+03 | 1.7E+04 S | CF 1 | 1.2E+05 S | 1.3E+06 E | CF 2 |
| Dimethylphenol, 2,4- | 105-67-9 | 7870 | 3.6E+11 E | 3.8E+12 E | CF 2 | 7.9E+11 E | 8.5E+12 E | CF 2 | 1.6E+12 E | 1.8E+13 E | CF 2 |
| Divalent mercury | 7439-97-6(d) | 74074 | 9.0E+06 E | 9.6E+07 E | CF 2 | 2.8E+07 E | 3.0E+08 E | CF 2 | 9.5E+06 E | 1.0E+08 E | CF 2 |
| Ethylbenzene | 100-41-4 | 169 | 8.4E+05 S | 9.0E+06 E | NA 3 | 1.3E+05 S | 1.4E+06 E | NA 3 | 1.4E+06 E | 1.6E+07 E | NA 3 |
| Ethylene glycol | 107-21-1 | 1000000 | 2.1E+29 E | 2.2E+30 E | NA 3 | 3.1E+28 E | 3.3E+29 E | NA 3 | 3.7E+32 E | 4.0E+33 E | NA 3 |
| Formaldehyde | 50-00-0 | 550000 | 5.8E+07 E | 6.2E+08 E | CF 2 | 8.6E+07 E | 9.2E+08 E | CF 2 | 5.2E+07 E | 5.5E+08 E | CF 2 |
| Mercury | 7439-97-6(e) | 0.0562 | 2.6E+01 S | 2.7E+02 S | NA 3 | 3.8E+00 S | 4.1E+01 S | NA 3 | 2.1E+01 S | 2.3E+02 S | NA 3 |
| Methanol | 67-56-1 | 1000000 | 5.4E+08 E | 5.8E+09 E | CF 2 | 1.4E+08 E | 1.5E+09 E | NA 3 | 8.5E+08 E | 9.1E+09 E | CF 2 |
| Methyl ethyl ketone | 78-93-3 | 223000 | 8.6E+06 E | 9.2E+07 E | NA 3 | 1.3E+06 E | 1.4E+07 E | NA 3 | 1.1E+07 E | 1.2E+08 E | NA 3 |
| Methyl isobutyl ketone | 108-10-1 | 19000 | 4.8E+05 S | 5.2E+06 E | NA 3 | 7.2E+04 S | 7.8E+05 S | NA 3 | 6.7E+05 S | 7.2E+06 E | NA 3 |
| Methyl methacrylate | 80-62-6 | 15000 | 8.2E+05 S | 8.8E+06 E | NA 3 | 1.2E+05 S | 1.3E+06 E | NA 3 | 1.1E+06 E | 1.1E+07 E | NA 3 |
| n-Butyl alcohol | 71-36-3 | 74000 | 7.0E+07 E | 7.5E+08 E | CF 2 | 5.1E+07 E | 5.5E+08 E | CF 2 | 1.0E+08 E | 1.1E+09 E | CF 2 |
| Pentachlorophenol | 87-86-5 | 1950 | 2.7E+06 E | 2.9E+07 E | CF 2 | 1.2E+06 E | 1.3E+07 E | CF 2 | 3.3E+06 E | 3.6E+07 E | CF 2 |
| Phenol | 108-95-2 | 82800 | 1.3E+11 E | 1.4E+12 E | CF 2 | 2.1E+11 E | 2.2E+12 E | CF 2 | 3.6E+11 E | 3.9E+12 E | CF 2 |
| Styrene | 100-42-5 | 310 | 2.1E+06 E | 2.3E+07 E | NA 3 | 3.2E+05 S | 3.4E+06 E | NA 3 | 4.1E+06 E | 4.4E+07 E | NA 3 |
| Tetrachloroethylene | 127-18-4 | 200 | 4.9E+03 S | 5.3E+04 S | CF 1 | 2.0E+03 S | 2.2E+04 S | CF 1 | 1.6E+04 S | 1.7E+05 S | CF 1 |
| Toluene | 108-88-3 | 526 | 7.5E+04 S | 8.1E+05 S | NA 3 | 1.1E+04 S | 1.2E+05 S | NA 3 | 8.8E+04 S | 9.4E+05 S | NA 3 |
| Vinyl acetate | 108-05-4 | 20000 | 6.2E+04 S | 6.7E+05 S | NA 3 | 9.3E+03 | 1.0E+05 S | NA 3 | 6.5E+04 S | 6.9E+05 S | NA 3 |
| Xylene (mixed isomers) | 1330-20-7 | 175 | 5.2E+05 S | 5.5E+06 E | NA 3 | 7.7E+04 S | 8.3E+05 S | NA 3 | 9.9E+05 S | 1.1E+07 E | NA 3 |

CF = Child farmer
NA = Not applicable to a particular receptor group.
E = The concentration exceeded 1 million ppm.
S = The concentration exceeded solubility checks.
1 = Risk
2 = HQ ingestion
3 = HQ inhalation

# Appendix W

# Results of Literature Search on Metal Complexes

# Appendix W

# Results of Literature Search on Metal Complexes

The raw materials used in paint production are complex mixtures of hundreds of different compounds, including organometallic complexes. The risks posed by the organometallic complexes were not assessed directly in our risk assessment work due to the lack of physical and chemical parameters and toxicity benchmarks required to perform source and fate and transport modeling. The required modeling parameters for organic compounds and metals are listed in Attachments A and B, respectively. The parameters listed in the attachments are not meant to be exhaustive, but reflect the required parameter inputs for the models used in this risk assessment.

Due to the lack of required model parameter inputs, the organometallic complexes were represented in this risk assessment by the ionic form of the metal. The decision to assess risks based on the ionic form of the metal is supported by evidence that, although the organometallic complexes are relatively insoluble, they would readily dissociate when in an aqueous solution (Weber and Washington, 2000). Methods and data used to model the constituents of concern are described in Section 5 of this document.

In order to judge the validity of using the ionic form of the metal as a surrogate for the organometallic complex in the risk assessment, a literature search was conducted to determine the state-of-the-science in modeling the geochemical behavior of these complexes. Specifically, the literature search was to obtain available information for the following complexes:

| **Complex** | **CAS No.** |
|---|---|
| Cadmium octoate | 2420-98-6 |
| Cerium octoate | |
| Lead octoate | |
| Cobalt naphthenate | 61789-51-3 |
| Cobalt octoate | |
| Copper naphthenate | 1338-02-9 |
| Iron octoate | 3130-28-7 |
| Lead naphthenate | 61790-14-5 |
| Lead oleate | |
| Magnesium octoate | |
| Magnesium oleate | |
| Zinc octoate | |
| Zinc oleate | |
| Zirconium octoate | |

Online databases were searched for information regarding the geochemical behavior of the selected organometallic compounds. Sixteen databases were searched, including:

- Toxline 1965-2000
- GeoRef, 1785-2000
- Environmental Bibliography, 1974-2000
- Enviroline, 1975-2000
- AGRICOLA, 1970-2000
- Water Resources Abstracts, 1967-2000
- Wilson Applied Science & Technology Abstracts, 1983-2000
- GEOBASE, 1980-2000
- Pollution Abstracts, 1970-2000
- Aquatic Sciences & Fisheries Abstracts, 1978-2000
- NTIS, 1964-2000
- CAB Abstracts, 1972-2000
- Dissertation Abstracts Online, 1861-2000
- World Surface Coatings Abstracts, 1976-2000
- Analytical Abstracts, 1980-2000
- Hazardous Substance Database.

The literature search was conducted using key words and phrases to focus the search so that the most relevant titles/references were captured. In this case, the key words and phrases were used to focus the search to produce titles/references most likely to contain information on the constituents of interest in the environmental context of the paints risk assessment. The key words selected for this purpose included the name of the complex, common chemical synonyms, and the CAS number (where available). Key phrases included "fate and transport," "paint formulation," "paint waste treatment," and "environmental fate."

The search words and phrases were carefully selected to capture the most useful information available. However, literature searches are frequently iterative in nature, and, depending upon the results of the preliminary search, the search words are modified to broaden or narrow the search. The preliminary results of this search produced significantly fewer titles/references than expected (e.g., zero records were returned for cobalt octoate and other constituents). As a result, the paints literature search was broadened by eliminating the use of key phrases and focusing solely on the constituent name, synonyms, and CAS number. The results of the literature search are provided below.

As a result of the search, 494 reference titles were returned. A list of returned titles is provided in Attachment C. As shown below, the number of returned titles was not comparable for all complexes of interest. Individual titles for each compound were reviewed and a decision was made whether to obtain the abstract for further review. Because it is not always easy to discern the subject matter of a reference based solely on the title, the decision was made to order abstracts for all references that could contain the required information. The following discussion gives the number of abstracts that were ordered on a compound-by-compound basis.

**Cadmium octoate** (2420-98-6)

Five titles were returned for cadmium octoate. All five titles referenced “letters” between companies and between companies and EPA. Two of the five titles mentioned “physical and chemical properties” and were ordered.

**Cerium octoate**

Two titles were returned for cerium octoate. One title referenced “fuel additive system for test cells” and the other referenced “silicone solvent-less pressure-sensitive adhesive compositions.” Neither reference was ordered.

**Lead octoate**

Nine titles were returned for lead octoate. The titles focused on lead toxicity in rats, lead absorption in the gut, catalysts, degradants in polyester, composition of linseed oil films, and urethane resin film formation. Two of the nine titles referenced paints: “Preparation and application of drying agents in paints” and “Biochemical and toxicological response of infant baboons to lead driers in paints.” Both abstracts were ordered.

**Cobalt naphthenate** (61789-51-3)

Four titles containing “fate and transport” were returned for cobalt naphthenate. Two of the four titles included “the use of naphthenates salts by the paint industry” and “function of cobalt naphthenate in paint.” Both abstracts were ordered.

Eighty-one additional reference titles were returned for cobalt naphthenate. These titles contained the complex name, but did not contain any of the key words of interest. Many of the titles suggested suggested toxicity and occupational exposure relevance; however, none of the titles suggested that the references would contain information useful for this risk assessment. Other titles focused on resins, polymers, preparation, curing, etc. None of these abstracts were ordered.

**Cobalt octoate**

Zero records containing the key words were returned for cobalt octoate; however, 31 records were returned for titles containing the chemical name. All of the titles focused on latex film formation, polymerization, curing, and resins. No abstracts were pursued.

**Copper naphthenate** (1338-02-9)

Two titles were returned that included “fate and transport.” One title referenced “fungal tolerance” and the other referenced “supply and conveyance by road.” Neither abstract was pursued.

One hundred seventy-three titles were returned for the chemical name. Important categories included wood preservation, termite control, toxicity, occupational hazards, pesticides, and poison control. The titles related to toxicity did not suggest that the references would contain information useful to this risk assessment. Abstracts for the following titles were requested:

- Application of environmental scanning electron microscopy to the study of macro distribution of copper in copper naphthenate treated hardwoods
- Ultraviolet spectrophotometry and Fourier transform infrared spectroscopy characterization of copper naphthenate
- The comparative performance of copper naphthenate formulations in laboratory decay tests
- Leaching of wood preservative components and their mobility in the environment
- On the leaching and volatility of the active agents of surface applied wood preservatives
- Formation of chlorinated dioxins and furans in a hazardous waste firing industrial boiler
- Laboratory tests on light organic solvent preservatives for use in Australia
- Metallic soaps of naphthenic acids.

**Iron octoate** (3130-28-7)

Four titles were returned. None of the four were pursued.

**Lead naphthenate** (61790-14-5)

Five records were returned that included “fate and transport.” Four of the five titles referenced letters between companies and EPA. Three of the letters were pursued because the subject matter referenced the “use of lead naphthenate by the paint industry.”

One hundred forty one titles were returned for the chemical name alone. Important categories included toxicity, occupational health, dermatitis, plant growth stimulation, and corrosion in petroleum refineries. None of these titles, including those related to toxicity, suggested that the references would contain information useful to this risk assessment.

**Lead oleate**

Two records were returned. The abstract was ordered for “Phase behavior of metal (II) soaps in one-, two-, and three-component systems.”

**Magnesium octoate**

One record was returned. The abstract was not pursued.

**Magnesium oleate**

Two records were returned. Neither abstract was pursued.

**Zinc octoate**

Eighteen records were returned. The references focused primarily on resins and enamels, with minor toxicity information, which was not relevant to this risk assessment. No abstracts were pursued.

**Zinc oleate**

Seven records were returned. All seven references pertained to toxicity, anti-corrosion, and coatings. The titles related to toxicity did not suggest that the references would contain information useful to this risk assessment. No abstracts were pursued.

**Zirconium octoate**

Seven records were returned. All seven references pertained to films, film formers, polyurethane adhesives, silicone coatings, and drying agents. No abstracts were pursued.

The following summarizes the number of titles returned and the number of abstracts ordered for each for the organometallic complexes of interest:

| Complex | Number of Titles Returned | Number of Abstracts Ordered |
|---|---|---|
| Cadmium octoate | 5 | 2 |
| Cerium octoate | 2 | 0 |
| Lead octoate | 9 | 2 |
| Cobalt naphthenate | 85 | 3 |
| Cobalt octoate | 31 | 0 |
| Copper naphthenate | 175 | 8 |
| Iron octoate | 4 | 0 |
| Lead naphthenate | 146 | 14 |
| Lead oleate | 2 | 1 |
| Magnesium octoate | 1 | 0 |
| Magnesium oleate | 2 | 0 |
| Zinc octoate | 18 | 0 |
| Zinc oleate | 7 | 0 |
| Zirconium octoate | 7 | 0 |

Thirty abstracts were ordered and reviewed for geochemical information (Attachment D). Based on review of the abstracts, 11 references were ordered. The citations for each of these references are included in the reference section below. Data for copper naphthenate and cadmium octoate have been compiled. No data were found for the remaining 12 complexes. Following is a summary of information.

**Copper naphthenate** (Lower, 1986)

- Very low solubility in water (0.00015 g/100 g at 25° C), which suggests that copper naphthenate is not likely to migrate easily through the natural environment.
- Although relatively insoluble in water, it is soluble in aromatic hydrocarbons, benzene, coal tar naphtha, white spirit, xylol, toluol, fuel oil, and turpentine.
- Vapor pressure is equal to 0.4 mm at 138° C, which suggests that copper naphthenate does not volatilize and that the air pathway is of little concern.
- Stable up to 140° C.
- Decomposes in the presence of strong acids and alkalies, suggesting that, if the pH of the system is either strongly acidic or strongly alkaline, copper naphthenate will decompose.
- Easily oxidized and would not be expected to be present in an oxidizing environment.
- $LD_{50}$ in excess of 6 g/kg.

**Cadmium octoate** (Lebow, 1996)

- Infinitely miscible with aliphatic and aromatic hydrocarbons suggesting that if the system contains hydrocarbons, cadmium octoate will dissolve into the hydrocarbons and migrate in conjunction with them.
- Limited water solubility, which suggests that cadmium octoate is not likely to migrate easily through the natural environment.
- Vapor pressure equal to 0.03 mm at 20° C, which suggests that cadmium octoate does not volatilize and that the air pathway is of little concern.

As shown, data for the organometallic complexes of interest are scarce. The available data were insufficient to determine whether the organometallic complexes are stable in the environment. It was also not possible to determine how these complexes behave in the environment or their potential for bioaccumulation in plant and animal tissues. Physical and chemical values and toxicity benchmarks required to perform fate and transport modeling were not available from the literature.

**References**

Bertrand, P.A., and P.D. Fleischauer. 1980. X-Ray Photoelectron Spectroscopy Study of the Chemisorption of Lead Naphthenate to Nucleophilic Surfaces. The Aerospace Corporation. El Segundo, California. Report Number SD-TR-80-66.

Hurley, R., Interstab Chemicals, Inc. 1963. Letter to Has Shah, Chemical Manufacturings Association, regarding function of cobalt naphthanate in paint, December 19.

Lebow, S. 1996. Leaching of Wood Preservative Compounds and Their Mobility in the Environment, Summary of Pertinent Literature. General Technical Report FPL-GTR-93. U.S. Forest Service, U.S. Department of Agriculture.

Lower, Edgar S. 1986. The Metallic Soaps of Naphthenic Acids – Part 4. *Pigment and Resin Technology*. August.

MacPherson, J.R., Dynamac Corporation. 1983. Letter to TSCA Interagency Testing Committee, regarding physical and chemical properties of cadmium 2-ethylhexanoate, February 28.

MacPherson, J.R., Dynamac Corporation. 1983. Letter to TSCA Interagency Testing Committee, regarding physical and chemical properties, production and use of cadmium 2-ethylhexanoate, March 11.

Renson, J.E., National Association of Printing Ink Manufacturing, Inc. 1983. Letter to Steven D. Newburg-Rinn, U.S. Environmental Protection Agency, Test Rules Development Branch, regarding test priority listing of calcium, cobalt, and lead naphthenates. July 1.

Scott, M.J., Mooney Chemicals, Inc. 1984. Letter to Mr. Philip Wirdzek, U.S. Environmental Protection Agency, Test Rules Development Branch, Sanitized, regarding the use of lead naphthenate, January 12.

Quanstrom, R.L., Mayco Oil & Chemical Company. 1983. Letter to Steven D. Newburg-Rinn, U.S. Environmental Protection Agency, Test Rules Development Branch, regarding response to U.S. EPA's inquiry for information, September 13.

Weber, E.J., and Washington, J.M. 2000. *Summary of the Environmental Fate of Organometallic Drying Reagents in Landfill Environments*. Memorandum. Ecosystems Research Division, National Exposure Research Laboratory, U.S. Environmental Protection Agency, Athens, GA.

Zacharias, K.L., National Paint & Coatings Association. 1983. Letter to Phil Wirdzek, U.S. Environmental Protection Agency, Test Rules Development Branch, regarding information on naphthenate metal salts. August 11.

Zou, L., B. Han, H. Yan, K.L. Kasperksi, Y. Xu, and L.G. Hepler. 1997. Enthalpy of Adsorption and Isotherms for Adsorption of Naphthenic Acid onto Clays. Journal of Colloid and Interface Science, v. 190, pp 472-475.

# Attachment A

## Parameters Required for Modeling Organic Compounds

**Chemical/physical properties**

molecular weight
vapor pressure
water solubility
Henry's law constant
diffusivity in air
diffusivity in water
octanol-water partition coefficient
organic carbon partition coefficient

**Degradation rates**

degradation rate in surface water
degradation rate in soil
degradation rate in sediment
hydrolysis rate in landfills
hydrolysis rate in tanks and SI

**Temperature correction**

boiling point
critical temperature
Antoines's B constant
Antoine's C constant
critical pressure

**Biotransfer factors - plants**

soil to plant, exposed vegetables
soil to plant, exposed fruit
soil to plant, protected fruit
soil to plant, forage
soil to plant, grain
soil to plant, silage
root concentration factor
plant surface loss coefficient (particulate)
plant surface loss coefficient (vapors)

**Biotransfer factors - food chain**

beef biotransfer factor
milk biotransfer factor
water biotransfer factor for cattle

**Toxicity benchmarks**

reference dose (RfD)
reference concentration (RfC)
cancer slope factor for oral
cancer slope factor for inhalation

# Attachment B

# Parameters Required for Modeling Metals

**Chemical/physical properties**

molecular weight
soil water partition coefficient

**Biotransfer factors - plants**

soil to plant, exposed vegetables
soil to plant, exposed fruit
soil to plant, protected fruit
soil to plant, forage
soil to plant, grain
soil to plant, roots
soil to plant, silage
plant surface loss coefficient (particulate)

**Biotransfer factors - food chain**

beef biotransfer factor
milk biotransfer factor
water biotransfer factor for cattle

**Toxicity benchmarks**

reference dose (RfD)
reference concentration (RfC)
cancer slope factor for oral
cancer slope factor for inhalation

# Attachment C

# List of Returned Titles

#1
cadmium octoate or cadmium 2-ethylhexanoate or 2420-98-6
5 records:

4/6/1 (Item 1 from file: 156)
03362158 Subfile: TSCATS-302406
LETTER FROM EASTMAN KODAK CO TO USEPA REGARDING EHA USE BY ANY OF EASTMAN
KODAK'S CUSTOMERS

4/6/2 (Item 2 from file: 156)
03362157 Subfile: TSCATS-302404
LETTER FROM STAUFFER CHEMICAL CO TO USEPA REGARDING THE REPORTING OF 8(d)
TEST DATA

4/6/3 (Item 3 from file: 156)
03362156 Subfile: TSCATS-302400
LETTER FROM FILO CHEMICAL INC TO DYNAMAC CORP REGARDING IMPORTATION OF
2-ETHYLHEXANOIC ACID

4/6/4 (Item 4 from file: 156)
03362155 Subfile: TSCATS-302398
LETTER FROM DYNAMAC CORP TO TSCA INTERAGENCY TESTING COMMITTEE REGARDING
THE PHYSCIAL AND CHEMICAL PROPERTIES, PRODUCTION & USE OF CADIUM
2-ETHYLHEXANOATE

4/6/5 (Item 5 from file: 156)
03362154 Subfile: TSCATS-302396
LETTER FROM DYNAMAC CORPORATION TO TSCA INTERAGENCY TESTING COMMITTEE
REGARDING PHYSICAL AND CHEMICAL PROPERTIES OF CADMIUM
2-ETHYLHEXANOATE

#2
cerium octoate
2 records:

6/6/1 (Item 1 from file: 156)
02386758 Subfile: NTIS-AD-A200 801-9
Fuel-Additive System for Test Cells.
Publication Year: 1988

6/6/2 (Item 1 from file: 31)
00506785 WSCA ABSTRACT NUMBER: 97-04818 WSCA ID NUMBER: 444818
Silicone solventless pressure-sensitive adhesive compositions.

#3
lead octoate
9 records:

9/6/1 (Item 1 from file: 156)
01623507 Subfile: HEEP-78-10548
Increased susceptibility to lead toxicity in rats fed semipurified diets.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1978

9/6/2 (Item 2 from file: 156)
01490080 Subfile: TOXBIB-79-254778
Effect of particle size on lead absorption from the gut.
Publication Year: 1979

9/6/3 (Item 1 from file: 6)
1246691 NTIS Accession Number: DE86009072
Analysis of Lead in Polyurethane Catalyst
Apr 86

9/6/4 (Item 1 from file: 31)
00388191 WSCA ABSTRACT NUMBER: 85-05453 WSCA ID NUMBER: 205453
Effect of catalysts on the kinetics of the water/toluene diisocyanate
reaction.
1985

9/6/5 (Item 2 from file: 31)
00343066 WSCA ABSTRACT NUMBER: 80-08940 WSCA ID NUMBER: 108940
Metal salts as pro- and anti-degradants in polyesters.
1980

9/6/6 (Item 3 from file: 31)
00322292 WSCA ABSTRACT NUMBER: 78-05852 WSCA ID NUMBER: 65852
Drier composition and yellowing of linseed oil films.
1978

9/6/7 (Item 4 from file: 31)
00314593 WSCA ABSTRACT NUMBER: 77-06812 WSCA ID NUMBER: 46812
Urethane resin film formation.

