Soil Cleanup Levels for Industrial Land Use

Table 745-1

Notes on the Development of Method A Cleanup Levels WAC 173-340-720, 740, and 745

The following tables were prepared as part of the rule-making process for the amended MTCA rule adopted February 12, 2001. The information in the tables was used when Ecology developed the Method A Cleanup Levels for the revised regulation.

The tables compile cleanup level calculations for various exposure pathways for both carcinogenic and noncarcinogenic heath effects, applicable state and federal laws, laboratory practical quantitation limits and other relevant information that was used to develop the Method A cleanup levels. While this is useful background information, the values in these tables are not the adopted rule and should not be used as Method A cleanup levels. Use the tables, footnotes and accompanying text in the adopted regulation to develop Method A cleanup levels.

NOTE: Some columns in these tables refer to "current" and "proposed" Method A values. "Current" as used in these tables refers to the cleanup levels as they existed prior to the adoption of the February 12, 2001 rule amendments. "Proposed" as used in these tables are the cleanup levels that were adopted on February 12, 2001.

February 9, 2001

November 23, 2004 revision (1)

TO: Interested Persons

FROM: Pete Kmet, Senior Environmental Engineer

Toxics Cleanup Program

SUBJECT: Calculations for Table 745-1

Method A Soil Cleanup Levels for Industrial Properties

Attached are several tables in excel format providing information on the development of the Method A soil cleanup levels for industrial properties in Table 745-1, WAC 173-340-900.

<u>Table 1</u>: A quick summary providing Method A cleanup levels for industrial properties (Table 745-1) and a brief explanation of the reasoning in the development of Method A values

<u>Table 2</u>: A detailed compilation of the information considered in the development of Method A soil cleanup levels for unrestricted land uses. This information includes:

- The Method B direct contact exposure pathway soil values for each substance. This includes values for both soil ingestion and soil ingestion plus dermal adsorption (adsorption through the skin) for both carcinogens and non-carcinogens, where sufficient information was available for the calculations as of February, 2001;
- The results for the soil leaching pathway from the 3 and 4 phase models as of February, 2001;
- Terrestrial ecological evaluation values from Tables 749-2 and 749-3;
- Regulatory values from other laws as of February, 2001; and
- Natural background, practical quantitation limits and other relevant information available as of February, 2001.

<u>Table 3</u>: Describes the assumptions used to calculate the standard Method C soil direct contact cleanup values for industrial land uses for carcinogens using equation 745-2 in WAC 173-340-745(5)(b)(iii)(B)(II).

<u>Table 4</u>: Describes the assumptions used to calculate the standard Method C soil direct contact cleanup values for industrial land uses for non-carcinogens using equation 745-1 in WAC 173-340-745(5)(b)(iii)(B)(I).

Table 5: Describes the assumptions and equation used to calculate the modified Method C values for industrial land uses assuming concurrent soil ingestion plus dermal (skin) absorption for carcinogens using equation 745-5 in WAC173-340-745(3)(b)(iii)(B).

<u>Table 6</u>: Describes the assumptions and equation used to calculate the modified Method C values for industrial land uses assuming concurrent soil ingestion plus dermal (skin) absorption for noncarcinogens using equation 745-4 in WAC173-340-745(3)(b)(iii)(A).

<u>Table 7</u>: Describes the assumptions and equations used to calculate soil concentrations protective of ground water for drinking water use, using the 3 phase leaching model.

<u>Tables 8-10</u>: 4-phase model results summary sheets for 2 brands of fresh gasoline and these same gasolines using various weathered compositions.

(1) This memo and attached excel tables explain the basis for the Method A cleanup levels in the MTCA rule adopted February 12, 2001. The memos and tables have been slightly revised from the originals issued on February 9, 2001 to clarify certain information in response to questions received since issuance of the original memos and tables. The original memos and tables can be found in appendix D of the concise explanatory statement for the February 12, 2001 rule amendments (http://www.ecy.wa.gov/programs/tcp/regs/reg_main.html)

Table 1: Quick Summary -- Basis for Method A Industrial Land Use Soil Values

| | 1 | 1991 | 2001 | |
|-----------------------------------|---------------------|---------------|---------------|--|
| | | Method A | adopted | Basis |
| Hazardous Substance | CAS Number | Cleanup Level | Cleanup Level | for |
| i ideal dodo o destallo | 0,10114 | mg/kg | mg/kg | Standard |
| Arsenic | 7440-38-2 | 200 | 20 | Protection of drinking water, adjusted for background (1) |
| Benzene | 71-43-2 | 0.5 | 0.03 | Protection of drinking waterbased on both 3 and 4 phase models. |
| | | | | |
| Benzo(a)Pyrene | 50-32-8 | none | 2 | Protection of drinking water3 phase model. |
| Cadmium | 7440-43-9 | 10 | 2 | Protection of drinking water, adjusted for PQL. |
| Chromium (total) | 7440-47-3 | 500.0 | none | Replaced by values for Cr III and Cr VI. |
| Chromium VI | 18540-29-9 | | 19 | Protection of drinking water3 phase model. |
| Chromium III | 16065-83-1 | | 2000 | Protection of drinking water3 phase model. |
| DDT | 50-29-3 | 5 | 4 | Protection of drinking water3 phase model. |
| Ethylbenzene | 100-41-4 | 20 | 6 | Protection of drinking water3 phase model. |
| Ethylene dibromide (EDB) | 106-93-4 | 0.001 | 0.005 | Protection of drinking water, adjusted for PQL |
| Lead | 7439-92-1 | 1000.0 | 1000 | Ingestion (3) |
| | | | | ``` |
| Lindane | 58-89-9 | 20 | 0.01 | Protection of drinking water, adjusted for PQL |
| Methylene chloride | 75-09-2 | 0.5 | 0.02 | Protection of drinking water3 phase model. |
| Mercury (inorganic) | 7439-97-6 | 1 | 2 | Protection of drinking water3 phase model. |
| MTBE | 1634-04-4 | none | 0.1 | Protection of drinking water3 phase model. |
| Naphthalenes | 91-20-3 | none | 5 | Protection of drinking water3 phase model. Total of naphthalene, 1-methyl naphthalene & 2-methyl naphthalene |
| PAHs (carcinogenic) | | 20 | none | Replaced by benzo(a)pyrene. |
| PCB Mixtures | 1336-36-3 | 10.0 | 10 | ARAR. This is a total value for all PCBs in the soil sample. |
| Tetrachloroethylene | 127-18-4 | 0.5 | 0.05 | Protection of drinking water3 phase model. |
| | | | | |
| Toluene 1.1.1 Trichloroethane | 108-88-3 71-55-6 | 40 20 | 7 2 | Protection of drinking water3 phase model. Protection of drinking water3 phase model. |
| , , | | | | ž i |
| Trichloroethylene | 79-01-5 | 0.5 | 0.03 | Protection of drinking water3 phase model. |
| Xylenes | 1330-20-7 | 20 | 9 | Protection of drinking water3 phase model. Total of all m, o & p xylene. |
| TPH (total) | 14280-30-9 | | | |
| Gasoline range organics | 6842-59-6 | | | |
| GRO with benzene | 30.2 00 0 | 100 | 30 | Protection of drinking water4 phase model, assuming weathered gasoline composition. |
| GRO w/o benzene | | 100 | 100 (5) | Protection of drinking water4 phase model, assuming highly weathered gasoline composition. |
| Diesel Range Organics | | 200 | 2000 | Protection of drinking waterresidual saturation |
| Heavy Oils | | 200 | 2000 | Protection of drinking waterresidual saturation for diesel. |
| Electrical Insulating Mineral Oil | • | 200 (4) | 4000 | Protection of drinking waterresidual saturation |
| | | | | |

⁽¹⁾ Based on background value in table 740-1. Ecology intends to review and, if appropriate, update this value in a future rulemaking.

⁽²⁾ This can also be used as the total toxic equivalents for all cPAHs. See WAC 173-340-708(8).

⁽³⁾ Ecology decision not to change at this time. Ecology intends to review and, if appropriate, update this value in a future rulemaking.

⁽⁴⁾ Ecology also issued a fact sheet in 1995 (#95-157-TCP) allowing the use of 2000 mg/kg at electrical substations and switchyards.

With the adoption of the rule in 2001, this fact sheet has been withdrawn.

⁽⁵⁾ To use this value no benzene must be present in the soil and the total of ethyl benzene, toluene & xylene must be less than 1% of the gasoline mixture.

Table 2: Summary Table for Method A Industrial Soil Cleanup Values in Table 745-1

