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INTERIM SITE ASSESSMENT GUIDANCE FOR FORMER AGRICULTURAL SITES IN MIAMI-DADE COUNTY (September 16, 2020).

This document is intended to provide interim guidance regarding minimum contamination assessment requirements to adequately investigate soil and groundwater at properties undergoing land use change from a former bona fide agricultural land to other non-agricultural purpose, including residential. Please note that this guidance is intended to address areas historically utilized for growing agricultural crops and is not intended to address ancillary use areas e.g., agrichemical storage, mix-load areas, fuel storage areas etc., which will require more targeted assessment and may include additional contaminants of concern. Additionally, additional assessment may be required for properties at which a non-agricultural land use predated the bona-fide agricultural use (i.e., landfill, military installation, etc.). Golf courses are not a bona-fide agriculture use and as such are not covered by this interim guidance. This document represents generalized guidance of minimum sampling requirements; however, alternative sampling methodologies may be appropriate based on site-specific conditions.

Soil

An appropriate sampling methodology that provides representative assessment of the entire property (e.g., one ten-point composite sample per approximate one-acre, incremental sampling methodology (ISM), discrete samples, etc.), shall be implemented.

- Discrete sampling

Discrete sampling may not be practical for larger areas (i.e., more than 1 acre); but may be suitable for smaller areas or source areas. An appropriate number of discrete soil samples shall be collected to account for potential spatial variability and heterogeneity in contaminant concentrations and soil characteristics. The appropriate number and placement of discrete soil samples shall be based on an appropriately designed Conceptual Site Model (CSM) and established Data Quality Objectives (DQOs). The United States Environmental Protection Agency (USEPA) publication EPA/240/R-02/005 (December 2002) available at: https://www.epa.gov/sites/production/files/2015-06/documents/g5s-final.pdf is one of several available resources for guidance on sampling design for environmental data collection.

- Composite Sampling

A minimum of one composite sample per acre which shall account for and include areas that represent the highest potential for contaminant accumulation (e.g., topographic lows, crop variations, etc.) is required. Each composite sample shall consist of eight (8) subsamples which shall be evenly distributed within each composite sampling area. The above referenced USEPA publication along with EPA publication EPA-230-R-95-005 (August 1995) available at https://www.epa.gov/sites/production/files/2016-03/documents/comp-samp.pdf provides guidance on composite sampling techniques.

Delivering Excellence Every Day

- ISM

  ISM sampling shall be conducted in accordance with the Interstate Technology & Regulatory Council's (ITRC's) Incremental Sampling Methodology (ISM) guidance document (https://www.itrcweb.org/Guidance/ListDocuments?topicID=11&subTopicID=16), and any updates or clarifications therein.

Regardless of the use of either composite or ISM sampling, discrete samples are required in areas of potential contaminant accumulation/discharge (e.g., mixing tank/mix-load areas, agrichemical storage, etc.).

Soil samples shall be collected from the 0-6 inch and 6-24 inch below land surface intervals and each subsequent two (2) foot interval to the water table and analyzed for the following contaminants of concern:

i. Total Arsenic, Cadmium, Chromium, Lead, Iron, and Copper
ii. Organochlorine Pesticides (EPA method 8081 or equivalent)
iii. Leachable arsenic via the synthetic precipitation leaching procedure (SPLP)

A subset (20%) of the collected soil samples from each interval shall also be analyzed for:

i. Organophosphorus Pesticides (EPA method 8141 or equivalent)
ii. Chlorinated Herbicides (EPA method 8151 or equivalent)
iii. Manganese and Zinc
iv. If muck soils are documented at the site a subset (20%) these soils shall also be sampled and analyzed for SPLP ammonia.

If the concentration of any of the additional COC's analyzed in the subset of samples exceed their applicable soil cleanup target level (SCTL), then the remaining samples (i.e., 80%) shall be analyzed.

For inorganics without a default leachability SCTL, SPLP analysis is required if the total concentration exceeds the applicable Miami-Dade County background concentration.

The selected sampling design shall account for those parameters where the direct exposure SCTL is based on acute toxicity (i.e., barium, copper, and fluoride) to ensure that the exposure units (e.g., residential lot, etc.) are appropriately and adequately evaluated. Please see the attached Whitepaper - *Recalculation of Acute Soil Cleanup Target Levels Based on Updated Toxicity and Exposure Parameters* for additional information on those parameters with acute toxicity.

DERM reserves the right to request additional COC's based on the specifics of a particular site.

