Ecological Risk Assessment Step 3a
Refinement of Chemicals of Potential Concern

Davis Timber Site
Lamar County, Mississippi

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1.0 Introduction

The Refinement of Chemicals of Potential Concern (COPCs) Report (Black & Veatch 2003) refined chemicals known to be associated with the Davis Timber Site as mentioned in the site history. Because there were only about eight chemicals mentioned, the rest of the chemicals identified as of preliminary concern in the Screening-level Ecological Risk Assessment (SLERA) were retained for further evaluation in the risk assessment. This report is an effort to further refine the COPCs prior to Step 4 of the ERA. It should be used as a companion report to Black & Veatch (2003).

2.0 Refinement of Chemicals of Potential Concern

2.1 Surface Soil

2.1.1 Volatile Organic Compounds

Several VOCs in surface soil were identified as preliminary COPCs in the Draft Revision 1 SLERA Steps 1 & 2 Report (Table 2.1). Of the 19 VOCs identified as preliminary COPCs, only three compounds were detected in surface soil. The rest of the VOCs were identified as preliminary COPCs due to either lack of a screening value or the half of maximum sample quantitation limits exceeding a screening value. Many of the analytes are common industrial chemicals that could potentially have been used at the site, although there is no specific record of their use. Volatile compounds tend not to persist for any length of time in surface soils. This report discussed the three detected VOCs (acetone, methyl ethyl ketone, and methyl isobutyl ketone).

Acetone was identified as a preliminary COPC due to lack of a Region 4 screening value. Acetone is a common laboratory contaminant, which may explain its relatively frequent detection
in surface soil. Acetone concentrations ranged from 29 to 320 ug/kg. Because acetone is a common laboratory contaminant and does not persist in surface soil, the low levels detected in Davis Timber soil are not expected to result in sufficient exposures to cause harm to ecological receptors.

The two ketones were sporadically detected (1 or 2 detections out of 15) at low levels (6 to 32 ug/kg). Neither methyl ethyl ketone or methyl isobutyl ketone had Region 4 screening values. However, for most of the VOCs the Region 4 screening values ranged between 10 and 100 ug/kg. Based on the low frequency of detection, the fact that the volatile nature of these compounds would tend to make them evaporate rapidly from soils, and the low magnitude of detection relative to the range of screening values for other VOCs, the ketones are not carried forward for further evaluation in the risk assessment. All indications are that the VOCs are laboratory contaminants and were not actually present at the site. No VOCs were detected in ground water.

Several other VOCs were undetected with detection limits ranging from 6 to 28 ug/kg. Of the undetected compounds, six (1,3-dichlorobenzene, 1,4-dichlorobenzene, chloroform, tetrachloroethene, trichloroethene, and vinyl chloride) were identified as preliminary COPCs on account of having half of their detection limit greater than the Region 4 screening number. The other 11 preliminary COPCs were not detected and lacked Region 4 screening values. Given the site history of unknown use of these chemicals and the fact that they were not detected with detection limits within the 10 to 100 ug/kg range of typical screening values for VOCs, there is limited potential for unacceptable exposure to VOCs at this site. The non-detected preliminary COPCs as VOCs in soil were not carried forward into the baseline ecological risk assessment.

2.1.2 Pesticides and Polychlorinated Biphenyls (PCBs)

There were no detections of pesticides at the Davis Timber site except for 2.0 ug/kg of 4',4'-DDD in one sample (DT022SLA). The 2.0 ug/kg is below the Region 4 screening value for.
soils. While properties vary for individual compounds, pesticides and PCBs tend to be of concern in soil due to their potential for bioaccumulation into prey items and subsequent exposure to wildlife. Since wildlife integrate their exposure over an area, isolated low-level hits of pesticides in soils or sediments will generally result in insufficient exposures to wildlife to result in unacceptable risk. The detection limits for non-detect pesticides that lacked Region 4 screening values were compared to Region 5 screening values (USEPA 2003) and Region 3 Biological Technical Advisory Group (BTAG) values (USEPA 1995). None of the half detection limits exceeded the Region 5 or Region 3 screening values. The Region 5 screening values are based on protection of the least shrew, assuming bioaccumulation into earthworms.

The detection limit for toxaphene is typically high relative to ecological screening values. In Davis Timber surface soils, toxaphene was not detected with detection limits ranging from 34 to 380 ug/kg relative to a Region 5 screening value of 119 ug/kg. Toxaphene was not detected in surface soils and there is no reason to expect toxaphene to have been present based on the site history.

The pesticide DDT and its breakdown products, DDD and DDE, were totaled assuming half the detection limit as a surrogate for non-detected compounds. Due to the practice of summing the surrogate concentrations with the detected concentration for total DDD/DDE/DDT, the total was greater than the Region 4 screening value. Given the limited potential for widespread exposure to bioaccumulative compounds, DDD/DDE/DDT was eliminated from further evaluation.

PCBs were not detected at the site. There was no record of their use. PCBs were identified as a preliminary COPC based on the total of the surrogate concentrations for non-detected compounds having exceeded a Region 4 screening value. Given that the PCBs are non-detect, it is unlikely that they are actually present at the site or that exposure to PCBs would be widespread.
Gamma-BHC (lindane) was identified in the site history as a chemical used at the Davis Timber site. Gamma-BHC was identified as a preliminary COPC based on having a range of detection limits (1.8 to 7.8 ug/kg) greater than the Region 4 screening value of 0.05 ug/kg. Gamma-BHC is a bioaccumulative chemical that may be of potential concern due to accumulation into prey items, with subsequent exposure to wildlife. Given the magnitude of the detection limits relative to the screening value, the status of gamma-BHC as a COPC was evaluated in a food chain model (Black & Veatch 2003). The hazard quotient for gamma-BHC was less than 1 for the avian insectivore. It is unlikely that gamma-BHC will be a major player in the ecological risk assessment; however, it may be a candidate for future characterization.

Based on non-detected or sporadic low-level detections, pesticides in surface soils were eliminated from further evaluation in the risk assessment.