| Method A Soil Cleanup Levels -for In | dustrial Land Us | es | | | | | | | | | | |
|--|-------------------|------------------|--------------------|------------------|------------------|------------------|---------------|--------------------|----------------|-----------|--|--------------|
| | | | | | | | | | | | | |
| | | 2001 adopted | | | Dermal + | Dermal + | Leaching | 100 X | | | | |
| | | Method A | Ingestion | Ingestion | Ingestion | Ingestion | 3-Phase | Ground water | ., | | | |
| Hazardous Substance | CAS Number | Cleanup Level | Carcinogen | Noncarc. | Carcinogen | Noncarc. | M odel | C/U level | Vapor | Other | | |
| | | mg/kg (1) | mg/kg (2) | mg/kg (3) | mg/kg (4) | mg/kg (5) | mg/kg (6) | mg/kg (7) | mg/kg (8) | mg/kg (9) | | - |
| Arsenic | 7440-38-2 | 200.0 | 88.0 | 1,050 | 39 | 466 | 2.9 | 0.5 | | | | |
| Benzene | 71-43-2 | 0.5 | 4,526 | 10,500 | 2,627 | | 0.028 | 0.5 | | 0.1 | | |
| Benzo(a)Pyrene | 50-32-8 | none | 18 | | 4.3 | | 0.23/1.9 | 0.01 | | | | |
| Cadmium | 7440-43-9 | 10.0 | | 3,500 | - | 1,460 | 0.69 | 0.5 | | | | |
| Chromium (total) | 7440-47-3 | 500.0 | | | | | | | | | 1 | - |
| Chromium VI | 18540-29-9 | 300.0 | | 10,500 | | 1,226 | 19 | 5 | | 500 | | - |
| Chromium III | 16065-83-1 | | | pure | | 352,726 | 2,000 | 10 | | 000 | | |
| DDT | 50-29-3 | 5.0 | 386 | 1,750 | 158 | 715 | 4.1 | 0.03 | | | | |
| Ethylbenzene | 100-41-4 | 20.0 | 386 | 350,000 | 158 | 148,655 | 6.1 | 70 | | | | + |
| • | | | | 330,000 | | 140,000 | | | | | - | - |
| Ethylene dibromide (EDB) | 106-93-4 | 0.001 | 1.5 | | 0.66 | | 0.00005 | 0.001 | | | | |
| Lead | 7439-92-1 | 1000.0 | 1,000 (10) | | | | 3,000 | 1.5 | | | | - |
| Lindane | 58-89-9 | 20.0 | 101 | 1,050 | 33 | 341 | 0.0062 | 0.02 | | | | |
| Methylene chloride | 75-09-2 | 0.5 | 17,500 | 210,000 | 10,157 | 121,878 | 0.022 | 0.5 | | | | |
| Mercury (inorganic) | 7439-97-6 | 1.0 | | 1,050 | | 252 | 2.1 | 0.2 | | | + | + |
| MTBE | 1634-04-4 | none | | 1,000 | | 202 | 0.085 | 2 | | | | |
| Naphthalene | 91-20-3 | | | 70,000 | | 16,613 | 4.5 | 16 | | | | |
| PAHs (carcinogenic)(11) | 91-20-3 | none 20.0 | 18 | 70,000 | 4.3 | 10,013 | 0.23 | 0.01 | | | + | + |
| | | | | | | | | | | | | |
| PCB Mixtures (12) | 1336-36-3 | 10.0 | 66/328/1,875 | 70/245 | 14/70/401 | 15/52 | 0.2/1.6 | 0.01 | | | | |
| Tetrachloroethylene | 127-18-4 | 0.5 | 2,574 | 35,000 | 1,093 | | 0.053 | 0.5 | | | | - |
| Toluene | 108-88-3 | 40.0 | | 700,000 | | 297,309 | 7.3 | 100 | | | | |
| 1,1,1 Trichloroethane | 71-55-6 | 20.0 | | pure | | pure | 1.6 | 20 | | | | |
| Trichloroethylene | 79-01-5 | 0.5 | 11,932 | | 5,068 | pure | 0.033 | 0.5 | | | | |
| Xylenes | 1330-20-7 | 20.0 | | pure | | • | 9.1 | 100 | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| (1) From WAC 173-340-740 Table 2 [1/ | 26/96 revision]. | | | | | | | | | | | |
| (2) Calculated using equation 745-2. | | | | | | | | | | | | - |
| (3) Calculated using equation 745-1.(4) Calculated using equation 745-5. Fe | or comparison on | ly Not used in a | cotting cloanup la | vols since defa | ulte not changed | for other nathwa | WC. | | | | | |
| (5) Calculated using equation 745-3. Fi | | | | | | | | | | | | - |
| (6) Calculated using equation 747-1 and | | | | | | | | A and B values for | or B(a)P. | | | |
| (7) Calculated using 100 X table 720-1 | | | | | | | | | (-) | | | |
| (8) Vapor values not calculated. | | | | | | | | | | | | |
| (9) Benzene from 4 phase leaching mod | | | cumented in 199 | 1 MTCA respon | siveness summa | ıry. | | | | | | |
| (10) Value documented in 1991 MTCA | | | | | | | <u> </u> | | | | _ | |
| (11) Based on benzo (a) pyrene. For le | | | | ater cleanup lev | el, second value | is based on Me | thod A ground | water cleanup le | vel for B(a)P. | | | |
| (12) PCB values based on various aroc | niors and IRIS va | ues for PCB mi | xtures. | | | | | | | | | 1 |
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| | Ta | able 2: Sur | nmary Tab | le for Meth | od A Indust | rial Soil C | leanup Val | ues in Tab | le 745-1 | | | | |
|---|----------------------|--|------------------|--------------------|--------------------|----------------|-------------------|--|-----------------|----|---|--|---|
| | | | | | | | | | | 1 | T | | |
| Method A Soil Cleanup Levels -for In | dustrial Land Us | ies | | | | | | | | | | | |
| - | | 2001 adopted | | Dermal + | Leaching | | 100 X | | | | | | |
| | | Method A | Ingestion | Ingestion | Using | Residual | Ground water | | | | | | |
| Hazardous Substance | CAS Number | Cleanup Level | Noncarc. | Noncarc. | 4-phase Model | Saturation | C/U level | Vapor | | | | | |
| riazardous oubstance | OAO Number | mg/kg (1) | mg/kg (2) | mg/kg (3) | mg/kg (4) | mg/kg (5) | mg/kg (6) | mg/kg (7) | | | | | |
| | | 1119/119 (1) | mg/kg (2) | ing/kg (o) | mg/kg (+) | mg/kg (o) | mg/kg (o) | mg/kg (7) | | 1 | 1 | | 1 |
| | | | | | | | | | | | | | |
| TPH (total) | 14280-30-9 | | | | | | | | | | | | |
| | 0010 50 0 | 400 | | | | | | | | | | | |
| Gasoline range organics | 6842-59-6 | 100 | | | | | | | | | | | |
| GRO with benzene | | <u> </u> | 210,000 | 150,000 | 1 / 23 to 28 | 1,000 | 80 | unknown | | | | | |
| GRO without benzene | | | | | 105 | 1,000 | 100 | unknown | | | | | |
| Diesel Range Organics | | 200 | 170,000 | 39,000 | No upper limit | 2,000 | 50 | >10,000 | | | | | |
| Heavy Oils (8) | | 200 | 170,000 | 39,000 | No upper limit | 2,000 | 50 | >10,000 | | | | | |
| Electrical Insulating Mineral Oil | | 2000 (9) | 340,000 | 70,000 | No upper limit | 4,000 | 100 | Not volatile | | | | | |
| | | 1 | | | | | | | | | | | |
| (4) 5 | (0.0.(0.0 | 1 | | | | | | | | | | | |
| (1) From WAC 173-340-740 Table 2 [1/ | | ! | | | | | | | | | | | |
| (2) Calculated using surrogates. See 1. | | | | | | | | | | | | | |
| (3) Calculated using surrogates and equ | uation /40-4. See | ∋ 1/29/99 Steve F | KODD memo. | (00) | | | (0 40() | | | | 1 | | |
| (4) Calculated using 4 phase model. Fo | | | | | | | | | | | | | |
| For GRO without benzene, assume | | | | | | | | | | | | | |
| For diesel, heavy oils and mineral o | | | | | | e the water ta | ble. | | | | | | |
| (5) Residual saturation for coarse soils | | | | | ral oil. | | | | | | | | |
| (6) Calculated using 1991 method of 10 | | | | | | | | | | | | | |
| (7) Gasoline vapors not calculated. The | e current Method | A value of 100 pr | om thought to be | protective for | vapor pathway. Di | esel vapors ba | sed on qualitativ | ve observations | at sites by PLI | Α. | | | |
| (8) Based on diesel composition. | | <u> </u> | | | | | | | | | | | |
| (9) Ecology also issued a fact sheet in 1 | | | | kg at electrical s | substations and sw | ritchyards. | | | | | | | |
| With the adoption of the rule in 200 | 1, this fact sheet r | ias been withdra | wn. | | | | | | | | | | |
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Table 2: Summary Table for Method A Industrial Soil Cleanup Values in Table 745-1

| • | | | | | | | | | | | | |
|---|---------------------|-------------------|-------------------|-----------------------|------------------|----------------------------------|-----------------|-----------------|------------------------|--|---------------|----------------|
| | Ecological | Ecological | | | | | | 1991 | 2001 adopted | | | |
| | Simplified | Indicator | Most Stringent | Controlling | | | | Method A | Method A | | Basis | |
| Hazardous Substance | Evaluation | Concentration | Non-Eco Path | Non-Eco | ARARs | PQL | Background | | | | for | |
| | mg/kg (1) | mg/kg (2) | mg/kg | Pathway | mg/kg | mg/kg (3) | mg/kg (4) | mg/kg | mg/kg | | Standard | |
| Arsenic | 20 | 7 | 2.9 | Leaching | | 1 (SW7060) | 7 & 20 | 200.0 | 20 | Leaching, adjusted | | |
| Benzene | | | 0.1 | Leaching | | 0.005 (SW8260) | | 0.5 | 0.1 | Protection of drinki | ng water4 pha | ase model |
| Benzo(a)Pyrene | 300 | 12 | 1.9 | Leaching | | 0.05 (SW8270) | | none | 2 | Protection of drinking | ng water3 pha | ase model (6) |
| Cadmium | 36 | 14 | 0.69 | Leaching | | 2 (SW6010A) | 1 | 10.0 | 2 | Leaching, adjusted | for PQL. (7) | ` ' |
| Chromium (total) | 135 | 67 | | | | 2 (SW6010A) | 42 | 500.0 | | | | |
| Chromium VI | | 0. | 19 | Leaching | | 1 (SW3060A) | | 000.0 | 19 | Protection of drinking | ng water3 pha | ase model |
| Chromium III | | | 2,000 | Leaching | | 2 (SW6010A) | | | 2000 | Protection of drinki | | |
| DDT | 1 | 0.75 | 4.1 | Leaching | | 0.05 (SW8081) | | 5.0 | 4 | Protection of drinki | na water3 nh: | asa modal |
| Ethylbenzene | | 0.73 | 6.1 | Leaching | | 0.005 (SW8260) | | 20.0 | 6 | Protection of drinki | | |
| • | | | | | | | | | | | | |
| Ethylene dibromide (EDB) Lead | 220 | 118 | 0.00005 1,000 | Leaching Ingestion | | 0.005 (SW8260) 5.0 (SW6010A) | 17 | 0.001 1000.0 | 0.001 1000 | Leaching, adjusted Ingestion (8) | for PQL | |
| | | | | | | ` ' | 17 | | | 9 , , | | |
| Lindane | 10 | 6 | 0.0062 | Leaching | | 0.01 (SW8081) | | 20.0 | 0.01 | Leaching, adjusted | | |
| Methylene chloride | | | 0.022 | Leaching | | 0.005 (SW8260) |) | 0.5 | 0.02 | Protection of drinki | ng water3 pha | ase model |
| Mercury (inorganic) | 9 | 5.5 | 2.1 | Leaching | | 0.1 (SW7471) | 0.07 | 1.0 | 2 | Protection of drinking | | |
| MTBE | | | 0.085 | Leaching | | 0.005 (SW8260) |) | none | 0.1 | Protection of drinki | ng water3 pha | ase model |
| Naphthalenes | | | 4.5 | Leaching | | 0.5 (SW8260) | | none | 5 | Protection of drinking | ng water3 pha | ase model (10) |
| PAHs (carcinogenic) | 300 | 12 | 1.9 | Leaching | | 0.05 (SW8270) | | 20.0 | none | Replaced with benz | zo(a)pyrene. | , , |
| PCB Mixtures | 2 | 0.65 | 0.2 | Leaching | 10 | 0.04 (SW8082) | | 10.0 | 10 | ARAR (9) | | |
| Tetrachloroethylene | | 0.03 | 0.053 | Leaching | - 10 | 0.005 (SW8260) | | 0.5 | 0.05 | Protection of drinking | ng water3 pha | ase model |
| • | | | | | | ì | | | | | | |
| Toluene 1,1,1 Trichloroethane | | | 7.3 1.6 | Leaching Leaching | _ | 0.005 (SW8260) 0.005 (SW8260) | | 40.0 20.0 | 7 2 | Protection of drinki | | |
| | | | | | | ` ′ | ' | | | | | |
| Trichloroethylene | | | 0.033 | Leaching | | 0.005 (SW8260) | | 0.5 | 0.03 | Protection of drinking | | |
| Xylenes | | | 9.1 | Leaching | | 0.015 (SW8260) | 1 | 20.0 | 9 | Protection of drinki | ng water3 pna | ase model |
| | | | | | | | | | | | | |
| (1) Value from Table 749-2 for industria | al land use. For re | eference only, no | t used in develor | ing Method A v | alues. | | | | | | | |
| (2) Wildlife protection value from Table | | | | | | | | | | | | |
| (3) From Manchester Lab | | | | | | | | | | | | |
| (4) For arsenic, 1st value from upper 9 | | | | | | | ental Services. | All others uppe | r 90% in WA S | tate from report # 94 | -115. | |
| (5) Based on background value in table | | | | | value in a futur | e rulemaking. | | | | | | |
| (6) This can also be used as the total to(7) For cadmium, there are two possib | | | | | a later bas ba | | in the mean on | | 4 4 | | | |
| (8) Ecology decision not to change curr | | | | | | | | mmonly used tes | st method. | | | |
| (9) Cleanup level is sum of all PCBs. A | | | | | | | | of PCB contamin | L ated facilities u | nder TSCA) | | |
| (10) This is a total of all naphthalene, 1 | | | | | | | | - CD comanii | atou raominoo u | 1 | | |
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|---------------------|--|---|---|---|--|---|--|--|--|
| | Table 2: S | ummary 1a | pie for Met | nod A Inc | dustrial Soil | Cleanup v | alues in Ta | bie /45-1 | |
| | | | | | | | | | |
| dustrial Land Us | es | | | | | | | | |
| | | | | | | | | | |
| | Ecological | | | | | | | | |
| | Indicator | Most Stringent | Controlling | | | | Method A | Method A | Basis |
| Evaluation | Concentration | Non-Eco Path | Non-Eco | ARARs | PQL | Background | Cleanup Level | Cleanup Level | l for |
| mg/kg (1) | mg/kg (2) | mg/kg | Pathway | mg/kg | mg/kg (3) | mg/kg | mg/kg | mg/kg | Standard |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 1,000 to 12,000 | 1,000 to 5,000 | 23 to 28 | Leaching | | 5 (NWTPH-Gx) | | 100 | 30 | Protection of drinking water(4) |
| 1,000 to 12,000 | 1,000 to 5,000 | 105 | Leaching | | 5 (NWTPH-Gx) | | 100 | 100 | Protection of drinking water(5) |
| 2,000 to 15,000 | 2,000 to 6,000 | 2000 | Leaching | | 25 (NWTPH-Dx) | | 200 | 2000 | Residual Saturation |
| 2,000 to 15,000 | 2,000 to 6,000 | 2000 | Leaching | | 100 (NWTPH-Dx | :) | 200 | 2000 | Residual Saturation |
| | | 4000 | Leaching | | 100 (NWTPH-Dx | (1) | 200 (7) | 4000 | Residual Saturation |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| able 749-3. For r | eference only, n | ot used in develo | ping Method A | values. | | | | | |
| | | | | 1 | | | | | |
| | | | | | | | | | |
| weathered gasoli | ne assuming no | benzene present | in soil and that | ethyl benzene | e, toluene & xylene | are less than 1 | % of the gasolin | e mixture. | |
| | | | | | | | | | |
| | | | g at electrical su | ubstations and | switchyards. | | | | |
| , this fact sheet h | as been withdra | wn. | | | | | | | |
| | | | | | | | | | |
| t . | Lustrial Land Us Ecological Simplified Evaluation mg/kg (1) 1,000 to 12,000 2,000 to 15,000 2,000 to 15,000 2,000 to 15,000 ed land use. For able 749-3. For investhered gasolii weathered gasolii weathered gasolii g95 (#95-157-TC | Simplified Indicator Evaluation Evaluation Evaluation Evaluation Evaluation Mg/kg (2) | Simplified Indicator Most Stringent | Ecological Ecological Simplified Indicator Evaluation Concentration mg/kg (1) mg/kg (2) Most Stringent Controlling Non-Eco Path Non-Eco mg/kg Pathway | Simplified Indicator Evaluation Concentration Most Stringent Controlling Non-Eco Path Non-Eco ARARS mg/kg (1) mg/kg (2) Non-Eco Path Non-Eco ARARS mg/kg Pathway mg/kg Pathw | Simplified Indicator Most Stringent Controlling Non-Eco Path Non-Eco | Simplified Indicator Most Stringent Controlling Non-Eco Path Policy Path Non-Eco Path Non-Eco Path Policy Po | Simplified Indicator Most Stringent Controlling Method A | Ecological Ecological Simplified Indicator Evaluation Concentration mg/kg (1) mg/kg (2) Most Stringent Non-Eco ARARs PQL Background Cleanup Level Cleanup Leve mg/kg Pathway mg/kg mg/kg (3) mg/kg mg/ |