DERM recommends that the responsible party request that the laboratory retain the samples (for a minimum of 30 days) to facilitate conducting (as applicable based on initial sample results) leachability testing via SPLP and/or analysis for the additional COC's (as applicable) on the original samples.

DERM recommends submitting a sampling plan to DERM for review and comment prior to implementation. Based on the results of the above sampling requirements, additional assessment may be required. Note that the results shall be utilized to understand contaminant distribution, determine potential exposure concerns, to ensure proper handling of contaminated soils, and to minimize/eliminate potential worker exposure during any site construction activities through the implementation of an appropriately designed Soil Management Plan (SMP), Dust Control Plan (DCP), and Health and Safety Plan (HASP). ***Please note that prior to approval of any construction and drainage plans, an approved SMP and DCP and appropriate HASP (if applicable) shall be on file with DERM.***

Groundwater

A representative number of shallow, properly constructed groundwater monitoring wells, minimum one per acre, or alternative frequency that provides equivalent or greater coverage, shall be installed, properly developed, and sampled for the following contaminants of concern:

i. Total Arsenic, Cadmium, Chromium, Lead, Iron, and Copper
ii. Organochlorine Pesticides (EPA method 8081 or equivalent)
iii. Ammonia, Nitrate, and Nitrite

A subset (20%) of monitoring wells shall also be sampled for

i. Organophosphorus Pesticides (EPA method 8141 or equivalent)
ii. Chlorinated Herbicides (EPA method 8151 or equivalent)
iii. Manganese and Zinc

If the concentration of any of the additional COC's analyzed in the subset of samples exceed the groundwater cleanup target level (GCTL), then the remaining monitoring wells (i.e., the other 80%) shall be sampled for the contaminant(s) that exceed. DERM reserves the right to request additional COC's based on the specifics of a particular site.

DERM recommends that groundwater assessment be deferred pending evaluation of the soil assessment results to help inform the locations of the required monitoring wells. Additional groundwater assessment may be required based on the soil assessment results. To the extent possible, the monitoring well locations shall be optimized to allow for assessment in areas of proposed (if known) drainage (please see attached Guidance Drainage for Contaminated Sites).

Please be advised that monitoring wells shall not be abandoned until such time DERM has given written approval that the wells are no longer required as part of site assessment/remediation activities.

An excel file which includes a compilation of all available summary of the laboratory analytical data, and for each sampled interval and parameter, and includes the coordinates of all the soil borings and monitoring well locations, the geographic coordinate system utilized and any pertinent geo-referencing data shall be included with technical reports.

DERM shall be notified in writing a minimum of three (3) working days prior to the implementation of any sampling or field activities. Email notifications shall be directed to DERMPCD@miamidade.gov. DERM has the option to split any samples deemed necessary with the consultant or laboratory at the subject site. The consultant collecting the samples shall perform field sampling work in accordance with the Standard Operating Procedures provided in Chapter 62-160, FAC, as amended. The laboratory analyzing the samples shall perform laboratory analyses pursuant to the National Environmental Laboratory Accreditation Program (NELAP) certification requirements. If the data submitted exhibits a substantial variance from DERM split sample analysis, a complete resampling using two independent certified laboratories will be required.

Attachments

Recalculation of Acute Soil Cleanup Target Levels Based on Updated Toxicity and Exposure Parameters

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1. *Introduction*

This white paper was developed to provide updated acute soil cleanup target levels (SCTLs) calculated using updated toxicity values and exposure parameters. An acute exposure scenario is defined as a one-time soil pica event by a small child. A soil pica event occurs when a child intentionally ingests a large amount of soil (on the order of 1,000-5,000 mg/day or more) (USEPA, 2017). Therefore, these acute SCTLs are applicable in current or future use scenarios where small children are present (e.g., residential, recreational). This document re-examines the acute toxicity-based SCTLs for barium, cadmium, copper, cyanide, fluoride, nickel, phenol, and vanadium promulgated in Chapter 62-777, F.A.C. Acute toxicity SCTLs are only applicable if they are lower than their corresponding chronic toxicity SCTLs. Based on this update, risk of acute toxicity from barium, copper, and fluoride exists at concentrations lower than the chronic SCTLs. Consequently, acute toxicity SCTLs for these chemicals should be retained.

