PART 3
UPDATED HUMAN HEALTH RISK ASSESSMENT REPORT OLIN MCINTOSH OPERABLE UNIT 2

OPERABLE UNIT 2, McINTOSH, ALABAMA

Prepared for:

OLIN CORPORATION
Cleveland, Tennessee

Prepared by:

AMEC E&I, INC.
3200 Town Point Drive NW, Suite 100
Kennesaw, Georgia 30144

May 25, 2010
Revised November 22, 2010
Revised November 14, 2011

EPA Preface

This preface presents the EPA perspective on the Updated Human Health Risk Assessment for Olin McIntosh OU-2, Revised November 14, 2011. Though uncertainty remains in some areas, EPA believes that the risk assessment adequately characterizes site risk to allow for remedial decisions to be made for contaminants of concern (mercury, methylmercury, DDTR, and HCB)

The standard practice in human health risk assessment is to evaluate "baseline" (i.e. current) risk on unrestricted use of the site. Since Olin OU-2 currently has limited access and is patrolled by Olin security, EPA has agreed to consider the current restricted use scenarios as "baseline", and allow future use scenarios to consider risk under conditions where current use restrictions are not maintained. The updated human health risk assessment assumed that no residential construction would ever occur within the boundaries of OU-2. EPA agrees with this assumption due to the fact that OU-2 floods on a yearly basis during years with normal precipitation. The human health risk assessment assumed that nearby residents might trespass onto OU-2 under current conditions and utilize the Basin and flood plain for recreational purposes such as swimming and fishing, and that fisherman will eat fish caught from the Basin. Future use scenarios were the same as current use scenarios; with the exception that intensity of future use was assumed to be greater. All current and future use scenarios evaluated risk to both adult and pre-adolescent/adolescent receptors. Carcinogenic risk for all scenarios fell within the acceptable risk range of 10E-04 to 10E-06, with a maximum carcinogenic risk across all exposure pathways of 3E-05 for a future time-frame adult. Ingestion of HCB and DDTR concentrations in fish tissue was the primary contributor to carcinogenic risk. The non-carcinogenic hazard index (HI) exceeds 1 for adult and adolescent receptors, in both current and future use time frames. The maximum HI of 6 was for the future adult receptor. For all scenarios, the HI was driven by ingestion of mercury in fish caught from OU-2, with minimal contribution from dermal contact with surface water and soil, and inhalation of soil particulates. EPA concurs with the conclusions of the human health risk assessment update.

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix

LIST OF TABLES

Table

9.0 HUMAN HEALTH RISK ASSESSMENT

9.1 INTRODUCTION

Note to Reader: Olin/MACTEC submitted *Part 3, Section 9: Updated Human Health Risk Assessment Report for Olin McIntosh Operable Unit 2* (MACTEC, 2010b) to USEPA on May 25, 2010. The purpose of this HHRA was to provide an update of the risk assessment methodology and site-specific analytical data for OU-2 that has evolved since the original risk assessment was completed in 1994. The May 2010 Updated HHRA was submitted to USEPA prior to the collection of floodplain soils in July 2010. This document was revised on November 22, 2010 to respond to USEPA's September 10, 2010 comments and include information from the July 2010 floodplain data collection event. It has been revised again based on USEPA's October 9, 2011 comments.

OU-2 comprises the Basin, Round Pond, surrounding wetlands on the Olin Property, and the former wastewater ditch that discharged to the Basin from 1952 to 1974, as depicted in Part 1, Figure 1-1. In 1993, an HHRA Report was completed by WCC as part of the RI for OU-1 and OU-2. The WCC HHRA Report was approved by the USEPA Region 4 on February 23, 1994 (USEPA, 1994). The focus of the 1993 HHRA for OU-2 was exposure of off-site resident trespassers to mercury, HCB, and DDTR in ingested fish. Additional exposure media considered for OU-2 in 1993 included surface soil, sediment, and surface water.