2.1.3 Metals

Seventeen metals were identified as preliminary COPCs in surface soil at Davis Timber. Except for mercury, all metals were detected in surface soils. Mercury was identified as a preliminary COPC because its detection limit was greater than the Region 4 screening number. The detection limit was most commonly 0.6 ug/kg; it was 1.5 ug/kg in sample DT022SLA. Sample DT022SLA is an isolated hit of elevated levels of antimony, chromium, lead, and selenium. The high levels of metals detected in this sample are probably the cause of the elevated detection limit for mercury. Mercury would likely have been detected in surface soils if it were widespread at levels sufficient to cause unacceptable risk to wildlife. The detection limits are greater than the Region 4 screening values, therefore there is some uncertainty regarding the exposure point concentration. Given that mercury was not known to be used at the site, the potential for widespread exposure is insufficient to warrant further ecological evaluation.

Aluminum levels in Davis Timber soil are relatively low compared to what is typically seen in background soils. Aluminum was identified as of preliminary concern in the SLERA due
to exceeding a Region 4 screening number. The screening value is for acid soil conditions that
tend to enhance the bioavailability of aluminum to cause toxicity to plants and soil invertebrates.
Aluminum is not recommended as a COPC at this site unless acidic conditions were caused by
the site. Comparison to background and a soil pH test would probably provide sufficient
evidence to eliminate aluminum from further study.

Antimony was undetected in surface soil except for the one elevated hit in Sample
DT022SLA. Antimony is recommended to be retained as a COPC for further evaluation to
catalogize what appears to be a localized area of metals contamination in soil. The same is true
for beryllium, chromium, cyanide, lead, manganese, selenium, and thallium, which occurred at
elevated levels in the same sample. These metals all occurred at very low levels or were
undetected apart from Sample DT022SLA. These chemicals may be treated as “hotspot” COPCs
and may be addressed by removal of the affected soils, provided the extent of contamination is
not extensive. The metals are recommended for retention as COPCs because, particularly for
antimony, chromium, lead and selenium, levels are high enough that risk will be unacceptable.
Additional characterization can determine if widespread low to moderately low levels are
present. If contamination is uniformly high, additional risk evaluation of the metals may not be
necessary, because it can be assumed that unacceptable risk exists.

Calcium, magnesium, potassium, and sodium were eliminated as essential nutrients.
Vanadium was identified as a preliminary COPC due to exceeding a Region 4 screening value.
Vanadium concentrations ranged between 1.6 to 21 mg/kg. Vanadium might be present in the
reference soil, but no background data were available for the refinement. The vanadium
screening value is based on potential toxic effects on plants (Efroymson et al. 1997). The
screening value for potential effects on invertebrates published by the same group at Oak Ridge
was 20 mg/kg. Because only one of the soil samples was slightly higher (21 mg/kg) than the
benchmark for earthworms, it is recommended that any further assessment of potential vanadium
toxicity in surface soil focus on plant versus earthworm toxicity at least for vanadium.
Background data for surface soil is recommended to further evaluate whether vanadium is site-
related. There is no evidence from the site history or knowledge of the wood treating process to suspect vanadium to be present. Vanadium is recommended to be retained as a COPC pending background evaluation.

2.1.4 Semivolatile Organic Compounds (SVOCs)

SVOCs detected in surface soil included (3-and/or 4-) methylphenol, 1,1-biphenyl, benz butyl phthalate, isophorone, and pentachlorophenol. The compound 1,1-biphenyl had a Region 4 screening value and screened out in the SLERA. Pentachlorophenol is a site related compound with a maximum concentration in surface soil of 68 mg/kg. Pentachlorophenol is substantially elevated and will be carried forward as a COPC.

The (3-and/or 4-) methylphenol, benz butyl phthalate, and isophorone were identified as preliminary COPCs due to lack of a Region 4 screening value. The 3- and/or 4-methylphenol was detected in two samples with concentrations ranging from 4 to 92 ug/kg. The Region 3 BTAG has a recommended screening value of 100 ug/kg for protection of flora and fauna. Methylphenol is probably related to wood treatment operations at the site. Methylphenol is unlikely to be of concern at the concentrations measured. Sample DT046SLA, however, had elevated detection limits for all SVOCs. Sample DT046SLA is influencing the results of the screen by elevating the detection limit range. It would be best to assume that sample DT046SLA might have contained concentrations of pentachlorophenol and possibly other compounds associated with wood treating operations despite the fact that no SVOCs were detected.

Isophorone was detected at 96 J ug/kg in Sample DT022SLA. No Region 4 screening value was available. There was no screening value available among the regions for protection of soil invertebrates, which are anticipated to be the most sensitive receptor for isophorone. The Region 5 value (159 mg/kg) is based on protection of the least shrew for bioaccumulation of compound into earthworms. Assuming a value similar to the 100 ug/kg Region 3 BTAG value for protection of plants and earthworms, the single detection of isophorone is probably not a
concern for either protection of soil invertebrates or wildlife in surface soil.

The other SVOCs identified as preliminary COPCs in the SLERA were not detected in surface soil but were identified for further evaluation due to lack of a screening value or having a detection limit in excess of a screening value. Those compounds identified in the SLERA as preliminary COPCs based on having half of the maximum detection limit greater than a Region 4 screening value were 2,4-dichlorophenol, 2-chlorophenol, atrazine, and phenol. The remaining 34 preliminary semi-volatile COPCs were non-detects with no Region 4 screening value. The Region 4 screening values for dichlorophenol, atrazine, and phenol are 1994 Dutch Ministry values. The Region 4 screening value for 2-chlorophenol is a Beyer (1990) value. The Dutch Ministry values have the greatest uncertainty as they may have more to do with elevation over background versus effects values for protection of ecological resources. The Dutch Ministry revises their benchmarks periodically, but none of these values have changed. The Region 3 BTAG is using 100 ug/kg as a screening value for low-level dichlorophenol contamination. The Ontario Ministry of the Environment has published a value of 200 ug/kg for dichlorophenol as protective of soil invertebrates—likely to be the most sensitive ecological receptors. Although the detection limits for dichlorophenol are higher than the screening values in use, the detection of SVOCs at levels considerably lower than the sample quantitation limits in other samples indicates that compound present at levels in the 100 to 200 ug/kg range would have been detected if actually present. Chlorinated phenolic compounds are potentially present at the site as breakdown products of pentachlorophenol. If these compounds were present in other site media, they may have been recommended for inclusion as COPCs. However, they were not detected elsewhere at the site; and if dichlorophenol were present as a breakdown product it would be co-located with the pentachlorophenol. Any action to remedy the pentachlorophenol contamination would most likely take care of any low levels of breakdown products. Hence, 2,4-dichlorophenol is not recommended for further evaluation in the ecological risk assessment.