Table 3: Method C Industrial Soil Calculations for Carcinogens

| Risk CalculationsCarcino | genic Effects | of Soil Ing | estion | | | | | | | | | | |
|-------------------------------|-----------------|-------------|--------------|--------------|------------|----------------|---------------|-------------------|---------------|-----------------|------------|---------|------------|
| | | | | | | Cancer | | | | | | | |
| _ | | Risk | Avg. Body | Lifetime | Unit Conv. | Potency | G.I. Abs. | Soil | Duration | Frequency | Method C | | |
| Parameter | CAS No. | | Weight | | Factor | Factor | Fraction | Ing. Rate | of Exposure | | Carcinogen | | ARAR(4) |
| | | (unitless) | (kg) | (years) | (ug/mg) | (kg-day/mg) | (unitless) | (mg/day) | (years) | (unitless) | (mg/kg) | (mg/kg) | (unitless) |
| Arsenic (5) | 7440-38-2 | 0.00001 | 70 | 75 | 1,000,000 | 1.5 | 1.0 | 50 | 20 | 0.4 | 88 | | |
| Benzene | 71-43-2 | 0.00001 | 70 | 75 | 1,000,000 | 0.029 | 1.0 | 50 | 20 | 0.4 | 4,526 | | |
| Cadmium | 7440-43-9 | | | | | not available | | | | | | | |
| T Chromium | 7440-47-3 | | | | | | | | | | | | |
| Chromium III | 16065-83-1 | | | | | not available | | | | | | | |
| Chromium VI | 18540-29-9 | | | | | not available | | | | | | | |
| DDT | 50-29-3 | 0.00001 | 70 | 75 | 1.000.000 | 0.34 | 1.0 | 50 | 20 | 0.4 | 386 | | |
| Ethylbenzene | 100-41-4 | 0.00001 | 70 | 13 | 1,000,000 | not available | | 30 | 20 | U. 4 | 300 | | |
| . , | | | _ | _ | | | | _ | _ | _ | | | |
| Ethylene dibromide (EDB) | 106-93-4 | 0.00001 | 70 | 75 | 1,000,000 | 85 | 1.0 | 50 | 20 | 0.4 | 1.5 | | |
| Lead | 7439-92-1 | | | | | not available | | | | | | | |
| Lindane | 58-89-9 | 0.00001 | 70 | 75 | 1,000,000 | 1.3 | 1.0 | 50 | 20 | 0.4 | 101 | | |
| Methylene chloride | 75-09-2 | 0.00001 | 70 | 75 | 1,000,000 | 0.0075 | 1.0 | 50 | 20 | 0.4 | 17,500 | | |
| Mercury (inorganic) | 7439-97-6 | | | | | not available | | | | | | | |
| MTBE | 1634-04-4 | | | | | not available | | | | | | | |
| Naphthalene | 91-20-3 | | | | | not available | | | | | | | |
| cPAH Mixtures | na | | | | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | | | | | not available | | | | | - | | |
| Benzo[b]fluoranthene | 205-99-2 | | | | | not available | | | | | | | |
| Benzo[k]fluoranthene | 207-08-9 | | | | | not available | | | | | - | | |
| Benzo[a]pyrene | 50-32-8 | 0.00001 | 70 | 75 | 1,000,000 | 7.3 | 1.0 | 50 | 20 | 0.4 | 18 | | |
| Chrysene | 218-01-9 | 0.00001 | 70 | 73 | 1,000,000 | not available | | 30 | 20 | 0.4 | 10 | | |
| Dibenzo[a,h]anthracene | 53-70-3 | | | | | not available | | | | | | | |
| Ideno[1,2,3-cd]pyrene | 207-08-9 | | | | | not available | | | | | | | |
| idene[1,2,0 da]pyrene | 201 00 0 | | | | | Tiot available | | | | | | | |
| (1) Source of Cancer Potence | y Factor is the | oral slope | factors from | FDΔ'e IDI | S database | except for Lin | dane which | is from HE | ΔST | | | | |
| (2) Value calculated using ed | | | | | | CACCPL IOI LII | GUITE WITHOUT | i io ii oiii i IL | | | + | | |
| (3) Applicable, relevant and | | | accumption | is in that 6 | quation. | | | | | | + | | |
| (4) ARAR divided by Method | | | lded values | indicate A | RAR exceed | ds MTCA reau | irement tha | t risk not ex | ceed 1 X 10-5 | fi.e. >101. | 1 | | |
| (5) The MTCA 2.0 CLARC to | | | | | | | | | | | ere. | | |
| , | , , , , , , | , - | | | | | . 3 | | | | | | |
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Table 3: Method C Industrial Soil Calculations for Carcinogens

| Risk CalculationsCarcino | genic Effects | of Soil Ing | jestion | | | | | | | | | | |
|-------------------------------|---------------|-------------|--------------|-----------|------------|---------------|--------------|--------------|----------------|-----------------|-----------------|----------|------------|
| | | | | | | Cancer | | | | | | | |
| | | Risk | Avg. Body | Lifetime | Unit Conv. | Potency | G.I. Abs. | Soil | Duration | Frequency | Method C | ARAR (3) | Risk @ |
| Parameter | CAS No. | | Weight | | Factor | Factor | Fraction | Ing. Rate | of Exposure | of Contact | Carcinogen | | ARAR(4) |
| | | (unitless) | (kg) | (years) | (ug/mg) | (kg-day/mg) | (unitless) | (mg/day) | (years) | (unitless) | (mg/kg) | (mg/kg) | (unitless) |
| PCB mixtures | 1336-36-3 | | | | | | | | | | | 1.0 | |
| High Risk & Persistence | | 0.00001 | 70 | 75 | 1,000,000 | 2.0 | 1.0 | 50 | 20 | 0.4 | 66 | 1.0 | 0.02 |
| Low Risk & Persistence | | 0.00001 | 70 | 75 | 1,000,000 | 0.4 | 1.0 | 50 | 20 | 0.4 | 328 | 1.0 | 0.003 |
| Lowest Risk & Persistence | | 0.00001 | 70 | 75 | 1,000,000 | 0.07 | 1.0 | 50 | 20 | 0.4 | 1,875 | 1.0 | 0.001 |
| Aroclor 1016 | 12674-11-2 | | | | | not available | | | | | | | |
| Arochlor 1248 | 12672-29-6 | | | | | not available | | | | | | | |
| Arochlor 1254 | 11097-69-1 | | | | | not available | | | | | | | |
| Arochlor 1260 | | | | | | not available | | | | | | | |
| Tetrachloroethylene (PCE) | 127-18-4 | 0.00001 | 70 | 75 | 1,000,000 | 0.051 | 1.0 | 50 | 20 | 0.4 | 2,574 | | |
| Toluene | 108-88-3 | | | | | not available | | | | | | | |
| 1,1,1 Trichloroethane | 71-55-6 | | | | | not available | | | | | - | | |
| Trichloroethylene | 79-01-6 | 0.00001 | 70 | 75 | 1,000,000 | 0.011 | 1.0 | 50 | 20 | 0.4 | 11,932 | | |
| Xylenes | 1330-20-7 | | | | | not available | | | | | | | |
| m-Xylene | 108-38-3 | | | | | not available | | | | | | | |
| o-xylene | 95-47-6 | | | | | not available | | | | | | | |
| p-xylene | | | | | | not available | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |
| (1) Source of Cancer Potency | Factor is the | oral slope | factors from | FPA's IRI | S database | except for te | trachloroeth | vlene trichl | orothylene and | d vinyl chloric | le which are fo | om HEAST | - |
| (2) Value calculated using eq | | | | | | | | ,, | , | | 1 | | - |

⁽²⁾ Value calculated using equation 745-2 and default assumptions in that equation.

(3) Applicable, relevant and appropriate requirement. Source for PCBs is 40 CFR Part 761.61(a)(4)(i)(A).

(4) ARAR divided by Method B value in column K. Bolded values indicate ARAR exceeds MTCA requirement that risk not exceed 1 X 10-5 [i.e. >10].