Children are of particular concern for the soil ingestion pathway as their behavior usually results in an increased amount of soil ingested relative to body weight. These behaviors include mouthing hands and objects, more frequent hand-to-mouth behavior, and a decrease in hand washing events. Additionally, some children exhibit soil-pica behavior. Soil ingestion rates for a one-time soil pica event vary between 400 to 41,000 mg/day (Stanek et al., 1998; Calabrese et al., 1989; 1991; 1997a&b; Calabrese and Stanek, 1993; Barnes, 1990; Wong, 1988; Vermeer and Frate, 1979). It is important to note that soil-pica behavior is not limited to children. Although it appears most often in children, soil-pica behavior can occur in adults up to age 21 (USEPA, 2017; Hyman et al., 1990). For a soil-pica event, the United States Environmental Protection Agency (USEPA) recommends using a soil ingestion rate of 1,000 mg/d (1 g/d) (USEPA, 2017). This is a substantial decrease from the previously recommended soil-pica ingestion rate of 10,000 mg/d (10 g/d) (USEPA, 2000).

2. *Updated soil-pica ingestion rate and child body weight*

Based on the recommendation from the USEPA, an updated soil-pica ingestion rate of 1 g/d and an updated child body weight of 15 kg was used to derive the acute SCTLs (USEPA, 2017; USEPA, 2014). The acute SCTLs promulgated in Chapter 62-777, F.A.C. were calculated using the previously recommended soil-pica ingestion rate of 10 g/d (USEPA, 2000). The updated soil-pica ingestion rate will result in an acute SCTL that is 10 times higher than the previous value. However, acute reference doses were also updated to provide the most accurate estimate of acute toxicity. The updated acute reference doses were increased for some chemicals and decreased for others. Therefore, the change in the acute SCTL is not always equal to a factor of 10. The updated body weight of 15 kg represents a slight decrease in the value used to derive the acute SCTLs promulgated in Chapter 62-777, F.A.C. (16.8 kg). Use of the lower body weight will slightly decrease the acute SCTLs.

3. *Acute toxicity-based SCTLs*

Acute reference doses (RfDs) were updated for barium, cadmium, copper, cyanide, fluoride, nickel, phenol, and vanadium (chemicals with acute toxicity-based SCTLs in Chapter 62-777, F.A.C.). Analyses for these chemicals were based on reports of acute poisoning cases in humans. Use of human data is always preferred over animal studies because it increases confidence in the endpoints and does not require the use of an

uncertainty factor for extrapolation across species. The method used to derive acute toxicity-based SCTLs in Chapter 62-777 F.A.C. in 2005 was as follows: From the literature on acute poisonings in humans, the acute lowest observable adverse effect level (LOAEL) or no observable adverse effect level (NOAEL) was identified. The NOAEL was chosen over the LOAEL when both were available. For systemic endpoints, the LOAEL or NOAEL was then divided by uncertainty factors (UFs) or modifying factors (MFs) to produce a provisional acute toxicity reference dose (RfD_{acute}), analogous to the procedure used by the USEPA to derive chronic RfDs. The UFs were used to address uncertainty when extrapolating (e.g., from animals to humans, from healthy subjects to sensitive subjects, etc.) and the MFs were applied to extend the safety margin when the database being assessed is limited or weak. Gastrointestinal effects were considered to be of lesser concern and no UFs were applied in deriving the provisional RfD_{acute} for most chemicals with this critical effect. The RfD_{acute} for each chemical was then compared to the chemical's chronic RfD. A safe dose for chronic exposure was expected to be the same or lower than a safe dose for acute exposure. If the provisional RfD_{acute} was greater than the chronic RfD for a chemical, the provisional RfD_{acute} was used to derive the acute toxicity-based SCTL. If the RfD_{acute} was less than the chronic RfD for the chemical, the chronic RfD was assumed to be also protective for acute exposure and used to derive the acute toxicity-based SCTL. Acute toxicity-based SCTLs were calculated using the following equation and assumptions:

$$SCTL_{acute} = \frac{BW}{\frac{1}{RfD_{acute}} \times IR \times CF}$$

Where:

BW = body weight (15.0 kg)
RfD_{acute} = acute reference dose (mg/kg)
IR = soil ingestion rate (1 g)
CF = conversion factor (0.001 kg/g)

This equation assumes a single exposure event. Additionally, as acute toxicity in soil is driven almost exclusively by ingestion, the acute SCTL equation does not include the dermal or inhalation routes. After the derivation of the acute SCTL, it is compared with the chronic SCTL for that chemical. For the purposes of this document, we updated the chronic SCTLs for each chemical using the non-carcinogenic SCTL equation promulgated in Figure 5 of Chapter 62-777, F.A.C. The updated chronic SCTLs were calculated using current toxicity values, chemical and physical parameters, and exposure assumptions. If the acute toxicity-based SCTL is lower than the chronic SCTL, it is applicable for all current and future use scenarios where small children may be present. If the acute toxicity-based SCTL is higher than the chronic SCTL, the chronic SCTL is considered protective of a soil-pica event and is used as the SCTL.