Substantive changes since completion of the 1993 HHRA include:

- Changes in the oral reference dose for methylmercury
- Continuing attenuation of concentrations within OU-2
- Collection of additional fish fillet, sediment, soil, and surface water samples

This HHRA addresses potential exposures to surface water through incidental ingestion of and dermal contact with surface water, to soil through incidental ingestion of, dermal contact with, and inhalation of particulates from soil, and through ingestion of fish. OU-2 is surrounded by a berm/gate system to the north, east, and south and a steep bluff to the west, which limits boat access from the Tombigbee River except during flooding conditions when water levels overtop the berm by several feet. OU-2 is wholly contained within Olin property and has limited access for on-site employees. Fishing by Olin employees is specifically prohibited, and the OU-2 area is patrolled by Olin security. In addition, Olin is committed to securing this area and prohibiting future unrestricted access through the use of institutional controls. The only potential receptors would be off-site residents that are trespassing onto the Olin property; the

frequency of exposure for both current and future trespassers is expected to be low due to the limited accessibility to the area and site security.

Exposure pathways for sediment are considered incomplete per USEPA Region 4 risk assessment guidance for Superfund (USEPA, 2000) because sediment will remain submerged throughout the year; therefore, exposure to submerged OU-2 sediments has not been included in the HHRA as a complete exposure pathway Floodplains soils are periodically submerged, and have been included in the data set for exposure because these soils may be partially dry under various water level conditions.

In December 2009, MACTEC met with representatives from USEPA Region 4 to discuss which media and sampling events should be included in the updated ERA for OU 2. This HHRA also follows the recommendations received from USEPA concerning data use.

USEPA requires a potential future scenario that assumes unrestricted access to OU-2 and no limited recreational exposures to surface soil, surface water, or fish from the Basin (USEPA, 2010a; MACTEC, 2010). This potential future scenario has been incorporated into the HHRA based on USEPA assumption requirements of no institutional controls. Institutional controls may be part of a remedy for the site, depending on the estimated risk for human exposure. Olin is committed to maintaining restricted access to OU-2 currently and in the future. Future exposures for OU-2 are expected to be very similar to current exposures in regards to exposure frequency.

9.1.1 Site Description

A detailed site description is provided in Part 1, Section 1.1. The Basin and Round Pond are located between a bluff to the west and the Tombigbee River to the east. The bluff is approximately 20 to 30 feet higher in elevation than the floodplain areas. Trespassers would access the floodplain areas primarily from the River. Because of the elevation of the berm (12 feet NAVD88), access to surface water in the Basin/Round Pond would be from the bluff or from the boat ramp. The sediment in OU-2 does not support wading because of its soft mud consistency. Therefore, wading is very unlikely to occur, and exposure to surface water would be from a boat or by swimming off the bluff or boat ramp. Because of the topography and Olin security measures, fishing access is limited and would only occur after trespassing.

9.1.2 Conceptual Exposure Model

Historical use of the property has resulted in releases of mercury and HCB to soils, surface water, and biota. DDTR originated from an upgradient Superfund site unrelated to the Olin plant operations. Exposure media, potential receptors, and potentially complete exposure pathways are identified in Table 9-1. Potentially complete exposure routes for soil include incidental ingestion, dermal contact, and inhalation of fugitive dust. Exposure routes for surface water might include incidental ingestion and dermal contact. Exposure pathways for sediment are considered incomplete and not quantified. Ingestion of fish may occur as a rare event and is quantified in the updated HHRA.

9.1.3 Purpose and Approach

The purpose of this HHRA is to evaluate potential exposures associated with floodplain soils, surface water and ingestion of fish at OU-2 for current and future land use. The Olin McIntosh Plant is an active facility and is expected to remain active in the future. Off-site land use is assumed to remain recreational and residential. This HHRA has been completed in accordance with USEPA's *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Part A* (USEPA, 1989) and subsequent *Part D* (USEPA, 2001), *Part E* (USEPA, 2004), *Part F* (USEPA, 2009a), and other relevant guidance documents. The tables in this HHRA follow the RAGS Part D formats and naming conventions (USEPA, 2001). The table numbering includes the section number followed by the RAGS D table number. Sections of the HHRA are as follows:

- Data Collection and Evaluation
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Uncertainty Analysis
- Conclusions

9.2 DATA COLLECTION AND EVALUATION

Numerous investigations have been conducted at OU-2 since the 1980s. Data collected up to and including 2001 are considered historical data. Baseline data were collected in 2006. ESPP-related data were collected in 2008 and 2009. Data collection methods are discussed in Section 3 of Part 1. Results are discussed in Section 4 of Part 1.