2-Chlorophenol was not detected at the site. It had a half detection limit greater than the Region 4 screening value, which was based on a value for chlorophenols in Beyer (1990). The
Beyer (1990) value of 100 ug/kg represents protection of soil invertebrates. Although the detection limit for the non-detected samples was greater than the benchmark, the detection of other SVOCs at levels approximating 100 ug/kg may indicate that the laboratory would have detected compound at levels below the sample quantitation limit if the compound had actually been present. 2-Chlorophenol may be a degradation product of pentachlorophenol. Any action to remedy pentachlorophenol will effectively treat the breakdown products. Hence, 2-chlorophenol is not recommended to be carried forward as a COPC for further evaluation in the ecological risk assessment.

Phenol was not detected in Davis Timber surface soils. It was identified as a preliminary COPC due to the half detection limit exceeding a Region 4 screening value. As stated previously, the Dutch Ministry “optimum” value has low certainty because its relationship to toxicity to ecological receptors is unclear. A benchmark for toxicity to earthworms was published by Efroymson et al. (1997) 30 mg/kg. Given the uncertainty with the screening the fact that the compound was undetected, and the low detection limits relative to an alternative screening value (ASV), phenol is not recommended for further evaluation in the ecological risk assessment.

There is no record or expectation of use of atrazine at this site. The low screening value for atrazine probably reflects its high solubility and concern for potential leaching to ground water with respect to human health concerns in agricultural settings where this pesticide is extensively applied. While the screening value for atrazine may be appropriate, atrazine was not detected at the site and is not considered to be present. Low levels represented by the detection limits are not expected to present unacceptable risk to ecological receptors. Atrazine is not retained for further evaluation.

The other 34 preliminary COPCs in the SLERA were not detected at the site and had no Region 4 screening values. Region 5 has published screening values for many of the SVOCs. The Region 5 values are typically based on protection of a least shrew, assuming bioaccumulation into the diet. The detection limits of the remaining non-detected SVOCs were low in relation to
the benchmarks for protection of wildlife. In terms of protection of soil invertebrates and plants, soil invertebrates will tend to be the more sensitive for this class of compounds. Nitrogenated compounds are not expected to be present at this site. The SVOC compounds not containing nitrogen may be represented by a screening value for low-level contamination of 100 ug/kg, which is the Region 3 BTAG value in cases where an alternate screening value is available. As these compounds were not detected and the laboratory analysis would probably have detected them if they were present at 100 ug/kg, the non-detected SVOCs with no Region 4 screening value are not recommended to be carried forward for further evaluation.

The total PAHs, including carbazole, are recommended to be carried forward into the next step of the ecological risk assessment for soils. The assessment of potential soil toxicity of PAHs will at the same time test for toxicity of any other compounds present. Dioxin TEQ should also be carried forward as a site-related COPC.

2.1.5 Summary of Surface Soils Refinement

No VOCs were retained for further evaluation. Gamma-BHC was identified as a potential COPC in soil based on the uncertainty associated with the screening benchmark and the detection limit having exceeded the Region 4 screening value. Gamma-BHC was not detected in surface soils, but was listed in the site history as having been used at the site. The low level associated with the detection limit for gamma-BHC produced a hazard quotient less than 1 for the insectivorous bird, hence gamma-BHC was not recommended for further evaluation in the risk assessment.

Antimony, beryllium, chromium, cyanide, lead, manganese, selenium, and thallium were flagged as occurring at a high concentrations relative to screening values and effects values in one sample (DT022SLA). Future ecological evaluation should focus on demonstrating a risk at the high concentrations measured. Biological sampling to further refine the ecological risk assessment may not be necessary for the metals if a basis for action can be derived from the
existing information. Further characterization of the extent of metals contamination is recommended. If the contamination is found to be wide spread over a gradient of contamination levels, toxicity testing of soil invertebrates is recommended. If the contamination is localized, hot spot removal is recommended with no further biological evaluation.

Vanadium was recommended for further evaluation due to wide-spread levels above the Region 4 screening value and uncertainty as to whether the vanadium was site related. The uncertainty was caused by lack of an appropriate set of reference samples for background soils.

Pentachlorophenol, dioxin TEQ and PAHs were carried forward as COPCs into the next step of the ecological risk assessment. Biological study to reduce uncertainty in establishing the protective levels is recommended for the pentachlorophenol, dioxin TEQ, and PAHs. No other semivolatile organic compounds were recommended for further evaluation in surface soils.

2.2 Sediments

The SLERA Report split the evaluation of sediments into Riverine and wetland sediments (Table 2-2) and Lacustrine sediments (Table 2-3). Several constituents were identified as preliminary COPCs in the SLERA. Since the composition of the sediments was chemically similar, except for the generally lower concentrations in lacustrine sediments, the refinement treated the sediments from different habitats together.

2.2.1. Volatile Organic Compounds

All volatile organic compounds analyzed in sediments were identified as preliminary COPCs in the SLERA in sediments for lack of Region 4 screening values. Detected VOCs in sediments were acetone, carbon disulfide, ethyl benzene, methyl ethyl ketone, and toluene. The maximum concentration detected of any single compound was acetone at 240 µg/kg. The maximum detection limit was typically 58 µg/kg. Volatile organic compounds and semi-volatile
organic compounds with no specific mechanism of toxicity are narcotic to benthic organisms at concentrations approaching the mg/kg range. Since the VOCs have no known specific mechanism of toxicity and the detection limits and detections are low, none are recommended for further evaluation in the ecological risk assessment. Some detected VOCs are common laboratory contaminants, such as acetone, carbon disulfide, and toluene. The concentrations of the VOCs are too low to cause unacceptable risk to sediment-dwelling organisms. Bioaccumulation does not occur for VOCs.