3.1 Barium

Barium toxicity is dependent on the form ingested. Insoluble barium salts, such as barium sulfate, are poorly absorbed and are nontoxic. Soluble barium salts (e.g., barium sulfide, barium carbonate, barium chloride) are toxic. Barium salts have a variety of uses including as rodenticides, components in explosives and ammunition, additives for oils and fuels and in the manufacturing of plastics and paper. Barium toxicity causes nausea,

vomiting, diarrhea, and abdominal pain. Large doses cause muscle excitability which may lead to hypokalemia (low potassium levels). Hypokalemia results in cardiac arrhythmias, muscle weakness and paralysis, and respiratory paralysis (Bhoelan et al., 2014; ATSDR, 2007).

After the *Acute Toxicity Guidance* was written in 2016 (CEHT, 2016), two additional case reports involving barium poisoning were published. In the first report, a 44-year old male intentionally ingested 10 g of barium carbonate. Two hours following ingestion he began vomiting and developed diarrhea. Six hours post ingestion he displayed generalized weakness, tingling to his face, and elevated blood pressure. One-half hour later he was taken to the hospital to receive treatment and made a full recovery (McNeill and Isoardi, 2019). In the case report by Tao et al. (2016), a 19-year old male ingested 3 grams of barium chloride. He was brought to the emergency room with nausea, vomiting, stomach burning, dizziness, weakness, abdominal pain, and diarrhea. Treatment was administered before toxicity could progress and he made a full recovery. These case reports involve the ingestion of large doses of barium. Death can result from doses ranging from 1 to 30 g (Dawson, 2019). Therefore, these patients would not likely have recovered without medical intervention.

Currently, the LOAEL for barium toxicity in humans is generally considered to be 200 mg (Dawson, 2019). An acute toxicity LOAEL of 200 mg corresponds to a dose of approximately 2.5 mg/kg assuming an 80 kg body weight. Application of a UF of 100 (10 for sensitive subjects and 10 for extrapolation from a LOAEL to a NOAEL) would yield an acute oral RfD of 0.03 mg/kg (rounded to one significant digit). This value is lower than the current USEPA Integrated Risk Information System (IRIS) chronic oral RfD of 0.2 mg/kg/day. As the safe acute dose cannot be lower than the safe chronic dose, the RfD_{acute} is equivalent to the chronic RfD, resulting in an acute toxicity SCTL for barium of 3,000 mg/kg. This value is lower than the updated chronic SCTL for barium of 14,000 mg/kg/day. The acute toxicity-based SCTL (3,000 mg/kg) is the residential SCTL as this value is protective of both acute toxicity and chronic toxicity. This value is higher than the currently promulgated residential SCTL for barium of 120 mg/kg.

3.2 Cadmium

Cadmium is primarily used in electroplating and in the production of nickel-cadmium batteries (Traub and Hoffman, 2019). Other anthropogenic sources of cadmium include the manufacture and application of phosphate fertilizers, fossil fuel combustion, the incineration of waste, and in the mining of zinc, lead, and copper ore (ATSDR, 2012a). Acute cadmium toxicity presents with gastrointestinal effects. Symptoms include nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea (ATSDR, 2012a; Traub and Hoffman, 2019). Based on our review of the literature, no additional case reports involving acute cadmium toxicity in humans have been published since 2016. Therefore, the acute cadmium RfD is identical to the one derived in the 2016 *Acute Toxicity Guidance* (CEHT, 2016).