Data included in this HHRA are as follows:

- Upper trophic level fish – LMB fillets collected in 2008 and analyzed for mercury and HCB
- LMB fillets collected in 2001 and analyzed for DDTR
- Surface water collected in 2008 and 2009 and analyzed for unfiltered mercury and methylmercury
- Surface water collected in 1991 and 1994 and analyzed for HCB and DDTR
- Floodplain soils collected in 2010

9.2.1 Data Evaluation

Evaluation of data quality is discussed in Section 3.13 of Part 1, and data validation is discussed in Section 4.13 of Part 1. One hundred percent of mercury in fish fillet tissues is assumed to be methylmercury, a conservative assumption. Overall data quality is acceptable and usable for risk assessment.

9.2.2 Selection of COPCs

Tables 9-2.1 (surface water), 9-2.2 (fish tissue), and 9-2.3 (floodplain soil) list the following information for environmental media assessed in this HHRA:

1. Constituents detected
2. Minimum and maximum detected concentrations
3. Detection frequency
4. AWQC for surface water and risk-based screening levels, i.e., values from the USEPA Regional Screening Levels (RSLs) for fish and residential soil (USEPA, 2010a). Noncarcinogenic screening values were corrected for additivity by multiplying the RSL by 0.1.
5. Indication of constituents selected as a COPCs

COPCs in surface water were selected by comparing the maximum detected concentration for each detected constituent to federal AWQC protective of human health (USEPA, 2009d). COPCs in fish fillets were selected by comparing the maximum detected concentration for each detected constituent to fish RSLs. COPCS in soil were selected by comparing the maximum detected concentration in floodplains soils to residential soil RSLs (USEPA, 2010b). If the maximum detected concentration exceeded RSL or

regulatory standards, then the constituent was selected as a COPC and carried through the quantitative risk assessment.

Mercury, methylmercury, HCB, and DDTR were selected as COPCs for surface water (Table 9-2.1). The maximum detected concentrations of HCB and DDTR (screened as DDT) exceeded the National AWQC protective of human health from fish ingestion. Mercury and methylmercury were selected as surface water COPCs because mercury (as methylmercury) was selected as a COPC in LMB fish fillets. However, surface water samples collected at the overflow from the gate at the Basin indicate that AWQC are not exceeded in the Tombigbee River, further indicating that potential impacts are localized to OU-2.

Mercury (as methylmercury), HCB, and DDTR were selected as COPCs in LMB fish fillets (Table 9-2.2). The maximum detected concentrations in LMB fish fillets exceeded the fish RSLs. The maximum detected concentration of total mercury exceeded the AWQC for methylmercury, which is based on fish tissue concentrations. Mercury and DDTR were selected as COPCs in floodplain soils (Table 9-2.3) because the maximum detected concentrations exceed the residential RSLs.

9.3 EXPOSURE ASSESSMENT

This section provides a discussion of exposure setting, potential receptors, and exposure pathways, calculation methods for EPCs, and an explanation of exposure assumptions.

9.3.1 Exposure Setting

The source and primary release for the constituents detected were through transport to surface water. Transport to floodplain soils and bioaccumulation of constituents in surface water to fish residing in the Basin are also pathways of exposure. As shown in Table 9-1, floodplain soils around the water features, surface water, and fish fillets were considered as potential exposure media of concern. Sediment is submerged and exposure to sediment is not a significant exposure pathway (USEPA, 2000).

9.3.2 Potential Receptors and Exposure Pathways

A complete exposure pathway has four essential components. Without the presence of these four components, exposure typically does not occur. USEPA guidance defines an exposure pathway as consisting of the following elements:

- A source and mechanism of chemical release to the environment (i.e., a source of contamination)
- An environmental transport medium for the released chemical (i.e., surface water)
- A point of potential human contact with the contaminated medium (i.e., an exposure point)
- A route of exposure at the exposure point (ingestion, inhalation, or dermal contact)

The complete exposure pathways identified for this site are carried through the HHRA. Current and future offsite land use is expected to remain unchanged. The most likely receptors include offsite resident trespassers (adults and adolescents aged 7 to 16 years) that may have infrequent access to OU-2.

