

Table 1. Soil Concentrations for Contaminants of Concern

| Contaminants of Concern | Screening Value (mg/kg) | Highest Soil Concentration (mg/kg) | Location of Highest Concentration | Number Soil Samples Above Screening Value |
|-------------------------|-----------------------------|------------------------------------|--|---|
| Arsenic | 2.1 DEP proposed RSCTL** | 28 | 0.25' deep, in right-of-way west of south bound off ramp (SB-9) | 23/35 |
| Arsenic | 12 DEP proposed ISCTL** | 28 | 0.25' deep, in right-of-way west of south bound off ramp (SB-9) | 4/35 |
| Lead | 400 DEP RSCTL | 750 | 2' deep, north of East Fairfield (SB-4) | 2/35 |
| Mercury | 3 DEP RSCTL | 10 | 0.25' deep, in right-of-way west of south bound off ramp (SB-5) | 1/35 |
| PAHs | 0.1 ATSDR CREG*, DEP RSCTL† | 5.9 | 0.25' deep, in right-of-way west of south bound off ramp (SB-12) | 3/35 |

*ATSDR 1×10^{-6} excess cancer risk evaluation guide (ATSDR 2001).

**DEP's 1×10^{-6} excess cancer risk evaluation guide is currently 0.8 mg/kg. They have proposed a new guide of 2.1 mg/kg based on an ingestion bioavailability factor of 3 for residential land use and 12 for industrial land use.

†DEP's 1×10^{-6} excess guide for cancer risk evaluation, set for residential property use.

mg/kg = milligrams per kilogram

PAHs = polycyclic aromatic hydrocarbons

EMEG - Environmental Media Evaluation Guide, child and adult values are given.

Model Parameters and Assumptions for Table 2

Exposure Medium: Soil

Exposure Point: **On-site soil and dust**
Scenario Time frame: Future
Land Use Conditions: Residential

Receptor Population: Residents

We calculated these doses using Risk Assistant software and accepted values for soil consumption, dust inhalation exposure and dermal exposure parameters (EPA, 1991). We calculated the following doses using the following values:

| | |
|--------------------------|-----------------------|
| Adult body weight- | 70 kg |
| Child body weight- | 15 kg |
| Adult soil consumption- | 100 mg/day |
| Child soil consumption- | 200 mg/day |
| Adult/Child shower time- | 0.2 hours |
| Adult skin surface area- | 23,000cm ² |
| Child skin surface area- | 7,200cm ² |

* We give the air concentration in milligrams per cubic meter because the Toxicological Profiles give the values for inhalation studies in these units. The air concentration is not a dose; therefore, it is the same for adults and children.

mg/kg = milligram per kilogram of soil

mg/kg/day = milligrams per kilogram body weight per day

Table 2. Estimated Doses from Exposure to On-site Surface Soil

| Contaminant of Concern (maximum concentration) (mg/kg) | Oral MRL (mg/kg/day) | Estimated Soil Ingestion (mg/kg/day) | | Inhalation MRL (mg/m ³) | Estimated Dust Inhalation (mg/m ³) |
|--|---------------------------------|---|------------------------------|--|---|
| | | Child | Adult | | Child and Adult |
| Arsenic (28) | 0.005 Prov. Acute 0.0003 Chr | 0.00037 | 0.00004 | None | 0.000002 |
| Lead (750) | None | 2.4- 6.4 µg/dl (modeled) | 1.8 - 6.0 µg/dl (modeled) | None | |
| Mercury (10) | None | .0001 | .00001 | None | 0.0000007 |
| PAHs (5.9) | None | 0.00008 | 0.000008 | None | 0.0000003 |

MRL—Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure.

mg/kg—milligrams per kilogram

PAHs—polycyclic aromatic hydrocarbons

Chr—Chronic exposure length of more than 365 days

mg/kg/day—milligram chemical per kilogram body weight per day

mg/m³—microgram of chemical per cubic meter of air

Table 3. Comparison of doses calculated from highest measured road widening project soil values to the most sensitive effects doses (effects occurring at the lowest doses in animal and human medical studies).