9/6/8 (Item 5 from file: 31)
00308440 WSCA ABSTRACT NUMBER: 77-00659 WSCA ID NUMBER: 40659
Preparation and application of drying agents in paints.
1976

9/6/9 (Item 6 from file: 31)
00303159 WSCA ABSTRACT NUMBER: 76-03159 WSCA ID NUMBER: 23159
Biochemical and toxicological response of infant baboons to lead driers in
paints.
1974

#4
cobalt napthenate or cobalt naphthenate or 61789-51-3 or cobaltous naphthenate
These 4 records had the terms fate or transport:

16/6/1 (Item 1 from file: 156)
03361836 Subfile: TSCATS-209534
PUBLIC MEETING OF JULY 7,1983: ATTENDEES; ENVIRONMENTAL
PROTECTION
AGENCY, CHEMICAL MANUFACTURES ASSOC, NUODEX INC, MOONEY
CHEMICALS INC, &
TROY CHEMICAL CORP.

16/6/2 (Item 2 from file: 156)
03361832 Subfile: TSCATS-209492
LETTER FROM NATIONAL PAINT & COATINGS ASSOC TO USEPA WITH COVER
LETTER
DATED AUGUST 11, 1983 (REGARDING THE USE OF NAPHTHENATES SALTS BY THE
PAINT
INDUSTRY)

16/6/3 (Item 3 from file: 156)
03361829 Subfile: TSCATS-209480
LETTER FROM INTERSTATE CHEM TO CHEMIAL MANUF ASSOC WITH ENCLOSURE
(REGARDING FUCTION OF COBALT NAPHTHANATE IN PAINT)
Publication Year: 1983

16/6/4 (Item 4 from file: 156)
03361826 Subfile: TSCATS-209456
COVER LETTER FROM G.V. COX, CMA TO S.NEWBURG-RINN EPA ON THE NAPHTHENATE
METAL SOAPS PROGRAM PANEL WITH ENCLOSURE
Publication Year: 1983

These 81 records did not have the keywords but, some may be of interest:

20/6/1 (Item 1 from file: 156)
03805230 Subfile: BIOSIS-00-06751
Absorption and disposition of cobalt naphthenate in rats after a single oral dose.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1999

20/6/2 (Item 2 from file: 156)
03390048 Subfile: RISKLINE-97080020
Cobalt Naphthenate
Publication Year: 1997

20/6/3 (Item 3 from file: 156)
03389130 Subfile: RISKLINE-95020030
114. Cobalt and cobalt compounds
Publication Year: 1994

20/6/4 (Item 4 from file: 156)
03388010 Subfile: RISKLINE-93090001
Cobalt and cobalt compounds
Publication Year: 1993

20/6/5 (Item 5 from file: 156)
03386771 Subfile: RISKLINE-91090014
Cobalt and cobalt compounds
Publication Year: 1991

20/6/6 (Item 6 from file: 156)
03377177 Subfile: TSCATS-433282
INITIAL SUBMISSION: TOXICOLOGICAL INVESTIGATION OF: CP 60809 WITH COVER
LETTER DATED 081892
Publication Year: 1992

20/6/7 (Item 7 from file: 156)
03361830 Subfile: TSCATS-209486
LETTER FROM MONSANTO TO TSCA, USEPA WITH COVER LETTER DATED AUGUST 8,
1983 (SUBMITTING TOXICITY DATA ON LEAD AND COBALT NAPTHENATES)

20/6/8 (Item 8 from file: 156)
03356966 Subfile: TSCATS-020848
EYE IRRITATION TESTS
Publication Year: 1983

20/6/9 (Item 9 from file: 156)
03356965 Subfile: TSCATS-020847
ORAL LD50 TEST WITH COVER LETTER
Publication Year: 1983

20/6/10 (Item 10 from file: 156)
03356878 Subfile: TSCATS-020717
TOXICOLOGICAL INVESTIGATION OF: CP 60809 WITH COVER LETTER
Publication Year: 1983

20/6/11 (Item 11 from file: 156)
03237610 Subfile: BIOSIS-95-34584
LYMPHOMATOID-LIKE CONTACT DERMATITIS FROM COBALT NAPHTHENATE
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1995

20/6/12 (Item 12 from file: 156)
03201675 Subfile: BIOSIS-94-32750
THE GEOBIOCHEMISTRY OF COBALT
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1994

20/6/13 (Item 13 from file: 156)
03164399 Subfile: BIOSIS-93-32763
Exposure, skin protection and occupational skin diseases in the glass
fibre-reinforced plastics industry.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1993

20/6/14 (Item 14 from file: 156)
02871333 Subfile: BIOSIS-85-12147
MUTAGENICITY STUDIES IN A TIRE PLANT IN-VITRO ACTIVITY OF WORKERS
URINARY
CONCENTRATES AND RAW MATERIALS
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1985

20/6/15 (Item 15 from file: 156)
02869480 Subfile: BIOSIS-85-10263
IS COBALT NAPHTHENATE AN ALLERGEN
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1985

20/6/16 (Item 16 from file: 156)
02413335 Subfile: NTIS-BIBRA257
BIBRA Toxicity Profile of cobalt naphthenate.
Publication Year: 1987

20/6/17 (Item 17 from file: 156)
02303670 Subfile: EMIC-62130
MUTAGENICITY STUDIES IN A TYRE PLANT: IN VITRO ACTIVITY OF WORKERS'
URINARY CONCENTRATES AND RAW MATERIALS
Publication Year: 1985

20/6/18 (Item 18 from file: 156)
02008063 Subfile: CIS-85-01941
Contact dermatitis caused by cobalt naphthenate
Publication Year: 1984

20/6/19 (Item 1 from file: 40)
00385226 ENVIROLINE NUMBER: 91-04331
Cobalt Exposure and Cancer Risk
1990

20/6/20 (Item 1 from file: 6)
1960765 NTIS Accession Number: BIBRA257
BIBRA Toxicity Profile of cobalt naphthenate
1987

20/6/21 (Item 2 from file: 6)
1214719 NTIS Accession Number: DE86000309
Combined Processing of Coal and Heavy Resids. Progress Report, April 16-July 15, 1985
1985

20/6/22 (Item 1 from file: 50)
02613639 CAB Accession Number: 920232386
Anatomical organization of the tracheal system of Varroa jacobsoni (Acari: Varroidae).

20/6/23 (Item 2 from file: 50)
02378943 CAB Accession Number: 910648377
Extended durability by the chemical fixation of unsaturated alkyd surface finishes to wood.

20/6/24 (Item 1 from file: 31)
00538666 WSCA ABSTRACT NUMBER: 00-07188 WSCA ID NUMBER: 507188
Investigation of cobalt drier retardation.
2000

20/6/25 (Item 2 from file: 31)
00531634 WSCA ABSTRACT NUMBER: 99-09329 WSCA ID NUMBER: 489329
Effect of temperature on cure kinetics and mechanical properties of vinyl
ester resins.
1999

20/6/26 (Item 3 from file: 31)
00515976 WSCA ABSTRACT NUMBER: 98-04302 WSCA ID NUMBER: 464302
Oxidising alkyd ceramers.
1998

20/6/27 (Item 4 from file: 31)
00501161 WSCA ABSTRACT NUMBER: 96-09391 WSCA ID NUMBER: 429391
Composition for utilising synthetic polymer packages.
PUBLICATION YEAR: 1996

20/6/28 (Item 5 from file: 31)
00485933 WSCA ABSTRACT NUMBER: 95-03161 WSCA ID NUMBER: 403161
Air-drying mechanism of propargyl-terminated resins. I. Cobalt drier.
1993

20/6/29 (Item 6 from file: 31)
00469484 WSCA ABSTRACT NUMBER: 93-06855 WSCA ID NUMBER: 366855
Radical cross-linking in saturated polyesters.
1991

20/6/30 (Item 7 from file: 31)
00461855 WSCA ABSTRACT NUMBER: 92-09347 WSCA ID NUMBER: 349347
Modification of total hydrolysed lac. III. With linseed oil fatty acids
(LOFA) for use in air-drying aqueous paints.
1992

20/6/31 (Item 8 from file: 31)
00457726 WSCA ABSTRACT NUMBER: 92-05218 WSCA ID NUMBER: 345218
Influence of allyl ethers in coating resins.
1991

20/6/32 (Item 9 from file: 31)
00456987 WSCA ABSTRACT NUMBER: 92-04479 WSCA ID NUMBER: 344479
Water-soluble linseed oil alkyds.
1991

20/6/33 (Item 10 from file: 31)
00456432 WSCA ABSTRACT NUMBER: 92-03924 WSCA ID NUMBER: 343924
Cobalt exposure and cancer risk.
1990

20/6/34 (Item 11 from file: 31)
00455095 WSCA ABSTRACT NUMBER: 92-02587 WSCA ID NUMBER: 342587
Unsaturated polyester resins with enhanced chemical, thermal and mechanical resistance.
1990

20/6/35 (Item 12 from file: 31)
00449710 WSCA ABSTRACT NUMBER: 91-07226 WSCA ID NUMBER: 327226
Corrosion prevention constituent for surface coatings.
PUBLICATION YEAR: 1991

20/6/36 (Item 13 from file: 31)
00446410 WSCA ABSTRACT NUMBER: 91-03926 WSCA ID NUMBER: 323926
Photo-crosslinkable vinyl esters with alpha,beta-unsaturated ketone groups in the backbone.
1990

20/6/37 (Item 14 from file: 31)
00444983 WSCA ABSTRACT NUMBER: 91-02499 WSCA ID NUMBER: 322499
Curing mechanism in allyl ether-functional coatings.
1990

20/6/38 (Item 15 from file: 31)
00443939 WSCA ABSTRACT NUMBER: 91-01455 WSCA ID NUMBER: 321455
Probing organic/inorganic interactions and curing processes in coatings by photoacoustic Fourier transform infrared spectroscopy.
1990

20/6/39 (Item 16 from file: 31)
00436029 WSCA ABSTRACT NUMBER: 90-03569 WSCA ID NUMBER: 303569
Polymer solution for use in building.
PUBLICATION YEAR: 1989

20/6/40 (Item 17 from file: 31)
00432097 WSCA ABSTRACT NUMBER: 89-09644 WSCA ID NUMBER: 289644
Investigation of network formation in drying oils by dilute solution viscometry.
1989

20/6/41 (Item 18 from file: 31)
00424143 WSCA ABSTRACT NUMBER: 89-01690 WSCA ID NUMBER: 281690
Properties of an adhesive composition based on PN-16 polyester/maleate resin.
1988

20/6/42 (Item 19 from file: 31)
00417716 WSCA ABSTRACT NUMBER: 88-05272 WSCA ID NUMBER: 265272
ESR study of the curing reaction of unsaturated polyester with vinyl monomers and the thermal behaviour of the cured polymers.
1988

20/6/43 (Item 20 from file: 31)
00417639 WSCA ABSTRACT NUMBER: 88-05195 WSCA ID NUMBER: 265195
Driers from some vegetable oils.
1987

20/6/44 (Item 21 from file: 31)
00404010 WSCA ABSTRACT NUMBER: 87-01627 WSCA ID NUMBER: 241627
Metallic soaps of naphthenic acids. IV.
1986

20/6/45 (Item 22 from file: 31)
00404009 WSCA ABSTRACT NUMBER: 87-01626 WSCA ID NUMBER: 241626
Metallic soaps of naphthenic acids. III.
1986

20/6/46 (Item 23 from file: 31)
00403361 WSCA ABSTRACT NUMBER: 87-00978 WSCA ID NUMBER: 240978
Curing of an unsaturated polyester resin in the presence of
methacryloylanthraquinone colourants.
1985

20/6/47 (Item 24 from file: 31)
00400710 WSCA ABSTRACT NUMBER: 86-08378 WSCA ID NUMBER: 228378
Effect of oil length of alkyd on the physico-chemical properties of its
coatings.
1986

20/6/48 (Item 25 from file: 31)
00400630 WSCA ABSTRACT NUMBER: 86-08298 WSCA ID NUMBER: 228298
Metallic soaps of naphthenic acids. II.
1986

20/6/49 (Item 26 from file: 31)
00398993 WSCA ABSTRACT NUMBER: 86-06661 WSCA ID NUMBER: 226661
Metallic soaps of naphthenic acids. I.
1986

20/6/50 (Item 27 from file: 31)
00396429 WSCA ABSTRACT NUMBER: 86-04097 WSCA ID NUMBER: 224097
Process for the preparation of polyether-ester polyols.
PUBLICATION YEAR: 1985

20/6/51 (Item 28 from file: 31)
00390715 WSCA ABSTRACT NUMBER: 85-07977 WSCA ID NUMBER: 207977
Processes for preparing hydroxyaromatic oligomers containing triazine
groups and for preparing epoxy resins from the oligomers.

20/6/52 (Item 29 from file: 31)
00384629 WSCA ABSTRACT NUMBER: 85-01891 WSCA ID NUMBER: 201891
Contact dermatitis caused by cobalt naphthenate.
1984

20/6/53 (Item 30 from file: 31)
00382865 WSCA ABSTRACT NUMBER: 85-00127 WSCA ID NUMBER: 200127
Process for controlling gelation and cure of unsaturated resins.

20/6/54 (Item 31 from file: 31)
00381877 WSCA ABSTRACT NUMBER: 84-09608 WSCA ID NUMBER: 189608
Low-temperature curing of unsaturated polyester resins.
1984

20/6/55 (Item 32 from file: 31)
00380798 WSCA ABSTRACT NUMBER: 84-08529 WSCA ID NUMBER: 188529
Preparation of coloured pigments for surface coating from petroleum fractions.
1984

20/6/56 (Item 33 from file: 31)
00365636 WSCA ABSTRACT NUMBER: 83-02005 WSCA ID NUMBER: 162005
Copolymerisation of unsaturated polyesters with triethylene glycol dimethacrylate.
1982

20/6/57 (Item 34 from file: 31)
00362909 WSCA ABSTRACT NUMBER: 82-08801 WSCA ID NUMBER: 148801
Drier compositions for air-drying coatings.
1982

20/6/58 (Item 35 from file: 31)
00353953 WSCA ABSTRACT NUMBER: 81-10167 WSCA ID NUMBER: 130167
Curing of unsaturated polyester resins initiated by visible light.
1981

20/6/59 (Item 36 from file: 31)
00347745 WSCA ABSTRACT NUMBER: 81-03959 WSCA ID NUMBER: 123959
Polyurethane compositions.

20/6/60 (Item 37 from file: 31)
00347633 WSCA ABSTRACT NUMBER: 81-03847 WSCA ID NUMBER: 123847
Radioisotope tracer technique of measuring adsorption of paint driers by pigments.
1980

20/6/61 (Item 38 from file: 31)
00345964 WSCA ABSTRACT NUMBER: 81-02178 WSCA ID NUMBER: 122178
Synergistic effects in the trimerisation of isocyanates by organometallic catalysts.
1980

20/6/62 (Item 39 from file: 31)
00342469 WSCA ABSTRACT NUMBER: 80-08343 WSCA ID NUMBER: 108343
Effects of polyhydric alcohols on properties of polyester paints for drip impregnation.
1979

20/6/63 (Item 40 from file: 31)
00339812 WSCA ABSTRACT NUMBER: 80-05685 WSCA ID NUMBER: 105685
Unsaturated polyester resin compositions for translucent laminates.

20/6/64 (Item 41 from file: 31)
00338941 WSCA ABSTRACT NUMBER: 80-04814 WSCA ID NUMBER: 104814
Hardening polyester resin paints containing phenolic resin.

20/6/65 (Item 42 from file: 31)
00336741 WSCA ABSTRACT NUMBER: 80-02614 WSCA ID NUMBER: 102614
Photo-crosslinkable unsaturated polyesters.
1979

20/6/66 (Item 43 from file: 31)
00335642 WSCA ABSTRACT NUMBER: 80-01515 WSCA ID NUMBER: 101515
Cold-curing acrylic wood varnishes.

20/6/67 (Item 44 from file: 31)
00329090 WSCA ABSTRACT NUMBER: 79-04059 WSCA ID NUMBER: 84059
Temporary paint for metals.

20/6/68 (Item 45 from file: 31)
00323316 WSCA ABSTRACT NUMBER: 78-06876 WSCA ID NUMBER: 66876
Rustproofing cable wires.

20/6/69 (Item 46 from file: 31)
00322757 WSCA ABSTRACT NUMBER: 78-06317 WSCA ID NUMBER: 66317
Unsaturated polyester resin topcoat.

20/6/70 (Item 47 from file: 31)
00322292 WSCA ABSTRACT NUMBER: 78-05852 WSCA ID NUMBER: 65852
Drier composition and yellowing of linseed oil films.
1978

20/6/71 (Item 48 from file: 31)
00322291 WSCA ABSTRACT NUMBER: 78-05851 WSCA ID NUMBER: 65851
Kinetic desciption of cumene hydroperoxide decomposition catalysed by cobalt(II) naphthenate.
1977

20/6/72 (Item 49 from file: 31)
00321402 WSCA ABSTRACT NUMBER: 78-04962 WSCA ID NUMBER: 64962
Wood stain.

20/6/73 (Item 50 from file: 31)
00321044 WSCA ABSTRACT NUMBER: 78-04604 WSCA ID NUMBER: 64604
Odourless fatty acid/acrylate resin compositions.

20/6/74 (Item 51 from file: 31)
00316538 WSCA ABSTRACT NUMBER: 78-00098 WSCA ID NUMBER: 60098
Micelle formation in non-aqueous cobalt stearate and cobalt naphthenate solutions.
1976

20/6/75 (Item 52 from file: 31)
00311181 WSCA ABSTRACT NUMBER: 77-03400 WSCA ID NUMBER: 43400
Diallyl phthalate resin hardening.

20/6/76 (Item 53 from file: 31)
00307244 WSCA ABSTRACT NUMBER: 76-07244 WSCA ID NUMBER: 27244
ESR study of copolymerisation of unsaturated polyesters with styrene.
1976

20/6/77 (Item 54 from file: 31)
00306804 WSCA ABSTRACT NUMBER: 76-06804 WSCA ID NUMBER: 26804
Effect of peak exotherm temperature on degree of cure of unsaturated
polyester resins in copolymerisation with styrene.
1975

20/6/78 (Item 55 from file: 31)
00304641 WSCA ABSTRACT NUMBER: 76-04641 WSCA ID NUMBER: 24641
Gelation of unsaturated oligomeric esters in presence of redox initiators.
1975

20/6/79 (Item 56 from file: 31)
00304052 WSCA ABSTRACT NUMBER: 76-04052 WSCA ID NUMBER: 24052
White alkyd enamel.

20/6/80 (Item 57 from file: 31)
00303313 WSCA ABSTRACT NUMBER: 76-03313 WSCA ID NUMBER: 23313
Polymer cross-linking by bimolecular peroxide decomposition.
1975

20/6/81 (Item 1 from file: 305)
244856
Rapid direct analysis of p-xylene oxidation products by reversed-phase
high-performance liquid chromatography.
PD- Jan 1996 ; 960100|

#5
cobalt octoate
These 31 records did not have the keywords, but they may be of interest:

26/6/1 (Item 1 from file: 35)
01656872 ORDER NO: AADNQ-28278
MOLECULAR AND ENVIRONMENTAL ASPECTS OF LATEX FILM FORMATION (THIN FILMS,
BLEND DISPERSIONS, DRYING, CROSSLINKING)
Year: 1997

26/6/2 (Item 2 from file: 35)
01414307 ORDER NO: AADAA-I9517848
KINETIC MODELING OF POLYMERIZATION OF BUTADIENE USING COBALT-BASED ZIEGLER-NATTA CATALYST
Year: 1994

26/6/3 (Item 3 from file: 35)
01296864 ORDER NO: AAD93-19681
SYNTHESIS, ARCHITECTURE AND MICROSTRUCTURE OF POLY(1,3,5-HEXATRIENE) VIA
ANIONIC POLYMERIZATION (POLYHEXATRIENE)
Year: 1993

26/6/4 (Item 4 from file: 35)
938907 ORDER NO: NOT AVAILABLE FROM UNIVERSITY MICROFILMS INT'L.
MODELLING OF KINETICS OF POLYMERIZATION OF BUTADIENE WITH COBALT OCTOATE-DEAC CATALYST
Year: 1986

26/6/5 (Item 5 from file: 35)
925717 ORDER NO: NOT AVAILABLE FROM UNIVERSITY MICROFILMS INT'L.
ZIEGLER-NATTA POLYMERIZATION OF BUTADIENE
Year: 1985

26/6/6 (Item 6 from file: 35)
781344 ORDER NO: AAD82-13719
ELASTOMERIC ABA TRIBLOCK COPOLYMERS OF BUTADIENE AND ISOPRENE WITH
CRYSTALLINE END BLOCKS
Year: 1982

26/6/7 (Item 1 from file: 31)
00529570 WSCA ABSTRACT NUMBER: 99-08978 WSCA ID NUMBER: 488978
Kinetic analysis of an asymmetrical differential scanning calorimetry (DSC) peak in the curing of an unsaturated polyester resin catalysed with methyl ethyl ketone peroxide and cobalt octoate.
1999

26/6/8 (Item 2 from file: 31)
00524124 WSCA ABSTRACT NUMBER: 99-02676 WSCA ID NUMBER: 482676
Characterisation of unsaturated polyester resin cured with styrene.
1998

26/6/9 (Item 3 from file: 31)
00499263 WSCA ABSTRACT NUMBER: 96-07157 WSCA ID NUMBER: 427157
In-mould coating compositions and use thereof.

26/6/10 (Item 4 from file: 31)
00493293 WSCA ABSTRACT NUMBER: 96-01774 WSCA ID NUMBER: 421774
Cross-linkable resin composition comprising a thermoplastic resin.

26/6/11 (Item 5 from file: 31)
00479427 WSCA ABSTRACT NUMBER: 94-07015 WSCA ID NUMBER: 387015
Heat-stable acrylamide polysiloxane composition.
PUBLICATION YEAR: 1993

26/6/12 (Item 6 from file: 31)
00478571 WSCA ABSTRACT NUMBER: 94-05596 WSCA ID NUMBER: 385596
Influence of the styrene ratio on the copolymerisation kinetics of dimethacrylate of diglycidyl ether of bisphenol A vinyl ester resins cross-linked with styrene.
1993

26/6/13 (Item 7 from file: 31)
00477189 WSCA ABSTRACT NUMBER: 94-04272 WSCA ID NUMBER: 384272
In-mould coating compositions.

26/6/14 (Item 8 from file: 31)
00472697 WSCA ABSTRACT NUMBER: 94-00509 WSCA ID NUMBER: 380509
Cure-induced particle migration within polymer coatings.
1993

26/6/15 (Item 9 from file: 31)
00468670 WSCA ABSTRACT NUMBER: 93-06027 WSCA ID NUMBER: 366027
Polyester resin based composition having the dual function of adhesive and
putty, for use on a variety of materials.