Exposure pathways addressed in the HHRA are summarized below:

Current and Potential Future Offsite Adult and Adolescent Trespassers

- Incidental ingestion of surface water during swimming or fishing
- Dermal contact with surface water during swimming or fishing
- Ingestion of LMB fish fillets
- Incidental ingestion, dermal contact, and inhalation of particulates from floodplain soils during trespassing

9.3.3 Exposure Point Concentrations

The method for defining EPCs includes calculation of a UCL of the arithmetic mean in accordance with *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (USEPA, 2002a). The HHRA data were tested for distribution type using statistical tests included in USEPA's ProUCL Software, Version 4.00.04 (USEPA, 2009b). The data and ProUCL outputs are included in Appendix R. The data sets include normal, gamma, and nonparametric distributions. The recommendations of the ProUCL software were followed regarding selection of EPCs.

EPCs for surface water are listed on Table 9-3.1. EPCs for LMB fish fillets are listed on Table 9-3.2, and EPCs for floodplain surface soil are listed on Table 9-3.3. The supporting calculations for the dermal EPCs for surface water and soil are presented in Appendix Q, Tables Q.1 RME through Q.4 RME. The dermal EPCs were calculated in agreement with RAGS, Part E (USEPA, 2004).

9.3.4 Daily Exposure Intake Calculations

The following section presents the receptor-specific exposure assumptions that were used in the HHRA. Some assumptions are chemical-specific, and the chemical-specific assumptions are listed in Appendix Q tables. RAGS D Tables 9-4.1 through 9-4.4 list the exposure assumptions associated with current and future potential exposures for OU-2. The exposure assumptions have been primarily taken from *RAGS, Part A* (USEPA, 1989), *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (USEPA, 2002b), *RAGS, Part E* (USEPA, 2004), *Region 4 Supplement to RAGS* bulletins (USEPA, 2000), and *Exposure Factors Handbook: 2009 Update* (USEPA, 2009c).

9.3.4.1 General Exposure Assumptions

For resident trespasser exposures, the reasonable maximum exposure (RME) duration for an adolescent is assumed to be 10 years (site-specific assumption) with 30 years assumed for adults (USEPA, 2002b). For trespassing and swimming exposures, a site-specific current exposure frequency of 12 days/year is assumed (i.e., one day per month) (WCC, 1993), and is based on a 1993 fishing survey. Information regarding fishing activity behavior was obtained from a subpopulation that claimed to have actually fished in the Basin. The most conservative response was once per month (WCC, 1993). This frequency is likely an overestimation because construction in 2007 and continued operation of the berm and gate system further limits access since the survey was conducted in 1993. Therefore, it is likely that an exposure frequency of 12 days per year overestimates current exposures. Per USEPA requirement, trespassers were assumed to have increased access to the site in the potential future scenario. For trespassing and swimming exposures, a potential future exposure frequency of 45 days/year is assumed (USEPA, 2000).

A body weight of 70 kg is assumed for adult resident trespassers and a body weight of 48 kg is assumed for adolescent resident trespassers (7 to 16 years of age) (USEPA, 2009c).

The averaging time for noncarcinogenic exposures is equal to the exposure duration times 365 days (USEPA, 1989). The averaging time for carcinogenic exposures is assumed to occur over a 70-year lifetime (25,550 days).

9.3.4.2 Incidental Ingestion of Surface Water

Table 9-4.1 illustrates the calculation of surface water incidental ingestion intakes. It is assumed that adult and adolescent trespassers ingest 0.02 liter per hour (L/hr) and 0.05 L/hr, respectively (USEPA, 2009c) for two hours per event (professional judgment).

9.3.4.3 Dermal Contact with Surface Water

Table 9-4.1 illustrates the calculation of dermal contact with surface water intakes. A total body surface area of 18,000 cm^2 and 14,110 cm^2 was assumed for resident trespasser adults and adolescents, respectively. The assumptions used to calculate chemical-specific dermally absorbed doses are listed in Appendix Q, Tables Q.1 RME, Q.2 RME, and Q.3 RME.

9.3.4.4 Ingestion of Fish Fillets

Table 9-4.2 illustrates the calculation of ingestion of fish fillet intakes. The daily intake of fish is based on the 95th percentile intake for uncooked fish weight in grams per day (g/day) from a freshwater and estuarine source (USEPA, 2009c). Adult trespassers are assumed to eat 31.9 g/day. Adolescents are assumed to ingest 17 g/day. The adolescent rate is an age-adjusted rate (USEPA, 2009c).