Case reports of acute poisonings from cadmium in food and beverages consumed by children suggest that the LOAEL is 0.07 mg/kg (ATSDR, 2012a). This dose causes vomiting, which is a route-specific effect. Because the endpoint is gastrointestinal distress, no UFs are applied to a LOAEL dose, yielding an RfD_{acute} of 0.07 mg/kg. This value is higher than the current USEPA IRIS chronic oral RfD for cadmium of 0.001 mg/kg/day, and is therefore used to derive an acute toxicity-based SCTL. Based on the equation provided

in Section 3, the resulting acute toxicity-based SCTL for cadmium is 1,100 mg/kg. This value is higher than the updated chronic SCTL for cadmium of 71 mg/kg/day. Therefore, the chronic SCTL (71 mg/kg) is the residential SCTL, as this value is protective of both acute and chronic toxicity. This value is lower than the currently promulgated residential SCTL for cadmium of 82 mg/kg, which was also based on chronic toxicity. The decrease in the chronic SCTL is due to a change in the estimate for gastrointestinal absorption (GI). In 2005, Chapter 62-777, F.A.C. utilized a GI absorption of 0.044 (4.4%) to derive the chronic cadmium SCTLs. This GI absorption was obtained from the Agency for Toxic Substances and Disease Registry (ATSDR). The updated chronic SCTL of 71 mg/kg was derived using a GI absorption of 0.025 (2.5%). This value was obtained from the USEPA's Regional Screening Level (RSL) tables dated November 2019.

3.3 Copper

Copper salts are used as fungicides and algicides. Metallic copper is used in electrical wiring, in water pipes, and in the formation of brass and bronze. In the environment, copper is found near mines, smelters, landfills, and waste disposal sites. (ATSDR, 2004). Acute copper poisoning results in gastrointestinal effects. Symptoms include nausea, vomiting, and abdominal pain. Other possible symptoms include gastroduodenal hemorrhage, ulceration, and perforation (Nelson, 2019). A critical review on setting regulatory health criteria of ingested copper was published in 2020. The review concludes that an oral RfD of 0.04 mg/kg-d copper would be protective of both acute and chronic toxicity in adults and children (Taylor et al, 2020). This is equivalent to the chronic oral RfD listed on the USEPA Health Effects Assessment Summary Tables (HEAST) and the USEPA November 2019 RSL tables.

The ATSDR has developed an acute oral Minimal Risk Level (MRL) of 0.01 mg/kg/day for copper (ATSDR, 2004). This value is lower than the current HEAST oral RfD of 0.04 mg/kg/day. As the safe acute dose cannot be lower than the safe chronic dose, the RfD_{acute} is equivalent to the chronic RfD, resulting in an acute toxicity SCTL for copper of 600 mg/kg. This value is lower than the updated chronic SCTL for copper of 3,100 mg/kg/day. Therefore, the acute toxicity-based SCTL (600 mg/kg) is the residential SCTL, as this value is protective of both acute toxicity and chronic toxicity. This is higher than the currently promulgated residential SCTL for copper based on acute toxicity, 150 mg/kg.

3.4 Cyanide

Cyanide is used in photographic developing, metallurgy, blueprint drawing, plastic manufacturing, fumigation, and mining (Holstege and Kirk, 2019; Lischkova et al., 2018). Symptoms of cyanide toxicity are consistent with central nervous system toxicity and progressive hypoxia. These symptoms include headache, anxiety, agitation, confusion, lethargy, seizures, and coma. Gastrointestinal distress occurs after ingestion and includes abdominal pain, nausea, and vomiting (Holstege and Kirk, 2019). Since the *Acute Toxicity Guidance* was written in 2016 (CEHT, 2016), two additional case reports and a scientific review involving cyanide poisoning were published.

In one case report a 37-year-old male ingested 80 g of pure potassium ferricyanide. This is equivalent to an ingested cyanide dose of approximately 770 mg/kg. Two hours after ingestion, the subject reported vertigo and diarrhea. Upon admission to the hospital, the patient displayed elevated potassium levels and, in a few hours, acute renal failure developed. Due to medical intervention, the patient was stabilized and survived the

cyanide ingestion (Lischkova et al., 2018). In the second case report, a 60-year-old woman was admitted to the hospital after ingesting 10-15 apricot kernels. Apricot kernels contain approximately 0.5 mg cyanide per kernel (EFSA, 2016). Therefore, she ingested between 5 and 7.5 mg cyanide. Assuming an 80 kg body weight results in a cyanide dose of approximately 63 to 94 μg/kg. This cyanide dose is not usually considered toxic. However, the woman displayed vomiting, headache, and a diminished level of consciousness (Tatli et al., 2017). It is possible that the patient underestimated the number of kernels ingested or was highly sensitive to cyanide toxicity.