Table 4: Soil Ingestion -- Method C Industrial Soil Calculations for Noncarcinogens

| Risk CalculationsNoncar | cinogenic Ef | tects of Soil | Ingestion | | | | | | | | |
|-------------------------------|---------------|---------------|-------------|-------------|------------|-----------|------------|------------|------------|---------------|-----------|
| | | | | | | | | | | | |
| | | Reference | Avg. Body | Unit Conv. | Hazard | Soil | G.I. Abs. | Frequency | Method C | ARAR (3) | HQ @ |
| Parameter | CAS No. | Dose (1) | Weight | Factor | Quotient | Ing. Rate | Fraction | of Contact | Noncarc(2) | | ARAR (4 |
| | | (mg/kg-day) | (kg) | (ug/mg) | (unitless) | (mg/day) | (unitless) | (unitless) | (mg/kg) | (mg/kg) | (unitless |
| Arsenic (5) | 7440-38-2 | 0.0003 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 1,050 | | |
| Benzene | 71-43-2 | 0.003 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 10,500 | | |
| Cadmium | 7440-43-9 | 0.001 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 3,500 | | |
| T Chromium | 7440-47-3 | not available | | | | | | | | | |
| Chromium III | 16065-83-1 | | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 5,250,000 | | |
| Chromium VI | 18540-29-9 | | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 10,500 | | |
| DDT | 50-29-3 | 0.0005 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 1,750 | | |
| Ethylbenzene | 100-41-4 | 0.1 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 350,000 | | |
| Ethylene dibromide (EDB) | 106-93-4 | not available | | | | | | | | | |
| Lead | | not available | | | | | | | | | |
| Lindane | 58-89-9 | 0.0003 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 1,050 | | |
| | | | | | | | | | | _ | |
| Methylene chloride | 75-09-2 | 0.06 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 210,000 | | |
| Mercury (inorganic) | 7439-97-6 | | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 1,050 | | |
| MTBE | 1634-04-4 | not available | | | | | | | | | |
| Naphthalene | 91-20-3 | 0.02 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 70,000 | | |
| cPAH Mixtures | na | not available | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | not available | : | | | | | | | | |
| Benzo[b]fluoranthene | 205-99-2 | not available | : | | | | | | | | |
| Benzo[k]fluoranthene | 207-08-9 | not available | : | | | | | | | | |
| Benzo[a]pyrene | 50-32-8 | not available | : | | | | | | | | |
| Chrysene | 218-01-9 | not available | | | | | | | | | |
| Dibenzo[a,h]anthracene | 53-70-3 | not available | | | | | | | | | |
| Ideno[1,2,3-cd]pyrene | 207-08-9 | not available | | | | | | | | | |
| | | | | | | | | | | | |
| (1) Source of RfDs is EPA's | | | | | | ٨. | | | | | |
| (2) Value calculated using ed | quation 740-1 | and default a | assumptions | in that equ | ation. | | | | | | |
| (3) Applicable, relevant and | | | | | | | | | | | |
| (4) ARAR divided by Method | B value in co | olumn K. Bolo | | | | | | | | | |
| (5) The MTCA 2.0 CLARC ta | | | | | | | | | | 1.0 is used h | nere. |
| · · | , , , | <u> </u> | | | | | | | | | |
| | | | | | | | | | | | |

Table 4: Soil Ingestion -- Method C Industrial Soil Calculations for Noncarcinogens

| Risk CalculationsNoncard | inogenic Ef | fects of Soil | Ingestion | | | | | | | | |
|--------------------------------|---------------|----------------|--------------|--------------|------------|--------------|-------------|---------------|------------|----------|------------|
| | | | | | | | | | | | |
| | | Reference | | Unit Conv. | Hazard | Soil | G.I. Abs. | _ | Method C | ARAR (3) | |
| Parameter | CAS No. | Dose (1) | Weight | Factor | Quotient | Ing. Rate | | of Contact | Noncarc(2) | | ARAR (4) |
| | | (mg/kg-day) | (kg) | (ug/mg) | (unitless) | (mg/day) | (unitless) | (unitless) | (mg/kg) | (mg/kg) | (unitless) |
| PCB mixtures | 1336-36-3 | not available | | | | | | | | 1.0 | |
| High Risk & Persistence | | not available | | | | | | | | | |
| Low Risk & Persistence | | not available | | | | | | | | | |
| Lowest Risk & Persistence | | not available | | | | | | | | | |
| Aroclor 1016 | 12674-11-2 | 0.00007 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 245.0 | 1.0 | 0.004 |
| Arochlor 1248 | 12672-29-6 | not available | | | | | | | | | |
| Arochlor 1254 | 11097-69-1 | 0.00002 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 70.0 | 1.0 | 0.01 |
| Arochlor 1260 | | not available | | | | | | | | | |
| Tetrachloroethylene (PCE) | 127-18-4 | 0.01 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 35,000 | | |
| Toluene | 108-88-3 | 0.2 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 700,000 | | |
| 1,1,1 Trichloroethane | 71-55-6 | 0.9 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 3,150,000 | | |
| Trichloroethylene | 79-01-6 | not available | | | | | | | | | |
| Xylenes | 1330-20-7 | 2.0 | 70 | 1,000,000 | 1 | 50 | 1.0 | 0.4 | 7,000,000 | | |
| m-Xylene | 108-38-3 | not available | | | | | | | | | |
| o-xylene | 95-47-6 | not available | | | | | | | | | |
| p-xylene | | not available | | | | | | | | | |
| | | | | | | | | | | | |
| (1) Source of RfDs is EPA's I | RIS databas | e except for 1 | ,1,1, TCE w | hich is from | HEAST. | | | | | | |
| (2) Value calculated using eq | uation 740-1 | and default a | ssumptions | in that equa | ation. | | | | | | |
| (3) Applicable, relevant and a | ppropriate re | equirement. S | Source for P | CBs is 40 C | FR Part 76 | 61.61(a)(4)(| (i)(A). | | | | |
| (4) ARAR divided by Method | B value in co | olumn K. Bolo | ded values i | ndicate ARA | R exceeds | MTCA rec | quirement t | hat HQ not ex | ceed 1.0. | | |
| | | | | | | | | | | | ĺ |

Table 5: Method C Industrial Calculations for Carcinogens for Soil Ingestion plus Dermal Contact

| Risk CalculationsCarcino | yenic Enecis (| Ji Juli Ilige: | SHOLL + DELL | nai Goniac | · | | | | | | | - | | | | + |
|---|----------------------|----------------|--------------|---------------|-------------|---------------|-------------|--------------|--------------------------------|--|--------------------|---------------------------|---------------|------------|--|-------------|
| | | Risk | Ava Body | Averaging | Exposure | Exposure | Soil | G.I. Abs. | Oral | Unit Conv. | Surface | Adherence | Dermal | G.I. Conv. | Dermal | Method C (3 |
| Parameter | CAS No. | 11.011 | Weight | Time | Frequency | | | Fraction | CPF (1) | Factor | Area | Factor | Abs. Fraction | Factor | CPF (2) | Carcinoger |
| | | (unitless) | (kg) | (days) | (days/yr) | (yrs) | (mg/day) | (unitless) | (kg-day/mg) | (ug/mg) | (cm ²) | (mg/cm ² -day) | (unitless) | (unitless) | | (mg/kg) |
| Arsenic | 7440-38-2 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 1.5 | 1,000,000 | 2,500 | 0.2 | 0.03 | 0.95 | 1.6 | 38.8 |
| Benzene | 71-43-2 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.029 | 1,000,000 | 2,500 | 0.2 | 0.0005 | 0.80 | 0.036 | 2,62 |
| Cadmium | 7440-43-9 | | | | | | | | not available | | | | | | | |
| Γ Chromium | 7440-47-3 | | | | | | | | | | | | | | | |
| Chromium III | 16065-83-1 | | | | | | | | not available | | | | | | | |
| Chromium VI | 18540-29-9 | | | | | | | | not available | | | | | | | |
| DDT | 50-29-3 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.34 | 1,000,000 | 2,500 | 0.2 | 0.03 | 0.70 | 0.49 | 157.8 |
| Ethylbenzene | 100-41-4 | | | , | | | | | not available | | , | | | | | |
| Ethylene dibromide (EDB) | 106-93-4 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 85 | 1,000,000 | 2,500 | 0.2 | 0.03 | 0.80 | 106 | 0.656 |
| Lead | 7439-92-1 | | | | | | | | not available | | _,,,,,, | 3.2 | | | | |
| Lindane | 58-89-9 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 1.3 | 1,000,000 | 2,500 | 0.2 | 0.04 | 0.50 | 2.6 | 32.76 |
| Methylene chloride | 75-09-2 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.0075 | 1,000,000 | 2,500 | 0.2 | 0.0005 | 0.80 | 0.0094 | 10,157 |
| Mercury (inorganic) | 7439-97-6 | | | | | | | | not available | | | | | | | |
| MTBE | 1634-04-4 | | | | | | | | not available | | | | | | | |
| Naphthalene | 91-20-3 | | | | | | | | not available | | | | | | | |
| • | | | | | | | | | not available | | | | | | | |
| cPAH Mixtures | na | | | | | | | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | | | | | | | | not available | | | | | | | |
| Benzo[b]fluoranthene Benzo[k]fluoranthene | 205-99-2 207-08-9 | | | | | | | | not available not available | | | | | | | |
| Benzo[a]pyrene | 50-32-8 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 7.3 | 1,000,000 | 2,500 | 0.2 | 0.13 | 0.89 | 8.2 | 4.27 |
| Chrysene | 218-01-9 | 0.00001 | 70 | 21,010 | 250 | 20 | 30 | 1.0 | not available | | 2,000 | 0.2 | 0.10 | 0.00 | 0.2 | 7.27 |
| Dibenzo[a,h]anthracene | 53-70-3 | | | | | | | | not available | | | | | | | |
| Ideno[1,2,3-cd]pyrene | 207-08-9 | | | | | | | | not available | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| (1) Source of Cancer Potent | y Factor is the | oral slope fa | ctors fromEl | PA's IRIS da | atabase, ex | cept for Line | dane which | is from HE | AST. | | | | | | | |
| (2) Dermal CPF = Oral CPF | | | | factor is che | emical spec | ific. See ed | uation 745- | 5 for defaul | ts and 1/25/99 | memo for c | hemical spe | ecific factors us | ed here. | | | |
| (3) Calculated using equatio | n 745-5 and def | ault assump | tions. | | | | | | | | | | | | | |
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Table 5: Method C Industrial Calculations for Carcinogens for Soil Ingestion plus Dermal Contact

| Risk CalculationsCarcino | genic Effects o | of Soil Inges | stion + Deri | nal Contac | t | · | · | | | | | | <u>-</u> | | | |
|-------------------------------|-----------------|----------------|--------------|---------------|--------------|---------------|-------------|---------------|----------------|---------------|-------------|---------------------------|---------------|------------|-------------|--|
| | | Risk | Ava Body | Averaging | Exposure | Exposure | Soil | G.I. Abs. | Oral | Unit Conv. | Surface | Adherence | Dermal | G.I. Conv. | Dermal | Method C (3 |
| Parameter | CAS No. | TOOL | Weight | | Frequency | | Ing. Rate | Fraction | CPF (1) | Factor | Area | Factor | Abs. Fraction | Factor | CPF (2) | Carcinogen |
| - arameter | 07101101 | (unitless) | (kg) | (days) | (days/yr) | (yrs) | (mg/day) | | (kg-day/mg) | (ug/mg) | | (mg/cm ² -day) | (unitless) | (unitless) | (kg-day/mg) | (mg/kg) |
| PCB mixtures | 1336-36-3 | | 1 | | | | | | | | | | | | | |
| High Risk & Persistence | | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 2.0 | 1,000,000 | 2,500 | 0.2 | 0.14 | 0.81 | 2.5 | 14.05 |
| Low Risk & Persistence | | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.4 | 1,000,000 | 2,500 | 0.2 | 0.14 | 0.81 | 0.49 | 70.2 |
| Lowest Risk & Persistence | | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.07 | 1,000,000 | 2,500 | 0.2 | 0.14 | 0.81 | 0.0864 | 401 |
| Aroclor 1016 | 12674-11-2 | | | | | | | | not available | | | | | | | |
| Arochlor 1248 | 12672-29-6 | | | | | | | | not available | | | | | | | |
| Arochlor 1254 | 11097-69-1 | | | | | | | | not available | | | | | 0.81 | | |
| Arochlor 1260 | | | | | | | | | not available | | | | | | | |
| Tetrachloroethylene (PCE) | 127-18-4 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.051 | 1,000,000 | 2,500 | 0.2 | 0.03 | 0.80 | 0.064 | 1,093 |
| Toluene | 108-88-3 | | | | | | | | not available | | | | | | | |
| 1,1,1 Trichloroethane | 71-55-6 | | | | | | | | not available | | | | | | | |
| Trichloroethylene | 79-01-6 | 0.00001 | 70 | 27,375 | 250 | 20 | 50 | 1.0 | 0.011 | 1,000,000 | 2,500 | 0.2 | 0.03 | 0.80 | 0.014 | 5,068 |
| Xylenes | 1330-20-7 | | | | | | | | not available | | | | | | | |
| m-Xylene | 108-38-3 | | | | | | | | not available | | | | | | | |
| o-xylene | 95-47-6 | | | | | | | | not available | | | | | | | |
| p-xylene | | | | | | | | | not available | | | | | | | |
| | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | |
| (1) Source of Cancer Potency | Factor is the o | oral slope fac | ctors from E | PA's IRIS d | atabase, ex | cept for tetr | achloroethy | lene, trichlo | orothylene and | vinyl chlorid | e which are | from HEAST. | | | | |
| (2) Dermal CPF = Oral CPF/ | GI abs convers | ion factor. 7 | The GI abs. | factor is che | emical speci | fic. See eq | uation 745- | 5 for defaul | ts and 1/25/99 | memo for cl | hemical spe | cific factors us | ed here. | | | |
| (3) Calculated using equation | | | | | · | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