2.2.2 Pesticides and Polychlorinated Biphenyls (PCBs)

Several pesticides were detected at low levels in wetland and riverine sediments including alpha-BHC, beta-BHC, dieldrin, endrin, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone, gamma-BHC, gamma-chlordane, heptachlor epoxide, methoxychlor, and DDD/DDE/DDT. Dieldrin, endrin, gamma-BHC, and gamma-chlordane were eliminated as COPCs in the SLERA for having maximum detected concentrations below Region 4 ESVs. The remaining detected pesticides were retained in the SLERA due to lack of a Region 4 ESV. Pesticides and PCBs tend to be of concern due to their potential for bioaccumulation into prey items and subsequent exposure to wildlife. Since wildlife integrate their exposure over an area, isolated low-level hits of pesticides in soils or sediments will generally result in insufficient exposures to wildlife to result in unacceptable risk. The screening values and alternative screening values (ASVs) used in the evaluation were designed to be protective to benthic organisms. For alpha-BHC, beta-BHC and heptachlor epoxide, ASVs were available from Persuad et al. (1993), as 6.0, 5.0, and 5.0 ug/kg, respectively. None of the detected concentrations in sediments exceeded the ASVs. ASVs for endosulfan II, endosulfan sulfate, and methoxychlor were developed from equilibrium partitioning theory with assumed organic carbon content in sediment of 1.0 percent. The ASVs for endosulfan II and endosulfan sulfate (14 and 5.4, respectively) were greater than the detected concentrations at the site. For methoxychlor, the ASV was 19 ug/kg, which was exceeded in one sample (DTEMCSD1). Results indicated that sediments might be toxic to sediment invertebrates due to methoxychlor in one location. No
alternative screening values were available for endrin aldehyde and endrin ketone. They are breakdown products of endrin with anticipated lower toxicity than the parent compound.

Alpha-chlordane was not detected in wetland and riverine sediments. It was identified as a potential COPC in the SLERA for having a half detection limit greater than a screening value. Due to the magnitude of the maximum detection limit (5.2 ug/kg) relative to the screening value 1.7 ug/kg, even if the pesticide were present it would not produce a high hazard quotient, given that the laboratory can often measure below the sample quantitation limit.

The detection limits for non-detected pesticides that lacked Region 4 screening values were compared to alternative screening values, where available, for aldrin, delta-BHC, endosulfan I, heptachlor, and toxaphene. Aldrin had an ASV available from Persuad et al. (1993) of 2.0 ug/kg. Detection limits for aldrin were only slightly higher than the ASV. Delta-BHC had no available benchmark, but is the least toxic BHC. Delta-BHC was measured with adequate detection limits for the ecological risk assessment. Endosulfan I has an ASV of 2.9 ug/kg based on equilibrium partitioning theory and an assumed organic carbon content in sediment of 1 percent. The detection limits for endosulfan I were adequate for the ecological risk assessment. Heptachlor has an ASV of 68 ug/kg (Jones et al. 1997). The detection limits for heptachlor fell below the ASV. The detection limit for toxaphene is typically high relative to ecological screening values. In Davis Timber sediments, toxaphene was not detected with detection limits ranging from 210 to 520 ug/kg relative to 28 ug/kg (estimated screening value by equilibrium partitioning from the Tier II surface water toxicity value and assuming 1.0 percent organic carbon in sediment [USEPA 1996]). Toxaphene was not detected in surface soils, and there is no reason to expect toxaphene to be present based on the site history.

Total DDD/DDE/DDT exceeded the Region 4 ESV and was identified as a COPC in the SLERA. Many of the detections of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were flagged “N” as based on presumptive evidence of presence of the material by the laboratory quality assurance. The maximum concentration of 14.1 u/kg used in the SLERA was the result of a 9.1 N detection
of 4,4'-DDT and non-detects of 5.0 ug/kg for 4,4'-DDD and 4,4'-DDE. The highest total DDT value in a sample without N-qualified data was 8.0 ug/kg in Sample 303SD. This total was based on a 3.5 J ug/kg result for 4,4-DDE and two non-detects at 4.5 ug/kg for the DDD and DDT. The hazard quotient of 2.4 was considered low relative to the uncertainty in the analytical data and the fact that much of the total for DDD/DDE/DDT was accounted for by an assumed half detection limit as a surrogate for non-detected pesticides. The total of DDD/DDE/DDT is not recommended for further evaluation in the ecological risk assessment. DDT is not known to have been used at the site. Low levels of pesticides are commonly detected in sediments and may not be associated with the site.

PCBs were not detected in sediments and were not associated with the site based on either site history or results of site characterization of soils. PCBs were identified as a preliminary COPC in the SLERA for having a half detection limit greater than the Region 4 ESV. The detection limits for individual congeners typically ranged from 39 to 100 ug/kg. The upper range of detection limits for PCBs was the exception rather than the rule. Based on the fact that PCBs were not detected in any sample of any media and the adequate detection limits, PCBs are not recommended for further evaluation in the ecological risk assessment.