The European Food Safety Authority (EFSA) derived an acute reference dose for cyanide. Using a bioavailability study by Abraham et al. (2016), they established an acute reference dose of 20 μg/kg body weight. In the study, 12 healthy adult volunteers consumed 6.8 mg total cyanide from several different food sources including apricot kernels and cassava. No toxicity was observed in these individuals. The mean cyanide dose was 0.105 mg/kg in women and 0.084 mg/kg in men. The EFSA Panel concluded that the mean cyanide dose of 0.105 mg/kg in women should be considered the NOAEL. EFSA divided the NOAEL by a factor of 1.5 to account for any variability in toxicokinetics and a factor of 3.16 for differences in toxicodynamics. The resulting acute reference dose is 20 μg/kg (2E-02 mg/kg) body weight. This value is higher than the current USEPA IRIS chronic oral RfD for cyanide of 6E-04 mg/kg-d, and is therefore used to derive an acute toxicity-based SCTL. Based on the equation provided in Section 3, the resulting acute toxicity-based SCTL for cyanide is 300 mg/kg. This value is higher than the updated chronic SCTL for cyanide of 0.8 mg/kg. Therefore, the chronic SCTL (0.8 mg/kg) is the residential SCTL, as this value is protective of both acute and chronic exposures. The chronic SCTL for cyanide promulgated in Chapter 62-777, F.A.C. is 34 mg/kg. The updated chronic SCTL is 0.8 mg/kg. The reason for the decrease in the chronic SCTL is a change in the toxicity value. In 2005, the chronic RfD for cyanide was 2E-02 mg/kg-d. The current chronic RfD in IRIS is 6.3E-04 mg/kg-d.

3.5 Fluoride

Fluoride has a variety of uses depending on its form. Fluoride is used in industrial processes (e.g., electroplating, leather tanning) in the form of hydrofluoric acid. Sodium fluoride is used as an insecticide, rodenticide, anthelminthic, and delousing powder. Fluoride salts are used as an additive to drinking water and toothpaste and in lumber treatment and the electroplating industry (Su, 2019). Fluoride is corrosive to the gastrointestinal tract, and symptoms from acute fluoride poisoning episodes include nausea, vomiting, diarrhea, weakness, and abdominal pain. More severe cases can include decreased calcium levels, elevated potassium levels, cardiac arrhythmias, hypotension, muscle spasm, tetany of hands and feet, and convulsions resulting in death (Ullah et al., 2017; Augenstein et al., 1991; Spoerke et al., 1980). Since 2016, two reviews regarding fluoride toxicity have been published.

The first article by Ullah et al. (2017) is a review of the acute and chronic effects of fluoride poisoning. Individual case studies were not reported. The article states the toxic dose of fluoride for children and adults is 5 mg/kg. This is considered the minimum dose likely to cause toxicity that requires medical intervention. The second review article summarizes phone calls made to the New Jersey Poison Control Center from 2010 to 2012 regarding acute fluoride ingestion. The study examined 2,476 records of fluoride poisoning over this time period. The amount of fluoride ingested was estimated based on self-reported consumption of fluoride containing products (e.g., toothpaste, mouthwash) (Shah

et al., 2016). Because individual consumption rates were not reported, the data could not be used to develop an RfD_{acute}.

Whitford (1992) proposed 5 mg/kg as a "probably toxic dose" of fluoride, and this value has been repeated by others as a recommendation for doses above which immediate medical attention is required. However, this is not the lowest toxic dose. Augenstein et al. (1991) surveyed 87 cases of fluoride ingestion from a poison control center and found 8% were symptomatic with fluoride doses less than 1 mg/kg. As Akiniwa (1997) has pointed out, 5 mg/kg is not a threshold for toxicity, and in fact a number of studies have found GI symptoms in children ingesting fluoride in doses extending down to 0.1 mg/kg. Using 0.1 mg/kg as the toxicity threshold and applying no uncertainty factor (as the critical effect is gastrointestinal effects), results in an acute RfD of 0.1 mg/kg. This value is higher than the current USEPA RSL chronic RfD of 0.04 mg/kg-d, and is therefore used as the acute RfD. The acute toxicity-based SCTL for fluoride is 1,500 mg/kg. This value is lower than the updated chronic SCTL for fluoride of 3,100 mg/kg. Therefore, the acute toxicity SCTL of 1,500 mg/kg is the residential SCTL. This is higher than the currently promulgated residential SCTL for fluoride based on acute toxicity, 840 mg/kg.