26/6/16 (Item 10 from file: 31)
00467061 WSCA ABSTRACT NUMBER: 93-04554 WSCA ID NUMBER: 364554
Structure/property relationships for styrene cross-linked polyesters. I.
Network structure and rubbery elastic modulus.
1992

26/6/17 (Item 11 from file: 31)
00463963 WSCA ABSTRACT NUMBER: 93-00977 WSCA ID NUMBER: 360977
N-(Carboxymethyl)trimellitimide-based polyester-imides as film formers for
air-drying protective coatings.
1991

26/6/18 (Item 12 from file: 31)
00454279 WSCA ABSTRACT NUMBER: 92-01771 WSCA ID NUMBER: 341771
Hardening of unsaturated polyester resin-based binders.
1991

26/6/19 (Item 13 from file: 31)
00440694 WSCA ABSTRACT NUMBER: 90-08234 WSCA ID NUMBER: 308234
Cross-linking of polyester/styrene detected by thermal photoacoustic
Fourier transform infrared spectroscopy.
1989

26/6/20 (Item 14 from file: 31)
00428510 WSCA ABSTRACT NUMBER: 89-06057 WSCA ID NUMBER: 286057
In situ photoacoustic Fourier transform studies of polyester/styrene
cross-linking.
1989

26/6/21 (Item 15 from file: 31)
00424016 WSCA ABSTRACT NUMBER: 89-01563 WSCA ID NUMBER: 281563
Residual styrene monomer in cured unsaturated polyester resins.
1988

26/6/22 (Item 16 from file: 31)
00421255 WSCA ABSTRACT NUMBER: 88-08811 WSCA ID NUMBER: 268811
Rust transformer.

26/6/23 (Item 17 from file: 31)
00418478 WSCA ABSTRACT NUMBER: 88-06034 WSCA ID NUMBER: 266034
Influence of the cure cycle upon selected physical properties of a vinyl ester resin.
1988

26/6/24 (Item 18 from file: 31)
00396414 WSCA ABSTRACT NUMBER: 86-04082 WSCA ID NUMBER: 224082
Unsaturated polyester/styrene resins: effect of the catalyst concentration on the kinetic rate and activation energy of the radical cross-linking reactions.
1985

26/6/25 (Item 19 from file: 31)
00323765 WSCA ABSTRACT NUMBER: 78-07325 WSCA ID NUMBER: 67325
Air-drying unsaturated polyester resins.

26/6/26 (Item 20 from file: 31)
00322292 WSCA ABSTRACT NUMBER: 78-05852 WSCA ID NUMBER: 65852
Drier composition and yellowing of linseed oil films.
1978

26/6/27 (Item 21 from file: 31)
00319495 WSCA ABSTRACT NUMBER: 78-03055 WSCA ID NUMBER: 63055
Drier composition.

26/6/28 (Item 22 from file: 31)
00318150 WSCA ABSTRACT NUMBER: 78-01710 WSCA ID NUMBER: 61710
Anti-greening agent for unsaturated polyesters.

26/6/29 (Item 23 from file: 31)
00318142 WSCA ABSTRACT NUMBER: 78-01702 WSCA ID NUMBER: 61702
Air-drying polyester resins.

26/6/30 (Item 24 from file: 31)
00311138 WSCA ABSTRACT NUMBER: 77-03357 WSCA ID NUMBER: 43357
Coating composition drying agents.

26/6/31 (Item 25 from file: 31)
00304153 WSCA ABSTRACT NUMBER: 76-04153 WSCA ID NUMBER: 24153
IR-curing unsaturated polyester.

#6
copper napthenate or copper naphthenate or 1338-02-9 or copper(II)naphthenate
These 2 records had the terms fate or transport:

33/6/1 (Item 1 from file: 50)
03348857 CAB Accession Number: 970603292
Fungal degradation of wood treated with metal-based preservatives: 1.
Fungal tolerance.
Document - International Research Group on Wood Preservation

33/6/2 (Item 1 from file: 31)
00419085 WSCA ABSTRACT NUMBER: 88-06641 WSCA ID NUMBER: 266641
Authorised and Approved List. Information Approved for the Classification,
Packaging and Labelling of Dangerous Substances for Supply and Conveyance
by Road. Second Edition.
1988

These 173 records did not have the keywords but, they may be of interest:

36/6/1 (Item 1 from file: 156)
03818646 Subfile: BIOSIS-00-20220
Formation of chlorinated dioxins and furans in a hazardous-waste-firing
industrial boiler.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 2000

36/6/2 (Item 2 from file: 156)
03815448 Subfile: BIOSIS-00-17012
Mitigation of fisheries impacts from the use and disposal of wood residue in British Columbia and the Yukon.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1999

36/6/3 (Item 3 from file: 156)
03772871 Subfile: BIOSIS-00-04470
Wolfiporia cocos: A potential agent for composting or bioprocessing Douglas-fir wood treated with copper-based preservatives.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1998

36/6/4 (Item 4 from file: 156)
03752316 Subfile: BIOSIS-00-02402
Elevated serum copper levels and methemoglobinemia from residential exposure to copper naphthenate.
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1999

36/6/5 (Item 5 from file: 156)
03706858 Subfile: DART-M-98039097
Household pesticides and risk of pediatric brain tumors.
Publication Year: 1997

36/6/6 (Item 6 from file: 156)
03684910 Subfile: DART-T-93001550
Metals.
Publication Year: 1993

36/6/7 (Item 7 from file: 156)
03388165 Subfile: RISKLINE-93110013
Copper naphthenate
Publication Year: 1993

36/6/8 (Item 8 from file: 156)
03367358 Subfile: TSCATS-408269
TESTING OF SELECTED WORKPLACE CHEMICALS FOR TERATOGENIC POTENTIAL WITH
ATTACHMENTS, COVER SHEETS AND LETTER DATED 022581
Publication Year: 1981

36/6/9 (Item 9 from file: 156)
03358522 Subfile: TSCATS-029613
TESTING OF SELECTED WORKPLACE CHEMICALS FOR TERATOGENIC POTENTIAL
Publication Year: 1981

36/6/10 (Item 10 from file: 156)
03224388 Subfile: BIOSIS-95-21354
BIOCIDES USED IN WOOD PRESERVATION
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1995

36/6/11 (Item 11 from file: 156)
03224386 Subfile: BIOSIS-95-21352
BIOCIDES FOR USE IN THE TEXTILE INDUSTRY
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1995

36/6/12 (Item 12 from file: 156)
03129632 Subfile: BIOSIS-93-33856
Comparison of the performance of several wood preservatives in a tropical environment.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1992

36/6/13 (Item 13 from file: 156)
03110025 Subfile: BIOSIS-92-14247
INCREASED BLOOD AND URINE COPPER AFTER RESIDENTIAL EXPOSURE TO COPPER
NAPHTHENATE
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1992

36/6/14     (Item 14 from file: 156)
03069413   Subfile: BIOSIS-91-10899
HEAVY METAL SOURCES UPTAKE AND DISTRIBUTION IN TERRESTRIAL MACROINVERTEBRATES
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1991

36/6/15     (Item 15 from file: 156)
03032531   Subfile: BIOSIS-90-08068
ILLNESS INJURIES AND DEATHS FROM PESTICIDE EXPOSURES IN CALIFORNIA USA
1949-1988
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1990

36/6/16     (Item 16 from file: 156)
02990252   Subfile: BIOSIS-89-01901
1987 ANNUAL REPORT OF THE AMERICAN ASSOCIATION OF POISON CONTROL CENTERS
NATIONAL DATA COLLECTION SYSTEM
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1988

36/6/17     (Item 17 from file: 156)
02907025   Subfile: BIOSIS-86-30435
EXTENDING THE LIFE OF BEEHIVES WITH AND WITHOUT PRESERVATIVES
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1986

36/6/18     (Item 18 from file: 156)
02874997   Subfile: BIOSIS-85-15812
WOOD PRESERVATIVES FOR BEEHIVES
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1985

36/6/19     (Item 19 from file: 156)
02855814   Subfile: NTIS-BIBRA258
BIBRA Toxicity Profile of copper naphthenate.
Publication Year: 1993

36/6/20 (Item 20 from file: 156)
02716940 Subfile: TOXBIB-95-186918
Leaching from stone crab traps dipped in fungitrol: diesel fuel preservative.
Publication Year: 1994

36/6/21 (Item 21 from file: 156)
02592618 Subfile: NTIS-PB93-122406
Drinking Water Toxicity Profiles.
Publication Year: 1992

36/6/22 (Item 22 from file: 156)
02583285 Subfile: CIS-93-00041
Copper naphthenate
Publication Year: 1991

36/6/23 (Item 23 from file: 156)
02386902 Subfile: NTIS-AD-A201 272-2
Preliminary Assessment of the Relative Toxicity of Copper Naphthenate , (Mooney Chemicals), Acute Studies. Phase 3. May 1984 - October 1987.
Publication Year: 1988

36/6/24 (Item 24 from file: 156)
02384581 Subfile: NTIS-AD-A190 851-6
Preliminary Assessment of the Relative Toxicity of Copper Naphthenate Acute Studies. Phase 2. May 1984 - June 1986.
Publication Year: 1988

36/6/25 (Item 25 from file: 156)
02004315 Subfile: NTIS-AD-A144 526-1
Preliminary Toxicological Evaluation of Eight Chemicals Used as Wood Preservatives.
Publication Year: 1984

36/6/26 (Item 26 from file: 156)
02003969 Subfile: NTIS-AD-A143 607-0
Role of Water Repellents and Chemicals in Controlling Mildew on Wood Exposed Outdoors.
Publication Year: 1984

36/6/27 (Item 27 from file: 156)
01927697 Subfile: NTIS-PB89-216212
Information Profiles on Potential Occupational Hazards: Copper and Compounds.
Publication Year: 1982

36/6/28 (Item 28 from file: 156)
01913749 Subfile: HEEP-83-05099
TESTING OF SELECTED WORKPLACE CHEMICALS FOR TERATOGENIC POTENTIAL
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1981

36/6/29 (Item 29 from file: 156)
01864655 Subfile: EMIC-44238
NITRO DERIVATIVES OF POLYNUCLEAR AROMATIC HYDROCARBONS IN AIRBORNE AND SOURCE PARTICULATE
Publication Year: 1981

36/6/30 (Item 30 from file: 156)
01645161 Subfile: HEEP-81-00923
TIMBER PRESERVATIVES
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1979

36/6/31 (Item 31 from file: 156)
01605154 Subfile: PESTAB-81-1924
Environmental and occupational exposure to copper.
Publication Year: 1979

36/6/32 (Item 32 from file: 156)
01372501 Subfile: HEEP-76-07028
Phytotoxicity of copper treated burlap on balled and burlapped Cotoneaster divaricata Rehd. et Wils.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1975

36/6/33 (Item 33 from file: 156)
01355557 Subfile: HEEP-75-01282
Health of workers exposed to a cocktail of pesticides.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1974

36/6/34 (Item 34 from file: 156)
01331418 Subfile: PESTAB-77-2068
Comparison of wood preservatives in stake tests: 1975 progress report.
Publication Year: 1975

36/6/35 (Item 1 from file: 40)
00546728 ENVIROLINE NUMBER: 98-05299
Groundline Treatments with a Waterborne Copper Napthenate-Boron Paste
Nov 6-8, 96

36/6/36 (Item 2 from file: 40)
00416789 ENVIROLINE NUMBER: 93-12795
Wood Preservation: Extending the Forest Resource
Nov 93

36/6/37 (Item 3 from file: 40)
00328931 ENVIROLINE NUMBER: 82-02129
Caution: Treated Wood
Jan 82

36/6/38 (Item 1 from file: 10)
3814433 22037215 Holding Library: AGL
Ultraviolet spectrophotometry and Fourier transform infrared spectroscopy characterization of copper naphthenate
1999

36/6/39 (Item 2 from file: 10)
3768929 21999673 Holding Library: AGL
The effect of pressure on retention and bending properties of copper naphthenate and CCA type C treated hardwoods
1999

36/6/40 (Item 3 from file: 10)
3742143 21982244 Holding Library: AGL
The effect of post-streaming on copper naphthenate-treated southern pine
1998

36/6/41 (Item 4 from file: 10)
3517617 20518747 Holding Library: AGL
Preservative treatment of red maple
1996 Mar

36/6/42 (Item 5 from file: 10)
3505161 20509187 Holding Library: AGL
Laboratory evaluation of the decay resistance of red oak (Quercus rubra) pressure treated with copper naphthenate
1995 Sep

36/6/43 (Item 6 from file: 10)
3487659 20494269 Holding Library: AGL
Results of test activity on a water-borne copper naphthenate wood preservation system
1994

36/6/44 (Item 7 from file: 10)
3487088 20493649 Holding Library: AGL
Adhesion of phenol-formaldehyde resin to waterborne emulsion preservatives in aspen veneer
1990 Nov

36/6/45 (Item 8 from file: 10)
3484166 20491838 Holding Library: AGL
Chemically protecting cellulosic string from microbial attack
1995 Jun

36/6/46 (Item 9 from file: 10)
3484162 20491834 Holding Library: AGL
Evaluation of diffusible preservatives using an accelerated field simulator
1995 Jun

36/6/47 (Item 10 from file: 10)
3415972 20436669 Holding Library: AGL
Evaluation of wood and soil samples from copper naphthenate-treated utility poles in service
1994

36/6/48 (Item 11 from file: 10)
3362719 20389478 Holding Library: AGL
A report on southern pine utility poles treated with copper napthhenate
1993

36/6/49 (Item 12 from file: 10)
3361969 20388711 Holding Library: AGL
Evaluation of the termite resistance of wood pressure treated with copper naphthenate
1993 Nov

36/6/50 (Item 13 from file: 10)
3260822 93011157 Holding Library: AGL
Diffusion of copper and boron from a groundline wrap formulation through Douglas-fir heartwood
1992 Nov

36/6/51 (Item 14 from file: 10)
3215571 92270316 Holding Library: RQF; AGL
Fence post preservation with copper naphthenate by the cold soaking method / [by Warren S. Thompson]
1953

36/6/52 (Item 15 from file: 10)
3168677 92025004 Holding Library: AGL
Wood preservation of timber products
1979 May

36/6/53 (Item 16 from file: 10)
3109628 91039824 Holding Library: AGL
A resin-compatible copper naphthenate to preserve aspen composites
1991 May

36/6/54 (Item 17 from file: 10)
3090260 91029562 Holding Library: AGL
Treatment of Douglas-fir heartwood with copper naphthenate in AWPA P9 type A solvents
1989

36/6/55 (Item 18 from file: 10)
3089464 91028589 Holding Library: AGL
The comparative performance of " copper naphthenate" formulations in laboratory decay tests
1990

36/6/56 (Item 19 from file: 10)
2985313 90019484 Holding Library: AGL
Compatibility of nonacidic waterborne preservatives with phenol-formaldehyde adhesive
1990 Feb

36/6/57 (Item 20 from file: 10)
2951242 89061616 Holding Library: AGL
Field trials of copper naphthenate-treated wood
1988

36/6/58 (Item 21 from file: 10)
864354 769102692
Copper naphthenate--a better [nursery] burlap treatment than copper sulfate [to slow the breakdown of burlap in soil]
1976

36/6/59 (Item 22 from file: 10)
657838 759046149
Copper naphthenate [wood preservative] treated flats toxic to pine [Pinus] seedling
1975

36/6/60 (Item 1 from file: 99)
2124512 H.W. WILSON RECORD NUMBER: BAST00030496
Restoration of severely weathered wood
20000300

36/6/61 (Item 2 from file: 99)
1687139 H.W. WILSON RECORD NUMBER: BAST98033981
Dynamic and isothermal thermogravimetric analysis of a polycyanurate thermosetting system
19980400

36/6/62 (Item 1 from file: 41)
100395 84-02897
Loss of the rot-proofing effect of organic copper compounds by the action of Aspergillus niger and other fungi Publ.Yr: 1983

36/6/63 (Item 1 from file: 6)
2142939 NTIS Accession Number: PB99-175788/XAB
Effect of Prestain on the Release Rate of Copper, Chromium, and Arsenic from Western Hemlock
(Forest service research note)
Sep 1999

36/6/64 (Item 2 from file: 6)
1983711 NTIS Accession Number: PB97-115521
Leaching of Wood Preservative Components and Their Mobility in the Environment: Summary of Pertinent Literature
(Forest Service general technical rept)
Aug 96

36/6/65 (Item 3 from file: 6)
1960766 NTIS Accession Number: BIBRA258
BIBRA Toxicity Profile of copper naphthenate
1993

36/6/66 (Item 4 from file: 6)
1624504 NTIS Accession Number: PB92-125194
Comparison of Wood Preservatives in Stake Tests: 1991 Progress Report
(Forest Service research note)
Sep 91

36/6/67 (Item 5 from file: 6)
1505501 NTIS Accession Number: AD-A219 704/4
Efficacy of Solvent and Water-Based Preservatives for Wood. Phase 2
(Final rept. Oct 85-Dec 89)
Feb 90

36/6/68 (Item 6 from file: 6)
1499050 NTIS Accession Number: AD-A218 263/2
Summary of Experimental Piling Inspections at Pearl Harbor, Hawaii
(Final rept. for FY89)
Dec 89

36/6/69 (Item 7 from file: 6)
1464267 NTIS Accession Number: PB89-224042
Comparison of Wood Preservatives in Stake Tests: 1987 Progress Report
(Forest Service research note)
May 89

36/6/70 (Item 8 from file: 6)
1458762 NTIS Accession Number: PB89-216212
Information Profiles on Potential Occupational Hazards: Copper and Compounds
(Draft rept. (Second))
Mar 82

36/6/71 (Item 9 from file: 6)
1300534 NTIS Accession Number: PB87-173324
Efficacy of Alternative Preservatives Used in Dip Treatments for Wood Boxes
(Research paper)
Nov 86

36/6/72 (Item 10 from file: 6)
1207253 NTIS Accession Number: AD-A954 897/5
Mildew-Proofing Treatment for Sandbags
29 Oct 51

36/6/73 (Item 11 from file: 6)
1109274 NTIS Accession Number: AD-A140 276/7
Comparison of Wood Preservatives in Stake Tests (1983 Progress Report)
(Forest Service research note)
Dec 83

36/6/74 (Item 12 from file: 6)
1061964 NTIS Accession Number: PB83-252494
Preservative Treatment of Hardwoods: A Review
(Forest Service general technical rept)
1981

36/6/75 (Item 13 from file: 6)
0965602 NTIS Accession Number: PB82-206178/XAB
On the Leaching and Volatility of the Active Agents of Surface Applied Wood Perservatives
May 79

36/6/76 (Item 14 from file: 6)
0734877 NTIS Accession Number: AD-A060 650/9/XAB
Wood Finishing: Water Repellents and Water-Repellent Preservatives. Revision
(Forest service research note)
1978

36/6/77 (Item 1 from file: 50)
03870622 CAB Accession Number: 20000608110
X-ray diffraction as an analytical method in wood preservatives.

36/6/78 (Item 2 from file: 50)
03778817 CAB Accession Number: 990609796
Development and field testing of a new copper boronaphthenate paste for the remedial treatment of utility poles.
The second international conference on wood protection with diffusible preservatives and pesticides.

36/6/79 (Item 3 from file: 50)
03754198 CAB Accession Number: 990608521
Development of naphthenic acid fractionation with supercritical fluid extraction for use in wood decay testing.
Proceedings, Ninety-Fourth Annual Meeting of the American Wood-Preservers' Association, Scottsdale, Arizona, USA, 17-19 May, 1998.

36/6/80 (Item 4 from file: 50)
03754190 CAB Accession Number: 990608513
Cu-naphthenate treated SYP: effect of post treatment steaming.
Proceedings, Ninety-Fourth Annual Meeting of the American Wood-Preservers' Association, Scottsdale, Arizona, USA, 17-19 May, 1998.

36/6/81 (Item 5 from file: 50)
03722801 CAB Accession Number: 990606546
Long-term appraisal of on-site preservative treatments for preventing decay in exterior woodwork.

36/6/82 (Item 6 from file: 50)
03663175 CAB Accession Number: 990600459
Application of environmental scanning electron microscopy to the study of macrodistribution of copper in copper naphthenate treated hardwoods.

36/6/83 (Item 7 from file: 50)
03650147 CAB Accession Number: 980616112
The effect of post-steaming on copper naphthenate-treated southern pine.

36/6/84 (Item 8 from file: 50)
03412869 CAB Accession Number: 970607892
XPS and FTIR applied to the study of waterborne copper naphthenate wood preservatives.

36/6/85 (Item 9 from file: 50)
03348479 CAB Accession Number: 970602914
International collaborative laboratory comparison of two wood preservatives against subterranean termites: third update and first report.
Document - International Research Group on Wood Preservation

36/6/86 (Item 10 from file: 50)
03261644 CAB Accession Number: 960608115
Efficacy of water-borne emulsion of copper naphthenate as preservative for northern red oak (Quercus rubra) and soft maple (Acer rubrum).

36/6/87 (Item 11 from file: 50)
03105590 CAB Accession Number: 950615705
Preliminary evaluation of parallel laminated veneer lumber made from preservative treated veneers.
Technical Report - Natural Resources Research Institute, University of Minnesota

36/6/88 (Item 12 from file: 50)
02932778 CAB Accession Number: 940608961
Distribution of biocides in Douglas-fir poles 42 months after application of groundline preservative systems.

36/6/89 (Item 13 from file: 50)
02756054 CAB Accession Number: 930670758
Durability of preservative-treated transmission poles.

36/6/90 (Item 14 from file: 50)
02731782 CAB Accession Number: 930668380
Properties of treated and untreated Pinus radiata plywood after 12 years' weathering.

36/6/91 (Item 15 from file: 50)
02402613 CAB Accession Number: 910651052
Laboratory tests on light organic solvent preservatives for use in Australia. Part 4. Assessment of several new candidate fungicides.

36/6/92 (Item 16 from file: 50)
02402612 CAB Accession Number: 910651051
Laboratory tests on light organic solvent preservatives for use in Australia. Part 3. Evaluation of fully formulated commercial preservatives.

36/6/93 (Item 17 from file: 50)
02402604 CAB Accession Number: 910651043
Laboratory tests on light-organic solvent preservatives for use in Australia. 2. Assessments of further candidate fungicides.

36/6/94 (Item 18 from file: 50)
02351478 CAB Accession Number: 910229682
Practical preservation procedures for beehive bodies.

36/6/95 (Item 19 from file: 50)
02317845 CAB Accession Number: 900645341
A note on the durability of kempas treated with copper naphthenate.

36/6/96 (Item 20 from file: 50)
02034075 CAB Accession Number: 880226243
Problem products and materials used by beekeepers.

36/6/97 (Item 21 from file: 50)
02023979 CAB Accession Number: 880627712
Timber preservation - copper and zinc naphthenates.

36/6/98 (Item 22 from file: 50)
01945008 CAB Accession Number: 880621203
Wood preservation in Victorian commercial apiaries.

36/6/99 (Item 23 from file: 50)
01945007 CAB Accession Number: 880621202
Beekeeping and wood preservation in Australia.

36/6/100 (Item 24 from file: 50)
01933638 CAB Accession Number: 880620616
Bioassaying wood preservatives with Aspergillus niger.