Table 6: Method C Industrial Calculations for Noncarcinogens for Soil Ingestion plus Dermal Contact

| Risk CalculationsNoncar | | | | | | | | | | | | | | | | |
|---|------------|------------|-----------|----------------|--------------|-------------|----------------|----------------|----------------|---------------|----------------|---------------------|--------------------|-----------------------|-------------|------------|
| | | Hazard | Avg. Body | Averaging | Exposure | Exposure | Oral Ref. | Soil | G.I. Abs. | Unit Conv. | G.I. Conv. | Dermal | Surface | Adherence | Dermal Abs. | Method C |
| Parameter | CAS No. | Index | Weight | Time | Frequency | Duration | Dose (1) | Ing. Rate | Fraction | Factor | Factor | Rfd (2) | Area | Factor | Fraction | Noncarc(2) |
| | | (unitless) | (kg) | (days) | (days/yr) | (years) | (mg/kg-day) | (mg/day) | (unitless) | (mg/kg) | (unitless) | (mg/kg-day) | (cm ²) | (mg/cm ²) | (unitless) | (mg/kg) |
| Arsenic | 7440-38-2 | 1 | 70 | 7,300 | 250 | 20 | 0.0003 | 50 | 1 | 1,000,000 | 0.95 | 0.00029 | 2,500 | 0.2 | 0.03 | 46 |
| Benzene | 71-43-2 | 1 | 70 | 7,300 | 250 | 20 | 0.003 | 50 | 1 | 1,000,000 | 0.80 | 0.0024 | 2,500 | 0.2 | 0.0005 | |
| Cadmium | 7440-43-9 | 1 | 70 | 7,300 | 250 | 20 | 0.001 | 50 | 1 | 1,000,000 | 0.025 | 0.000025 | 2,500 | 0.2 | 0.001 | 1,460 |
| T Chromium | 7440-47-3 | | | | | | not available | | | | | | | | | |
| Chromium III | 16065-83-1 | 1 | 70 | 7,300 | 250 | 20 | 1.5 | 50 | 1 | 1,000,000 | 0.013 | 0.020 | 2,500 | 0.2 | 0.01 | 352,726 |
| Chromium VI | 18540-29-9 | 1 | 70 | 7,300 | 250 | 20 | 0.003 | 50 | 1 | 1,000,000 | 0.025 | 0.000075 | 2,500 | 0.2 | 0.01 | 1,226 |
| DDT | 50-29-3 | 1 | 70 | 7,300 | 250 | 20 | 0.0005 | 50 | 1 | 1,000,000 | 0.70 | 0.00035 | 2,500 | 0.2 | 0.03 | 715 |
| Ethylbenzene | 100-41-4 | 1 | 70 | 7,300 | 250 | 20 | 0.1 | 50 | 1 | 1,000,000 | 0.80 | 0.080 | 2,500 | 0.2 | 0.03 | 148,65 |
| • | | | | | | | | | | | | | | | | |
| Ethylene dibromide (EDB) | 106-93-4 | | | | | | not available | | | | | | | | | |
| Lead | 7439-92-1 | | | | | | not available | | | | | | | | | |
| Lindane | 58-89-9 | 1 | 70 | 7,300 | 250 | 20 | 0.0003 | 50 | 1 | 1,000,000 | 0.50 | 0.00015 | 2,500 | 0.2 | 0.04 | 34 |
| Methylene chloride | 75-09-2 | 1 | 70 | 7,300 | 250 | 20 | 0.06 | 50 | 1 | 1,000,000 | 0.80 | 0.048 | 2,500 | 0.2 | 0.0005 | 121,878 |
| | | | | | | | | | | | | | | | | |
| Mercury (inorganic) | 7439-97-6 | 11 | 70 | 7,300 | 250 | 20 | 0.0003 | 50 | 1 | 1,000,000 | 0.07 | 0.000021 | 2,500 | 0.2 | 0.01 | 252 |
| MTBE | 1634-04-4 | | | | | | not available | | | | | | | | | |
| Naphthalene | 91-20-3 | 1 | 70 | 7,300 | 250 | 20 | 0.02 | 50 | 1 | 1,000,000 | 0.89 | 0.018 | 2,500 | 0.2 | 0.13 | 16,613 |
| cPAH Mixtures | na | | | | | | not available | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | | | | | | not available | | | | | | | | | |
| Benzo[b]fluoranthene | 205-99-2 | | | | | | not available | | | | | | | | | |
| Benzo[k]fluoranthene | 207-08-9 | | | | | | not available | | | | | | | | | |
| Benzo[a]pyrene | 50-32-8 | | | | | | not available | | | | | | | | | |
| Chrysene | 218-01-9 | | | | | | not available | | | | | | | | | |
| Dibenzo[a,h]anthracene | 53-70-3 | | | | | | not available | | | | | | | | | |
| Ideno[1,2,3-cd]pyrene | 207-08-9 | | | | | | not available | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| (1) Source of oral RfDs is E (2) Dermal RfD = Oral RfD 3 | | | | | | | ti 745 4 | for defection | d 4/05/00 | | ninal annaitia | fa ataua a l la aus | | | | |
| (3) Calculated using equation | | | | ads. factor is | chemicai spe | ecilic. See | equation 745-4 | ior delaults a | and 1/25/99 ff | nemo for cher | nicai specilic | ractors used nere | a. | | | |
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| | 1 | | 1 | 1 | I | l | l . | 1 | l . | 1 | 1 | | 1 | 1 | | 1 |

| Risk CalculationsNoncar | cinogenic E | ffects of So | oil Ingestion | 1 + Dermal C | ontact | | | | | | | | | | | |
|-------------------------------|-------------|--------------|---------------|--------------|------------|----------|---------------|-----------|------------|------------|------------|-------------|-----------------------|-----------------------|-------------|--|
| | | | | | | | | | | | | | | | | |
| | | Hazard | Avg. Body | Averaging | Exposure | Exposure | Oral Ref. | Soil | G.I. Abs. | Unit Conv. | G.I. Conv. | Dermal | Surface | Adherence | Dermal Abs. | Method C |
| Parameter | CAS No. | Index | Weight | Time | Frequency | Duration | Dose (1) | Ing. Rate | Fraction | Factor | Factor | Rfd (2) | Area | Factor | Fraction | Noncarc(2) |
| | | (unitless) | (kg) | (days) | (unitless) | (years) | (mg/kg-day) | (mg/day) | (unitless) | (mg/kg) | (unitless) | (mg/kg-day) | (mg/cm ²) | (mg/cm ²) | (unitless) | (mg/kg) |
| PCB mixtures | 1336-36-3 | | I | | | ı | not available | l | | I | | | l | 1 | | |
| High Risk & Persistence | 1336-36-3 | | | | | | not available | | | | | | | | | |
| Low Risk & Persistence | - | | | | | | not available | | | | | | | | | |
| Lowest Risk & Persistence | | | | | | | not available | | | | | | | | | |
| Aroclor 1016 | 12674-11-2 | 1 | 70 | 7.300 | 250 | 20 | 0.00007 | 50 | 1 | 1.000.000 | 0.81 | 0.000057 | 2.500 | 0.2 | 0.14 | 52. |
| Arochlor 1248 | 12672-29-6 | | 7.0 | 7,000 | 200 | 20 | not available | - 00 | | 1,000,000 | 0.01 | 0.000001 | 2,000 | 0.2 | 0.14 | <u> </u> |
| Arochlor 1254 | 11097-69-1 | 1 | 70 | 7.300 | 250 | 20 | 0.00002 | 50 | 1 | 1.000.000 | 0.81 | 0.000016 | 2.500 | 0.2 | 0.14 | 15.0 |
| Arochlor 1260 | | | | .,,,,, | | | not available | | | .,, | 0.0. | | _,,,,,, | 7 | | |
| Tetrachloroethylene (PCE) | 127-18-4 | 1 | 70 | 7.300 | 250 | 20 | 0.01 | 50 | 1 | 1,000,000 | 0.80 | 0.0080 | 2.500 | 0.2 | 0.03 | 14,86 |
| Toluene | 108-88-3 | 1 | 70 | 7,300 | 250 | 20 | 0.2 | 50 | 1 | 1,000,000 | 0.80 | 0.16 | 2,500 | 0.2 | 0.03 | 297,30 |
| 1.1.1 Trichloroethane | 71-55-6 | 1 | 70 | 7.300 | 250 | 20 | 0.9 | 50 | 1 | 1.000.000 | 0.80 | 0.72 | 2.500 | 0.2 | 0.0005 | 1.828.17 |
| Trichloroethylene | 79-01-6 | | 70 | 7,300 | 250 | 20 | not available | 30 | | 1,000,000 | 0.00 | 0.72 | 2,300 | 0.2 | 0.0003 | 1,020,17 |
| Xvlenes | 1330-20-7 | 1 | 70 | 7.300 | 250 | 20 | 2.0 | 50 | 1 | 1.000.000 | 0.80 | 1.6 | 2.500 | 0.2 | 0.03 | 2,973,09 |
| m-Xylene | 108-38-3 | | 7.0 | 7,000 | 200 | 20 | not available | - 00 | | 1,000,000 | 0.00 | 1.0 | 2,000 | 0.2 | 0.00 | 2,010,00 |
| o-xylene | 95-47-6 | | | | | | not available | | | | | | | | | |
| p-xylene | | | | | | | not available | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| (1) Source of oral RfDs is El | 1 | | L | | | L | | | | | | | | | | |