2.2.3 Metals

None of the metals detected in site sediments had hazard quotients greater than 1 in the SLERA. Several metals were identified as preliminary COPCs in the SLERA because they did not have a Region 4 screening value (aluminum, barium, calcium, cobalt, iron, magnesium, manganese, potassium, selenium, sodium, thallium, and vanadium). Of these calcium, magnesium, potassium and sodium are essential nutrients and are not considered further in the ERA. The metals lacking Region 4 screening values were at low levels that were likely consistent with background. Aluminum was present at a maximum of 10,000 mg/kg and iron at 13,000 mg/kg. These levels are not high given the ubiquitous nature of iron and aluminum. Barium was detected within a range of 12 to 140 mg/kg. These levels of barium are not uncommon to observe...
in sediments. No alternative screening values were available for barium. Cobalt was detected at 1 to 9.1 mg/kg. A Dutch Ministry Target Value of 20 mg/kg for cobalt is one number to consider but may not be based on toxicity. A lowest effect level (LEL) of 460 mg/kg is an alternative screening value for manganese (Persuad et al. 1993). The levels at the site ranged from 68 to 880 mg/kg in sediments. Manganese concentrations were on the low end of the range except for in Sample DTEMCSD2. Manganese is also naturally occurring and may not be site related.

Selenium was detected in one sample at 0.91 mg/kg. Selenium is naturally occurring in sediments at levels similar to detected here. Selenium is of concern for bioaccumulation, but without widespread contamination it is unlikely to produce sufficient exposure to generate unacceptable ecological risk. No alternative screening values were available for thallium or vanadium. Appropriate background samples of sediments would certainly help to eliminate these metals as COPCs.

2.2.4 Semivolatile Organic Compounds

All semivolatile organic compounds analyzed in sediments were identified as preliminary COPCs in the SLERA. Only bis(2-ethylhexyl) phthalate exceeded a screening value. The other compounds were identified as preliminary COPCs for lack of a Region 4 ESV. SVOCs detected in sediments included 3- and/or 4-methylphenol, 2,4,6-trichlorophenol, acetophenone, benzaldehyde, bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, and pentachlorophenol. Apart from bis(2-ethylhexyl) phthalate, none of these SVOCs had Region 4 screening values. Alternative screening values are discussed below.

An alternative screening value for 4-methylphenol was 670 ug/kg based on a Washington State Sediment Quality Standard, which was an Apparent Effects Threshold (AET) (Ginn and Pastorak 1992) as cited by Jones et al. (1997). 3- and/or 4-Methylphenol concentrations ranged between 68 to 950 ug/kg and were detected in two samples of 34 total. The highest concentration detected was greater than the ASV. Methylphenol is potentially site related. Hence, 3- and/or 4-methylphenol was recommended for retention as a COPC in sediment.
An alternative screening value was available for 2,4,6-trichlorophenol from Region 5 as 208 ug/kg. The ASV is based on a Tier II value and equilibrium partitioning into sediment. 2,4,6-Trichlorophenol was detected in one sample at 930 ug/kg and is retained as a COPC. 2,4,6-Trichlorophenol may be a site related compound.

No alternative screening values were available for acetophenone and benzaldehyde. Benzaldehyde was detected in 11 of 28 samples at concentrations ranging from 41 to 1100 ug/kg. Acetophenone was detected in one sample (315SD) at 51 ug/kg. Acetophenone and benzaldehyde were not detected in soils. These constituents might be associated with the site. Bis(2-ethylhexyl) phthalate and di-n-butyl phthalate were detected in sample DTEMCS1 only at 2000 and 510 ug/kg, respectively. Bis(2-ethylhexyl) phthalate was identified as a COPC. An alternative screening value used in Region 5 is 1114 ug/kg for di-n-butyl phthalate. Based on the ATV and the limited detection of di-n-butyl phthalate, it is not recommended for further evaluation in the ecological risk assessment.

Pentachlorophenol was detected in 20 of 34 samples at concentrations ranging from 130 to 8200 ug/kg. Pentachlorophenol concentrations exceeded the alternative screening value of 360 ug/kg as an Apparent Effects Threshold (AET) from Washington State Sediment Quality Standards (Ginn and Pastorak 1992) as cited by Jones et al. (1997). The exceedence of the ASV means that sediments are potentially toxic to sediment invertebrates. As pentachlorophenol is a bioaccumulative chemical, the potential effects to organisms that feed from the aquatic food base will also need to be examined in the ecological risk assessment. Hazard quotients greater than 1 were predicted for the avian aquatic insectivore for pentachlorophenol in the wetland and riverine habitats (Black & Veatch 2003). Pentachlorophenol is recommended to remain a COPC.

SVOCs not detected in sediments for which there was no Region 4 screening value were only evaluated further if they were detected in soils. Otherwise it was assumed that the compounds were not site related. Compounds considered in more detail were isophorone, 1,1-biphenyl, and benz butyl phthalate.
Isophrone was not detected and had detection limits ranging from 390 to 1000 ug/kg. An alternate screening value of 432 ug/kg was developed by Region 5 based on equilibrium partitioning into sediments. For 1,1-biphenyl an ASV of 1,100 ug/kg was considered from the Eco Update Ecotox Thresholds and the Tier II screening value for surface water. By a similar methodology but using the surface water quality screening values used in Region 5, an ASV of 1970 ug/kg was derived for benz butyl phthalate. Given that the three compounds detected in soils were not detected in sediments and that the ASVs are lower or only slightly greater than the detection limits, the isophrone, 1,1-biphenyl, and benz butyl phthalate are not recommended to be carried forward as COPCs into the risk assessment.

2.2.5 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs in sediments were evaluated by Black and Veatch (2003) as site-related compounds. The concentrations of PAHs are relatively low at this site. The highest concentrations were from East Mineral Creek. Total PAHs exceeded the screening value, however, the estimated total was inflated by the use of a surrogate concentration of ½ the detection limit for non-detected PAHs. Given the low concentrations of PAHs and the ability of most organisms to metabolize these compounds, further food-chain studies or modeling is not recommended. Given the low-levels of detected PAHs these compounds would not drive additional ecological study if they were the only contaminants present. PAHs and pesticides are likely to be small contributors to the toxicity in sediment compared to the phenols. It is recommended, however, that pesticides and PAHs be analyzed in any sediments tested for toxicity to account for any unexplained toxic responses.

2.2.6 Dioxin/Furans

Dioxin TEQ is a site-related constituent that will be evaluated in food chain models in the ecological risk assessment. Food chain models in Black and Veatch (2003) indicated hazard quotients greater than 1 for aquatic and terrestrial receptors. Because site-specific prey tissue
concentrations may be important to refine the recommended protective level, dioxin TEQ is recommended to be retained in the risk assessment.