36/6/101 (Item 25 from file: 50)
01917401 CAB Accession Number: 871338383
Biology and control of Nectria galligena in orchards.
Annual Report 1985, Research Station for Fruit Growing.

36/6/102 (Item 26 from file: 50)
01913485 CAB Accession Number: 870220346
Preservation of hive equipment.

36/6/103 (Item 27 from file: 50)
01907151 CAB Accession Number: 870618329
Comparative laboratory testing of strains of the dry rot fungus Serpula lacrymans (Schum. ex Fr.) S.F. Gray. III. The action of copper naphthenate in wood.

36/6/104 (Item 28 from file: 50)
01766675 CAB Accession Number: 860611811
Treatment and durability of wooden roofing materials.

36/6/105 (Item 29 from file: 50)
01744594 CAB Accession Number: 860611032
The residual effects of remedial timber treatments on bats.

36/6/106 (Item 30 from file: 50)
01729616 CAB Accession Number: 860609755
Exterior weathering trials on Pinus radiata roofing shingles.

36/6/107 (Item 31 from file: 50)
01727018 CAB Accession Number: 860218109
Effect of wood preservative treatment of beehives on honey bees and hive products.

36/6/108 (Item 32 from file: 50)
01635546 CAB Accession Number: 850217063
Preservation of bee hive components.

36/6/109 (Item 33 from file: 50)
01495855 CAB Accession Number: 840696000
A rapid wood preservative test over thirteen years.

36/6/110 (Item 34 from file: 50)
01480578 CAB Accession Number: 840694189
Antitermitic properties of cellulose pads treated with bark extractives.

36/6/111 (Item 35 from file: 50)
01296208 CAB Accession Number: 830685570
Evaluating various preservative treatments and treating methods for western redcedar shingles.
Publication, Forest Service, Texas

36/6/112 (Item 36 from file: 50)
01012825 CAB Accession Number: 810670632
Conifer seedling growth in limed peat in copper napthenate-treated flats.

36/6/113 (Item 37 from file: 50)
00867779 CAB Accession Number: 800658860
British Standard methods of analysis of wood preservatives and treated timber. Part 4. Quantitative analysis of preservatives and treated timber containing copper naphthenate.
British Standard

36/6/114 (Item 38 from file: 50)
00867762 CAB Accession Number: 800658841
The suitability of the double vacuum process and its modifications for making class B impregnated wood.
Tiedonanto Puutavaralaboratorio, Valtion Teknillinen Tutkimuskeskus

36/6/115 (Item 39 from file: 50)
00619786 CAB Accession Number: 780647488
Fence post service tests at Auburn University: a 25-year report.
Forestry Departmental Series, Agricultural Experiment Station, Auburn University, Alabama

36/6/116 (Item 40 from file: 50)
00466065 CAB Accession Number: 760343901
Copper naphthenate - a better burlap treatment than copper sulfate.

36/6/117 (Item 41 from file: 50)
00350145 CAB Accession Number: 760341275
Phytotoxicity of copper treated burlap on balled and burlapped Cotoneaster divaricata Rehd. & Wils.

36/6/118 (Item 42 from file: 50)
00349662 CAB Accession Number: 760340548
Copper toxicity from copper-treated burlap.

36/6/119 (Item 43 from file: 50)
00285452 CAB Accession Number: 751319693
Copper naphthenate treated flats toxic to pine seedlings.

36/6/120 (Item 44 from file: 50)
00231785 CAB Accession Number: 750327314
Effects of time, temperature, copper source, and concentration on burlap strength-a preliminary report.

36/6/121 (Item 45 from file: 50)
00141103 CAB Accession Number: 730507367
Soil poisons for proofing buildings against subterranean wood-destroying termites.

36/6/122 (Item 46 from file: 50)
00127772 CAB Accession Number: 730311657
Chemical control of root growth in containers.

36/6/123 (Item 47 from file: 50)
00031127 CAB Accession Number: 730306634
New preservative treatment saves time, trouble and wood for Ohio growers.

36/6/124 (Item 1 from file: 31)
00537304 WSCA ABSTRACT NUMBER: 00-05826 WSCA ID NUMBER: 505826
Use of chemicals to prevent the degradation of wood.
2000

36/6/125 (Item 2 from file: 31)
00535440 WSCA ABSTRACT NUMBER: 00-03962 WSCA ID NUMBER: 503962
Studies on cyclohexanone-formaldehyde/styrenated cashew nutshell liquid (CNSL) coatings.
2000

36/6/126 (Item 3 from file: 31)
00535387 WSCA ABSTRACT NUMBER: 00-03909 WSCA ID NUMBER: 503909
Radical polymerisation initiated from a solid substrate. III. Grafting from the surface of an ultrafine powder.
1999

36/6/127 (Item 4 from file: 31)
00534898 WSCA ABSTRACT NUMBER: 00-03420 WSCA ID NUMBER: 503420
Restoration of severely weathered wood.
2000

36/6/128 (Item 5 from file: 31)
00518280 WSCA ABSTRACT NUMBER: 98-06606 WSCA ID NUMBER: 466606
Specification for ready-mixed aluminium priming paints for woodwork.
1998

36/6/129 (Item 6 from file: 31)
00511644 WSCA ABSTRACT NUMBER: 97-09677 WSCA ID NUMBER: 449677
Specification for preparations of wood preservatives in organic solvents.
1997

36/6/130 (Item 7 from file: 31)
00508602 WSCA ABSTRACT NUMBER: 97-06635 WSCA ID NUMBER: 446635
Wood preservation composition and method.

36/6/131 (Item 8 from file: 31)
00485345 WSCA ABSTRACT NUMBER: 95-02640 WSCA ID NUMBER: 402640
Wood preservative finishes.
1994

36/6/132 (Item 9 from file: 31)
00480831 WSCA ABSTRACT NUMBER: 94-07937 WSCA ID NUMBER: 387937
Pigmented polymer particles with controlled morphologies.
1992

36/6/133 (Item 10 from file: 31)
00480666 WSCA ABSTRACT NUMBER: 94-08324 WSCA ID NUMBER: 388324
Copper and dithiocarbamate containing compositions for preserving and/or colouring wood.

36/6/134 (Item 11 from file: 31)
00472697 WSCA ABSTRACT NUMBER: 94-00509 WSCA ID NUMBER: 380509
Cure-induced particle migration within polymer coatings.
1993

36/6/135 (Item 12 from file: 31)
00460438 WSCA ABSTRACT NUMBER: 92-07930 WSCA ID NUMBER: 347930
Comparison of the performance of several wood preservatives in a tropical environment.
1992

36/6/136 (Item 13 from file: 31)
00458968 WSCA ABSTRACT NUMBER: 92-06460 WSCA ID NUMBER: 346460
Wood preservation.
1992

36/6/137 (Item 14 from file: 31)
00455424 WSCA ABSTRACT NUMBER: 92-02916 WSCA ID NUMBER: 342916
Comparison of preservative treatments in marine exposure of small wood panels. I and II.
1991

36/6/138 (Item 15 from file: 31)
00454843 WSCA ABSTRACT NUMBER: 92-02335 WSCA ID NUMBER: 342335
International chemical safety cards: fifth series.
1991

36/6/139 (Item 16 from file: 31)
00454645 WSCA ABSTRACT NUMBER: 92-02137 WSCA ID NUMBER: 342137
Laboratory tests on light organic solvent preservatives for use in Australia. IV. Assessment of several new candidate fungicides.
1988

36/6/140 (Item 17 from file: 31)
00454644 WSCA ABSTRACT NUMBER: 92-02136 WSCA ID NUMBER: 342136
Laboratory tests on light organic solvent preservatives for use in Australia. III. Evaluation of fully-formulated commercial preservatives.
1988

36/6/141 (Item 18 from file: 31)
00454643 WSCA ABSTRACT NUMBER: 92-02135 WSCA ID NUMBER: 342135
Laboratory tests on light organic solvent preservatives for use in
Australia. II. Assessments of further candidate fungicides.
1988

36/6/142 (Item 19 from file: 31)
00450609 WSCA ABSTRACT NUMBER: 91-08125 WSCA ID NUMBER: 328125
Improvements in or relating to preservatives and/or biocides.

36/6/143 (Item 20 from file: 31)
00434082 WSCA ABSTRACT NUMBER: 90-01622 WSCA ID NUMBER: 301622
Complementary acquisition.
1989

36/6/144 (Item 21 from file: 31)
00421634 WSCA ABSTRACT NUMBER: 88-09190 WSCA ID NUMBER: 269190
Standard specification for high-boiling hydrocarbon solvent for preparing
oil-borne preservative solutions.
1986

36/6/145 (Item 22 from file: 31)
00421273 WSCA ABSTRACT NUMBER: 88-08829 WSCA ID NUMBER: 268829
A process and an agent for stabilising tributyltin fungicides for
preservation of wood.

36/6/146 (Item 23 from file: 31)
00418041 WSCA ABSTRACT NUMBER: 88-05597 WSCA ID NUMBER: 265597
Resinous particles and preparation thereof.

36/6/147 (Item 24 from file: 31)
00417158 WSCA ABSTRACT NUMBER: 88-04714 WSCA ID NUMBER: 264714
Comparative laboratory testing of strains of the dry rot fungus Serpula
lacrymans. III. Action of copper naphthenate in wood.
1987

36/6/148 (Item 25 from file: 31)
00417156 WSCA ABSTRACT NUMBER: 88-04712 WSCA ID NUMBER: 264712
Exterior weathering trials on Pinus radiata roofing shingles.
1984

36/6/149 (Item 26 from file: 31)
00415763 WSCA ABSTRACT NUMBER: 88-03319 WSCA ID NUMBER: 263319
Development of novel driers.
1988

36/6/150 (Item 27 from file: 31)
00415236 WSCA ABSTRACT NUMBER: 88-02792 WSCA ID NUMBER: 262792
Coating compositions.

36/6/151 (Item 28 from file: 31)
00410463 WSCA ABSTRACT NUMBER: 87-08087 WSCA ID NUMBER: 248087
Arsenical creosote wood preservatives.
PUBLICATION YEAR: 1987

36/6/152 (Item 29 from file: 31)
00409609 WSCA ABSTRACT NUMBER: 87-07226 WSCA ID NUMBER: 247226
Process for preserving wood.

36/6/153 (Item 30 from file: 31)
00407659 WSCA ABSTRACT NUMBER: 87-05276 WSCA ID NUMBER: 245276
Non-lead driers.
1986

36/6/154 (Item 31 from file: 31)
00404011 WSCA ABSTRACT NUMBER: 87-01628 WSCA ID NUMBER: 241628
Metallic soaps of naphthenic acids. V.
1986

36/6/155 (Item 32 from file: 31)
00404010 WSCA ABSTRACT NUMBER: 87-01627 WSCA ID NUMBER: 241627
Metallic soaps of naphthenic acids. IV.
1986

36/6/156 (Item 33 from file: 31)
00400128 WSCA ABSTRACT NUMBER: 86-07796 WSCA ID NUMBER: 227796
Evaluation of wood preservatives for surface treatment.
1986

36/6/157 (Item 34 from file: 31)
00398993 WSCA ABSTRACT NUMBER: 86-06661 WSCA ID NUMBER: 226661
Metallic soaps of naphthenic acids. I.
1986

36/6/158 (Item 35 from file: 31)
00394178 WSCA ABSTRACT NUMBER: 86-01846 WSCA ID NUMBER: 221846
Role of water repellents and chemicals in controlling mildew on wood exposed outdoors.
1984

36/6/159 (Item 36 from file: 31)
00388526 WSCA ABSTRACT NUMBER: 85-05788 WSCA ID NUMBER: 205788
Water repellents and chemicals in controlling mildew on wood exposed outdoors. I-II.
1985

36/6/160 (Item 37 from file: 31)
00383860 WSCA ABSTRACT NUMBER: 85-01122 WSCA ID NUMBER: 201122
EPA bans consumer market use of pentachlorophenol and creosote.
1984

36/6/161 (Item 38 from file: 31)
00380798 WSCA ABSTRACT NUMBER: 84-08529 WSCA ID NUMBER: 188529
Preparation of coloured pigments for surface coating from petroleum fractions.
1984

36/6/162 (Item 39 from file: 31)
00360799 WSCA ABSTRACT NUMBER: 82-06691 WSCA ID NUMBER: 146691
Metal soap compositions.
PUBLICATION YEAR: 1982

36/6/163 (Item 40 from file: 31)
00356041 WSCA ABSTRACT NUMBER: 82-01932 WSCA ID NUMBER: 141932
Future of biocides as wood preservatives.
1981

36/6/164 (Item 41 from file: 31)
00348861 WSCA ABSTRACT NUMBER: 81-05075 WSCA ID NUMBER: 125075
Performance of mildewcides in a semi-transparent stain wood finish.
1980

36/6/165 (Item 42 from file: 31)
00345237 WSCA ABSTRACT NUMBER: 81-01451 WSCA ID NUMBER: 121451
Wood preservatives ( copper naphthenate).
1977

36/6/166 (Item 43 from file: 31)
00345042 WSCA ABSTRACT NUMBER: 81-01256 WSCA ID NUMBER: 121256
Chemical compounds used as pesticides: recommendations for safe use in the United Kingdom.
1980

36/6/167 (Item 44 from file: 31)
00328896 WSCA ABSTRACT NUMBER: 79-03865 WSCA ID NUMBER: 83865
Organic solvent wood preservatives.
1977

36/6/168 (Item 45 from file: 31)
00324147 WSCA ABSTRACT NUMBER: 78-07707 WSCA ID NUMBER: 67707
Residual pentachlorophenol still limits decay in woodwork 22 years after dip-treating.
1978

36/6/169 (Item 46 from file: 31)
00320787 WSCA ABSTRACT NUMBER: 78-04347 WSCA ID NUMBER: 64347
Photopolymerisable compounds stabilised against premature gelation with copper compounds and thiocarbamates.

36/6/170 (Item 47 from file: 31)
00312918 WSCA ABSTRACT NUMBER: 77-05137 WSCA ID NUMBER: 45137
Hardening unsaturated polyesters.

36/6/171 (Item 48 from file: 31)
00304438 WSCA ABSTRACT NUMBER: 76-04438 WSCA ID NUMBER: 24438
Detection of organic solvent preservatives in wood by thin-layer chromatography.
1975

36/6/172 (Item 49 from file: 31)
00304107 WSCA ABSTRACT NUMBER: 76-04107 WSCA ID NUMBER: 24107
Maleinised diene electropaint binder.

36/6/173 (Item 1 from file: 305)
002068
Methods of analysis of wood preservatives and treated timber. Part 4. Quantitative analysis of preservatives and treated timber containing copper naphthenate.
PD- 1979 ; 790000|

#7
iron octoate or 3130-28-7 or iron(III)octoate or iron(III)2-ethylhexanoate
4 records:

41/6/1 (Item 1 from file: 6)
1701772 NTIS Accession Number: DE92041282
Technology development for iron Fischer-Tropsch catalysts. Technical progress report No. 4, June 26, 1991--September 26, 1991
26 Aug 92

41/6/2 (Item 1 from file: 35)
01177516 ORDER NO: AAD91-26139
PREPARATION AND CHARACTERIZATION OF HEXAGONAL FERRITE FILMS FROM ORGANOMETALLIC PRECURSORS (FERRITE FILMS)
Year: 1991

41/6/3 (Item 1 from file: 31)
00468486 WSCA ABSTRACT NUMBER: 93-05953 WSCA ID NUMBER: 365953
Effect of fumed silica upon the reaction of iron octoate and
polysiloxanes.
1992

41/6/4 (Item 2 from file: 31)
00379003 WSCA ABSTRACT NUMBER: 84-06734 WSCA ID NUMBER: 186734
Photoelectrochemical and dielectric properties of coated iron oxide
electrodes.
1984

#8
lead napthenate or lead naphthenate or 61790-14-5 or naphthenic acid
These 5 records had the terms fate or transport:

6/6/1 (Item 1 from file: 156)
03361837 Subfile: TSCATS-209562
LETTER FROM MAYCO OIL AND CHEMICAL CO TO USEPA IN RESPONSE TO
EPA'S
INQUIRY FOR INFORMATION

6/6/2 (Item 2 from file: 156)
03361836 Subfile: TSCATS-209534
PUBLIC MEETING OF JULY 7,1983: ATTENDEES; ENVIRONMENTAL
PROTECTION
AGENCY, CHEMICAL MANUFACTURES ASSOC, NUODEX INC, MOONEY
CHEMICALS INC, &
TROY CHEMICAL CORP.

6/6/3 (Item 3 from file: 156)
03361832 Subfile: TSCATS-209492
LETTER FROM NATIONAL PAINT & COATINGS ASSOC TO USEPA WITH COVER
LETTER
DATED AUGUST 11, 1983 (REGARDING THE USE OF NAPHTHENATES SALTS BY THE
PAINT
INDUSTRY)

6/6/4 (Item 4 from file: 156)
03361831 Subfile: TSCATS-209490
LETTER FROM MOONEY CHEMICAL TO USEPA (SANITIZED) WITH COVER LETTER DATED
JANUARY 12, 1984 (REGARDING USE OF LEAD NAPHTHENATE)

6/6/5 (Item 5 from file: 156)
03361826 Subfile: TSCATS-209456
COVER LETTER FROM G.V. COX, CMA TO S.NEWBURG-RINN EPA ON THE NAPHTHENATE
METAL SOAPS PROGRAM PANEL WITH ENCLOSURE
Publication Year: 1983

These 141 records did not have the keywords but, they may be of interest:

8/6/1 (Item 1 from file: 156)
03747108 Subfile: TOXBIB-20-046727
Absorption and disposition of cobalt naphthenate in rats after a single oral dose.
Publication Year: 1999

8/6/2 (Item 2 from file: 156)
03690716 Subfile: DART-M-94257930
"Occupational" exposure of infants to toxic chemicals via breast milk.
Publication Year: 1994

8/6/3 (Item 3 from file: 156)
03688050 Subfile: DART-T-94000247
Phase 4, toxicological study no. 75-51-0497-91, assessment of the developmental toxicity of zinc naphthenate in rats, June 1985-July 1988.
Publication Year: 1991

8/6/4 (Item 4 from file: 156)
03386122 Subfile: RISKLINE-90080019
Lead naphthenate
Publication Year: 1988

8/6/5 (Item 5 from file: 156)
03384436 Subfile: RISKLINE-84100004
Lead and lead compounds
Publication Year: 1980

8/6/6 (Item 6 from file: 156)
03373246 Subfile: TSCATS-424805
INITIAL SUBMISSION: ACUTE DERMAL TOXICITY STUDY OF CRUDE NAPHTHENIC
ACID IN RABBITS WITH COVER LETTER DATED 082592
Publication Year: 1992

8/6/7 (Item 7 from file: 156)
03361830 Subfile: TSCATS-209486
LETTER FROM MONSANTO TO TSCA, USEPA WITH COVER LETTER DATED AUGUST 8,
1983 (SUBMITTING TOXICITY DATA ON LEAD AND COBALT NAPTHENATES)

8/6/8 (Item 8 from file: 156)
03361828 Subfile: TSCATS-209472
LETTER DATED 083083 FROM GULF OIL TO TSCA, USEPA WITH ENCLOSURES (CELL
TRANSFORMATION ASSAY & MOUSE LYMPHOMA ASSAY)

8/6/9 (Item 9 from file: 156)
03361827 Subfile: TSCATS-209468
LETTER FROM DUPONT TO USEPA ON THE ACTUE SKIN ADSORPTION TEST ON RABBITS
(8D SUBMISSIONS)

8/6/10 (Item 10 from file: 156)
03356964 Subfile: TSCATS-020846
ACUTE SKIN ABSORPTION TEST ON RABBITS WITH COVER LETTER
Publication Year: 1983

8/6/11 (Item 11 from file: 156)
03356891 Subfile: TSCATS-020734
TOXICITY OF LEAD NAPHTHENATE
Publication Year: 1983

8/6/12 (Item 12 from file: 156)
03356880 Subfile: TSCATS-020720
L5178Y MOUSE LYMPHOMA FORWARD MUTATION ASSAY
Publication Year: 1983

8/6/13 (Item 13 from file: 156)
03356879 Subfile: TSCATS-020718
TOXICITY OF LEAD NAPHTHENATE WITH COVER LETTER
Publication Year: 1983

8/6/14 (Item 14 from file: 156)
03355486 Subfile: TSCATS-018656
OCCUPATIONAL HEALTH EVALUATION OF THE IRVING, TEXAS PLANT OF
KOPPERS CO.,
INC.
Publication Year: 1982

8/6/15 (Item 15 from file: 156)
03323196 Subfile: BIOSIS-98-08484
BIOLOGICAL RELEVANCE AND INTERPRETATION OF POPULATION
HISTOLOGICAL AND
BIOCHEMICAL PARAMETERS IN YELLOW PERCH AN OIL SANDS EXAMPLE
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1997

8/6/16 (Item 16 from file: 156)
03291300 Subfile: BIOSIS-97-11518
Photochemical elimination of phenols and COD in industrial wastewaters.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1997

8/6/17 (Item 17 from file: 156)
03271650 Subfile: BIOSIS-96-33517
Factors that affect the degradation of naphthenic acids in oil sands
wastewater by indigenous microbial communities.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1996

8/6/18 (Item 18 from file: 156)
03255398 Subfile: BIOSIS-96-17256
Use of supercritical fluid extraction and fast ion bombardment mass spectrometry to identify toxic chemicals from a refinery effluent adsorbed onto granular activated carbon.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1996

8/6/19 (Item 19 from file: 156)
03180247 Subfile: BIOSIS-94-11310
AN INVESTIGATION OF THE POTENTIAL FOR IN SITU BIOREMEDIATION OF OIL SANDS
TAILINGS
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1993

8/6/20 (Item 20 from file: 156)
03032083 Subfile: BIOSIS-90-07620
THREE INDUSTRIAL LEAD POISONING INCIDENTS
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1989

8/6/21 (Item 21 from file: 156)
02949037 Subfile: BIOSIS-87-34584
EXCESSIVE LEAD ABSORPTION RESULTING FROM EXPOSURE TO LEAD NAPHTHENATE
BIOSIS COPYRIGHT: BIOL ABS. RRM
Publication Year: 1987

8/6/22 (Item 22 from file: 156)
02774805 Subfile: TOXBIB-96-085759
Lymphomatoid-like contact dermatitis from cobalt naphthenate.
Publication Year: 1995

8/6/23 (Item 23 from file: 156)
02694089 Subfile: TOXBIB-94-326319
Biodegradation of naphthenic acids by microbial populations indigenous to oil sands tailings.
Publication Year: 1994

8/6/24 (Item 24 from file: 156)
02641825 Subfile: TOXBIB-93-364827
Biodegradation of cycloalkane carboxylic acids in oil sand tailings.
Publication Year: 1993

8/6/25 (Item 25 from file: 156)
02583287 Subfile: CIS-93-00043
Lead naphthenate
Publication Year: 1991

8/6/26 (Item 26 from file: 156)
02413332 Subfile: NTIS-BIBRA252
BIBRA Toxicity Profile of lead naphthenate.
Publication Year: 1988