The fraction of fish ingested from the site was based on the non-flood season for OU-2 and the results of the 1993 fishing survey. The fishermen responded that they did not fish during the flood season, which is the only time boat access is available. In the 1993 WCC HHRA, a fraction ingested from the Basin of 0.125 was calculated (or 1/8 of total fish ingested per year) (WCC, 1993). This value was retained for the current exposure fraction ingested in the updated HHRA. However, based on construction in 2007 and continued operation of the berm and gate system that serve to limit site access, the assumptions based on the 1993 survey potentially overestimate current exposures to OU-2 media. Per USEPA requirement, a higher fraction ingested from the site was assumed (0.5) for potential future exposures. The 1993 HHRA included the ingestion of catfish and bass, but the current HHRA assumes only ingestion of bass. Using concentrations for just LMB is a conservative approach to the estimation of exposures for trespassing fishermen because bass have a long lifespan and tend to bioaccumulate more COPCs than other species.

9.3.4.5 Ingestion of Soil

Table 9-4.3 illustrates the intake calculation of ingestion of floodplain surface soil. The daily intake of soil for adults and adolescents is assumed to be 100 mg/day (USEPA, 2000; 2002b). Fifty percent of the daily soil intake is assumed to be from the site (WCC, 1993).

9.3.4.6 Dermal Contact with Soil

Table 9-4.3 illustrates the calculation of the dermally absorbed dose from floodplain surface soil. The dermal EPCs are calculated in accordance with RAGS Part E (USEPA, 2004) and are presented in Appendix Q, Table Q.4. Exposed surface area is assumed to be hands, forearms, feet, and lower legs with the adult and adolescent surface areas calculated as 5,700 cm^2/event and 4,050 cm^2/event, respectively (USEPA, 2004).

9.3.4.7 Inhalation of Particulates Emitted from Floodplain Surface Soils

Table 9-4.4 lists the assumptions used to calculate inhalation exposures. Trespassers are assumed to have 50 percent of their daily dose from the site. A default particulate emission factor from USEPA guidance (USEPA, 2002b), 1.36E+9 m^3/kg, is used to estimate particulate emissions at the site. Because of the wet nature of some of the soil and the presence of vegetation, inhalation of particulate emissions at the site is expected to be a minor pathway of exposure.

9.4 TOXICITY ASSESSMENT

The toxicity assessment is an integral part of the risk evaluation process. Toxicity values, such as reference doses and carcinogenic slope factors, are based primarily on human and animal studies with supportive evidence from pharmacokinetics, mutagenicity, and chemical structure studies. The USEPA has developed toxicity values that reflect the magnitude of adverse noncarcinogenic and carcinogenic effects from exposure to specific chemicals. The hierarchy of sources for toxicity values used in the HHRA is 1) USEPA's Integrated Risk Information System (IRIS) database, 2) the National Center for Environmental Assessment Provisional Peer Reviewed Toxicity Values, and 3) other reviewed toxicity values as published in the USEPA RSL table (USEPA, 2010b). Values for this HHRA were available in IRIS.

9.4.1 Toxicity Values for Noncarcinogenic Effects

Chemicals that give rise to toxic endpoints other than cancer and gene mutations are often referred to as "systemic toxicants" because of their effects on the function of various organ systems. Chemicals considered carcinogenic can also exhibit systemic toxicity effects. For many noncarcinogenic effects, protective mechanisms (i.e., exposure or dose threshold) are believed to exist that must be overcome before an adverse effect is manifested. This characteristic distinguishes systemic toxicants from carcinogens and mutagens, which are often treated as acting without a distinct effects threshold. As a result, a range of exposure exists from zero to some finite value that can be tolerated with essentially no risk of the organism expressing adverse effects. The standard approach for developing toxicity values to evaluate noncarcinogenic effects is to identify the upper bound of this tolerance range or threshold and to establish the toxicity values based on this threshold.

The toxicity values most often used in evaluating noncarcinogenic effects are a reference concentration (RfC) or reference dose (RfD) for inhalation and oral exposures, respectively. Various types of noncarcinogenic toxicity values are available depending on the exposure route of concern (e.g., oral or inhalation), the critical effect of the chemical (e.g., developmental or other), and the length of exposure being evaluated (e.g., chronic or subchronic).