2.2.7 Summary of Sediments

The concentrations in sediments of the Lacustrine areas were very similar but considerably lower than in the Wetland and Riverine areas. The same constituents were of potential concern for both areas. Concentrations of pesticides in sediments were low relative to ESVs or ASVs (used where Region 4 screening values were unavailable). The only exceedence of an ASV was for methoxychlor in one sample. The total of DDD DDE and DDT was reevaluated to remove the “N” qualified data. Once N-qualified data were removed, and given the fact that surrogate concentrations were used for non-detects, the concentrations were not substantially greater than the screening benchmark. Pesticides are not recommended for further ecological study. However if sediments are analyzed for toxicity tests, it is recommended that pesticides be part of the analysis.

Although metal concentrations were low, sediment screening values were unavailable for many. Background data is recommended to use to determine if any of the metals aluminum, barium, calcium, cobalt, iron, magnesium, manganese, potassium, selenium, sodium, thallium, and vanadium may be site related. Biological testing is not recommended for metals in sediments.

PAH concentrations were low in sediments, although not recommended for further biological study, PAHs should be analyzed in sediments taken for toxicity studies. PAHs are not anticipated to be a major cause of effect to benthic organisms.

Several SVOCs were identified as preliminary COPCs in the SLERA. This evaluation looked at the SVOCs that were detected in either sediments or soils. No undetected organic compounds were retained as COPCs in sediments. In all the constituents retained as COPCs in
sediments included 3- and/or 4-methylphenol, 2,4,6-trichlorophenol, benzaldehyde, acetophenone, bis(2-ethylhexyl) phthalate, pentachlorophenol, and dioxin/furans.

2.3 Surface Water

Numerous constituents were identified as preliminary COPCs by Black and Veatch (2003) in the Draft Revision 1 SLERA Steps 1 & 2 Report (Table 2-4). The refinement was broken down by chemical class. Surface water data were available for four locations—resident's pond south of the site, wetlands adjacent to the site, Country Club Lake Estates, and Phillip's Lake. The five samples consisted on one from the locations listed and one field duplicate. No samples were available from East Mineral Creek.

2.3.1 Volatile Organic Compounds (VOCs)

Two VOC, 1,1,1-trichloroethane and toluene were detected in surface water. Both VOCs were detected at levels below a Region 4 screening value and were eliminated from further consideration in the SLERA. Twenty-five VOCs, not detected in surface water, were identified in the SLERA as preliminary COPCs for lack of a Region 4 screening value. VOCs that were not detected are recommended for elimination from further consideration when there is no evidence from either site history or laboratory data that the constituent was associated with the site. Detected VOCs in surface soil were acetone, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, toluene, and total xylenes. In sediments, detected VOCs were acetone, carbon disulfide, ethyl benzene, methyl ethyl ketone, and toluene. Because the compounds detected in either soil or sediment might conceivably be related to the site, they were the only undetected compounds in surface water that were further evaluated with alternative screening values. Those VOC potentially associated with the site, through detection in other media, lacking Region 4 screening values, were acetone, carbon disulfide, methyl ethyl ketone, methyl isobutyl ketone, and total xylenes. They were discussed in the following paragraph.
A Tier II value for acetone was 1,500 ug/L. The Detection limits for acetone were below
the ASV. Tier II values for methyl ethyl ketone and methyl isobutyl ketone are substantially
higher than the detection limits at 14,000 ug/L and 170 ug/L, respectively (Suter and Tsao, 1996).
Total xylenes have a Tier II value of 17 ug/L, which is also greater than the detection limits.
Carbon disulfide can be naturally produced by the decay of organic matter by bacteria in
anaerobic soils. It is also a common laboratory contaminant. Little toxicity information is
available on its effects on aquatic organisms. Since it was not detected and would be difficult
even if it were detected to associate with the site, carbon disulfide is not recommended for further
evaluation.

2.3.2 Semivolatile Organic Compounds

No SVOCs were detected in surface water at Davis Timber. Six SVOCs were identified
as preliminary COPCs in the SLERA for having a halved detection limit greater than the Region
4 screening value. The remaining 25 SVOCs that were identified as preliminary COPCs did not
have a Region 4 screening value.

SVOCs having detection limits above the Region 4 screening values included 2,4,6-
trichlorophenol, 2,4-dinitrophenol, 2-methyl-4,6-dinitrophenol, bis(2-ethylhezyl)phthalate,
hexachlorobutadiene, and hexachlorocyclopentadiene. The nitrophenols and dienes are unlikely
to be associated with this site. Given the fact that the nitrophenols and dienes were not detected
in surface water or in other site media, they were eliminated from further consideration.

It is possible that chlorophenols may be present in surface water as breakdown products
of pentachlorophenol. Given the magnitude of the detection limit (10 ug/L) relative to the
screening value for 2,4,6-trichlorophenol, if the compound were actually present at a level
commensurate with the screening value, it is likely that the laboratory would have been able to
detect it at a level below the sample quantitation limit. Because there were only 4 samples of
surface water and none from East Mineral Creek, it is uncertain whether the surface water

20
pathway for 2,4,6-Trichlorophenol is complete. 2,4,6-Trichlorophenol is recommended for further characterization in surface water to support the ecological risk assessment.

Bis(2-ethylhexyl) phthalate was not detected in surface water but was detected in sediments of the wetlands and riverine habitats at a level above the Region 4 screening value for sediments. Bis(2-ethylhexyl) phthalate is a commonly detected chemical in sediments. Even if bis(2-ethylhexyl) phthalate were detected in surface water at levels commensurate with the detection limit, the risk assessment would probably not require site-specific biological study of surface water toxicity due to the EPA Recommended Water Quality Criteria and State standards, which function as ARARs. bis(2-Ethylhexyl) phthalate in surface water is not recommended for further evaluation.