8/6/27 (Item 27 from file: 156)
02413326 Subfile: NTIS-BIBRA245
BIBRA Toxicity Profile of naphthenic acid and its sodium, calcium, zinc a.
Publication Year: 1988

8/6/28 (Item 28 from file: 156)
02387038 Subfile: CIS-89-00860
Skin absorption of lead
Publication Year: 1988

8/6/29 (Item 29 from file: 156)
02165428 Subfile: TOXBIB-88-229967
Lead absorption resulting from exposure to lead naphthenate [letter]
Publication Year: 1988

8/6/30 (Item 30 from file: 156)
02125934 Subfile: TOXBIB-87-132373
A child with perioral eczema.
Publication Year: 1987

8/6/31 (Item 31 from file: 156)
02086445 Subfile: TOXBIB-85-256223
Is cobalt naphthenate an allergen?
Publication Year: 1985

8/6/32 (Item 32 from file: 156)
01615843 Subfile: HEEP-78-04676
Heavy metal pollution among autoworkers: I. Lead.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1977

8/6/33 (Item 33 from file: 156)
01614063 Subfile: HEEP-78-02178
ACUTE TOXICITY AND SUBACUTE TOXICITY OF NAPHTHENIC- ACID
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1977

8/6/34 (Item 34 from file: 156)
01545537 Subfile: TOXBIB-77-060169
Absorption of lead through the skin.
Publication Year: 1976

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01433545 Subfile: TOXBIB-77-060170
Selenium and lead: mutual detoxifying effects.
Publication Year: 1976

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01345078 Subfile: HEEP-74-00263
Photometric methods of determining potassium naphthenate (salt of naphthenic acid) in air.
HEEP COPYRIGHT: BIOL ABS.
Publication Year: 1973

8/6/37 (Item 37 from file: 156)
01155818 Subfile: TOXBIB-75-017000
Toxicity study of lead naphthenate.
Publication Year: 1974

8/6/38 (Item 1 from file: 89)
01862557 GEOREF NO.: 92-64992
TITLE: Naphthenic acids from crude oils of Campos Basin
DATE: 199211

8/6/39 (Item 2 from file: 89)
00522162 GEOREF NO.: 69-34169
TITLE: Distribution of naphthenic acids in an oil-bearing aquifer
DATE: 1969

8/6/40 (Item 1 from file: 40)
00560588 ENVIROLINE NUMBER: 99-01724
Hazardous Listings and Additional Exemptions Finalized for Petroleum Refining Process Wastes
Nov-Dec 98

8/6/41 (Item 2 from file: 40)
00276181 ENVIROLINE NUMBER: 75-00214
Toxicity Study of Lead Naphthenate
Jul 74

8/6/42 (Item 1 from file: 10)
2951242 89061616 Holding Library: AGL
Field trials of copper naphthenate-treated wood
1988

8/6/43 (Item 2 from file: 10)
2929983 89048257 Holding Library: AGL
Naphthenic derivatives of Ligularia macrophylla
1989 Jan

8/6/44 (Item 3 from file: 10)
836054 769077893
Mechanism of plant growth stimulation by naphthenic acid. II. Enzymes of $CO_2$ [carbon dioxide] fixation, $CO_2$ compensation point [kidney] bean embryo respiration [Maize, wheat, sugarbeet]
1976

8/6/45 (Item 4 from file: 10)
726303 759108442
Effect of naphthenic acid on 32P [phosphorus isotope] incorporation in the organs of the bush bean, Phaseolus vulgaris L
1974

8/6/46 (Item 5 from file: 10)
447087 739204440
Mechanism of plant growth stimulation by naphthenic acid. Effects on nitrogen metabolism of Phaseolus vulgaris L. [Kidney beans]
1973

8/6/47 (Item 6 from file: 10)
009964 709007669
Naphthenic acid and related compounds as plant growth regulators
1969

8/6/48 (Item 1 from file: 99)
2066635 H.W. WILSON RECORD NUMBER: BAST00022146
Materials for naphthenic acid service
AUGMENTED TITLE: question and answers
20000300

8/6/49 (Item 2 from file: 99)
2052302 H.W. WILSON RECORD NUMBER: BAST94060868
The use of naphthenic acid ester as a dispersing agent in aqueous conductive primers
19940900

8/6/50 (Item 3 from file: 99)
1787131 H.W. WILSON RECORD NUMBER: BAST98076315
Factors controlling naphthenic acid corrosion
19981100

8/6/51 (Item 4 from file: 99)
1481719 H.W. WILSON RECORD NUMBER: BAST97021698
New technology appears to perform several processes in one step
AUGMENTED TITLE: Darcy process
19970317

8/6/52 (Item 5 from file: 99)
1150638 H.W. WILSON RECORD NUMBER: BAST94019198
Phosphate ester inhibitors solve naphthenic acid corrosion problems
19940228

8/6/53 (Item 6 from file: 99)
1099143 H.W. WILSON RECORD NUMBER: BAST93031245
Design process equipment for corrosion control
19930500

8/6/54 (Item 7 from file: 99)
1090917 H.W. WILSON RECORD NUMBER: BAST93023002
Naphthenic acid corrosion in refinery settings
19930400

8/6/55 (Item 8 from file: 99)
0764392 H.W. WILSON RECORD NUMBER: BAST88006731
Naphthenic acid corrosion in crude distillation units
19880100

8/6/56 (Item 1 from file: 292)
00928818 SUPPLIER NO. 2227804
Acidic biomarkers from Albacora oils, Campos Basin, Brazil
1999

8/6/57 (Item 2 from file: 292)
00500707 SUPPLIER NO. 0950577
Compounds formed by gold and mercury with organic acids in Cheleken-
Peninsula hot brines
REPRINT TITLE: translated from: Geokhimiya, 9, 1991, pp 1353-1358
1992

8/6/58 (Item 3 from file: 292)
00244510 SUPPLIER NO. 0600708
Naphthenic acid corrosion in petroleum refineries. A review.
1986

8/6/59 (Item 1 from file: 44)
00188095 ASFA Accession Number: 0912497
Effects of sodium naphthenate on survival and some
physiological-biochemical parameters of some fishes.
, 1983

8/6/60 (Item 1 from file: 6)
1960760 NTIS Accession Number: BIBRA252
BIBRA Toxicity Profile of lead naphthenate
1988

8/6/61 (Item 2 from file: 6)
1960753 NTIS Accession Number: BIBRA245
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zinc a
1988

8/6/62 (Item 3 from file: 6)
1921175 NTIS Accession Number: N96-11130/7
XPS Study of the Chemical Interactions of the Extreme Pressure Lubricant
Additive Lead Naphthenate with Titanium and Titanium Compound Surfaces
1 Sep 94

8/6/63 (Item 4 from file: 6)
1743832 NTIS Accession Number: N93-27602/0
Investigation of Multiply Alkylated Cyclopentane Synthetic Oil and Lead
Naphthenate Additive under Boundary Contact Interactions
15 Apr 93

8/6/64 (Item 5 from file: 6)
1721370 NTIS Accession Number: AD-A261 065/7
Interaction of O2 with the Fe.84 Cr.16 (001) Surface Studied by
Photoelectron Spectroscopy
15 Jul 92

8/6/65 (Item 6 from file: 6)
1691831 NTIS Accession Number: AD-A256 458/1
Influence of Steel Surface Chemistry on the Bonding of Lubricant Films
(Technical rept)
1 Sep 92

8/6/66 (Item 7 from file: 6)
1685869 NTIS Accession Number: AD-A255 828/6
Chemistry of the Extreme Pressure Lubricant Additive Lead Naphthenate on Steel Surfaces
(Technical rept)
1 Sep 92

8/6/67 (Item 8 from file: 6)
1061964 NTIS Accession Number: PB83-252494
Preservative Treatment of Hardwoods: A Review
(Forest Service general technical rept)
1981

8/6/68 (Item 9 from file: 6)
0878135 NTIS Accession Number: AD-A093 759/9/XAB
Isotopic Determination of Lead by Secondary Ion Mass Spectrometry
(Interim rept)
15 Dec 80

8/6/69 (Item 10 from file: 6)
0874897 NTIS Accession Number: PB81-134405/XAB
Microemulsion Formation in Some Extractants and Its Effects on Extraction Mechanism
28 Jul 79

8/6/70 (Item 11 from file: 6)
0856375 NTIS Accession Number: AD-A089 895/7/XAB
X-Ray Photoelectron Spectroscopy Study of the Chemisorption of Lead Naphthenate to Nucleophilic Surfaces
(Interim rept)
10 Sep 80

8/6/71 (Item 1 from file: 50)
03817820 CAB Accession Number: 990613083
Ultraviolet spectrophotometry and fourier transform infrared spectroscopy characterization of copper naphthenate.

8/6/72 (Item 2 from file: 50)
03754198 CAB Accession Number: 990608521
Development of naphthenic acid fractionation with supercritical fluid extraction for use in wood decay testing.
Proceedings, Ninety-Fourth Annual Meeting of the American Wood-Preservers' Association, Scottsdale, Arizona, USA, 17-19 May, 1998.

8/6/73 (Item 3 from file: 50)
03532439 CAB Accession Number: 981905995
Enthalpy of adsorption and isotherms for adsorption of naphthenic acid onto clays.

8/6/74 (Item 4 from file: 50)
02615574 CAB Accession Number: 920662560
Protection of western redcedar sapwood from decay.

8/6/75 (Item 5 from file: 50)
01444140 CAB Accession Number: 841984065
Method of removal of fluorine salts from wet-process phosphoric acid.

8/6/76 (Item 6 from file: 50)
00507242 CAB Accession Number: 770762824
Metabolism and distribution of cyclohexanecarboxylic acid, a plant growth stimulant, in bush bean.

8/6/77 (Item 7 from file: 50)
00352023 CAB Accession Number: 760345598
Mechanism of plant growth stimulation by naphthenic acid. II. Enzymes of CO2 fixation, CO2 compensation point, bean embryo respiration.

8/6/78 (Item 8 from file: 50)
00267882 CAB Accession Number: 750730760
Distribution, metabolism, and localisation of cyclohexanecarboxylic acid, a naphthenic acid in Phaseolus vulgaris L.

8/6/79 (Item 9 from file: 50)
00235488 CAB Accession Number: 750335050
Pattern of growth response of bean, Phaseolus vulgaris L. to naphthenic and cyclohexanecarboxylic acids.

8/6/80 (Item 10 from file: 50)
00234517 CAB Accession Number: 750328332
Effect of naphthenic acid on 32P incorporation in the organs of the bush bean, Phaseolus vulgaris L.

8/6/81 (Item 11 from file: 50)
00134972 CAB Accession Number: 740326178
Structure of some cyclohexyl compounds as related to their ability to stimulate plant growth.

8/6/82 (Item 1 from file: 35)
01212434 ORDER NO: NOT AVAILABLE FROM UNIVERSITY MICROFILMS INT'L.
FABRICATION OF SUPERCONDUCTING WIRE USING ORGANOMETALLIC PRECURSORS AND
INFILTRATION
Year: 1991

8/6/83 (Item 2 from file: 35)
929281 ORDER NO: AAD86-19177
MECHANISMS OF FATIGUE IN AISI 304 AND 316 STAINLESS STEELS UNDER VISCOUS
OIL ENVIRONMENTS, INCLUDING A COAL PROCESS SOLVENT (CRACK INITIATION, GROWTH)
Year: 1986

8/6/84 (Item 3 from file: 35)
050965 ORDER NO: NOT AVAILABLE FROM UNIVERSITY MICROFILMS INT'L.
ISOLATION AND STUDY OF A C(10)H(18)O(2) NAPHTHENIC ACID OBTAINED FROM A
CALIFORNIA STRAIGHTRUN GASOLINE DISTILLATE
Year: 1941

8/6/85 (Item 1 from file: 31)
00535440 WSCA ABSTRACT NUMBER: 00-03962 WSCA ID NUMBER: 503962
Studies on cyclohexanone-formaldehyde/styrenated cashew nutshell liquid (CNSL) coatings.
2000

8/6/86 (Item 2 from file: 31)
00527489 WSCA ABSTRACT NUMBER: 99-06041 WSCA ID NUMBER: 486041
Effect of dissolved transition metal complexes on the rate of yellowing of
linseed oil.
1999

8/6/87 (Item 3 from file: 31)
00498266 WSCA ABSTRACT NUMBER: 96-05883 WSCA ID NUMBER: 425883
Resinated 2,9-dimethylquinacridone.
PUBLICATION YEAR: 1995

8/6/88 (Item 4 from file: 31)
00497969 WSCA ABSTRACT NUMBER: 96-06055 WSCA ID NUMBER: 426055
Cycloaliphatic epoxy and primary hydroxyl group-containing cationic resin.
PUBLICATION YEAR: 1995

8/6/89 (Item 5 from file: 31)
00496015 WSCA ABSTRACT NUMBER: 96-03447 WSCA ID NUMBER: 423447
Naphthenic acid esters as dispersing agents for pigment additives and
products incorporating same.
PUBLICATION YEAR: 1995

8/6/90 (Item 6 from file: 31)
00482389 WSCA ABSTRACT NUMBER: 95-00041 WSCA ID NUMBER: 400041
Use of naphthenic acid ester and a dispersing agent in aqueous
conductive primers.
1994

8/6/91 (Item 7 from file: 31)
00475352 WSCA ABSTRACT NUMBER: 94-02607 WSCA ID NUMBER: 382607
Cathodic electrocoat primer containing water-insoluble organo-lead
compounds as corrosion inhibitors.

8/6/92 (Item 8 from file: 31)
00456987 WSCA ABSTRACT NUMBER: 92-04479 WSCA ID NUMBER: 344479
Water-soluble linseed oil alkyds.
1991

8/6/93 (Item 9 from file: 31)
00454843 WSCA ABSTRACT NUMBER: 92-02335 WSCA ID NUMBER: 342335
International chemical safety cards: fifth series.
1991

8/6/94 (Item 10 from file: 31)
00432513 WSCA ABSTRACT NUMBER: 90-00053 WSCA ID NUMBER: 300053
Naphthenic acid. V.
1989

8/6/95 (Item 11 from file: 31)
00432097 WSCA ABSTRACT NUMBER: 89-09644 WSCA ID NUMBER: 289644
Investigation of network formation in drying oils by dilute solution viscometry.
1989

8/6/96 (Item 12 from file: 31)
00422455 WSCA ABSTRACT NUMBER: 89-00002 WSCA ID NUMBER: 280002
Coloured pigments from petroleum oxy acids for surface coatings.
1988

8/6/97 (Item 13 from file: 31)
00418440 WSCA ABSTRACT NUMBER: 88-05996 WSCA ID NUMBER: 265996
Naphthenic acid. III.
1988

8/6/98 (Item 14 from file: 31)
00414789 WSCA ABSTRACT NUMBER: 88-02345 WSCA ID NUMBER: 262345
Excessive lead absorption resulting from exposure to lead naphthenate.
1987

8/6/99 (Item 15 from file: 31)
00414064 WSCA ABSTRACT NUMBER: 88-01620 WSCA ID NUMBER: 261620
Naphthenic acid. II.
1987

8/6/100 (Item 16 from file: 31)
00412920 WSCA ABSTRACT NUMBER: 88-00476 WSCA ID NUMBER: 260476
Factors affecting salt spray resistance of aqueous coatings on metal.
1987

8/6/101 (Item 17 from file: 31)
00411832 WSCA ABSTRACT NUMBER: 87-09456 WSCA ID NUMBER: 249456
Aliphatic polyurethane sprayable coating compositions and method of preparation.

8/6/102 (Item 18 from file: 31)
00409252 WSCA ABSTRACT NUMBER: 87-06869 WSCA ID NUMBER: 246869
Naphthenic acid.
1987

8/6/103 (Item 19 from file: 31)
00404013 WSCA ABSTRACT NUMBER: 87-01630 WSCA ID NUMBER: 241630
Metallic soaps of naphthenic acids. VIII.
1986

8/6/104 (Item 20 from file: 31)
00404012 WSCA ABSTRACT NUMBER: 87-01629 WSCA ID NUMBER: 241629
Metallic soaps of naphthenic acids. VI.
1986

8/6/105 (Item 21 from file: 31)
00404011 WSCA ABSTRACT NUMBER: 87-01628 WSCA ID NUMBER: 241628
Metallic soaps of naphthenic acids. V.
1986

8/6/106 (Item 22 from file: 31)
00400710 WSCA ABSTRACT NUMBER: 86-08378 WSCA ID NUMBER: 228378
Effect of oil length of alkyd on the physico-chemical properties of its coatings.
1986

8/6/107 (Item 23 from file: 31)
00398993 WSCA ABSTRACT NUMBER: 86-06661 WSCA ID NUMBER: 226661
Metallic soaps of naphthenic acids. I.
1986

8/6/108 (Item 24 from file: 31)
00395588 WSCA ABSTRACT NUMBER: 86-03256 WSCA ID NUMBER: 223256
Catalyst compositions for polyaliphatic isocyanate-based polyurethanes.
PUBLICATION YEAR: 1985

8/6/109 (Item 25 from file: 31)
00393940 WSCA ABSTRACT NUMBER: 86-01608 WSCA ID NUMBER: 221608
Catalyst systems for polyurethane compositions.

8/6/110 (Item 26 from file: 31)
00392398 WSCA ABSTRACT NUMBER: 86-00066 WSCA ID NUMBER: 220066
Improvements in the adhesion of rubber to metals.

8/6/111 (Item 27 from file: 31)
00390899 WSCA ABSTRACT NUMBER: 85-08161 WSCA ID NUMBER: 208161
Cold paint stripping composition.
PUBLICATION YEAR: 1985

8/6/112 (Item 28 from file: 31)
00380798 WSCA ABSTRACT NUMBER: 84-08529 WSCA ID NUMBER: 188529
Preparation of coloured pigments for surface coating from petroleum
fractions.
1984

8/6/113 (Item 29 from file: 31)
00365557 WSCA ABSTRACT NUMBER: 83-01926 WSCA ID NUMBER: 161926
Calcium carbonate pigment production.
PUBLICATION YEAR: 1982

8/6/114 (Item 30 from file: 31)
00359918 WSCA ABSTRACT NUMBER: 82-05810 WSCA ID NUMBER: 145810
Oil-soluble manganese salts.

8/6/115 (Item 31 from file: 31)
00358136 WSCA ABSTRACT NUMBER: 82-04028 WSCA ID NUMBER: 144028
Unsaturated resin hardening accelerator mixture.

8/6/116 (Item 32 from file: 31)
00357279 WSCA ABSTRACT NUMBER: 82-03171 WSCA ID NUMBER: 143171
Flowability of rutile pigment.
PUBLICATION YEAR: 1981

8/6/117 (Item 33 from file: 31)
00352001 WSCA ABSTRACT NUMBER: 81-08215 WSCA ID NUMBER: 128215
Standard specification for liquid paint driers.
1981

8/6/118 (Item 34 from file: 31)
00347633 WSCA ABSTRACT NUMBER: 81-03847 WSCA ID NUMBER: 123847
Radioisotope tracer technique of measuring adsorption of paint driers by pigments.
1980

8/6/119 (Item 35 from file: 31)
00345965 WSCA ABSTRACT NUMBER: 81-02179 WSCA ID NUMBER: 122179
Oligotrimerisation of hexamethylene diisocyanate by organometallic catalysts.
1980

8/6/120 (Item 36 from file: 31)
00345964 WSCA ABSTRACT NUMBER: 81-02178 WSCA ID NUMBER: 122178
Synergistic effects in the trimerisation of isocyanates by organometallic catalysts.
1980

8/6/121 (Item 37 from file: 31)
00342011 WSCA ABSTRACT NUMBER: 80-07885 WSCA ID NUMBER: 107885
Rosin-containing compositions.

8/6/122 (Item 38 from file: 31)
00337990 WSCA ABSTRACT NUMBER: 80-03863 WSCA ID NUMBER: 103863
Effect of catalyst concentration in the preparation of a soya alkyd resin
by glycerolysis.
1979

8/6/123 (Item 39 from file: 31)
00331170 WSCA ABSTRACT NUMBER: 79-06140 WSCA ID NUMBER: 86140
Impregnating liquid for wood and wood products.
PUBLICATION YEAR: 1979

8/6/124 (Item 40 from file: 31)
00325003 WSCA ABSTRACT NUMBER: 78-08563 WSCA ID NUMBER: 68563
OSHA issues tentative list of carcinogens for possible regulation.
1978

8/6/125 (Item 41 from file: 31)
00322292 WSCA ABSTRACT NUMBER: 78-05852 WSCA ID NUMBER: 65852
Drier composition and yellowing of linseed oil films.
1978

8/6/126 (Item 42 from file: 31)
00317820 WSCA ABSTRACT NUMBER: 78-01380 WSCA ID NUMBER: 61380
Selenium and lead: mutual detoxifying effects.
1976

8/6/127 (Item 43 from file: 31)
00316532 WSCA ABSTRACT NUMBER: 78-00092 WSCA ID NUMBER: 60092
Non-toxic drier systems.
1977

8/6/128 (Item 44 from file: 31)
00316240 WSCA ABSTRACT NUMBER: 77-08459 WSCA ID NUMBER: 48459
Polyurethane wire enamel.

8/6/129 (Item 45 from file: 31)
00314593 WSCA ABSTRACT NUMBER: 77-06812 WSCA ID NUMBER: 46812
Urethane resin film formation.

8/6/130 (Item 46 from file: 31)
00311181 WSCA ABSTRACT NUMBER: 77-03400 WSCA ID NUMBER: 43400
Diallyl phthalate resin hardening.

8/6/131 (Item 47 from file: 31)
00308194 WSCA ABSTRACT NUMBER: 77-00413 WSCA ID NUMBER: 40413
Marine antifouling compositions.

8/6/132 (Item 48 from file: 31)
00305909 WSCA ABSTRACT NUMBER: 76-05909 WSCA ID NUMBER: 25909
Metal carboxylate alkoxy alcoholate composition and process.

8/6/133 (Item 49 from file: 31)
00305635 WSCA ABSTRACT NUMBER: 76-05635 WSCA ID NUMBER: 25635
Rust-inhibiting coating compositions.

8/6/134 (Item 50 from file: 31)
00304052 WSCA ABSTRACT NUMBER: 76-04052 WSCA ID NUMBER: 24052
White alkyd enamel.