Table 7: 3-Phase Model Assumptions and Results

| 3-Phase Model Results | | | | | | | | | | | | |
|----------------------------|---------------------|----------------------|--------------|-------------|--------------|-----------------------|----------------------|--------------|--------------|-----------------|-------------|--|
| | | Gd H₂O | | | | | | | | Dilution | Soil | |
| | CAS No. | C/U Level | Bulk Density | Soil Water | Soil Air | H' | Koc | foc | Kd | Factor | C/U Level | |
| | 07101101 | (mg/l) (1) | (g/cc) (2) | (cc/cc) (2) | (cc/cc) (2) | (cc/cc) (3) | (ml/g) (3) | (%) (4) | (cc/g) (5) | (dimensionless) | (mg/kg) (6) | |
| Arsenic | 7440-38-2 | 0.005 | 1.5 | 0.3 | 0.13 | 0 | - | - | 29 | 20 | 2.92 | |
| Benzene | 71-43-2 | 0.005 | 1.5 | 0.3 | 0.13 | 0.228 | 61.7 | 0.1% | 0.062 | 20 | 0.028 | |
| Cadmium | 7440-43-9 | 0.005 | 1.5 | 0.3 | 0.13 | 0 | - | - | 6.7 | 20 | 0.69 | |
| Chromium (total) | 7440-47-3 | | | | | | | | | | | |
| Chromium VI | 18540-29-9 | 0.05 | 1.5 | 0.3 | 0.13 | 0 | - | - | 19 | 20 | 19 | |
| Chromium III | 16065-83-1 | 0.10 | 1.5 | 0.3 | 0.13 | 0 | - | - | 1000 | 20 | 2000 | |
| DDT | 50-29-3 | 0.0003 | 1.5 | 0.3 | 0.13 | 0.000332 | 386,977 | 0.1% | 387 | 20 | 2.32 | |
| Ethyl Benzene | 100-41-4 | 0.7 | 1.5 | 0.3 | 0.13 | 0.323 | 204 | 0.1% | 0.204 | 20 | 6.05 | |
| Ethylene dibromide (EDB) | 106-93-4 | 0.00001 | 1.5 | 0.3 | 0.13 | 0.0336 | 66 | 0.1% | 0.066 | 20 | 0.000054 | |
| Lead | 7439-92-1 | 0.015 | 1.5 | 0.3 | 0.13 | 0 | - | - | 10000 | 20 | 3000 | |
| Lindane | 58-89-9 | 0.0002 | 1.5 | 0.3 | 0.13 | 0.000574 | 1,352 | 0.1% | 1.4 | 20 | 0.0062 | |
| Methylene Chloride | 75-09-2 | 0.005 | 1.5 | 0.3 | 0.13 | 0.0898 | 10 | 0.1% | 0.010 | 20 | 0.022 | |
| Mercury (inorganic) | 7439-97-6 | 0.002 | 1.5 | 0.3 | 0.13 | 0.467 | - | - | 52 | 20 | 2.09 | |
| MTBE | 1634-04-4 | 0.02 | 1.5 | 0.3 | 0.13 | 0.018 | 11 | 0.1% | 0.011 | 20 | 0.085 | |
| | | | | | | | | | | | | |
| Naphthalene | 91-20-3 | 0.16 | 1.5 | 0.3 | 0.13 | 0.0198 | 1,191 | 0.1% | 1.191 | 20 | 4.46 | |
| cPAH Mistures | na | | | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | 0.000012 | 1.5 | 0.3 | 0.13 | 0.000137 | 357,537 | 0.1% | 358 | 20 | 0.086 | |
| Benzo[b]fluoranthene | 205-99-2 | 0.000012 | 1.5 | 0.3 | 0.13 | 0.00455 | 1,230,000 | 0.1% | 1,230 | 20 | 0.30 | |
| Benzo[k]fluoranthene | 207-08-9 | 0.000012 0.000012 | 1.5 | 0.3 | 0.13 | 0.000034 0.0000463 | 1,230,000 968,774 | 0.1% | 1,230 969 | 20 | 0.30 | |
| Benzo[a]pryene Chrysene | 50-32-8 218-01-9 | 0.000012 | 1.5 1.5 | 0.3 | 0.13 0.13 | 0.0000463 | 398,000 | 0.1% 0.1% | 398 | 20 | 0.23 | |
| Dibenzo[a,h]anthracene | 53-70-3 | 0.000012 | 1.5 | 0.3 | 0.13 | 6.03E-07 | 1,789,101 | 0.1% | 1,789 | 20 | 0.43 | |
| Indeno[1,2,3-cd]pyrene | 207-08-9 | 0.000012 | 1.5 | 0.3 | 0.13 | 0.0000656 | 3,470,000 | 0.1% | 3470.00 | 20 | 0.83 | |
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Table 7: 3-Phase Model Assumptions and Results

| 3-Phase Model Results | | | | | | | | | | | | |
|---|----------------|----------------|-----------------|---------------|---------------|----------------|-------------------|------------------|-------------------|----------------------|-------------|----------|
| | | Gd H₂O | | | | | | | | Dilution | Soil | |
| | CAS No. | C/U Level | Bulk Density | Soil Water | Soil Air | H' | Koc | foc | Kd | Factor | C/U Level | |
| | 0/10/110. | (mg/l) (1) | (g/cc) (2) | | (cc/cc) (2) | | (ml/g) (3) | (%) (4) | (cc/g) (5) | (dimensionless) | (mg/kg) (6) | |
| | - | (1119/1) (1) | (9/00) (2) | (00/00) (2) | (00/00) (2) | (00/00) (0) | (1111/9) (0) | (70) (1) | (00/9) (0) | (dirriorioloriiloso) | (mg/kg) (o) | 1 |
| PCB Mixtures | 1336-36-3 | | | | | | | | | | | |
| Arochlor 1016 | 12674-11-2 | | 1.5 | 0.3 | 0.13 | 0.119 | 107,285 | 0.1% | 107 | 20 | 0.21 | |
| Arochlor 1260 | | 0.0001 | 1.5 | 0.3 | 0.13 | 0.189 | 822,422 | 0.1% | 822 | 20 | 1.65 | |
| Tetrachlorothylene (PCE) | 127-18-4 | 0.005 | 1.5 | 0.3 | 0.13 | 0.754 | 265 | 0.1% | 0.265 | 20 | 0.053 | |
| Toluene | 108-88-3 | 1.0 | 1.5 | 0.3 | 0.13 | 0.272 | 140 | 0.1% | 0.140 | 20 | 7.27 | |
| | | | | | | | | | | | | |
| 1,1,1 Trichlorothane | 71-55-6 | 0.2 | 1.5 | 0.3 | 0.13 | 0.705 | 135 | 0.1% | 0.135 | 20 | 1.58 | |
| Trichlorocthylene | 79-01-6 | 0.005 | 1.5 | 0.3 | 0.13 | 0.422 | 94 | 0.1% | 0.094 | 20 | 0.033 | |
| Xylenes | 1330-20-7 | 1.0 | 1.5 | 0.3 | 0.13 | 0.279 | 233 | 0.1% | 0.233 | 20 | 9.14 | |
| m-xylene | 108-38-3 | 1.0 | 1.5 | 0.3 | 0.13 | 0.301 | 196 | 0.1% | 0.196 | 20 | 8.44 | 1 |
| o-xylene | 95-47-6 | 1.0 | 1.5 | 0.3 | 0.13 | 0.213 | 241 | 0.1% | 0.241 | 20 | 9.19 | 1 |
| p-xylene | 33 47 0 | 1.0 | 1.5 | 0.3 | 0.13 | 0.213 | 311 | 0.1% | 0.241 | 20 | 10.76 | + |
| p Aylorio | 1 | 1.0 | 1.0 | 0.0 | 0.10 | 0.017 | 311 | 0.170 | 0.011 | 20 | 10.70 | + |
| | 1 | | | | | | | | | | | + |
| | 1 | | | | | | | | | | | + |
| (1) Ground water cleanup I | avalueed for | calculation E | rom proposed | table 720 1 | eveent for C | r III usad 0.1 | ma/Land for D | NHs used Meth | and B value for l | P(a)P | | |
| If the Method A ground | | | | | | | | | lou b value loi i | D(a)1 . | | |
| (2) From equation 747-1. | | | | | | | | | | | | |
| (2) From equation 747-1. (3) Source: Soil Screening | | | | | | | | | | | | |
| EDB values from ATSD | | | | EIII. EPA/54 | +U/K-95/12D | . May, 1996 | . Exceptions are | . | | | | - |
| MTBE from USGS final | | | | 200) | | | | | | | | - |
| Arochlor values for Her | | | | | aiaal Daafila | (Dan 1000) | . Augustau 1/22 f | FDA 400/ | | | | - |
| | | | | | | | | | | | | |
| Values for total xylenes | | | | | | iposition data | a from TPH Crit | eriai vvorking (| -roupvolume | 2 (May 1998). | | |
| That is: m = 51% of tot | | | | | | . 0 | | | | | | |
| H' for all metals except | | | | | | | | | 1 407 " | | | |
| DDT value for Koc base | | | | | idance is us | ed, Koc = 67 | 7,934 and soil o | leanup level e | quals 4.07 mg/l | kg. | | |
| (4) Based on review of data | | | | | | | | | | | | |
| (5) From equation 747-2 fo | | | | | | | | | | | | |
| (6) Calculated using equati | ion 747-1 (3-p | phase model) v | vith model defa | aults (as sho | wn in this ta | ble) and grou | und water clean | up level show | n in this table. | | | |
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Table 7: 3-Phase Model Assumptions and Results