| Chemical | Doses are in mg/kg/day | | | | Soil |
|---------------------|---|-----------------------------|--|---|------|
| | children's dose | adult's dose | children's theoretical increased cancer risk | adult's theoretical increased cancer risk | |
| Arsenic | Ing 0.0004 Inh 0.000002 | Ing 0.00004 Inh 0.000002 | Ing 3:100,000 Inh 2:1,000,000 | Ing 3:100,000 Inh 2:1,000,000 | |
| ATSDR 2000 (Update) | <p><u>Child ingestion dose</u> (0.0004) is 50 times less than the Lowest Observable Adverse Effect Level dose (0.022) associated with gastrointestinal irritation, diarrhea, nausea, skin pigmentation changes, and hyperkeratosis (dark raised spots on the skin that are possibly precancerous); persons in this study continuously ingested arsenic in their drinking water. This level equals the (0.0004) No Observable Adverse Effect Level (NOAEL), for these health effects (same study) and is $\frac{3}{4}$ of the MRL (0.0003) calculated from another NOAEL (0.0008) for adverse skin effects from long-term ingestion of arsenic in drinking water. ATSDR scientists divided this second NOEL dose (0.0008) by 3 to account for human diversity in calculating the (0.0003) MRL.</p> <p><u>Adult ingestion dose</u> is 10 times less than the (0.0004) dose referenced for children; therefore, we would not expect skin or gastrointestinal health effects for most adults.</p> <p><u>Inhalation dose</u> (0.000002) is 350 times less than the amount associated with increased risk of stillbirth in humans (0.0007) and 3,500 times less than the dose causing dermatitis (0.007) in humans inhaling arsenic. Dermatitis is skin inflammation that may cause redness, pain, and occasionally itching.</p> <p><u>Associated cancers:</u> From lowest to highest dose cancer effect levels, chronic arsenic exposures in people have been linked to lung cancer, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, ureter, and all urethral cancers), and intraepidermal cancers. Intraepidermal is the name for the early pre-invasive form of squamous cell skin cancer. Pre-invasive cancer cells grow in the outermost layer of skin, the epidermis. At this stage, the cancer cells are unlikely to have spread to the lymph nodes, but they can spread along the skin surface. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.</p> | | | | |



| Chemical | Doses are in mg/kg/day | | | Soil |
|---|---|------------------------------|---|---|
| | children's dose | adult's dose | children's theoretical increased cancer risk | adult's theoretical increased cancer risk |
| Lead ATSDR 1999a | 2.4- 6.4 µg/dl (modeled) | 1.8 - 6.0 µg/dl (modeled) | | |
| We compare the following health effects at blood lead levels between 1 and 200 micrograms per deciliter (µg/dl), in studies with the levels we modeled for exposure: 1.8 to 6.4µg/d | | | | |
| Children's Blood (µg/dl): Adults' Blood (µg/dl): | | | | |
| | No threshold | 3 - 56 µg/dl | Decreased aminolevulinic acid dehydratase (ALAD) enzyme activity. ALAD is necessary for hemoglobin synthesis. A large decrease in ALAD activity can lead to anemia. | |
| | 1 - 17 µg/dl | | Alterations in visual evoked potentials ¹ . | |
| | 6.5 µg/dl | | (Average value at 24 months of age) - Lower cognitive function test scores in children 5 to 10 years of age. | |
| | 6 - 200 µg/dl | | Decreased neurobehavioral function; slightly decreased performance on IQ tests and other measures of neuro-psychological function. | |
| | | 5.5 µg/dl (average) | Decreased performance on neurobehavioral tests. | |
| Mercury | Ing 0.0001 Inh 0.0000007 | Ing 0.00001 Inh 0.0000007 | No slope. | No slope. |
| ATSDR 1999b (Update) | <p><u>Child ingestion dose</u> (0.0001) is 5,600 times less than the dose (0.56) associated with kidney symptoms[†] in mice exposed for 10 weeks ad. lib. via drinking water.</p> <p><u>Adult ingestion dose</u> (0.00001) is 56,000 times less than the (0.56) sensitive dose health effects described above for children.</p> <p><u>Inhalation dose</u> (0.0000007) is 20,000 times less than the dose (0.014) associated with impaired performance on neurobehavioral tests in persons exposed 0.7-24 years.</p> <p><u>Cancer association:</u> Animal studies and human epidemiological studies for evaluating the carcinogenicity of mercury via inhalation or dermal exposure were not located; animal studies involving ingestion exposure were equivocal.</p> | | | |

¹The visual evoked potential measures the electrical response of the brain's primary visual cortex to a visual stimulus.

[†] The mouse kidney symptoms were increased granular IgG deposits, slight glomerular endocapillary cell hyperplasia; slight tubular atrophy, inflammation, and fibrosis.