8/6/135 (Item 1 from file: 305)
282534
Extraction of uranium(VI) with binary mixture of LIX 984 and naphthenic acid.
PD- 1998 ; 980000|

8/6/136 (Item 2 from file: 305)
279557
Analysis and characterization of naphthenic acids by gas chromatography-electron impact mass spectrometry of tert.-butyldimethylsilyl derivatives.
PD- 22 May 1998 ; 980522|

8/6/137 (Item 3 from file: 305)
275505
Synergistic solvent extraction studies of uranium(VI) using a combination of naphthenic acid and various neutral donors into benzene.
PD- Jan 1998 ; 980100|

8/6/138 (Item 4 from file: 305)
229482
Two-phase potentiometric metal extraction titrations of silver(I), copper(II) and cadmium(II) using some cation-exchangers as extractants.
PD- Jan 1995 ; 950100|

8/6/139 (Item 5 from file: 305)
187176
Characterization of naphthenic acids in petroleum by fast-atom-bombardment mass spectrometry.
PD- May-Jun 1991 ; 910500 910600|

8/6/140 (Item 6 from file: 305)
176659
Fluorimetric determination of micro amounts of aluminium in steel.
PD- Mar 1991 ; 910300|

8/6/141 (Item 7 from file: 305)
000939
Use of " naphthenic acid" and LIX 64N for separation of copper and nickel.
PD- 1979 ; 790000|

#9
lead oleate
2 records:

9/6/1 (Item 1 from file: 31)
00475352 WSCA ABSTRACT NUMBER: 94-02607 WSCA ID NUMBER: 382607
Cathodic electrocoat primer containing water-insoluble organo-lead compounds as corrosion inhibitors.

9/6/2 (Item 2 from file: 31)
00456368 WSCA ABSTRACT NUMBER: 92-03860 WSCA ID NUMBER: 343860
Phase behaviour of metal(II) soaps in one-, two-, and three-component systems.
1990

#10
magnesium octoate
1 record:

11/6/1 (Item 1 from file: 31)
00502951 WSCA ABSTRACT NUMBER: 97-00984 WSCA ID NUMBER: 440984
Consolidation of stone by mixtures of alkoxysilane and acrylic polymer.
1996

#11
magnesium oleate
2 records:

15/6/1 (Item 1 from file: 117)
00793871 WRA NUMBER: 3874105
Comparative study of selective separation of magnesium from brine and
seawater
1995

15/6/2 (Item 1 from file: 31)
00340946 WSCA ABSTRACT NUMBER: 80-06820 WSCA ID NUMBER: 106820
Antifouling composition containing electrically conductive additive.
PUBLICATION YEAR: 1980

#12
zinc octoate
18 records:

18/6/1 (Item 1 from file: 156)
03368107 Subfile: TSCATS-410593
28 DAYS SUBACUTE ORAL TOXICITY STUDY IN RATS (GAVAGE)
Publication Year: 1990

18/6/2 (Item 2 from file: 156)
02878201 Subfile: BIOSIS-86-20668
The residual effects of remedial timber treatments on bats.
BIOSIS COPYRIGHT: BIOL ABS.
Publication Year: 1986

18/6/3 (Item 1 from file: 31)
00470987 WSCA ABSTRACT NUMBER: 93-08570 WSCA ID NUMBER: 368570
Characterisation of bisphenol A based cyanate ester resin systems.
1991

18/6/4 (Item 2 from file: 31)
00465738 WSCA ABSTRACT NUMBER: 93-03808 WSCA ID NUMBER: 363808
Drying and hardening behaviour of paint films based on acrylic resins.
1992

18/6/5 (Item 3 from file: 31)
00461192 WSCA ABSTRACT NUMBER: 92-08684 WSCA ID NUMBER: 348684
Mildew-resistant paint compositions.

18/6/6 (Item 4 from file: 31)
00451076 WSCA ABSTRACT NUMBER: 91-08592 WSCA ID NUMBER: 328592
Kinetics of cross-linking of polyhydroxyethyl acrylate with isocyanates.
1991

18/6/7 (Item 5 from file: 31)
00425233 WSCA ABSTRACT NUMBER: 89-02780 WSCA ID NUMBER: 282780
Thermal shock resistant silicone coatings.

18/6/8 (Item 6 from file: 31)
00423368 WSCA ABSTRACT NUMBER: 89-00915 WSCA ID NUMBER: 280915
Comb-like polysiloxanes with oligo(oxyethylene) side chains. Synthesis and properties.
1988

18/6/9 (Item 7 from file: 31)
00390334 WSCA ABSTRACT NUMBER: 85-07596 WSCA ID NUMBER: 207596
Microhardness test for monitoring the thermal stabilisation of solid polyvinyl chloride.
1985

18/6/10 (Item 8 from file: 31)
00358140 WSCA ABSTRACT NUMBER: 82-04032 WSCA ID NUMBER: 144032
Rapid curing epoxy resin compositions for casting, moulding or adhesives.

18/6/11 (Item 9 from file: 31)
00330911 WSCA ABSTRACT NUMBER: 79-05880 WSCA ID NUMBER: 85880
Polyurethane car finishes.

18/6/12 (Item 10 from file: 31)
00323963 WSCA ABSTRACT NUMBER: 78-07523 WSCA ID NUMBER: 67523
Decal and method of making same.

18/6/13 (Item 11 from file: 31)
00321099 WSCA ABSTRACT NUMBER: 78-04659 WSCA ID NUMBER: 64659
Polyurethane stoving enamels.

18/6/14 (Item 12 from file: 31)
00320633 WSCA ABSTRACT NUMBER: 78-04193 WSCA ID NUMBER: 64193
Electric insulator varnishes.

18/6/15 (Item 13 from file: 31)
00314645 WSCA ABSTRACT NUMBER: 77-06864 WSCA ID NUMBER: 46864
Polyester-imide wire enamels.

18/6/16 (Item 14 from file: 31)
00308440 WSCA ABSTRACT NUMBER: 77-00659 WSCA ID NUMBER: 40659
Preparation and application of drying agents in paints.
1976

18/6/17 (Item 15 from file: 31)
00307255 WSCA ABSTRACT NUMBER: 76-07255 WSCA ID NUMBER: 27255
Epoxy resin compositions containing latent hardeners.

18/6/18 (Item 16 from file: 31)
00303984 WSCA ABSTRACT NUMBER: 76-03984 WSCA ID NUMBER: 23984
Epoxy resin compositions.

#13
zinc oleate
7 records:

21/6/1 (Item 1 from file: 156)
03380321 Subfile: TSCATS-443702
INITIAL SUBMISSION: L5178Y TK+/- MOUSE LYMPHOMA MUTAGENESIS ASSAY WITH
NINE ZINC DIALKYL DITHIOPHOSPHATES AND CALCIUM DIALKYL DITHIOPHOSPHATE,
ZINC OLEATE AND ZINC CHLORIDE
Publication Year: 1994

21/6/2 (Item 2 from file: 156)
03380237 Subfile: TSCATS-443563
INITIAL SUBMISSION: L5178Y TK+/- MOUSE LYMPHOMA MUTAGENESIS ASSAY OF 9
ZINC DIALKYL DITHIOPHOSPHATES, CALCIUM DIALKYL DITHIOPHOSPHATE, ZINC
OLEATE, AND ZINC CHLORIDE
Publication Year: 1994

21/6/3 (Item 3 from file: 156)
03359230 Subfile: TSCATS-031116
L5178Y TK+/- MOUSE LYMPHONA MUTAGENESIS ASSAY NINE ZINC DIALKYLDITHIOPHOSPHATE AND CALCIUM DIALKYL DITHIOPHOSPHATE, ZINC OLEATE
, LOT NO. 34495-10 AND ZINC CHLORIDE, LOT NO. KTJ
Publication Year: 1984

21/6/4 (Item 1 from file: 50)
00808878 CAB Accession Number: 782218555
Sheep blowfly breech strike control using aluminium alkoxide gellants.

21/6/5 (Item 1 from file: 31)
00456194 WSCA ABSTRACT NUMBER: 92-03686 WSCA ID NUMBER: 343686
Anticorrosive pigment composition and an anticorrosive coating composition
containing the same.

21/6/6 (Item 2 from file: 31)
00325941 WSCA ABSTRACT NUMBER: 79-00909 WSCA ID NUMBER: 80909
Magnetic recording media.
PUBLICATION YEAR: 1978

21/6/7 (Item 3 from file: 31)
00316293 WSCA ABSTRACT NUMBER: 77-08512 WSCA ID NUMBER: 48512
Lubricity coating for plastics-coated glass articles.

#14
zirconium octoate
7 records:

24/6/1 (Item 1 from file: 6)
1456491 NTIS Accession Number: AD-A210 149/1
Metal Oxide Films from Carboxylate Precursors
1988

24/6/2 (Item 1 from file: 31)
00463963 WSCA ABSTRACT NUMBER: 93-00977 WSCA ID NUMBER: 360977
N-(Carboxymethyl)trimellitimide-based polyester-imides as film formers for air-drying protective coatings.
1991

24/6/3 (Item 2 from file: 31)
00455263 WSCA ABSTRACT NUMBER: 92-02755 WSCA ID NUMBER: 342755
Heat-resistant, isocyanurate-containing polyurethane adhesives.
1991

24/6/4 (Item 3 from file: 31)
00425233 WSCA ABSTRACT NUMBER: 89-02780 WSCA ID NUMBER: 282780
Thermal shock resistant silicone coatings.

24/6/5 (Item 4 from file: 31)
00425020 WSCA ABSTRACT NUMBER: 89-02567 WSCA ID NUMBER: 282567
Solventless silicone coating compositions.

24/6/6 (Item 5 from file: 31)
00362909 WSCA ABSTRACT NUMBER: 82-08801 WSCA ID NUMBER: 148801
Drier compositions for air-drying coatings.
1982

24/6/7 (Item 6 from file: 31)
00308440 WSCA ABSTRACT NUMBER: 77-00659 WSCA ID NUMBER: 40659
Preparation and application of drying agents in paints.
1976

# Attachment D

# Abstracts Ordered

7/9/1
DIALOG(R)File 156:Toxline(R)


03818646 Subfile: BIOSIS-00-20220
Formation of chlorinated dioxins and furans in a hazardous-waste-firing industrial boiler.
GULLETT BK; TOUATI A; LEE C
Office of Research and Development, U.S. Environmental Protection Agency, National Risk Management Research Laboratory (MD-65
Source: ENVIRONMENTAL SCIENCE & TECHNOLOGY; 34 (11). 2000. 2069-2074.
Coden: ESTHA
Language: ENGLISH
Journal Announcement: 0010
BIOSIS COPYRIGHT: BIOL ABS. This research examined the potential for emissions of polychlorinated dibenzodioxin and dibenzofuran (PCDD/F) from industrial boilers that cofire hazardous waste. PCDD/F emissions were sampled from a 732 kW (2.5h), 3-pass, firetube boiler using #2 fuel oil cofired with 2,4-dichlorophenol or 1,2-dichlorobenzene and a copper naphthenate mixture. PCDD/F levels were significantly elevated when improved combustion conditions (reduced carbon monoxide, increased carbon dioxide) followed periods of flame wall-impingement and soot formation/deposition on the boiler tubes. Boiler tube deposits became a sink and source for PCDD/F reactants (copper and chlorine) and PCDD/F, resulting in continued formation and emissions long after waste cofiring ceased. The role of deposits in PCDD/F formation makes emissions dependent on current as well as previous firing conditions, resulting in uncerta inty regarding prediction of emissions based solely on the type and rate of cofired hazardous waste.
Descriptors/Keywords: Biochemical Studies-General; Toxicology-Environment al and Industrial Toxicology; Public Health: Environmental Health-Sewage Disposal and Sanitary Measures ; Public Health: Environmental Health-Air, Water and Soil Pollution; *ENVIRONMENTAL POLLUTANTS--Poisoning--PO; *OCCUPATIONAL DISEASES; BIOCHEMISTRY; SANITATION; SEWAGE; AIR POLLUTION;
SOIL POLLUTANTS; WATER POLLUTION
CAS Registry No.: 55722-27-5; 41903-57-5; 37871-00-4; 36088-22-9; 34465-46-8; 55684-94-1; 38998-75-3; 30402-15-4; 3268-87-9; 39001-02-0

7/9/2
DIALOG(R)File 156:Toxline(R)


03390048 Subfile: RISKLINE-97080020
Cobalt Naphthenate

BIBRA working group
Source: Toxicity profile. BIBRA International; 1997; 5 p
Language: ENGLISH
Journal Announcement: 9903
Cobalt naphthenate has induced allergic skin reactions in workers. It was a mild eye irritant in rabbits, and had a low acute oral toxicity in rats and a moderate-to-low acute dermal toxicity in rabbits. In mice, repeated injection resulted in tissue damage and tumour development at the site or injection. Cobalt naphthenate was not mutagenic to bacteria in Ames tests.
Descriptors/Keywords: ANIMAL; acute toxicity; irritancy; carcinogenicity; genetic toxicity; eye; skin; HUMAN; case report; occupational exposure; hypersensitivity; skin
CAS Registry No.: 61789-51-3

7/9/3
DIALOG(R)File 156:Toxline(R)


03362155 Subfile: TSCATS-302398
LETTER FROM DYNAMAC CORP TO TSCA INTERAGENCY TESTING COMMITTEE REGARDING
THE PHYSCIAL AND CHEMICAL PROPERTIES, PRODUCTION & USE OF CADIUM
2-ETHYLHEXANOATE
Source: EPA/OTS; Doc #40-8397081
Language: UNSPECIFIED
Contract Number: 40-8397081
Classification Code: TSCA Sect. 4 Rec 00/00/00
Order Info.: NTIS/OTS0513014
Journal Announcement: 9903
Descriptors/Keywords: DYNAMAC CORP; 2-ETHYLHEXANOIC ACID; ENVIRONMENTAL
FATE; PRODUCTION AND PROCESS
CAS Registry No.: 2420-98-6

7/9/4
DIALOG(R)File 156:Toxline(R)


03362154 Subfile: TSCATS-302396
LETTER FROM DYNAMAC CORPORATION TO TSCA INTERAGENCY TESTING COMMITTEE
REGARDING PHYSICAL AND CHEMICAL PROPERTIES OF CADMIUM
2-ETHYLHEXANOATE

Source: EPA/OTS; Doc #40-8397080
Language: UNSPECIFIED
Contract Number: 40-8397080
Classification Code: TSCA Sect. 4 Rec 00/00/00
Order Info.: NTIS/OTS0513014
Journal Announcement: 9903
Descriptors/Keywords: DYNAMAC CORP; 2-ETHYLHEXANOIC ACID;
ENVIRONMENTAL
FATE; PHYSICAL/CHEMICAL PROPERTIES; WATER SOLUBILITY; VAPOR PRESSURE
CAS Registry No.: 2420-98-6

7/9/5
DIALOG(R)File 156:Toxline(R)


03361837 Subfile: TSCATS-209562
LETTER FROM MAYCO OIL AND CHEMICAL CO TO USEPA IN RESPONSE TO
EPA'S
INQUIRY FOR INFORMATION
Source: EPA/OTS; Doc #40-8371069
Language: UNSPECIFIED
Contract Number: 40-8371069
Classification Code: TSCA Sect. 4 Rec 00/00/00
Order Info.: NTIS/OTS0512232
Journal Announcement: 9903
Descriptors/Keywords: MAYCO OIL & CHEMICAL CO; NAPHTHENATE;
ENVIRONMENTAL
FATE; PRODUCTION AND PROCESS
CAS Registry No.: 61790-14-5

7/9/6
DIALOG(R)File 156:Toxline(R)


03361832 Subfile: TSCATS-209492
LETTER FROM NATIONAL PAINT & COATINGS ASSOC TO USEPA WITH COVER
LETTER
DATED AUGUST 11, 1983 (REGARDING THE USE OF NAPHTHENATES SALTS BY THE
PAINT
INDUSTRY)
Source: EPA/OTS; Doc #40-8371029
Language: UNSPECIFIED
Contract Number: 40-8371029
Classification Code: TSCA Sect. 4 Rec 00/00/00

Order Info.: NTIS/OTS0512208
Journal Announcement: 9903
Descriptors/Keywords: NATL PAINT & COATINGS ASSOC; NAPHTHENATE; ENVIRONMENTAL FATE; PRODUCTION AND PROCESS
CAS Registry No.: 61789-36-4; 61789-51-3; 61790-14-5

7/9/7
DIALOG(R)File 156:Toxline(R)


03361831 Subfile: TSCATS-209490
LETTER FROM MOONEY CHEMICAL TO USEPA (SANITIZED) WITH COVER LETTER DATED
JANUARY 12, 1984 (REGARDING USE OF LEAD NAPHTHENATE)
Source: EPA/OTS; Doc #40-8471028
Language: UNSPECIFIED
Contract Number: 40-8471028
Classification Code: TSCA Sect. 4 Rec 00/00/00
Order Info.: NTIS/OTS0512207
Journal Announcement: 9903
Descriptors/Keywords: MOONEY CHEMICALS INC; NAPHTHENATE; ENVIRONMENTAL
FATE; PRODUCTION AND PROCESS
CAS Registry No.: 61790-14-5

7/9/8
DIALOG(R)File 156:Toxline(R)


03361829 Subfile: TSCATS-209480
LETTER FROM INTERSTATE CHEM TO CHEMIAL MANUF ASSOC WITH ENCLOSURE
(REGARDING FUCTION OF COBALT NAPHTHANATE IN PAINT)
Source: EPA/OTS; Doc #40-8371022
Language: UNSPECIFIED
Contract Number: 40-8371022
Classification Code: TSCA Sect. 4 Rec 01/05/83
Order Info.: NTIS/OTS0512202
Journal Announcement: 9903
Descriptors/Keywords: INTERSTAB CHEMS INC; NAPHTHENATE; ENVIRONMENTAL
FATE; PRODUCTION AND PROCESS
CAS Registry No.: 61789-51-3

7/9/9
DIALOG(R)File 156:Toxline(R)


03271650 Subfile: BIOSIS-96-33517
Factors that affect the degradation of naphthenic acids in oil sands wastewater by indigenous microbial communities.
LAI J WS; PINTO LJ; KIEHLMANN E; BENDELL-YOUNG LI; MOORE MM
Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.
Source: ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY; 15 (9). 1996. 1482-1491.
Coden: ETOCD
Language: ENGLISH
Journal Announcement: 9612
BIOSIS COPYRIGHT: BIOL ABS. The acute toxicity of wastewater generated during the extraction of bitumen from oil sands is believed to be due to naphthenic acids (NAs). To determine the factors that affect the rate of degradation of representative NAs in microcosms containing wastewater and the acute toxicity of treated and untreated wastewater, the effects of temperature, dissolved oxygen concentration, and phosphate addition on the rate of 14CO2 release from two representative naphthenic acid substrates, (linear) U-14C-palmitic acid (PA) and (bicyclic) decahydro-2-naphthoic acid-8-14C (DHNA), were monitored. Tailings pond water (TPW) contained microorganisms well adapted to mineralizing both PA and DHNA: PA was degraded more quickly (10-15% in 4 weeks) compared to DHNA (2-4% in 8 weeks). On addition of phosphate, the rate of NA degradation increased up to twofold in the first 4 weeks, with a concurrent increase in the rate of oxygen consumption by oil sands TPW. The degradation rate then declined to levels equivalent to those measured in flasks without phosphate. The observed plateau was not due to phosphate limitation. Decreases in either the dissolved oxygen concentration or the temperature reduced the rate. Phosphate addition also significantly decreased the acute toxicity of TPW to fathead minnows. In contrast, Microtoxs analyses showed no reduction in the toxicity of treated or untreated TPW after incubation for up to 8 weeks at 15.ANG. C.
Descriptors/Keywords: Toxicology-Environmental and Industrial Toxicology; Public Health: Environmental Health-Miscellaneous; Food and Industrial Microbiology-General and Miscellaneous; Microorganisms-Unspecified; Osteichthyes; *ENVIRONMENTAL HEALTH; ENVIRONMENTAL POLLUTANTS--Poisoning
--PO; OCCUPATIONAL DISEASES; FERMENTATION; INDUSTRIAL MICROBIOLOGY; FOOD
MICROBIOLOGY; MICROBIOLOGY; FISHES
CAS Registry No.: 57-10-3

7/9/10

03201675 Subfile: BIOSIS-94-32750
THE GEOBIOCHEMISTRY OF COBALT
HAMILTON EI
Source: SCIENCE OF THE TOTAL ENVIRONMENT; 150 (1-3). 1994. 7-39. Coden: STEND
Language: ENGLISH
Journal Announcement: 9412
BIOSIS COPYRIGHT: BIOL ABS. RRM LITERATURE REVIEW PLANT ANIMAL HUMAN
RADIOACTIVE FORMS BIOAVAILABILITY BIOACCUMULATION HARD METAL DISEASE AIR
POLLUTION WATER POLLUTION SOIL POLLUTION EMISSIONS TOXICITY OCCUPATIONAL
EXPOSURE
Descriptors/Keywords: Radiation-Radiation Effects and Protective Measures ; Ecology; Environmental Biology-Oceanography and Limnology; Biochemical Studies-Minerals; Metabolism-Minerals; Toxicology-Foods, Food Residues, Additives and Preservatives; Toxicology-Environmental and Industrial Toxicology; Public Health: Environmental Health-Occupational Health; Public Health: Environmental Health-Air, Water and Soil Pollution ; Public Health: Environmental Health-Radiation Health; Plant Physiology, Biochemistry and Biophysics-Metabolism; Plant Physiology, Biochemistry and Biophysics-Chemical Constituents ; Agronomy-General, Miscellaneous and Mixed Crops; Soil Science-Physics and Chemistry (1970- ); Plantae-Unspecified; Animalia-Unspecified; Hominidae; *AIR POLLUTION; *SOIL POLLUTANTS; *WATER POLLUTION; RADIATION EFFECTS; RADIATION PROTECTION;
ECOLOGY; OCEANOGRAPHY; FRESH WATER; MINERALS; MINERALS--Metabolism--ME;
FOOD ADDITIVES--Poisoning--PO; FOOD ADDITIVES--Toxicity--TO; FOOD CONTAMINATION; FOOD POISONING; FOOD PRESERVATIVES--Poisoning--PO; FOOD
PRESERVATIVES--Toxicity--TO; ENVIRONMENTAL POLLUTANTS--Poisoning--PO; OCCUPATIONAL DISEASES; OCCUPATIONAL HEALTH SERVICES; RADIATION DOSAGE;
BIOPHYSICS; PLANTS--Metabolism--ME; BIOPHYSICS; PLANTS--Chemistry--CH; PLANTS--Growth and Development--GD; SOIL; SOIL; PLANTS; ANIMALS; HOMINIDAE
CAS Registry No.: 61789-51-3; 10198-40-0; 7646-79-9; 7440-66-6; 7440-62-2 ; 7440-50-8; 7440-48-4; 7440-47-3; 7440-33-7; 7440-32-6; 7440-25-7; 7440-03-1; 7440-02-0; 7439-98-7; 7439-96-5; 7439-92-1; 7439-89-6; 7429-90-5 ; 1317-42-6; 1308-04-9; 1307-96-6

7/9/11
DIALOG(R)File 156:Toxline(R)


03180247 Subfile: BIOSIS-94-11310
AN INVESTIGATION OF THE POTENTIAL FOR IN SITU BIOREMEDIATION OF OIL SANDS
TAILINGS
HERMAN DC; FEDORAK PM; MACKINNON MD; COSTERTON JW
Source: NINETEENTH ANNUAL AQUATIC TOXICITY WORKSHOP, EDMONTON, ALBERTA,
CANADA, OCTOBER 4-7, 1992. CANADIAN TECHNICAL REPORT OF FISHERIES AND
AQUATIC SCIENCES; 0 (1942). 1993. 482-488. Coden: CTRSD
Language: ENGLISH
Journal Announcement: 9405
BIOSIS COPYRIGHT: BIOL ABS. RRM MEETING PAPER BACTERIA TOXICITY NAPHTHENIC ACID WATER POLLUTION
Descriptors/Keywords: General Biology-Symposia, Transactions and Proceedings of Conferences, Congresses, Revie; Ecology; Environmental Biology-Oceanography and Limnology; Biochemical Studies-General; Toxicology-Environmental and Industrial Toxicology; Physiology and Biochemistry of Bacteria; Public Health: Environmental Health-Air, Water and Soil Pollution ; Soil Science-Physics and Chemistry (1970- ); Bacteria-General Unspecified (1992- ); *ENVIRONMENTAL POLLUTANTS--Poisoning --PO; *OCCUPATIONAL DISEASES; CONGRESSES; BIOLOGY; ECOLOGY; OCEANOGRAPHY;
FRESH WATER; BIOCHEMISTRY; BACTERIA--Physiology--PH; BACTERIA--Metabolism --ME; AIR POLLUTION; SOIL POLLUTANTS; WATER POLLUTION; SOIL; BACTERIA
CAS Registry No.: 1338-24-5

7/9/12
DIALOG(R)File 156:Toxline(R)


02694089 Subfile: TOXBIB-94-326319
Biodegradation of naphthenic acids by microbial populations indigenous to oil sands tailings.
Herman DC; Fedorak PM; MacKinnon MD; Costerton JW
Department of Biological Sciences, University of Calgary, AB, Canada.
Source: Can J Microbiol; VOL 40, ISS 6, 1994, P467-77 ISSN: 0008-4166
Coden: CJ3
Language: ENGLISH
Document Type: JOURNAL ARTICLE
Journal Announcement: 9411

Organic acids, similar in structure to naphthenic acids, have been associated with the acute toxicity of tailings produced by the oil sands industry in northeastern Alberta, Canada. Bacterial cultures enriched from oil sands tailings were found to utilize as their sole carbon source both a commercial mixture of naphthenic acids and a mixture of organic acids extracted from oil sands tailings. Gas chromatographic analysis of both the commercial naphthenic acids and the extracted organic acids revealed an unresolved "hump" formed by the presence of many overlapping peaks. Microbial activity directed against the commercial mixture of naphthenic acids converted approximately 50% of organic carbon into CO2 and resulted in a reduction in many of the gas chromatographic peaks associated with this mixture. Acute toxicity testing utilizing the Microtox test revealed a complete absence of detectable toxicity following the biodegradation of the naphthenic acids. Microbial activity mineralized approximately 20% of the organic carbon present in the extracted organic acids mixture, although there was no indication of a reduction in any gas chromatographic peaks with biodegradation. Microbial attack on the organic acids mixture reduced acute toxicity to approximately one half of the original level. Respirometric measurements of microbial activity within microcosms containing oil sands tailings were used to provide further evidence that the indigenous microbial community could biodegrade naphthenic acids and components within the extracted organic acids mixture.