The RfC and RfD are defined as provisional estimated daily exposure levels for the human population, including sensitive subpopulations that are likely to be without appreciable risk of deleterious effects during a portion of a lifetime or a lifetime (chronic). Chronic RfCs/RfDs are specifically developed to be protective for long-term exposures, (i.e., 7 years to a lifetime of 70 years) and subchronic exposures are developed to be protective for short-term exposures. Chronic RfCs/RfDs were used in this HHRA. The oral RfDs are listed on Table 9-5.1 and the inhalation RfCs are listed on Table 9-5.2.

9.4.2 Toxicity Values for Carcinogenic Effects

Carcinogenesis, unlike many noncarcinogenic health effects, is generally thought to be a non-threshold effect. Accordingly, USEPA guidance for risk assessments assumes that a small number of molecular events can cause changes in a single cell that can lead to uncontrolled cellular growth. This hypothesized mechanism for carcinogenesis is referred to as "non-threshold" because any level of exposure to such a chemical is considered as posing a finite probability of generating a carcinogenic response.

To evaluate carcinogenic effects, the USEPA uses a two-part evaluation in which the chemical is first assigned a weight-of-evidence classification, and then either an inhalation unit risk (IUR) or oral carcinogenic slope factor (CSF) is calculated. The weight-of-evidence classification is based on an evaluation of available data to determine the likelihood that the chemical is a human carcinogen. Chemicals with the strongest evidence of human carcinogenicity are denoted with Class A, B1, or B2, while chemicals with less supporting evidence are classified as C or D. The slope factor quantitatively defines the relationship between the dose and the response. The slope factor is generally expressed as a plausible upper-bound estimate of the probability of response occurring per unit of chemical. The oral CSFs for COPCs are presented in Table 9-6.1, and the IURs are presented in Table 9-6.2.

9.4.3 Toxicity Assessment of Dermal Exposures

RfDs or CSFs have not been derived specifically for dermal absorption. The administered oral RfDs and CSFs may be adjusted by chemical-specific gastrointestinal (GI) absorption rates, resulting in an absorbed dose RfD or CSF, as described in the USEPA's risk assessment guidance (USEPA, 1989). The GI absorption rates are obtained from RAGS Part E (USEPA, 2004; 2010b). To evaluate potential risks from dermal exposures, the dermal intakes are compared to the adjusted (i.e., absorbed dose) toxicity values (USEPA, 1989). In accordance with RAGS Part E, when values for oral absorption efficiency are greater than 50 percent, the oral RfD and oral CSF are not adjusted for GI absorption. The adjusted toxicity values are provided in Table 9-5.1 and Table 9-6.1.

9.5 RISK CHARACTERIZATION

The risk characterization integrates the results of the exposure and toxicity assessments into quantitative and qualitative expressions of risk, provides an evaluation of the quality of the assessment and confidence level of the risk estimates and conclusions, describes the risk in terms of degree and severity of probable harm, and communicates the risk assessment results to the risk manager. To characterize potential noncarcinogenic effects, comparisons are made between the estimated chemical intakes and the RfDs for those chemicals. Estimated chemical intakes are multiplied by the chemical-specific slope factors to yield chemical-specific dose response information to characterize potential carcinogenic effects.

9.5.1 Noncarcinogenic Effects Characterization

Noncarcinogenic effects are characterized by comparing the estimated chemical intakes to the appropriate RfC or RfD values. The RfC/RfD value is, by definition, an estimate of a daily exposure level for the

human population, including sensitive subpopulations, that is likely to be without appreciable hazard of deleterious effects during a lifetime. Therefore, when the estimated chronic daily intake of a chemical exceeds the appropriate RfC or RfD, there may be a concern for potential noncancer effects from exposure to that chemical. The ratio of the daily intake to the RfC/RfD is referred to as the "hazard quotient" or HQ. The sum of the hazard quotients for each chemical in a specific pathway is termed the "hazard index" or HI. It is important to note that the hazard quotient does not represent a statistical probability; thus, a ratio of 0.01 does not mean that there is a 1 in 100 chance of the effect occurring. Rather, HQ greater than 1 indicates that the "threshold" for that constituent has been exceeded.