| 3-Phase Model Results | | | | | | | | | | | | |
|--------------------------|------------|---------------|------------|-----------|-------------|---------------|--------------|---------------------------|--------------|---------------|--------------|--------------|
| | | Pore Water | | NAPL | | Pore Water | | Vapor | | Soil | | Sum |
| | CAS No. | Concentration | Solubility | in | Csat | Concentration | Water Mass | Concentration | Vapor Mass | Concentration | Soil Mass | Mass |
| | | (mg/l) (7) | (mg/l) (3) | Soil? (8) | (mg/kg) (9) | (mg/l) (7) | (mg/kg) (10) | (mg/m ³) (11) | (mg/kg) (12) | (mg/kg) (13) | (mg/kg) (14) | (mg/kg) (15) |
| Arsenic | 7440-38-2 | - | - | n/a | - | 0.10 | 0.020 | - | - | 2.90 | 2.90 | 2.92 |
| Benzene | 71-43-2 | 0.10 | 1,750 | No | 493 | 0.10 | 0.020 | 22.8 | 0.0020 | 0.0062 | 0.0062 | 0.028 |
| | | | | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.10 | - | n/a | - | 0.10 | 0.020 | - | - | 0.67 | 0.67 | 0.69 |
| Chromium (total) | 7440-47-3 | | | | | | | | | | | |
| Chromium VI | 18540-29-9 | | - | n/a | - | 1.0 | 0.20 | | - | 19 | 19 | 19 |
| Chromium III | 16065-83-1 | 2.0 | - | n/a | - | 2.0 | 0.40 | - | - | 2000 | 2,000 | 2000 |
| DDT | 50-29-3 | 0.0060 | 0.0250 | No | 10 | 0.0060 | 0.0012 | 0.0020 | 1.73E-07 | 2.32 | 2.32 | 2.32 |
| Ethyl Benzene | 100-41-4 | 14 | 169 | No | 73 | 14 | 2.8 | 4522 | 0.39 | 2.86 | 2.86 | 6.05 |
| Ethylene dibromide (EDB) | 106-93-4 | 0.00020 | 4,000 | No | 1,076 | 0.00020 | 0.000040 | 0.0067 | 5.82E-07 | 0.000013 | 0.000013 | 0.000054 |
| Lead | 7439-92-1 | 0.30 | - | n/a | - | 0.30 | 0.060 | 1 | - | 3000 | 3000 | 3000 |
| Lindane | 58-89-9 | 0.0040 | 6.8 | No | 11 | 0.0040 | 0.00080 | 0.0023 | 1.99E-07 | 0.0054 | 0.0054 | 0.006 |
| Methylene Chloride | 75-09-2 | 0.0040 | 13,000 | No | 2,831 | 0.0040 | 0.0000 | 9.0 | 0.00078 | 0.0034 | 0.0034 | 0.000 |
| | | | | | , | | | | | | | |
| Mercury (inorganic) | 7439-97-6 | 0.040 | | n/a | - | 0.040 | 0.008 | 19 | 0.0016 | 2.08 | 2.08 | 2.09 |
| MTBE | 1634-04-4 | 0.40 | 50,000 | No | 10,628 | 0.40 | 0.080 | 7.2 | 0.00062 | 0.0044 | 0.0044 | 0.085 |
| Naphthalene | 91-20-3 | 3.2 | 31 | No | 43 | 3.2 | 0.64 | 63 | 0.0055 | 3.81 | 3.81 | 4.46 |
| cPAH Mistures | na | | | | | | | | | | | |
| Benzo[a]anthracene | 56-55-3 | 0.00024 | 0.0094 | No | 3.4 | 0.00024 | 0.000048 | 3.29E-05 | 2.85E-09 | 0.09 | 0.086 | 0.09 |
| Benzo[b]fluoranthene | 205-99-2 | 0.00024 | 0.0015 | No | 1.8 | 0.00024 | 0.000048 | 1.09E-03 | 9.46E-08 | 0.30 | 0.30 | 0.30 |
| Benzo[k]fluoranthene | 207-08-9 | 0.00024 | 8000.0 | No | 1.0 | 0.00024 | 0.000048 | 8.16E-06 | 7.07E-10 | 0.30 | 0.30 | 0.30 |
| Benzo[a]pryene | 50-32-8 | 0.00024 | 0.00162 | No | 1.6 | 0.00024 | 0.000048 | 1.11E-05 | 9.63E-10 | 0.23 | 0.23 | 0.23 |
| Chrysene | 218-01-9 | 0.00024 | 0.0016 | No | 0.64 | 0.00024 | 0.000048 | 9.31E-04 | 8.07E-08 | 0.10 | 0.096 | 0.10 |
| Dibenzo[a,h]anthracene | 53-70-3 | 0.00024 | 0.00249 | No | 4.5 | 0.00024 | 0.000048 | 1.45E-07 | 1.25E-11 | 0.43 | 0.43 | 0.43 |
| Indeno[1,2,3-cd]pyrene | 207-08-9 | 0.00024 | 0.000022 | Yes | 0.076 | 0.00024 | 0.000048 | 1.57E-05 | 1.36E-09 | 0.83 | 0.83 | 0.83 |
| | | | | | | | | | | | | |
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| | | 7 | Table 7: | 3-Phase | Model A | Assumption | s and Re | sults | | | | |
|----------------|--|---|--|----------------|---------------|----------------------|----------------|--|--|--|--|--|
| | | | | | | | | | | l l | | |
| | Pore Water | | NAPL | | | Pore Water | | Vapor | | Soil | | Sum |
| CAS No. | Concentration | Solubility | in | Csat | | Concentration | Water Mass | Concentration | Vapor Mass | Concentration | Soil Mass | Mass |
| | (mg/l) (7) | (mg/l) (3) | Soil? (8) | (mg/kg) (9) | | (mg/l) (7) | (mg/kg) (10) | (mg/m ³) (11) | (mg/kg) (12) | (mg/kg) (13) | (mg/kg) (14) | (mg/kg) (15 |
| 1336-36-3 | | | | | | | | | | | | T |
| 12674-11-2 | 0.0020 | 0.42 | No | 45 | | 0.0020 | 0.00040 | 0.24 | 2.06E-05 | 0.21 | 0.21 | 0.21 |
| | 0.0020 | 0.08 | No | 66 | | 0.0020 | 0.00040 | 0.38 | 3.28E-05 | 1.64 | 1.64 | 1.65 |
| 127-18-4 | 0.10 | 200 | No | 106 | | 0.10 | 0.020 | 75 | 0.0065 | 0.0265 | 0.0265 | 0.053 |
| 108-88-3 | 20 | 526 | No | 191 | | 20 | 4.0 | 5440 | 0.47 | 2.80 | 2.80 | 7.3 |
| 71-55-6 | 4.0 | 1,330 | No | 527 | | 4.0 | 0.80 | 2820 | 0.24 | 0.54 | 0.54 | 1.58 |
| 79-01-6 | 0.10 | 1,100 | No | 364 | | 0.10 | 0.020 | 42 | 0.0037 | 0.0094 | 0.0094 | 0.033 |
| 1330-20-7 | 20 | 171 | No | 78 | | 20 | 4.0 | 5580 | 0.48 | 4.66 | 4.66 | 9.1 |
| 108-38-3 | 20 | 161 | No | 68 | | 20 | 4.0 | 6020 | 0.52 | 3.92 | 3.92 | 8.4 |
| 95-47-6 | 20 | 178 | No | 82 | | 20 | 4.0 | 4260 | 0.37 | 4.82 | 4.82 | 9.2 |
| | 20 | 185 | No | 100 | | 20 | 4.0 | 6280 | 0.54 | 6.22 | 6.22 | 10.8 |
| | | | | | | | | | | | | + |
| n = ground v | vater cleanup le | vel X dilution | factor | | | | | | | | | |
| il if the pore | water concentra | tion exceeds | the solubilit | y limit. | | | | | | | | |
| ration above | which there is I | NAPL in the s | oil. It is calc | ulated by sub | stituting the | solubility limit for | or the [ground | water cleanup le | evel X DF] in equa | tion 747-1. | | |
| | | | | | the mass of | contaminant in t | he water phas | e. | | | | |
| | | | | | | | | | | | | |
| | | | density. Th | is is the mas | s of contam | nant in the vapo | r phase. | | | | | |
| | | | | | | | | | | | | |
| | | | | | | of contaminant in | the soil phase | Э. | | | | |
| ss + vapor m | nass + soil mass | . This value | equals the s | oil cleanup le | evel. | | | | | | | |
| | 1336-36-3 12674-11-2 127-18-4 108-88-3 71-55-6 79-01-6 1330-20-7 108-38-3 95-47-6 iii fi the pore tration above atter concent Pore water concent ration or water core water concentration or water core water core concentration. | CAS No. Concentration (mg/l) (7) 1336-36-3 12674-11-2 | Pore Water CAS No. Concentration Solubility (mg/l) (7) (mg/l) (3) 1336-36-3 12674-11-2 0.0020 0.42 0.0020 0.08 127-18-4 0.10 200 108-88-3 20 526 71-55-6 4.0 1,330 79-01-6 0.10 1,100 1330-20-7 20 171 108-38-3 20 161 95-47-6 20 178 20 185 In = ground water cleanup level X dilution ill if the pore water concentration exceeds tration above which there is NAPL in the sater concentration X soil water fraction] / soncentration X soil air fraction] / soll bulk ore water concentration X Kd x soil bulk density] / er concentration X Kd x soil bulk density] / | Pore Water | Pore Water | Pore Water | Pore Water | Pore Water CAS No. Concentration Solubility in Csat Concentration Water Mass (mg/l) (7) (mg/l) (3) Soil? (8) (mg/kg) (9) (mg/l) (7) (mg/kg) (10) 1336-36-3 | Pore Water NAPL Pore Water Vapor | Pore Water NAPL Pore Water Vapor | Pore Water NAPL Pore Water Cast Concentration Water Mass Concentration Cast Concentration Water Mass Concentration Concentration Cast C | Pore Water CAS No. Concentration Solubility in Csat Concentration Water Mass Concentration Concentration |

Table 8: 4-Phase Model Results using Fresh ARCO Gasoline

Solid: 46.1% Air: 33.0% Water: 20.9% NAPL: NONE 100.0%

| | Equilibrium Composition | Protective Soil | Predicted G.W |
|-------------------|----------------------------|--------------------|---------------|
| | % | ppm | ug/l |
| <u>Aliphatics</u> | ARCO 1 | | |
| EC >5-6 | 29.93% | 0.27 | 3.49 |
| EC >6-8 | 15.31% | 0.14 | 1 |
| EC >8-10 | 3.77% | 0.03 | 0.0 |
| EC >10-12 | 2.56% | 0.02 | 0.00 |
| EC >12-16 | | 0.00 | 0.00 |
| EC >16-21 | | 0.00 | 0.00 |
| <u>Aromatics</u> | | 0.00 | |
| Benzene | 3.67% | 0.033 | 5.86 |
| Toluene | 14.62% | 0.13 | 18 |
| Ethylbenzene | 2.73% | 0.02 | 3 |
| Xylenes | 13.45% | 0.12 | 13 |
| EC >8-10 | 4.15% | 0.04 | 1 |
| EC >10-12 | 7.47% | 0.07 | 1 |
| EC >12-16 | 0.0191 | 0.02 | 0 |
| EC >16-21 | | 0.00 | 0 |
| EC >21-35 | | 0.00 | 0 |
| Naphthalene | 0.43% | 0.00 | 0 |
| MTBE | | 0.00 | 0 |
| | | | |
| Total | 100.00% | 0.90 | 47 |

21% 0% 46%

Soil - Mass Distribution

Solid:
Air:
Water:
NAPL:

| Total soil porosity: default is 0.43 | n | 0.430 | Unitless |
|---|------|--------|----------|
| Volumetric water content: default is 0.3 | Qw | 0.300 | Unitless |
| Initial volumetric air content: default is 0.13 | Qa | 0.130 | Unitless |
| Soil bulk density measured: default is 1.5 | rb | 1.500 | kg/l |
| *or, use soil bulk density computed @solid density=2.65kg | g/l: | 1.811 | kg/l |
| Fraction Organic Carbon: default is 0.001 | foc | 0.0010 | Unitless |
| Dilution Factor: default is 20 | DF | 20.0 | Unitless |
| | | | |

| Soil Concentration: | 0.90 |
|---------------------|------|
|---------------------|------|

| Predicted Ground Water TPH (ug/l: | 47 |
|-----------------------------------|----|
| | |

| () | |
|------------------------------------|------|
| HI @ Predicted G.W. Concentration: | 0.27 |

Volumetric NAPL Content, QNAPL:

NAPL Saturation (%), QNAPL/n:

Type of model used for computation:

Computation completed?

NAPL phase is not existing!

N/A

3-Phase Model

Yes!

TPH Distribution @ 4-phase in soil pore system:

Total Mass distributed in Water Phase: 20.89% in Solid: 46.11%

Total Mass distributed in Air Phase: 33.00% in NAPL

in NAPL: NONE

Soil Concentration = 0.90

Gasoline composition from 9/3/98 neat product analysis conducted by Northcreek Analytical, Inc under contract to Ecology.

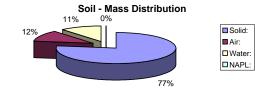
This is a summary sheet from an Excel program created by Hun Seak Park while at the Pollution Liability Insurance Agency (PLIA) and modified by Ecology staff.

For this particular composition, the allowable soil concentration is controlled by the predicted concentration of benzene (5.86 ug/l) in the ground water.

Table 9: 4-Phase Model Results using ARCO #5 (ARCO composition closest to 0.1% benzene)

| Solid: | 77.2% |
|--------|--------|
| Air: | 11.8% |
| Water: | 11.1% |
| NAPL: | NONE |
| | |
| | 100.0% |

| | C accellibrations | Drete etive | Predicted G.W. |
|-------------------|-------------------|--------------------|-------------------|
| | Equilibrium | Protective Soil | G.W. |
| | Composition % | | /1 |
| Alliebert | | ppm | ug/l |
| <u>Aliphatics</u> | ARCO 5 | | |
| EC >5-6 | 1.36% | 0.38 | 4.93 |
| EC >6-8 | 13.4% | 3.74 | 22 |
| EC >8-10 | 12.8% | 3.59 | 4.6 |
| EC >10-12 | 10.8% | 3.02 | 0.58 |
| EC >12-16 | | 0.00 | 0.00 |
| EC >16-21 | | 0.00 | 0.00 |
| <u>Aromatics</u> | | 0.00 | |
| Benzene | 0.066% | 0.019 | 3.29 |
| Toluene | 2.8% | 0.80 | 109 |
| Ethylbenzene | 1.8% | 0.51 | 59 |
| Xylenes | 10.0% | 2.81 | 308 |
| EC >8-10 | 11.6% | 3.26 | 89 |
| EC >10-12 | 26.3% | 7.35 | 135 |
| EC >12-16 | 7.7% | 2.16 | 21 |
| EC >16-21 | | 0.00 | 0 |
| EC >21-35 | | 0.00 | 0 |
| Naphthalene | 1.27% | 0.35 | 17 |
| MTBE | | 0.00 | 0 |
| | | | |
| Total | 100.00% | 28.00 | 774 |



| Total soil porosity: default is 0.43 | n | 0.430 | Unitless |
|--|-----|--------|----------|
| Volumetric water content: default is 0.3 | Qw | 0.300 | Unitless |
| Initial volumetric air content: default is 0.13 | Qa | 0.130 | Unitless |
| Soil bulk density measured: default is 1.5 | rb | 1.500 | kg/l |
| *or, use soil bulk density computed @solid density=2.65kg/l: | | 1.811 | kg/l |
| Fraction Organic Carbon: default is 0.001 | foc | 0.0010 | Unitless |
| Dilution Factor: default is 20 | DF | 20.0 | Unitless |

Soil Concentration: 28.00

Predicted Ground Water TPH (ug/l: 774
HI @ Predicted G.W. Concentration: 1.01

Volumetric NAPL Content, QNAPL:

NAPL Saturation (%), QNAPL/n:

Type of model used for computation:

Computation completed?

