# Appendix I

## Basis for Updated Cleanup Goals

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# I.1 Overview

This attachment explains the approach used to update the Florida groundwater cleanup target levels (GCTLs) for key pine tar-related constituents of concern (COCs) detected on the Cabot portion of the Site. Based on a review of the 2005 Technical Basis Document, which presents the approach used for the development of GCTLs by the Florida Department of Environmental Protection (FLDEP) (University of Florida, 2005), we concluded that the toxicity factors used in the calculations for some of the pine tar-related COCs were outdated (*e.g.*, used toxicity factors published in the 1990s) and did not reflect the findings of relevant toxicity studies and United States Environmental Protection Agency (US EPA) recommendations published since 2005. Also, since 2005, US EPA has published updated exposure factors that are relevant to the calculation of GCTLs. Accordingly, we updated the GCTLs for key COCs and the likely remedy drivers 2-, 3-, and 4-methylphenol, 2,4-dimethylphenol, and phenol, using updated chemical toxicity factors and recent guidance from US EPA regarding exposure assumptions that are consistent with recommendations provided to FLDEP in May by the University of Florida (Stuchal *et al*., 2015) and the July meeting minutes from FLDEP (2015).

## I.1.1 Key Changes in the Calculation of GCTL Values

### I.1.1.1 2-Methylphenol, 3-Methylphenol, and 4-Methylphenol

In the current GCTL values for these compounds, discussed in the 2005 Technical Basis Document (University of Florida, 2005), FLDEP applied a 10-fold safety factor to the oral reference dose (RfD) for these compounds, because they are classified as Class C carcinogens (*i.e.*, possibly carcinogenic to humans). FLDEP applied the additional safety factor to the non-cancer toxicity factor to account for uncertainty regarding the carcinogenic potential of these compounds and because a quantitative cancer toxicity factor was not available for them. However, consistent with more recent US EPA cancer risk assessment guidance (US EPA, 2005), these compounds would be classified as having "Inadequate Information to Assess Carcinogenic Potential," and no modifications to the non-cancer toxicity factor would be required (*i.e.*, the 10-fold safety factor would be removed). Furthermore, we understand that, consistent with updated US EPA guidance, FLDEP is planning to remove this 10-fold factor for all Class C carcinogens (FLDEP, 2015).

US EPA developed oral RfDs for these compounds for its Integrated Risk Information System (IRIS) in the early 1990s. In searching for more recent oral toxicity values for these compounds, which are also referred to as "cresols," we learned that the Agency for Toxic Substances and Disease Registry (ATSDR) developed a chronic minimum risk level (MRL) for oral exposure to o-, m-, and p-cresol of 0.1 mg/kg-day based on more recent toxicological studies (ATSDR, 2008). MRLs are broadly accepted by regulatory agencies and are used in the derivation of US EPA Regional Screening Levels (RSLs) (US EPA, 2014) when toxicity criteria from IRIS and US EPA's provisional toxicity criteria are not available. Furthermore, in its May update of toxicity factors for FLDEP's CTLs, the University of Florida included ATSDR MRLs as one of the preferred sources of toxicity values (Stuchal *et al*., 2015). Gradient used the MRL of 0.1 mg/kg-day to calculate updated GCTL values for 2-, 3-, and 4-methylphenol, which are presented in Table I.1.

#### I.1.1.2 2,4-Dimethylphenol

2,4-dimethylphenol is a non-carcinogen, and FLDEP used the oral RfD for this compound from US EPA's IRIS database (US EPA, 2002a) in the GCTL calculation. A search of FLDEP's preferred sources of toxicity criteria, including US EPA's IRIS, provisional toxicity criteria, and its Health Effects Assessment Summary Tables (HEAST), indicated that a more recent toxicity criterion is not available for this compound. A search of ATSDR's MRLs also showed that a more recent oral MRL is not available. Consequently, the toxicity factor previously used by FLDEP in the GCTL calculation for 2,4-dimethylphenol (RfD of 0.02 mg/kg-day) was left unchanged.

#### I.1.1.3 Phenol

FLDEP based the GCTL for phenol on its potential organoleptic effects, instead of its potential health effects, which resulted in a GCTL of 10 µg/L (University of Florida, 2005). To determine a health-based GCTL, we used the current oral RfD for phenol from IRIS (US EPA, 2002b) and exposure assumptions in FLDEP's 2005 technical basis document (University of Florida, 2005) to calculate a GCTL of 2,100 µg/L. Notably, FLDEP used the current oral RfD for phenol from IRIS to calculate a soil CTL for this compound (University of Florida, 2005).

#### I.1.1.4 Updated Exposure Factors for Superfund Sites

In September 2011, US EPA issued a substantive update to its exposure assessment recommendations, based on the results of studies deemed, as of July 2011, to be the most current and scientifically sound (Stalcup, 2014). The Human Health Regional Risk Assessors Forum (the Forum) within US EPA reviewed the recommended updates in the context of the default exposure factors used in the Superfund program and to derive RSL values. The Forum identified several Superfund-specific default exposure factors that warranted updating. In response, US EPA's Office of Solid Waste and Emergency Response published recommended updates to several default exposure factors and indicated that these new exposure data should be used for the following purposes (Stalcup, 2014):

- For Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/ Superfund remedial investigation and feasibility study process (*e.g.*, assessing baseline health risks, developing preliminary remediation goals, and evaluating risks of remedial alternatives);
- To evaluate health risks in the CERCLA/Superfund removal program; and
- In the process of 5-year reviews of selected remedies.