The compounds lacking Region 4 screening values in surface water were many. Some of the SVOCs might have a Tier II screening value which could be used as an alternate screening value. Only the SVOCs that were identified as possibly site-related based on presence in other media were refined as potential COPCs. The rest of the compounds were not detected and had no evidence of presence at the site. The SVOCs that were not detected in surface water, without a screening value, but were detected at low levels in either surface soil or sediment were 3- and/or 4-methylphenol, 1,1-biphenyl, acetophenone, and benzaldehyde. The following table is intended to present additional toxicity information. Since there were only 4 surface water samples and no samples taken of East Mineral Creek adjacent to the site, it is recommended that the SVOCs that are potentially associated with sediments and soils be retained in surface water pending surface water sampling. The alternate screening values provided in the table can guide the choice of analytical methods.

Benz butyl phthalate was identified in the SLERA as a preliminary COPC because it lacked a Region 4 screening value. The Region 4 screening value is 22 ug/L. Hence, benz butyl phthalate does have a screening value and should not have been identified as a preliminary COPC.
Pentachlorophenol was identified by Black and Veatch as a COPC in surface water due to its being site related. Pentachlorophenol was not detected in surface water, but the detection limit 25 ug/kg was greater than the screening value of 13 ug/L for a pH of 7.8. The screening value for pentachlorophenol depends on pH and could be refined by measurement of site-specific pH. Pentachlorophenol is recommended for retention as a COPC in surface water.

2.3.3 Polycyclic Aromatic Hydrocarbons (PAHs)

No PAHS were detected in surface water in the 4 samples analyzed. PAHs were discussed in detail by Black & Veatch (2003). Due to lack of surface water data for East Mineral Creek, the PAHs were retained as COPCs. Additional information on the toxicity of the PAHs lacking Regional screening values was provided by Black and Veatch (2003).

2.3.4 Metals

Aluminum, copper, iron, thallium, and zinc were detected in surface water at levels exceeding Region 4 screening values and were identified as preliminary COPCs in the SLERA. Thallium and zinc were detected at levels only slightly above the screening values and were not detected at high levels in other site media. If additional site characterization occurs for surface water...
water, TAL metal scans are recommended to address uncertainty associated with limited site characterization. Given the current data, it would not appear that thallium and zinc would need to be retained for additional ecological evaluation.

Lead, mercury, and silver were not detected in surface water but had detection limits above a screening value. Lead was detected at elevated levels in one soil sample, indicating it might be a site-related constituent. The low screening value for lead is due to the low water hardness. If the detection limit of 1.8 \text{ ug/L} is compared to the hardness-corrected screening value of 0.54 \text{ ug/L}, it becomes apparent that even if the laboratory missed any lead the levels missed would not be great relative to the screening value. Lead and silver are not identified as of concern based on the current results. If, however, the characterization of surface water is inadequate, future surface water samples should be analyzed for lead. Mercury was not detected in surface water and is not anticipated to be present at this site. The Region 4 screening benchmark for mercury is 0.012 \text{ ug/L} which was lower than the detection limit for mercury in surface water of 0.1 \text{ ug/L}. The National Recommended Water Quality Criteria for mercury expressed in terms of dissolved mercury in the water column is 0.77 \text{ ug/L} (USEPA 1999). The detection limit for mercury is below the nationally recommended criterion. The Region 4 value is based on Water Quality Criteria for 1986 and accounts for bioaccumulation into fish. Since mercury was not widespread at the site, the potential for wide-scale bioaccumulation into fish is unlikely. Silver was not detected at elevated levels in soil or sediment. Silver contamination is not anticipated at this site. Mercury and silver are not recommended for further evaluation. However, lead was detected at elevated levels in one soil sample and is recommended for the analyte list in surface water for any future characterization activities.

Barium and manganese were detected in surface water but lacked a Region 4 screening value. Barium has an alternative screening value of 4 \text{ ug/L} as a Great Lakes Water Quality Initiative (GLWQI) Tier II Value (USEPA 1996; Suter and Tsao 1996). The range of detections of barium at the site of 16 to 64 \text{ ug/L} exceeded the alternative screening value. Barium in surface water would remain a COPC by this analysis. Manganese has a Tier II alternative screening value
from the same source of 120 ug/L. The detected concentrations of manganese of 96 to 410 ug/L exceeded the alternative screening value. Manganese in surface water is also a COPC by this analysis. It is uncertain whether manganese and barium are site related. The elevated concentrations could be caused by particulates in the samples. Toxicity to aquatic organisms is associated with dissolved metals. Background data and filtered samples are recommended.

Cobalt and vanadium were undetected and without a Region 4 screening value. Cobalt’s detection limits were below the GLWQI Tier II value of 3 ug/L. Cobalt was not detected. It was eliminated from further consideration in the ecological risk assessment. Vanadium was not detected in surface water but was identified as a preliminary COPC for lack of a Region 4 screening value. A Tier II alternative screening value of 19 ug/L is available (Suter and Tsao 1996). The detection limit range of 4.2 to 7.1 ug/L fell below the alternative screening value. Vanadium in surface water was eliminated from further consideration in the ecological risk assessment. Vanadium was detected in soil and sediment without a Region 4 screening value and is recommended for the analyte list if additional surface water samples are taken.

Calcium, potassium, magnesium, and sodium were identified as preliminary COPCs for lack of toxicity information. They are recommended for exclusion from further evaluation as essential nutrients.

### 2.3.5 Pesticides and PCBs

No pesticides were detected in surface water. Gamma-BHC was analyzed with suitable detection limits. Some of the pesticides and PCBs have low Region 4 screening values, which caused them to be identified as preliminary COPCs in the SLERA. 4,4'-DDD was the only pesticide or PCB detected in site soils. The 4,4'-DDD was detected at such a low level in soils that it is unlikely to result in substantial exposures to aquatic organisms through migration from soils to the wetland, creeks, or lakes. Low levels of pesticides, including DDD/DDE/DDT, were detected in sediments. None of the levels detected were high enough in sediment to suggest a
substantial exposure pathway to surface water. PCBs were not detected in sediments. There is no
evidence both from the site history and from the characterization data that PCBs were used at this
site. The pesticides and PCBs are not recommended for further evaluation of surface water in the
ecological risk assessment.