| Chemical | Doses are in mg/kg/day | | | | Soil |
|------------------------|---|-------------------------------|--|---|------|
| | children's dose | adult's dose | children's theoretical increased cancer risk | adult's theoretical increased cancer risk | |
| PAHs TEQ | Ing 0.00008 Inh 0.0000003 | Ing 0.000008 Inh 0.0000003 | Ing 3:100,000 Inh <1:1,000,000 | Ing 3:100,000 Inh <1:1,000,000 | |
| ATSDR 1995 (Update) | <p><u>Child ingestion dose</u> (0.00008) is 32,500 times less than the dose (2.6) associated with stomach cancer in mice exposed to benzo[a]pyrene ad lib in food for 30 to 197 days.</p> <p><u>Adult ingestion dose</u> (0.000008) is 325,000 times less than the (2.6) sensitive dose health effects described above for children.</p> <p><u>Inhalation dose</u> (0.0000003) is 333 times less than the dose (0.0001) associated with reduced lung function, abnormal chest x-ray, cough, bloody vomit, and throat and chest irritation, in persons exposed from 6 months to 6 years.</p> <p><u>Cancer and occupational studies:</u> Worker exposures to high levels of PAHs show cancers (skin, bladder, lung and gastrointestinal) are the most significant endpoint of PAH toxicity. Long-term worker PAH exposures have been linked with skin and eye irritation, photosensitivity, respiratory irritation (with cough and bronchitis), leukoplakia[†], precancerous skin growths enhanced by exposure to sunlight, erythema^Δ, skin burns, acneiform lesions, mild hepatotoxicity, and haematuria[‡]. Also several PAH compounds are immunotoxic, and some suppress selective compounds of the immune system. Workers' dermal exposure studies indicate that although direct contact may be of concern at high exposure levels, they do not suggest that lower levels are likely to cause significant irritation (Goodfellow et al. 2001).</p> | | | | |

[†] Leukoplakia is a common, potentially pre-cancerous disease of the mouth that involves the formation of white spots on the mucous membranes of the tongue and inside of the mouth. Despite the increased risk associated with having leukoplakia, many people with this condition never get oral cancer

^Δ Erythema nodosum is an inflammation of subcutaneous fat tissue.

[‡] Haematuria is passage of blood in the urine.

Table 4. Estimated Blood Lead Concentrations In Children Ingesting On-Site Surface Soil (micrograms per deciliter - µg/dl)

| Media | Conc. * | | Time | Slope' | | Low | High |
|--------------|---------|------|------|--------|-------|----------------|----------------|
| | Low | High | | Low | High | | |
| Air (out) * | 0.1 | 0.2 | 0.33 | 2.46 | 3.04 | 0.08118 | 0.20064 |
| Air (in) * | 0.3 | 0.6 | 0.33 | 2.46 | 3.04 | 0.24354 | 0.60192 |
| Food* | 5 | 5 | 0.33 | 0.24 | 0.24 | 0.396 | 0.396 |
| Water* | 4 | 4 | 0.33 | 0.16 | 0.16 | 0.2112 | 0.2112 |
| Soil | 750 | 750 | 0.33 | 0.002 | 0.016 | 0.495 | 3.96 |
| Dust | 750 | 750 | 0.33 | 0.004 | 0.004 | 0.99 | 0.99 |
| Total | | | | | | 2.41692 | 6.35976 |

*Default Value from ATSDR 1999a, Appendix D.

These slopes were for children from ATSDR 1999a, Appendix D.

ATSDR=s Regression Analysis with Multiple-uptake Parameters to Estimate Blood Lead from Environmental Exposures (ATSDR 1999a, Appendix D)

Table 5. Estimated Blood Lead Concentrations In Adults Ingesting On-Site Surface Soil (micrograms per deciliter - µg/dl)

| Media | Conc. * | | Time | Slope' | | Low | High |
|--------------|---------|------|------|--------|--------|----------------|-----------------|
| | Low | High | | Low | High | | |
| Air (out) * | 0.1 | 0.2 | 0.33 | 1.59 | 3.56 | 0.05247 | 0.23496 |
| Air (in) * | 0.3 | 0.6 | 0.33 | 1.53 | 3.56 | 0.15147 | 0.70488 |
| Food* | 5 | 5 | 0.33 | 0.016 | 0.0195 | 0.0264 | 0.032175 |
| Water* | 4 | 4 | 0.33 | 0.03 | 0.06 | 0.0396 | 0.0792 |
| Soil | 750 | 750 | 0.33 | 0.002 | 0.016 | 0.495 | 3.96 |
| Dust | 750 | 750 | 0.33 | 0.004 | 0.004 | 0.99 | 0.99 |
| Total | | | | | | 1.75494 | 6.001215 |

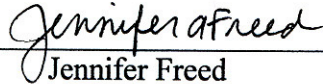
*Default Value from ATSDR 1999a, Appendix D.

These slopes were for adults from ATSDR 1999a, Appendix D.

ATSDR=s Regression Analysis with Multiple-uptake Parameters to Estimate Blood Lead from Environmental Exposures (ATSDR 1999a, Appendix D)

CERTIFICATION

The Florida Department of Health prepared this Brown Barge Middle School Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The Florida Department of Health wrote it in accordance with approved methodologies and procedures that existed when they began the health assessment. Editorial review was completed by the Cooperative Agreement Partner.



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The Division of Health Assessment and Consultation, ATSDR,
reviewed this health consultation, and concurred with its findings.



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