Gradient determined that the updated default exposure factors are applicable to the development of CTLs, because FLDEP specifically relies on such exposure factor data from US EPA's Superfund program to develop its CTLs. For the development of GCTLs, the relevant changes include an increased drinking water intake for adults of 2.5 L/day, compared to the previous value of 2 L/day, and a greater body weight for adults of 80 kg, compared to the previous value of 70 kg. Although the net effect of applying these exposure factors to the calculation of GCTLs results in a minor reduction (*i.e.*, about 10%), these changes are mentioned because they affect the calculated GCTL values for each of the COCs at the Site. The FLDEP meeting minutes indicate that the Department is considering updating exposure assumptions used to derive its CTLs to be consistent with current US EPA recommendations (FLDEP, 2015).

Based on the rationale presented above, updated toxicity factors and/or exposure assumptions were used to refine the GCTLs for 2-, 3-, and 4-methylphenol, 2,4-dimethylphenol, and phenol. All of these COCs are non-carcinogens; therefore, consistent with FLDEP's approach, Gradient used a hazard quotient of 1 to calculate the updated GCTLs. A summary of the updated GCTLs for these pine tar-related COCs, including key assumptions and inputs, is presented in Table I.1.

## References


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**Table I.1 Updated Groundwater Cleanup Target Levels (GCTLs) Cabot Carbon/Koppers Superfund Site, Gainesville, Florida**

| Constituent of Concern (COC) | 2005 FDEP[a] GCTL (µg/L) | Basis for 2005 FDEP GCTL | | Updated GCTL (µg/L) | Basis for Updated GCTL | |
|---|---|---|---|---|---|---|
| | | Toxicity | Exposure Assumptions | | Toxicity | Exposure Assumptions[b] |
| 2-Methylphenol (*o*- Cresol) | 35 | IRIS RfD of 0.05 mg/kg-day; application of 10-fold factor for Class C carcinogens | Adult with 70-kg body weight; 2 L/day water ingestion rate; 20% RSC | 640 | ATSDR MRL of 0.1 mg/kg-day; 10-fold factor not applicable to Class C carcinogens | Adult with 80-kg body weight; 2.5 L/day water ingestion rate; 20% RSC |
| 3-Methylphenol (*m* -Cresol) | 35 | IRIS RfD of 0.05 mg/kg-day; application of 10-fold factor for Class C carcinogens | Adult with 70-kg body weight; 2 L/day water ingestion rate; 20% RSC | 640 | ATSDR MRL of 0.1 mg/kg-day; 10-fold factor not applicable to Class C carcinogens | Adult with 80-kg body weight; 2.5 L/day water ingestion rate; 20% RSC |
| 4-Methylphenol (*p*- Cresol) | 3.5 | IRIS RfD of 0.005 mg/kg-day; application of 10-fold factor for Class C carcinogens | Adult with 70-kg body weight; 2 L/day water ingestion rate; 20% RSC | 640 | ATSDR MRL of 0.1 mg/kg-day; 10-fold factor not applicable to Class C carcinogens | Adult with 80-kg body weight; 2.5 L/day water ingestion rate; 20% RSC |
| 2,4-Dimethylphenol | 140 | IRIS RfD of 0.02 mg/kg-day | Adult with 70-kg body weight; 2 L/day water ingestion rate; 20% RSC | 128 | IRIS RfD of 0.02 mg/kg-day | Adult with 80-kg body weight; 2.5 L/day water ingestion rate; 20% RSC |
| Phenol | 10 | The GCTL of 10 µg/L is based on organoleptic effects only. A GCTL based on health effects and using University of Florida (2005) recommended toxicity and exposure assumptions[c] is 2,100 µg/L | | 1920 | IRIS RfD of 0.3 mg/kg-day | Adult with 80-kg body weight; 2.5 L/day water ingestion rate; 20% RSC |

Notes:

ATSDR = Agency for Toxic Substances and Disease Registry; IRIS = United States Environmental Protection Agency's Integrated Risk Information System.

RfD = Reference Dose; applicable to oral exposure route.

RSC = Relative Source Contribution. The RSC is an estimate of drinking water's contribution to total exposure for non-carcinogenic chemicals. An RSC of 20% represents a default value, to be replaced with a chemical-specific value when data are available (FDEP, 2005).

MRL = Minimum Risk Level; applicable to oral exposure.

(a) FDEP = Florida Department of Environmental Protection. Groundwater cleanup values were obtained from: University of Florida (2005).

(b) Updated drinking water ingestion rate and bodyweight for adults, as recommended in: Stalcup (2014).

(c) University of Florida (2005, p. 39) indicates that the SCTL for phenol, which includes oral exposure, uses an oral RfD of 0.3 mg/kg-day. Using this RfD value, a bodyweight of 70 kg, and a drinking water ingestion rate of 2 L/day results in a GCTL of 2,100 µg/L.