2.3.6 Dioxins/Furans

Dioxin TEQ was analyzed and detected in the single surface water sample at a level
above the Region 4 screening value. Dioxin TEQ is a site-related constituent retained as a COPC
for further analysis in the ecological risk assessment.

2.3.7 Summary of Surface Water Refinement

The characterization of surface water may be insufficient to eliminate certain SVOCs in
surface water even though they were not detected if sufficient data were not taken to characterize
all of the potential migration pathways. This statement applies to 3- and/or 4-methylphenol, 1,1-
biphenyl, 2,4,6-trichlorophenol, benz butyl phthalate, isophrone, acetophenone, benzaldehyde,
bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, pentachlorophenol, and all of the PAHs. This is
a characterization issue versus a risk assessment issue. With adequate characterization the only
SVOC recommended for further ecological risk evaluation would be pentachlorophenol.

Analysis of TAL metals is also recommended if additional samples were to be taken of
surface water. Of particular interest are barium, lead, manganese, thallium, vanadium, and zinc.
Background data for surface water would help eliminate certain metals, such as barium and
manganese, from further evaluation as site-related COPCs. Mercury and silver were not detected
in surface water and were not recommended for further evaluation.

Dioxins/furans are site-related constituents that were recommended for further evaluation
in surface water in the ecological risk assessment. VOCs, pesticides, and PCBs were not
recommended for further evaluation.

2.4 Summary and Recommendations

Several constituents were recommended for retention in the ecological risk assessment based on the chemistry data collected in 2000 and 2001 (Table 2-5). Recommendations are summarized below:

- Characterization of surface water in East Mineral Creek for a worst case sample to characterize potential migration from soils to surface water.

- Characterization of background levels of metals, PAHs, and pesticides in soils, sediments, and surface water. This will help to complete the analysis of certain metals that were detected but are potentially not related to site activities.

- Characterization of soil pH for analysis of iron and aluminum toxicity.

- Filtered surface water samples for dioxin/furans and barium.

- Earthworm bioaccumulation samples for pentachlorophenol and dioxin.

- Sediment toxicity and bioaccumulation testing for pentachlorophenol and dioxin.

3.0 References


Table 3-1
Factors for Modeling Abiotic-to-Biotic Media Transfer of Contaminants
Bioaccumulation Factors (BAF) and Biota-Sediment Accumulation Factors (BSAF)
Davis Timber Site, Lamar County, Mississippi

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<tr>
<th></th>
<th>BAF</th>
<th>BSAF</th>
</tr>
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<tr>
<td></td>
<td>Soil-to-</td>
<td>Soil-to-</td>
</tr>
<tr>
<td></td>
<td>Invertebrate</td>
<td>Plant</td>
</tr>
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<td><strong>Surface Soil Preliminary COPC</strong></td>
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<td>Pentachlorophenol</td>
<td>0.05 [a]</td>
<td>0.02 [c]</td>
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<tr>
<td>2,3,7,8-TCDD TEQ</td>
<td>0.49 [b]</td>
<td>0.38 [e]</td>
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<td>2.6 [c]</td>
<td>0.02 [c]</td>
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<td>Chromium</td>
<td>0.16 [c]</td>
<td>0.0015 [c]</td>
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<tr>
<td>PAHs</td>
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<td>0.02 [f]</td>
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<td><strong>Sediment Preliminary COPC</strong></td>
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<td>not applicable</td>
<td>0.49 [h]</td>
</tr>
<tr>
<td>PAHs</td>
<td>not applicable</td>
<td>1.61 [l]</td>
</tr>
</tbody>
</table>

BHC = benzene hexachloride
PAHs = polycyclic aromatic hydrocarbons
2,3,7,8-TCDD TEQ = dioxins/furans toxicity equivalence quotient

[a] = value for 2,4,6-trichlorophenol (HAZWRAP 1994) was used as a surrogate for pentachlorophenol
[b] = value for the biota-sediment accumulation factor (BSAF) was used as a surrogate (USACE 1999)
[c] = HAZWRAP 1994
[d] = Ma et al. 1998
[e] = value for Arochlor-1254 was used as a surrogate (HAZWRAP 1994)
[f] = value for acenaphthenethene was used as a surrogate for total PAHs (HAZWRAP 1994)
[g] = EPA 1999
[h] = USACE 1999
[i] = value for benzo(b) fluoranthene, benzo(k) fluoranthene, dibenz(a,h) anthracene, and indeno(1,2,3-cd) pyrene (EPA 1999) used as a surrogate for Total PAHs
[j] = value for acenaphthenethene was used as a surrogate for total PAHs (Travis and Arms 1988); value is calculated based on chemical-specific logKow.


<table>
<thead>
<tr>
<th>Receptor/Medium</th>
<th>Preliminary COPC</th>
<th>Exposure Concentration</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>Maximum</td>
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<tr>
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<td></td>
<td>A-1</td>
</tr>
<tr>
<td>Pentachlorophenol</td>
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<td>A-2</td>
</tr>
<tr>
<td>Dioxins/Furans TEQ</td>
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<td>A-3</td>
</tr>
<tr>
<td>gamma-BHC (lindane)</td>
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<tr>
<td>Chromium</td>
<td></td>
<td>A-5</td>
</tr>
<tr>
<td>Total PAHs</td>
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<td></td>
</tr>
<tr>
<td><strong>Terrestrial Herbivore/Soil</strong></td>
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<td>A-7</td>
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<td>Dioxins/Furans TEQ</td>
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<td>A-8</td>
</tr>
<tr>
<td>gamma-BHC (lindane)</td>
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</tr>
<tr>
<td>Chromium</td>
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<td>A-10</td>
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<tr>
<td>Total PAHs</td>
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<td></td>
</tr>
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<tr>
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<td>Total PAHs</td>
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<td></td>
</tr>
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<tr>
<td>Total PAHs</td>
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<td>A-19</td>
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