Descriptors/Keywords: *Bacteria--Metabolism--ME; *Carboxylic Acids --Metabolism--ME; *Soil Microbiology; Acinetobacter calcoaceticus --Metabolism--ME; Alberta; Alcaligenes--Metabolism--ME; Bacteria --Classification--CL; Biodegradation; Industrial Waste; Petroleum; Pseudomonas--Metabolism--ME; Pseudomonas fluorescens--Metabolism--ME

CAS Registry No.: 0 (Carboxylic Acids); 0 (Industrial Waste); 1338-24-5 (naphthenic acid)

7/9/13

DIALOG(R)File 156:Toxline(R)



02386902 Subfile: NTIS-AD-A201 272-2

Preliminary Assessment of the Relative Toxicity of Copper Naphthenate, (Mooney Chemicals), Acute Studies. Phase 3. May 1984 - October 1987.

Angerhofer RA; Metker LW

Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.

Source: Govt Reports Announcements & Index (GRA&I), Issue 08, 1989

Language: UNSPECIFIED

Contract Number: Rept no. USAEHA-75-51-0497-88

Order Info.: NTIS/AD-A201 272/2, 73p NTIS Prices: PC A04/MF A01

Journal Announcement: 8907

TD3: A series of studies was performed in laboratory animals and biological systems to determine the relative toxicities of copper naphthenate and a wood preservative formulation thereof (M-Gard W-510, Mooney Chemicals). The studies included primary skin and eye irritation, acute, oral and dermal toxicity, skin sensitization, saturated vapor inhalation, dominant lethal studies, avian toxicity and aquatic toxicity. The results of this testing indicated that M-Gard W-510 has the potential of cause moderate irritation by the dermal route. Copper naphthenate and M-Gard W-510 are of low toxicity by the oral route. High atmospheric concentrations of M-Gard W-510 did cause death in exposed rats. Recommendations provide for the wearing of protective eyewear, gloves and coveralls by the individuals involved in preservative treatment operations and that these operations should be carried out in well ventilated areas. Due to the high degree of toxicity of copper naphthenate in one fish species, it was further recommended that disposal of excess preservative materials should be done in an environmentally acceptable manner. (aw) Study rept.,

Descriptors/Keywords: Biology, Birds, Chemicals; Copper compounds, Death, Disposal, Exposure(Physiology), Eye, EEyeglasses, Fishes, Gloves, Inhalation, Irritation, Laboratory animals, Lethality, Low level; Naphthalenes, Rats, Saturation, Sensitizing, Skin(Anatomy); Toxicity; Preservatives, Wood, Vapors, Ventilation; Wood preservatives; Copper naphthenate, Acute exposure

7/9/14
DIALOG(R)File 156:Toxline(R)


02384581 Subfile: NTIS-AD-A190 851-6
Preliminary Assessment of the Relative Toxicity of Copper Naphthenate Acute Studies. Phase 2. May 1984 - June 1986.
Angerhofer RA; Taylor LM
Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.
Source: Govt Reports Announcements & Index (GRA&I), Issue 15, 1988
Language: UNSPECIFIED
Contract Number: Rept no. USAEHA-75-51-0497-87
Order Info.: NTIS/AD-A190 851/6, 73p NTIS Prices: PC A04/MF A01
Journal Announcement: 8810
TD3: A series of studies was performed in laboratory animals and biological systems to determine the relative toxicities of copper naphthenate and a wood preservative formulation thereof. The studies included primary skin and eye irritation, acute oral and dermal toxicity, skin sensitization, saturated vapor inhalation, mutagenicity screening, dominant lethal studies, avian toxicity and aquatic toxicity. The results of this testing indicated that Cunapsol 5 has the potential to cause severe irritation by the dermal and ocular routes. Copper naphthenate and Cunapsol

5 are of low toxicity by the oral route. Cunapsol 5 does cause death when applied to the skin of rabbits at moderate dosage levels. Recommendations provide for the wearing of protective eyewear, gloves, and coveralls by individuals involved in presentative treatment operations and that these operations should be carried out in well ventilated areas. Due to the high degree of toxicity of copper naphthenate in one fish species, it was further recommended that disposal of excess preservative materials should be done in an environmentally acceptable manner. Study rept.,

Descriptors/Keywords: Toxicity, Biology, Copper; Naphthalenes, Skin(Anatomy), Dosage, Level(Quantity), Gloves, Laboratory animals, Birds, Death, Disposal, Eye, Irritation, Lethality, Low level, Oral intake, Rabbits, High rate, Intensity, Irritation, Ventilation, Fishes, Eyeglasses, Saturation, Vapors, Sensitizing

7/9/15

DIALOG(R)File 156:Toxline(R)



02004315 Subfile: NTIS-AD-A144 526-1

Preliminary Toxicological Evaluation of Eight Chemicals Used as Wood Preservatives.

Dacre JC

Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.

Source: Govt Reports Announcements & Index (GRA&I), Issue 24, 1984

Language: UNSPECIFIED

Contract Number: Proj. 3E162720A835, Task AA

Order Info.: NTIS/AD-A144 526/1, 31p NTIS Prices: PC A03/MF A01

Journal Announcement: 8502

TD3: A preliminary toxicological evaluation of eight chemicals used as wood preservatives has been made and the data gaps identified. The mammalian toxicology, environmental and ecological effects, and environmental standards for pentachlorophenol, copper naphthenate, copper 8-quinolinolate, 3-iodo-2-propynyl butylcarbamate, 2-(thiocyanomethylthio)b enzothiazole, zinc naphthenate, ammoniacal copper borate, and tri-n-butyltin oxide have been reviewed, and recommendations made for further toxicological studies. (Author) Technical rept. Mar-Jun 81,

Descriptors/Keywords: Toxicology; Toxicity; Environmental impact; Preservatives; Wood

1/9/1

DIALOG(R)File 31:World Surface Coatings Abs



00456368 WSCA ABSTRACT NUMBER: 92-03860 WSCA ID NUMBER: 343860

Phase behaviour of metal(II) soaps in one-, two-, and three-component systems.
BURROWS H D
NATO ASI Series C (Mathematical & Physical Sciences) Vol 324, Kluwer Academic Publishers 1990 , 415-26.
1990
JOURNAL ANNOUNCEMENT: 9205 WSCA UPDATE CODE: 9203
DOCUMENT TYPE: Book LANGUAGE: English
SECTION (CODE,HEADING): 71 Other Properties and Testing Methods
SECTION CODE CROSS-REFERENCE: 07;

ABSTRACT: A brief review is presented of the thermal behaviour of the long-chain carboxylates (soaps) of divalent metal ions, and some of the important factors influencing the phase behaviour are highlighted. A more detailed discussion is then presented of the behaviour of the lead(II) soaps, where a variety of physical techniques have been employed to characterise the phase structures. The phase behaviour of divalent metal soaps in two- and three-component systems is also examined, both in terms of the effect of additional components on phase structures, and of the solubility of soaps in a variety of polar and non-polar solvents. 61 refs.
DESCRIPTORS: Phase Behaviour; Soaps; Carboxylates; Lead Compounds
CHEMICAL NAMES: PLUMBOUS CYCLOHEXYLBUTYRATE; PLUMBOUS DECANOATE;
MANGANESE; CARBOXYLATE; LEAD OLEATE; LEAD; STRONTIUM; PLUMBOUS OCTADECANOATE; CADMIUM; MAGNESIUM; PLUMBOUS OLEATE; CALCIUM; ZINC;
COPPER; MERCURY; LEAD(II); PLUMBOUS 9,10-DIHYDROCTADECANOATE; BARIUM
IDENTIFIERS: Phase Behaviour-- soaps, one-/two-/three-component systems; Soaps-- phase behaviour; Carboxylates-- phase behaviour, one-/two-/three-component systems; Lead Compounds-- carboxylated, phase behaviour
ADDITIONAL TERMS (IDENTIFIERS): liquid crystal; polar solvent

1/9/2
DIALOG(R)File 31:World Surface Coatings Abs


00432513 WSCA ABSTRACT NUMBER: 90-00053 WSCA ID NUMBER: 300053
Naphthenic acid. V.
LOWER E S
Speciality Chem. 1989, Vol 9 No 4, 267-8.
1989
JOURNAL ANNOUNCEMENT: 9001 WSCA UPDATE CODE: 8911
DOCUMENT TYPE: Journal LANGUAGE: English

SECTION (CODE,HEADING): 05 Solvents, Plasticisers and Intermediates

ABSTRACT: Patent and other literature on the preparation and uses of sodium naphthenate, sulphonated naphthenic acid and naphthenyl alcohols are reviewed. 111 refs.

DESCRIPTORS: Naphthenates; Naphthenic Acids; Naphthenyl Alcohols
CHEMICAL NAMES: NAPHTHENIC ACID; NAPHTHENYL ALCOHOL; SODIUM NAPHTHENATE
IDENTIFIERS: Naphthenates-- uses, review; Naphthenic Acids-- synthesis/uses, review; Naphthenyl Alcohols-- synthesis/products etc, review
ADDITIONAL TERMS (IDENTIFIERS): synthesis; review

1/9/3
DIALOG(R)File 31:World Surface Coatings Abs


00414789 WSCA ABSTRACT NUMBER: 88-02345 WSCA ID NUMBER: 262345
Excessive lead absorption resulting from exposure to lead naphthenate.
GOLDBERG R; GARABRANT D H; PETERS J M; SIMONOWITZ J A
J. Occup. Med. 1987, Vol 29 No 9, 750-1.
1987
JOURNAL ANNOUNCEMENT: 8803 WSCA UPDATE CODE: 8801
DOCUMENT TYPE: Journal LANGUAGE: English
SECTION (CODE,HEADING): 73 Industrial and other Hazards

ABSTRACT: In an aluminium forging operation where lead naphthenate was sprayed without local ventilation, the mean concentration of lead in air was 96 microg./cu m. The 29 forge operators who worked in this area had a mean blood lead concentration of 63 microg./dl, which was statistically significantly higher than the mean blood lead concentration of 17 microg./dl among the 103 unexposed workers. This is the first reported instance in which the use of lead naphthenate has been associated with increased lead absorption in humans.

DESCRIPTORS: Lead Naphthenate; Spraying; Blood
CHEMICAL NAMES: LEAD; LEAD NAPHTHENATE
IDENTIFIERS: Lead Naphthenate-- exposure, lead uptake, spraying; Spraying -- lead naphthenate, blood levels; Blood-- lead in, lead naphthenate spraying
ADDITIONAL TERMS (IDENTIFIERS): HPL; toxicity

1/9/4

DIALOG(R)File 31:World Surface Coatings Abs


00404011 WSCA ABSTRACT NUMBER: 87-01628 WSCA ID NUMBER: 241628
Metallic soaps of naphthenic acids. V.
LOWER E S
Pig. Resin Tech. 1986, Vol 15 No 9, 8-11.
1986
JOURNAL ANNOUNCEMENT: 8703 WSCA UPDATE CODE: 8701
DOCUMENT TYPE: Journal LANGUAGE: English
SECTION (CODE,HEADING): 07 Driers and Minor Additives
SECTION CODE CROSS-REFERENCE: 55;

ABSTRACT: The industrial uses of copper and iron naphthenate are surveyed. In the paint industry, for instance, naphthenic acid copper soaps are used in mildew-resistant and antifouling paints, while iron naphthenate acts as an adhesion promoter, drier and colour promoter. 125 refs.

DESCRIPTORS: Copper Naphthenate; Naphthenates; Antifoulants; Biocides; Driers; Adhesion Promoters; Iron Compounds; Silicones; Lead Naphthenate
CHEMICAL NAMES: COPPER NAPHTHENATE; FERRIC NAPHTHENATE; IRON NAPHTHENATE
; LEAD NAPHTHENATE
IDENTIFIERS: Copper Naphthenate-- uses, review; Naphthenates-- uses, review; Antifoulants-- copper naphthenate; Biocides-- copper naphthenate; Driers-- iron, for silicones; Adhesion Promoters-- iron naphthenate; Iron Compounds-- naphthenates, uses/review; Silicones-- driers (iron); Lead Naphthenate--
ADDITIONAL TERMS (IDENTIFIERS): fungicide; wood preservative

1/9/5
DIALOG(R)File 31:World Surface Coatings Abs


00404010 WSCA ABSTRACT NUMBER: 87-01627 WSCA ID NUMBER: 241627
Metallic soaps of naphthenic acids. IV.
LOWER E S
Pig. Resin Tech. 1986, Vol 15 No 8, 6-8.
1986
JOURNAL ANNOUNCEMENT: 8703 WSCA UPDATE CODE: 8701
DOCUMENT TYPE: Journal LANGUAGE: English
SECTION (CODE,HEADING): 07 Driers and Minor Additives

ABSTRACT: The industrial uses of cobalt naphthenate are surveyed, e.g. as a hardening accelerator for alkyds and epoxies, as curing agent for organosiloxanes, or colouring agent for some thermosetting resins. Copper naphthenate, its uses and properties, is also reviewed. 106 refs.

DESCRIPTORS: Cobalt Naphthenate; Driers; Copper Naphthenate
CHEMICAL NAMES: ALKYD RESIN; COBALT NAPHTHENATE; COPPER NAPHTHENATE;
EPOXY RESIN; NAPHTHENATE
IDENTIFIERS: Cobalt Naphthenate-- uses, review; Driers-- cobalt; Copper Naphthenate-- properties/uses, review
ADDITIONAL TERMS (IDENTIFIERS): drier; curing agent

1/9/6
DIALOG(R)File 31:World Surface Coatings Abs


00345964 WSCA ABSTRACT NUMBER: 81-02178 WSCA ID NUMBER: 122178
Synergistic effects in the trimerisation of isocyanates by organometallic catalysts.
DABI S; ZILKHA A
Europ. Polym. J. 1980, Vol 16 No 9, 827-9.
1980
JOURNAL ANNOUNCEMENT: 8104 WSCA UPDATE CODE: 8100
DOCUMENT TYPE: Journal LANGUAGE: English
SECTION (CODE,HEADING): 21 Nitrogenous Polymers

ABSTRACT: Use was made of combinations of organometallic catalysts, having different modes of interaction with the isocyanate group, to obtain strong synergistic effects in catalysing the trimerisation of aromatic, aliphatic and strongly hindered isocyanates. The induction period observed in the trimerisation of isocyanates with Group II catalysts (lead, zirconium and cobalt naphthenates) was eliminated in the presence of Group I catalysts (tributyltin oxide and zirconium butoxide). Group I catalysts in combination with nucleophiles such as potassium iodide also showed strong synergistic effects.

DESCRIPTORS: ORGANO-METALLIC COMPOUNDS; CATALYSTS; ISOCYANURATES;
NAPHTHENATES
CHEMICAL NAMES: ZIRCONIUM; POTASSIUM IODIDE; ISOCYANATE; LEAD; COBALT
NAPHTHENATE; ISOCYANURATE; ZIRCONIUM NAPHTHENATE; ZIRCONIUM BUTOXIDE;
LEAD NAPHTHENATE; ORGANO-METALLIC; TRIBUTYLTIN OXIDE; TRIMERISATION

IDENTIFIERS:  SYNERGISM WITH ORGANO-METALLIC COMPOUNDS IN TRIMERISATION OF
  ISOCYANATES;  SYNERGISM WITH CATALYSTS IN TRIMERISATION OF ISOCYANATES;
  SYNERGISM WITH CATALYSTS IN SYNTHESIS OF ISOCYANURATES;  NAPHTHENATES IN
  SYNTHESIS OF ISOCYANURATES
ADDITIONAL TERMS (IDENTIFIERS):  PRESENCE;  AROMATIC;  INDUCTION;  GROUP;
  USE;  DIFFERENT;  CATALYST;  ALIPHATIC;  HINDER;  OBSERVED;  EFFECT;
  STRONG;  OBTAIN;  SHOWED;  COMBINATION;  NUCLEOPHILE;  STRONGLY;
  ELIMINATED;  INTERACTING;  CATALYSING;  SYNERGISTIC;  PERIOD

1/9/7
DIALOG(R)File  31:World Surface Coatings Abs


00308440   WSCA ABSTRACT NUMBER: 77-00659   WSCA ID NUMBER: 40659
Preparation and application of drying agents in paints.
SKALSKY J
Progr. Org. Coatings 1976, Vol 4 No 2, 137-60.
1976
JOURNAL ANNOUNCEMENT:  7702   WSCA UPDATE CODE:  7700
DOCUMENT TYPE:  Journal  LANGUAGE:    English
SECTION (CODE,HEADING):  07  Driers and Minor Additives

ABSTRACT:  Methods for the industrial production of lead, zinc, barium, cobalt, manganese, calcium and zirconium octoate driers are described and suggestions for new production methods made. Complexometric methods are most popular for the analysis of driers and these may be carried out in aq. medium after mineralisationMor in non-aq. medium. The mechanism of drier action, uses of the individual driers and loss of drying phenomena are discussed. 84 refs.

CHEMICAL NAMES:  MANGANESE;  LEAD OCTOATE;  COBALT;  LEAD (CHEMICAL);
  MANGANESE OCTOATE;  BARIUM OCTOATE;  CALCIUM OCTOATE;  ZIRCONIUM OCTOATE;
  ZINC OCTOATE;  ZINC;  CALCIUM;  BARIUM
ADDITIONAL TERMS (IDENTIFIERS):  LOSS;  USES;  ANALYSIS;  METHOD;  PAINT;
  PREPARATION;  DRYING;  DRIER;  MECHANISM;  INDIVIDUAL;  DISCUSSED;
  DRYING AGENT;  AQ;  NEW;  POPULAR;  PRODUCTION;  MOST;  SUGGESTION;
  PHENOMENON;  NON-AQ;  ACTION;  CARRIED;  APPLICATION (USE);  INDUSTRIAL;
  MEDIUM

1/9/8
DIALOG(R)File 31:World Surface Coatings Abs


00303159 WSCA ABSTRACT NUMBER: 76-03159 WSCA ID NUMBER: 23159
Biochemical and toxicological response of infant baboons to lead driers in paints.
COHEN N; KNEIP T J; RULON V; GOLDSTEIN D H
Environ. Health Perspectives 1974, Exptl. Issue No 7, 161-73: Kettering Abs 1975, Vol 11 No 3, Abs 598aa.
1974
JOURNAL ANNOUNCEMENT: 7605 WSCA UPDATE CODE: 7600
DOCUMENT TYPE: Journal LANGUAGE: English
SECTION (CODE,HEADING): 73 Industrial and other Hazards

ABSTRACT: In an effort to define the toxicology and disposition of lead compounds that presently exist in paints lead octoate drier or lead acetate), a controlled dose feeding study was initiated using 28 infant baboons as experimental models for the child ingesting lead in paint. Examined for each lead compound were: general clinical surveillance; lead concns. in blood (by atomic absorption spectrophotometry), urine, and faeces; erythrocytic ALA-D (method of Granick 1972, with modifications) and free erythrocytic porphyrin (EP, by fluorometric techniques). Blood lead concns. increased during the exposure period and were significantly greater than control values for dose rates of 100, 200, and 500 micrograms lead as dried paint/kg/day. An upwardItrend became evident for doses of lead as lead acetate after approx. 2-3 months from start of ingestion. A similar trend was observable for paint only at the 500 micrograms lead/kg/day dose. The results from animals ingesting similar doses of lead as dried paint solids or as lead acetate were indicative of the greater solubility of the acetate compound. The early data from animals ingesting lead octoate in olive oil showed an immediate increase in blood lead concn. together with a corresponding depression of ALA-D activity. 12 refs.