TPH Distribution @ 4-phase in soil pore system:

NAPL phase is not existing!

N/A

3-Phase Model

Yes!

Total Mass distributed in Water Phase: 11.05% in Solid: 77.18%

Total Mass distributed in Air Phase: 11.76% in NAPL: NONE

Soil Concentration = 28.00

Gasoline composition is fresh product weathered to approximately 0.1% benzene, simulated by removal of mass in dissolved and vapor phases by successive model runs. This benzene composition is typical of soil benzene concentrations found in soils at gasoline contaminated sites in WA State.

This is a summary sheet from an Excel program created by Hun Seak Park while at the Pollution Liability Insurance Agency (PLIA) and modified by Ecology staff. For this particular composition, the allowable soil concentration is controlled by the predicted hazard index of the gasoline mixture in the ground water.

Table 10: 4-Phase Model Results using Fresh BP Gasoline

Solid: 52.9% Air: 32.4% Water: 14.8% NAPL: NONE 100.0%

| | | Protecti | |
|-------------------|-------------|----------|----------------|
| | Equilibrium | ve | Predicted G.W. |
| | Composition | Soil | |
| | % | ppm | ug/l |
| <u>Aliphatics</u> | Fresh BP | | |
| EC >5-6 | 28.48% | 0.28 | 3.69 |
| EC >6-8 | 17.2% | 0.17 | 1 |
| EC >8-10 | 4.6% | 0.05 | 0.1 |
| EC >10-12 | 5.5% | 0.06 | 0.01 |
| EC >12-16 | | 0.00 | 0.00 |
| EC >16-21 | | 0.00 | 0.00 |
| <u>Aromatics</u> | | 0.00 | |
| Benzene | 2.9% | 0.029 | 5.16 |
| Toluene | 7.7% | 0.08 | 11 |
| Ethylbenzene | 1.7% | 0.02 | 2 |
| Xylenes | 8.9% | 0.09 | 10 |
| EC >8-10 | 5.5% | 0.06 | 2 |
| EC >10-12 | 9.2% | 0.09 | 2 |
| EC >12-16 | 6.6% | 0.07 | 1 |
| EC >16-21 | 0.0% | 0.00 | 0 |
| EC >21-35 | 0.0% | 0.00 | 0 |
| Naphthalene | 1.6% | 0.02 | 1 |
| MTBE | 0.0% | 0.00 | 0 |
| | | | |
| Total | 100.0% | 1.00 | 37 |

0% 15% Solid: ■ Air: □ Water: □NAPL:

Soil - Mass Distribution

| Total soil porosity: default is 0.43 | n |
|--|------|
| Volumetric water content: default is 0.3 | Qw |
| Initial volumetric air content: default is 0.13 | Qa |
| Soil bulk density measured: default is 1.5 | rb |
| *or, use soil bulk density computed @solid density=2.65kg/l: | |
| Fraction Organic Carbon: default is 0.001 | foc |
| Dilution Factor: default is 20 | DF |
| | |
| Soil Concentration: | 1.00 |
| | |
| Predicted Ground Water TPH (ug/l: | 37 |
| HI @ Predicted G.W. Concentration: | 0.24 |

| Volumetric NAPL Content, QNAPL : | NAPL phase is not existing! |
|---|-----------------------------|
| NAPL Saturation (%), QNAPL/n: | N/A |
| Type of model used for computation: | 3-Phase Model |
| Computation completed? | Yes! |
| TPH Distribution @ 4-phase in soil pore system: | |

Total Mass distributed in Water Phase: 14.75% in Solid: 52.87%

0.430 Unitless 0.300 Unitless 0.130 Unitless

kg/l

kg/l 0.0010 Unitless 20.0

Unitless

1.500

1.811

Total Mass distributed in Air Phase: 32.38% in NAPL: NONE

Soil Concentration = 1.00

Gasoline composition from 9/3/98 neat product analysis conducted by Northcreek Analytical, Inc under contract to Ecology.

This is a summary sheet from an Excel program created by Hun Seak Park while at the Pollution Liability Insurance Agency (PLIA) and modified by Ecology staff. For this particular composition, the allowable soil concentration is controlled by the predicted concentration of benzene (5.16 ug/l) in the ground water.

Table 11: 4-Phase Model Results for BP #4 (BP composition closest to 0.1% benzene)

| Solid: | 78.7% |
|--------|--------|
| Air: | 12.4% |
| Water: | 8.9% |
| NAPL: | NONE |
| | |
| | 100.0% |

| | Equilibrium Composition % | Protective Soil ppm | Predicted G.W. |
|-------------------|---------------------------------|---------------------------|----------------|
| <u>Aliphatics</u> | BP #4 | | |
| EC >5-6 | 2.640% | 0.58 | 7.53 |
| EC >6-8 | 14.131% | 3.11 | 18 |
| EC >8-10 | 9.935% | 2.19 | 2.8 |
| EC >10-12 | 13.808% | 3.04 | 0.58 |
| EC >12-16 | | 0.00 | 0.00 |
| EC >16-21 | | 0.00 | 0.00 |
| <u>Aromatics</u> | | | |
| Benzene | 0.127% | 0.028 | 4.95 |
| Toluene | 2.003% | 0.44 | 61 |
| Ethylbenzene | 1.135% | 0.25 | 29 |
| Xylenes | 6.427% | 1.41 | 155 |
| EC >8-10 | 10.248% | 2.25 | 62 |
| EC >10-12 | 20.242% | 4.45 | 82 |
| EC >12-16 | 16.106% | 3.54 | 34 |
| EC >16-21 | 0.000% | 0.00 | 0 |
| EC >21-35 | 0.000% | 0.00 | 0 |
| Naphthalene | 3.198% | 0.70 | 34 |
| MTBE | 0.000% | 0.00 | 0 |
| | | | 0 |
| Total | 100.000% | 22.00 | 490 |

Soil - Mass Distribution



| Total soil porosity: default is 0.43 | n | 0.430 | Unitless |
|--|-----|--------|----------|
| Volumetric water content: default is 0.3 | Qw | 0.300 | Unitless |
| Initial volumetric air content: default is 0.13 | Qa | 0.130 | Unitless |
| Soil bulk density measured: default is 1.5 | rb | 1.500 | kg/l |
| *or, use soil bulk density computed @solid density=2.65kg/l: | | 1.811 | kg/l |
| Fraction Organic Carbon: default is 0.001 | foc | 0.0010 | Unitless |
| Dilution Factor: default is 20 | DF | 20.0 | Unitless |

Soil Concentration: 22.00

Predicted Ground Water TPH (ug/l: 490 HI @ Predicted G.W. Concentration: 0.92

Volumetric NAPL Content, QNAPL:

NAPL Saturation (%), QNAPL/n:

Type of model used for computation:

Computation completed?

NAPL phase is not existing!

N/A

3-Phase Model 78.72%

Yes!

TPH Distribution @ 4-phase in soil pore system:

Total Mass distributed in Water Phase: 8.90% in Solid: NONE

Total Mass distributed in Air Phase: 12.37% in NAPL:

Soil Concentration = 22.00

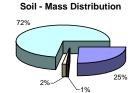
Gasoline composition is fresh product weathered to approximately 0.1% benzene, simulated by removal of mass in dissolved and vapor phases by successive model runs. This benzene composition is typical of soil benzene concentrations found in soils at gasoline contaminated sites in WA State.

This is a summary sheet from an Excel program created by Hun Seak Park while at the Pollution Liability Insurance Agency (PLIA) and modified by Ecology staff. For this particular composition, the allowable soil concentration is controlled by the predicted concentration of benzene (4.95 ug/l) in the ground water.

Table 12: 4-Phase Model Results for BP #24 (least weathered composition with HI<1 at 100 PPM in the Soil)

| Solid: | 25.5% |
|--------|--------|
| Air: | 0.6% |
| Water: | 1.5% |
| NAPL: | 72.4% |
| | |
| | 100.0% |

| | Equilibrium Composition | Protective Soil ppm | Predicted G.W. |
|------------------|----------------------------|---------------------------|----------------|
| Aliphatics | BP #24 | PP | ug/i |
| EC >5-6 | 0.0% | 0.00 | 0.00 |
| EC >6-8 | 0.1% | 0.06 | 0.00 |
| EC >8-10 | 10.5% | 10.98 | 2.8 |
| EC >10-12 | 31.4% | 32.94 | 0.61 |
| EC >12-16 | 0.0% | 0.00 | 0.00 |
| EC >16-21 | 0.0% | 0.00 | 0.00 |
| <u>Aromatics</u> | | 0.00 | |
| Benzene | 0.0% | 0.000 | 0.00 |
| Toluene | 0.0% | 0.00 | 0 |
| Ethylbenzene | 0.0% | 0.00 | 0 |
| Xylenes | 0.0% | 0.01 | 1 |
| EC >8-10 | 3.7% | 3.93 | 71 |
| EC >10-12 | 21.2% | 22.31 | 206 |
| EC >12-16 | 31.3% | 32.84 | 88 |
| EC >16-21 | 0.0% | 0.00 | 0 |
| EC >21-35 | 0.0% | 0.00 | 0 |
| Naphthalene | 1.8% | 1.92 | 30 |
| MTBE | 0.0% | 0.00 | 0 |
| | | | |
| Total | 100.0% | 105.00 | 399 |





| Total soil porosity: default is 0.43 | n | 0.430 | Unitless |
|--|-----|--------|----------|
| Volumetric water content: default is 0.3 | Qw | 0.300 | Unitless |
| Initial volumetric air content: default is 0.13 | Qa | 0.130 | Unitless |
| Soil bulk density measured: default is 1.5 | rb | 1.500 | kg/l |
| *or, use soil bulk density computed @solid density=2.65kg/l: | | 1.811 | kg/l |
| Fraction Organic Carbon: default is 0.001 | foc | 0.0010 | Unitless |
| Dilution Factor: default is 20 | DF | 20.0 | Unitless |

Soil Concentration: 105.00

Predicted Ground Water TPH (ug/l: 399
HI @ Predicted G.W. Concentration: 1.00

Volumetric NAPL Content, QNAPL: 0.000

NAPL Saturation (%), QNAPL/n: 0.03%

Type of model used for computation: 4-Phase Model Computation completed? Yes!

TPH Distribution @ 4-phase in soil pore system:

Total Mass distributed in Water Phase: 1.52% in Solid: 25.49%

Total Mass distributed in Air Phase: 0.62% in NAPL: 72.37%

Soil Concentration = 105.00

Gasoline composition is fresh product weathered until 100 PPM in the soil will pass, simulated by removal of mass in dissolved and vapor phases by successive model runs. This composition represents highly weathered gasoline with no detectable benzene in the soil.

This is a summary sheet from an Excel program created by Hun Seak Park while at the Pollution Liability Insurance Agency (PLIA) and modified by Ecology staff. For this particular composition, the allowable soil concentration is controlled by the predicted hazard index of the gasoline mixture in the ground water.