3.6 Nickel

Nickel compounds are abundant and are used in a variety of industries including magnets, jewelry, batteries, electroplating, and welding (Curtis, 2019). Acute exposure to nickel by ingestion results in gastrointestinal and nervous system toxicity. Symptoms include nausea, vomiting, abdominal cramps, weakness, dizziness, headache, and cough (Curtis, 2019; Sunderman et al., 1998). Since the *Acute Toxicity Guidance* was written in 2016 (CEHT, 2016), no additional case reports were published involving nickel poisoning.

In a study by Sunderman et al. (1998), 20 workers exposed to nickel sulfate and nickel chloride experienced symptoms of acute nickel poisoning including nausea, vomiting, abdominal cramps, giddiness, lassitude, headache, and cough. Ten of the workers were hospitalized. Estimated nickel doses ranged from 0.5 to 2.5 g, corresponding to 6 to 31 mg/kg (assuming a body weight of 80 kg). Taking the lower end of this range, and applying no uncertainty factor (as the critical effects were primarily gastrointestinal), an acute RfD of 6 mg/kg is derived. This value is higher than the USEPA IRIS chronic RfD of 0.02 mg/kg and is therefore used as the acute RfD. This results in an acute toxicity-based SCTL for nickel of 90,000 mg/kg. The updated chronic SCTL for nickel is 1,400 mg/kg. Therefore, the chronic SCTL of 1,400 mg/kg is protective of both acute and chronic toxicity. This is higher than the currently promulgated residential SCTL for nickel based on acute toxicity, 340 mg/kg.

It is important to note that gastrointestinal effects are not the most sensitive endpoint from nickel exposure. The most common adverse effect related to nickel exposure is allergic dermatitis. Approximately 10 to 15% of women and 2 to 3% of men have nickel sensitivities. The rate is increased in those with autoimmune disease (Curtis, 2019). Neither the acute nor chronic SCTLs are protective of nickel sensitive individuals.

3.7 Phenol

Phenol is released during municipal solid waste incineration and the combustion of coal wood. It is also a product of auto exhaust. In addition to industrial processes, phenol is found in many consumer products including lozenges, mouthwashes, and antiseptic

lotions (ATSDR, 2008). Acute exposure to phenol has been reported to cause burning mouth and gastrointestinal irritation and distress (Cleland and Kingsbury, 1977; Diechman, 1969). Systemic symptoms include seizures, lethargy, and coma. The lethal oral dose is 1 g (Haynes and Wax, 2019). In one study, consumption of water contaminated with phenol for several weeks was found to produce diarrhea, burning mouth, and mouth sores (Baker et al., 1978). The estimated doses of phenol in these individuals ranged from 0.14 to 3.4 mg/kg-d. Since the *Acute Toxicity Guidance* was written in 2016 (CEHT, 2016), no additional case reports were published involving phenol poisoning.

The ATSDR derived an acute-duration oral exposure MRL for phenol of 1 mg/kg-d (ATSDR, 2008). The acute RfD of 1 mg/kg-d is larger than the USEPA IRIS chronic RfD of 0.3 mg/kg-d and is therefore used to derive an acute SCTL. The acute toxicity-based SCTL is 15,000 mg/kg, which is higher than the updated chronic toxicity-based SCTL of 10,000 mg/kg. Therefore, the chronic SCTL of 10,000 mg/kg is the residential SCTL as this value is protective of both acute and chronic toxicity. This is higher than the currently promulgated residential SCTL for phenol based on acute toxicity, 500 mg/kg.

3.8 Vanadium

Vanadium is used in the production of rust-resistant steels, and in ceramics. It is also released during the combustion of coal and petroleum crude oils (ATSDR, 2012b). Symptoms of acute exposure to vanadium include gastrointestinal irritation and distress, including nausea, diarrhea, and abdominal cramps (ATSDR, 2012b). The ATSDR summarized studies of individuals receiving various doses of vanadium that reported GI complaints. Although the ATSDR did not develop an acute MRL based on these studies, a LOAEL for gastrointestinal effects of 0.35 mg/kg/day was identified (ATSDR, 2012b). Using this value without an uncertainty factor, results in an acute RfD of 0.35 mg/kg. This value is higher than the current USEPA RSL chronic RfD of 0.005 mg/kg-d, and is therefore used as the acute RfD. The acute toxicity-based SCTL for vanadium is 5,300 mg/kg. This value is higher than the updated chronic toxicity-based SCTL for vanadium of 360 mg/kg. Therefore, the chronic SCTL of 360 mg/kg is protective of both acute and chronic toxicity. This higher than the current promulgated residential SCTL for vanadium based on acute toxicity, 67 mg/kg.