CHEMICAL NAMES: LEAD (CHEMICAL); LEAD COMPOUND; ACETATE; PORPHYRIN;
LEAD OCTOATE; LEAD ACETATE; OLIVE OIL
ADDITIONAL TERMS (IDENTIFIERS): INCREASE; DOSES; BLOOD; ATOMIC ABSORPTION SPECTROMETRY; DRIED; DATA; EXPOSURE; EFFORT; PAINT; METHOD; SHOWED; DRIER; CONTROL; MODEL; EXIST; START; EXPERIMENTAL;
MODIFICATION; ACTIVITY; SOLUBILITY; RATE; EXAMINED; APPROX; CORRESPOND; SOLIDS; MONTH; TREND; 1972; SIGNIFICANTLY; STUDY; TECHNIQUE; INITIATED; CONCN; VALUE; DEPRESSION; TOXICOLOGY; RESULT;
USING; DEFINE; TOXICOLOGICAL; ANIMAL; FEEDING; EARLY; RESPONSE;

GENERAL; URINE LEAD CONCN; CLINICAL; BIOCHEMICAL; INGESTION; BECAME

1/9/1
DIALOG(R)File 10:AGRICOLA


3814433 22037215 Holding Library: AGL
Ultraviolet spectrophotometry and Fourier transform infrared spectroscopy characterization of copper naphthenate
Zyskowski, J. Kamdem, D.P.
Michigan State University, East Lansing, MI.
Madison, Wis. : The Society of Wood Science and Technology.
Wood and fiber science : journal of the Society of Wood Science and Technology. Oct 1999. v. 31 (4) p. 441-446.
ISSN: 0735-6161 CODEN: WFSCD4
DNAL CALL NO: TA419.W6
Language: English
Includes references
Place of Publication: Wisconsin
Subfile: IND; OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article
DESCRIPTORS: copper naphthenate - chemical composition - infrared spectroscopy - spectrophotometry - evaluation - quantitative analysis - detection - techniques - absorbance - preservative treated wood;
Section Headings: K510 FOREST PRODUCTS-WOOD

1/9/2
DIALOG(R)File 10:AGRICOLA


3089464 91028589 Holding Library: AGL
The comparative performance of "copper naphthenate" formulations in laboratory decay tests
Archer, K. Waals, J. van der; Hedley, M.
CSI, Harrisburg, NC
Stevensville, Md. : The Association.
Proceedings ... annual meeting - American Wood-Preservers' Association. 1990. v. 86 p. 78-95.
ISSN: 0066-1198 CODEN: PAWPAG
DNAL CALL NO: 300.9 AM3
Language: English
Meeting held April 30-May 2, 1990, Nashville, TN.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article
DESCRIPTORS: copper naphthenate - formulations - chemical composition - trametes - coniophora puteana - fungicidal properties - toxicity - laboratory tests;
Identifiers: trametes lilacino-gilva
Geographic Location: new zealand
Section Headings: K510 FOREST PRODUCTS-WOOD

1/9/1
DIALOG(R)File 50:CAB Abstracts


03663175 CAB Accession Number: 990600459
Application of environmental scanning electron microscopy to the study of macrodistribution of copper in copper naphthenate treated hardwoods.
Dawson-Andoh, B. E.; Kamdem, D. P.
West Virginia University, Division of Forestry, 206 D Percival Hall, Morgantown WV 26506-6125, USA.
Holzforschung vol. 52 (6): p.603-606
Publication Year: 1998
ISSN: 0018-3830
Language: English
Document Type: Journal article
The preliminary results are presented of a study of the macrodistribution of copper in the vessels, fibres and rays of the sapwood of northern red oak (Quercus rubra) and soft maple (Acer rubrum) which had been treated with copper naphthenate. High counts of copper were located in the vessels of both species. 15 ref.

DESCRIPTORS: copper; copper naphthenate; hardwoods; scanning electron microscopy; techniques; penetration; distribution; wood preservatives; wood anatomy
CAS REGISTRY NUMBERS: 7440-50-8; 1338-02-9
ORGANISM DESCRIPTORS: Quercus rubra; Acer rubrum
BROADER TERMS: Quercus; Fagaceae; Fagales; dicotyledons; angiosperms; Spermatophyta; plants; Acer; Aceraceae; Sapindales
CABICODES: Wood Properties & Utilization (KK510); Control by Chemicals & Drugs (HH400); Techniques & Methodology (ZZ900)

1/9/2
DIALOG(R)File 50:CAB Abstracts


03532439 CAB Accession Number: 981905995
Enthalpy of adsorption and isotherms for adsorption of naphthenic acid

onto clays.
Zou LizHuang; Han BuXing; Yan HaiKe; Kasperski, K. L.; Xu YuMing; Hepler, L. G.
Institute of Chemistry, Academia Sinica, Beijing 100080, China.
Journal of Colloid and Interface Science vol. 190 (2): p.472-475
Publication Year: 1997
ISSN: 0021-9797
Language: English
Document Type: Journal article
Enthalpies and isotherms for the adsorption of naphthenic acid onto the sodium forms of the clay minerals montmorillonite, kaolinite, and illite were studied by calorimetry and the static method. 14 ref.

DESCRIPTORS: adsorption; clay minerals; organic compounds; methodology
IDENTIFIERS: napthenic acid
CABICODES: Soil Chemistry & Mineralogy (JJ200); Chemistry (ZZ600)

1/9/3
DIALOG(R)File 50:CAB Abstracts


02402613 CAB Accession Number: 910651052
Laboratory tests on light organic solvent preservatives for use in Australia. Part 4. Assessment of several new candidate fungicides.
Greaves, H.; Schmalzl, K. J.; Cookson, L. J.
CSIRO Division of Chemical & Wood Technology, Melbourne, Australia.
Journal of the Institute of Wood Science vol. 11 (4): p.145-148
Publication Year: 1988
ISSN: 0020-3203
Language: English
Document Type: Journal article
Four candidate fungicides - 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (isothiazolone), azaconazole, copper dibutyl phosphate (CDBP) and copper di(2-ethylhexyl) phosphate (CDEHP), as well as treatment with a commercial copper naphthenate formulation were tested in Pinus radiata sapwood using a modified soil block technique. The test fungi were Amyloporia xantha, Coniophora olivacea, Perenniporia tephropora, Gloeophyllum abietinum, Pycnoporus coccineus, Serpula lacryman (S. lacrimans) and Trametes lilacino-gilva. Assessment of the suitability of the preservatives for wood protection were based on percentage mass loss of treated and artificially weathered blocks after exposure to the test fungi. At the nominal test loadings ranging from 0.5 to 2.0 kg active ingredient per cubic metre, isothiazolone gave effective control of all seven test fungi, whilst azaconazole gave effective control of A. xantha, Perenniporia tephropora and Pycnoporus coccineus. CDEHP appeared the best of the

copper-based preservatives giving effective control of A. xantha, Perenniporia tephropora, G. abietinum and Pycnoporus coccineus at the loadings 0.5-1.0 kg copper per cubic metre. Toxic limits for all five active ingredients and seven fungal species are presented in tabular form.
15 ref.

DESCRIPTORS: Solvents; Wood preservatives; laboratory tests; fungicides; Wood preservation; wood destroying fungi; biodeterioration
IDENTIFIERS: light organic solvent preservatives
ORGANISM DESCRIPTORS: fungi
GEOGRAPHIC NAMES: Australia
BROADER TERMS: pesticides; fungi; Australasia; Oceania
CABICODES: Wood Properties & Utilization (KK510); Control by Chemicals & Drugs (HH400); Biodeterioration, Storage Problems & Pests of Plant Products (SS210); Biodeterioration (General) (SS300); Forest Products (Wood-based Materials) (KK520); Forest Products (General) (KK500); Biodeterioration Organisms (SS320)

1/9/4
DIALOG(R)File 50:CAB Abstracts


02402612 CAB Accession Number: 910651051
Laboratory tests on light organic solvent preservatives for use in Australia. Part 3. Evaluation of fully formulated commercial preservatives.
Greaves, H.; Schmalzl, K. J.; Cookson, L. J.
CSIRO Division of Chemical & Wood Technology, Melbourne, Australia.
Journal of the Institute of Wood Science vol. 11 (4): p.140-144
Publication Year: 1988
ISSN: 0020-3203
Language: English
Document Type: Journal article
Four fully formulated commercial light-organic solvent preservatives (LOSPs) - Cuprivac Green WR (copper naphthenate), Impresol WR 205 (pentachlorophenol (PCP), tributyl tin oxide (TBTO)), Protim 80 WR (PCP, TBTO), Vacsol (TBTO) - and two water-dispersible formulations - Dura-Treet II (PCP, other chlorophenols) and Woodcare (3-iodo-2-propynyl butyl carbamate) - have been tested in radiata pine (Pinus radiata) sapwood using a modified soil-block technique. The test fungi were Amyloporia xantha, Coniophora olivacea, Perenniporia tephropora, Gloeophyllum abietinum, Pycnoporus coccineus, Serpula lacrymans (S. lacrimans) and Trametes lilacino-gilva. Assessments of the suitability of the preservatives for wood protection in practice were based on the examination of three retentions of each formulation after artificial

weathering. The results have been expressed on the basis of both percentage mass loss and macroscopic appearance of the blocks. The toxic limits showed that four of the preservatives - Dura-Treet II, Impresol WR 205, Protim 80 WR and Vacsol - controlled the amount of decay caused by all seven test fungi. The remaining two were only effective against all the fungi at higher retentions than those used. 8 ref.

DESCRIPTORS: Solvents; Wood preservatives; laboratory tests; wood preservation; wood destroying fungi; biodeterioration
IDENTIFIERS: light organic solvent preservatives
ORGANISM DESCRIPTORS: fungi
GEOGRAPHIC NAMES: Australia
BROADER TERMS: fungi; Australasia; Oceania
CABICODES: Wood Properties & Utilization (KK510); Control by Chemicals & Drugs (HH400); Biodeterioration, Storage Problems & Pests of Plant Products (SS210); Biodeterioration (General) (SS300); Forest Products (Wood-based Materials) (KK520); Forest Products (General) (KK500); Pathogen, Pest & Parasite Management (General) (HH000); Biodeterioration Organisms (SS320)

1/9/5
DIALOG(R)File 50:CAB Abstracts


02402604 CAB Accession Number: 910651043
Laboratory tests on light-organic solvent preservatives for use in Australia. 2. Assessments of further candidate fungicides.
Greaves, H.; Cookson, L. J.; Tighe, M. A.
CSIRO Division of Forestry and Forest Products, Melbourne, Australia.
Journal of the Institute of Wood Science vol. 11 (3): p.103-107
Publication Year: 1988
ISSN: 0020-3203
Language: English
Document Type: Journal article
Following previous research on the active ingredients in selected light organic solvent preservatives (LOSPs), a further 10 fungicides were used to impregnate radiata pine (Pinus radiata) sapwood blocks. The blocks were then bioassayed using a soil jar technique against seven Australian decay fungi - Amyloporia xantha, Coniophora olivacea, Fomes lividus, Gloeophyllum abietinum, Pycnoporus coccineus, Serpula lacrymans (S. lacrimans) and Trametes lilacino-gilva. The results showed that no single fungicide, at the retentions tested, will control all fungi although Permapruf T (tributyl tin oxide; alkyltrimethylbenzylammonium chloride) and Troysan Polyphase (3-iodo-2-propynyl butyl carbamate) controlled five out of seven. Vitavax (2,3-dihydro-5-carboxoanalido-6-methyl-1,4 oxathin)

and Traetex 98-10 (tributyl tin ether) controlled four, and copper naphthenate and copper-ethanolamine-nonanoate inhibited three fungi. 25 ref.

DESCRIPTORS: Solvents; Wood preservatives; laboratory tests; Wood preservation; Tributyltin oxide; fungicides; wood destroying fungi; biodeterioration
IDENTIFIERS: light organic solvent preservatives
CAS REGISTRY NUMBERS: 56-35-9
ORGANISM DESCRIPTORS: fungi
GEOGRAPHIC NAMES: Australia
BROADER TERMS: molluscicides; pesticides; organotin fungicides; fungicides; organotin pesticides; fungi; Australasia; Oceania
CABICODES: Wood Properties & Utilization (KK510); Control by Chemicals & Drugs (HH400); Biodeterioration, Storage Problems & Pests of Plant Products (SS210); Biodeterioration (General) (SS300); Forest Products (Wood-based Materials) (KK520); Biodeterioration Organisms (SS320)

1/9/1
DIALOG(R)File 89:GeoRef


00522162 GEOREF NO.: 69-34169
TITLE: Distribution of naphthenic acids in an oil-bearing aquifer
AUTHOR(S): Davis, J. B.
PUBLISHER: Elsevier, Amsterdam, Netherlands
SOURCE: Chemical Geology vol. 5 no. 2 p. 89-97
DATE: 1969
COUNTRY OF PUBLICATION: Netherlands
CODEN: CHGEAD ISSN: 0009-2541
DOCUMENT TYPE: Serial
BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus., tables
LANGUAGE: English
ABSTRACT: Organic fractions of artesian well waters from the oil-bearing Carrizo Formation, Atascosa County, Tex., were examined by infrared and chromatographic methods. A hexane-soluble naphthenic acid was extracted from ground waters of the formation. Water coproduced with the oil contains over 1000 times as much of the acid fraction as is found in the water updip of the oil. Water downdip of the oil contains five times as much as is found updip, and the downdip fraction is more similar to the coproduced water acids. An acid fraction is detectable in extracts of geologic formations associated with the Carrizo aquifer, and a phthalic acid ester is also present which is dissolved in the Carrizo water and may be common to ground waters, but apparently has not accumulated with

oil in the Carrizo.
DESCRIPTORS: aquifers; Atascosa County Texas; Carrizo Formation; distribution; ground water; naphthenic acids; organic acids; Texas; United States
SECTION HEADINGS: 21 (Hydrogeology)
GEOREF UPDATE: 1969



1/9/1
DIALOG(R)File 99:Wilson Appl. Sci & Tech Abs


1787131 H.W. WILSON RECORD NUMBER: BAST98076315
Factors controlling naphthenic acid corrosion
Turnbull, A; Shone, B; Slavcheva, E
Corrosion v. 54 no11 (Nov. '98) p. 922-30
DOCUMENT TYPE: Feature Article ISSN: 0010-9312 LANGUAGE: English
RECORD STATUS: Corrected or revised record

ABSTRACT: A study of the factors controlling naphthenic acid (NA) corrosion is presented. Model NA-oil mixtures with single and mixed acids were used to limit the effect of uncontrolled variables. The principal aim of the study was to provide a basis for processors to identify potentially corrosive crudes and to enable them to process low-cost "opportunity" crude oils in refineries constructed from inexpensive conventional steels.

DESCRIPTORS: Steel alloys--Corrosion; Acids--Corrosive effect; Petroleum--Heavy oil;

279557/9
DIALOG(R)File 305:Analytical Abstracts


279557 AA Accession No.: 60-10-E-00089 DOC. TYPE: Journal
Analysis and characterization of naphthenic acids by gas chromatography-electron impact mass spectrometry of tert.-butyldimethylsilyl derivatives.
AUTHOR: St. John, W. P. ; Rughani, J. ; Green, S. A. ; McGinnis, G. D.
CORPORATE SOURCE: Inst. Wood Res., Michigan Technol. Univ., Houghton, MI 49931, USA
JOURNAL: J. Chromatogr., A, (Journal of Chromatography, A), Volume: 807, Issue: 2, Page(s): 241-251

CODEN: JCRAEY ISSN: 0021-9673
PUBLICATION DATE: 22 May 1998 (980522) LANGUAGE: English
ABSTRACT: Naphthenic acid (NA) samples were derivatized with N-methyl-N-(t-butyldimethylsilyl)trifluoroacetamide (MTBSTFA) and analysed by GC-EIMS. The derivatization was performed by heating a mixture of 100 .mu.l 5 mg/ml NA in CH2Cl2 with 100 .mu.l MTBSTFA reagent at 60.degree.C for 20 min. Analysis was carried out on a 30 m DB-5MS column with temperature programming from 100.degree.C (held for 3 min) to 300.degree.C (held for 10 min) at 8.degree.C/min and spectra were recorded for m/e = 70-550 at a rate of 1.2 scans/s. The data allowed the purity of the NA sample to be assessed and the percentage composition of specific compounds to be determined.
MATRIX: naphthenic acid (1338-24-5) --analysis of, by GC-MS
SECTION: E-40000 (Applied and Industrial Analysis)

1/9/1
DIALOG(R)File 6:NTIS


1983711 NTIS Accession Number: PB97 -115521
Leaching of Wood Preservative Components and Their Mobility in the Environment: Summary of Pertinent Literature
(Forest Service general technical rept)
Lebow, S.
Forest Products Lab., Madison, WI.
Corp. Source Codes: 017958000
Report No.: FPL-GTR-93
Aug 96 42p
Languages: English
Journal Announcement: GRAI9703
Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.
NTIS Prices: PC A04/MF A01
Country of Publication: United States
The purpose of the report is to provide a summary of the pertinent literature on leaching of wood preservative components and their mobility in the environment.
Descriptors: *Wood preservatives; *Leaching; *Literature surveys; Water borne; Solubility; pH factor; Water flow; Exposure; Chemical reactivity; Life cycle management; Wood processing industry; Arsenates; Copper compounds
Identifiers: Chromated copper arsenate; Ammoniacal copper zinc arsenate; Ammoniacal copper quat; Copper dimethyldithiocarbamate; Ammoniacal copper citrate; Copper napthenate; NTISAGFPL

Section Headings: 68GE (Environmental Pollution and Control--General); 71R (Materials Sciences--Wood and Paper Products)

1/9/2
DIALOG(R)File 6:NTIS


1685869 NTIS Accession Number: AD -A255 828/6
Chemistry of the Extreme Pressure Lubricant Additive Lead Naphthenate on Steel Surfaces
(Technical rept)
Didziulis, S. V. ; Fleischauer, P. D.
Aerospace Corp., El Segundo, CA. Technology Operations.
Corp. Source Codes: 000512027; 403965
Report No.: TR-0091(6945-03)-3; SMC-TR-92-39
1 Sep 92 48p
Languages: English
Journal Announcement: GRAI9302
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NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: F04701-88-C-0089
The adsorption and chemical reactivity of the extreme pressure (EP) oil additive lead naphthenate (Pbnp) on steel surfaces is examined with X-ray photoelectron spectroscopy. In addition, the chemical compositions of AISI 440C and 52100 steel surfaces are studied as a function of sample cleaning treatment, including solvent cleaning, and treatments with acidic and basic solutions. At room temperature, Pbnp is shown to physisorb on the iron oxide overlayer present on both steel surfaces following solvent cleaning. A chemisorbed form of Pbnp is characterized by Pb 4f peaks chemically shifted by 0.3 to 0.4 eV to lower binding energy and significantly lower intensity of the C ls feature associated with the Pbnp carboxylate group. This form of Pbnp is observed on acid- and base-pretreated surfaces that lose their iron oxide overlayers. The chemisorbed Pbnp surface species is also observed when the steel surfaces are scratched while being immersed in the Pbnp solution. When the Pbnp-treated steel surfaces are heated to simulate the EP conditions for which Pbnp is used, most of the Pbnp on the oxide-covered surfaces desorbs. In addition, metallic Pb is readily formed on the scratched surfaces and whenever significant amounts of metallic Fe are present. These results point to two possible modes of boundary protection: chemisorbed Pbnp under mild wear conditions and a layer of metallic Pb under severe wear conditions. Lubrication, Steel, Oil

Additives, Surface Chemistry.
Descriptors: *Additives; *Lubrication; *Steel; *Surface chemistry; Acids; Addition; Adsorption; Boundaries; Chemical composition; Chemistry; Cleaning ; Energy; Functions; Intensity; Iron; Iron oxides; Layers; Oils; Oxides; Photoelectrons; Pressure; Protection; Reactivities; Room temperature; Solvents; Spectroscopy; Temperature; Wear; X ray photoelectron spectroscopy ; X rays
Identifiers: Lead napthalene; NTISDODXA
Section Headings: 71K (Materials Sciences--Lubricants and Hydraulic Fluids); 71J (Materials Sciences--Iron and Iron Alloys); 71L (Materials Sciences--Materials Degradation and Fouling); 99F (Chemistry--Physical and Theoretical Chemistry)

1/9/3
DIALOG(R)File 6:NTIS


0965602 NTIS Accession Number: PB82 -206178/XAB
On the Leaching and Volatility of the Active Agents of Surface Applied Wood Perservatives
Mansikkamaeki, P. ; Vaesaelae, L. ; Vihavainen, T.
Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Puutavaralaboratorio .
Corp. Source Codes: 067526016
Report No.: TIEDONANTO-28; ISSN-951-38-0795-9
May 79 27p
Languages: English
Journal Announcement: GRAI8218
Also pub. as ISSN-0355-3620
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NTIS Prices: PC A03/MF A01
Country of Publication: Finland
The leaching of surface applied preservatives from treated wood in water soaking and volatility at a temperature of 70C for four weeks were investigated in laboratory tests. The active agents investigated were pentachlorophenol, tributyltin oxide, dichlofluanide, and copper naphthenate. The active agents were dissolved into the similar basic solution, which contained alkyd resin as fixative. The specimens made of pine (Pinus silvestris L.) were immersed in the test preservatives.
Descriptors: *Wood preservatives; *Volatility; *Leaching; Activating agents; Surface finishing
Identifiers: *Foreign technology; Phenol/pentachloro; Tin oxide/tributyl;

Dichlofluanide; Copper naphthenate; NTISTFTISF
Section Headings: 71R (Materials Sciences--Wood and Paper Products)

1/9/4
DIALOG(R)File 6:NTIS


0856375 NTIS Accession Number: AD -A089 895/7/XAB
X-Ray Photoelectron Spectroscopy Study of the Chemisorption of Lead Naphthenate to Nucleophilic Surfaces
(Interim rept)
Bertrand, P. A. ; Fleischauer, P. D.
Aerospace Corp., El Segundo, CA. Lab. Operations.
Corp. Source Codes: 000512005; 009575
Sponsor: Space Div., Los Angeles AFB, CA
Report No.: TR-0080(5970-03)-1; SD-TR-80-66
10 Sep 80 29p
Languages: English
Journal Announcement: GRAI8103
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NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: F04701-79-C-0080
The adsorption of lead naphthenate on the surfaces of metals, oxides, and sulfides was studied by means of x-ray photoelectron spectroscopy (XPS). Lead naphthenate physically adsorbs on all surfaces. It chemisorbs on surfaces with basic sites, such as oxides, sulfides, and metals treated in basic solutions before adsorption. The two states have distinct XPS spectra: the Pb(4f(7/2)) binding energy for the physically adsorbed state is 139.1 eV, whereas that for the chemisorbed state is 136.6 eV. Conditions of surface preparation that result in the formation of each state are described. (Author)
Descriptors: *X ray photoelectron spectroscopy; *Chemisorption; *Lead compounds; *Naphthalenes; *Surfaces; pH factor; Feasibility studies; Metals ; Oxides; Sulfides; Absorption; Electron spectroscopy; Lubricants; Experimental data
Identifiers: Nucleophilic surfaces; NTISDODXA; NTISDODAF
Section Headings: 99F (Chemistry--Physical and Theoretical Chemistry)

050965/9
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Author: HORECZY, JOE THOMAS
Degree: PH.D.
Year: 1941
Corporate Source/Institution: THE UNIVERSITY OF TEXAS AT AUSTIN (0227)
Source: VOLUME W1941
. 42 PAGES
Descriptors: CHEMISTRY, GENERAL; ENERGY
Descriptor Codes: 0485; 0791