4. Application

As a result of updating the soil-pica ingestion rate and the toxicity values, the residential SCTLs for cadmium, cyanide, nickel, phenol, and vanadium are driven by the chronic exposure scenario. Previously, only the residential SCTL for cadmium was driven by the chronic exposure scenario. The residential SCTLs for the three remaining chemicals, barium, copper, and fluoride, are driven by acute toxicity. The acute toxicity SCTLs should be used as residential SCTLs for these chemicals in situations where small children might come into contact with soil (e.g. residential areas, schools, daycare facilities, etc.).

References:

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Table 1 – Acute and chronic reference doses (RfDs)

Chemical	RfD_{acute} (mg/kg)	Chronic RfD (mg/kg-d)	Source of Chronic RfD	RfD used in Acute Equation
Barium	0.03	0.2	IRIS	0.2
Cadmium	0.07	0.001	IRIS	0.07
Copper	0.01	0.04	USEPA RSL	0.04
Cyanide	0.02	0.00063	IRIS	0.02
Fluoride	0.1	0.04	USEPA RSL	0.1
Nickel	6	0.02	IRIS	6
Phenol	1	0.3	IRIS	1
Vanadium	0.35	0.005	USEPA RSL	0.35

IRIS – USEPA's Integrated Risk Information System
USEPA RSL – USEPA's Regional Screening Level table

Table 2 – Comparison of acute toxicity-based SCTLs and chronic SCTLs

Chemical	Old Acute SCTL (mg/kg)	Updated Acute SCTL (mg/kg)	Updated Chronic SCTL (mg/kg)	Updated Residential SCTL (mg/kg)
Barium	120	3,000	14,000	3,000
Cadmium	82*	1,100	71	71*
Copper	150	600	3,100	600
Cyanide	34	300	0.8	0.8*
Fluoride	840	1,500	3,100	1,500
Nickel	340	90,000	1,400	1,400*
Phenol	500	15,000	10,000	10,000*
Vanadium	67	5,300	360	360*

* Chronic SCTL used as the residential SCTL

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RER/ERM
POLLUTION REMEDIATION SECTION
TECHNICAL GUIDANCE

DRAINAGE PLANS FOR CONTAMINATED SITES

MINIMUM REQUIREMENTS

The appropriate location of drainage structures is essential in preventing the movement of contaminant plumes into previously uncontaminated areas. All drainage installations at contaminated sites shall be reviewed and approved by the RER/ERM's Pollution Remediation Section prior to construction. The scope of work provided by the PRS review is limited to evaluate the location of the proposed drainage system in reference to the contaminated areas. Approval from other departments, and/or sections and other governmental agencies having jurisdiction over the scope of work must be obtained prior to the implementation of the project. The following information is required:

1) The location of the contaminant plume(s) in reference to the area of the proposed drainage structures must be included on the site plan. The plume(s) must be delineated both horizontally and vertically to applicable target cleanup levels in the drainage area. Monitoring wells, including identification numbers, must be shown on the plan.

2) Groundwater analytical results must be submitted with the plan including copies of laboratory analyses sheets. An updated groundwater sampling event may be required if sample results are greater than nine (9) months old. The sampling event must include all applicable parameters associated with the site's type of contamination.

3) The groundwater flow direction must be shown on the plan.

4) The location and detailed construction drawings of the proposed drainage structure must be included on the plan (e.g., piping depth, drainage well depth, etc.). Plans must specify the locations of solid and perforated sections of piping. Details of the existing system must be provided if the proposed drainage system ties into the existing drainage system.

5) A minimum of two (2) plan sets that include all of the information requested are to be submitted for the review (1 set will be placed in the PRS RER/ERM file). All applicable pages of the drainage plan must be signed and sealed by a Professional Engineer registered in the State of Florida. The appropriate review fee (see below), made out to Miami-Dade County, must be included with the plans.

PRS REVIEW FEES
(See Fee Schedule at http://www.miamidade.gov/development/library/fees/schedule-environmental.pdf). All fees include a 7.5% RER surcharge.

- Site under one acre in size: $300.00+$22.50 = **$322.50**
- Sites over one acre in size or projects that encompassed multiple contaminated sites: $300.00+$22.50 **= $322.50** plus $100.00+$7.50 = **$107.50** per additional acre or site encompassed by the project