The USEPA assumes additive effects in evaluating noncarcinogenic effects from a mixture of chemicals. Strictly, additivity should only be assumed for chemicals that induce the same effect by the same mechanism of action. Practically, this consideration is often addressed by adding HIs for chemicals that critically affect the same target organ system, and additivity across chemicals affecting the same target organ has been addressed in this assessment. The constituent-specific hazard quotients are summed to yield an overall pathway HI; pathway HIs are then summed to yield a total HI for each relevant population. The current and potential future risk characterization tables for resident trespasser exposures to surface water are presented in Tables 9-7.1 RME through 9-7.4 RME. The current and future risk characterization tables for resident trespasser exposures to fish fillets are presented in Tables 9-7.5 RME through 9-7.8 RME. The current and potential future risk characterization tables for resident trespasser exposures to floodplain surface soil are presented in Tables 9-7.9 RME through 9-7.12 RME. Four Section 9 tables (9-9.1 RME through 9-9.4 RME) summarize the chronic HI estimates for the adult and adolescent resident trespasser receptors. The constituent-specific HQs are grouped and summed by target organ on the Section 9 tables.

9.5.2 Carcinogenic Risk Characterization

Risks from potential carcinogens are estimated as probabilities of excess cancers as a result of exposure to chemicals. The carcinogenic slope factor correlates estimated total lifetime daily intake directly to incremental cancer risk. The results of the risk characterization are expressed as upper bound estimates of the potential carcinogenic risk for each exposure point. Constituent-specific cancer risks are estimated by multiplying the slope factor by the lifetime daily intake estimates.

To be protective of human health, cumulative risk for carcinogenic compounds should be calculated so that the result does not exceed the acceptable risk range of 10^{-6} to 10^{-4}, with a cumulative upper bound

excess lifetime cancer risk of one in 10,000 (1×10^{-4}). The risk characterization tables for resident trespasser exposures to surface water are presented in Tables 9-7.1 RME through 9-7.4 RME. The risk characterization tables for resident trespasser exposures to fish fillets are presented in Tables 9-7.5 RME through 9-7.8 RME. The current and potential future risk characterization tables for resident trespasser exposures to floodplain surface soil are presented in Tables 9-7.9 RME through 9-7.12 RME. Four Section 9 tables (9-9.1 RME through 9-9.4 RME) summarize the cumulative carcinogenic risk for the two receptors.

9.5.3 Risk and Hazard Estimates

9.5.3.1 Potential Hazards and Risks for Offsite Resident Trespassers - Adults and Adolescents – Current and Future Land Use

Assuming exposure to nearby residents occasionally trespassing into OU-2 to fish and swim is the basis for potential hazards and risks estimated on Tables 9-7.1 RME through 9-7.12 RME and 9-9.1 RME through 9.4 RME. The current and potential future HIs for surface water and soil exposures for adult and adolescent trespassers are less than 1, while the current HIs for adults and adolescents ingesting fish are estimated as equal to 1. Potential future HIs associated with fish ingestion are 6 for adults and 5 for adolescents. In the future, based on the assumption of less access restrictions, trespassers and fishermen have approximately a four-fold increase in the frequency of visits to the site; thus, HIs increased by four-fold for future exposure scenarios. The majority of hazard is associated with methylmercury in fish tissues, with the cumulative potential future HIs for the central nervous system estimated at 6 for adults and 4 for adolescents. Both HIs under the assumed future scenario exceed 1.

The construction of the berm and gate occurred in 2007 and serves to limit access to the site to a frequency lower than observed in 1993. Thus, even the low rate of trespassing/fishing estimated from the 1993 survey may be overestimates for current exposures. Olin is committed to maintaining security and restricted access to OU-2. Based on access restrictions, both the current and potential future exposure scenarios probably overestimate hazards associated with fish ingestion.

The cancer risk associated with current exposure to surface water are below the target risk range (6×10^{-7} and 2×10^{-7}, respectively, for adults and adolescents). The excess cancer risk associated with potential future exposure to surface water is within or less than the acceptable risk range (2×10^{-6} and 9×10^{-7}, respectively, for adults and adolescents). The cancer risk associated with current exposure through fish ingestion is within the acceptable risk range (6×10^{-6} and 2×10^{-6}, respectively, for adults and

adolescents). The cancer risk associated with potential future exposure through fish ingestion is also within the acceptable risk range (3×10^{-5} and 6×10^{-6}, respectively, for adults and adolescents).

The cumulative RME risk for current adult trespassers is 6×10^{-6}, and for potential future adult trespassers is 3 x 10^{-5} (Table 9-9.1 and Table 9-9.3) The cumulative RME risk for current adolescent trespassers is 2×10^{-6}, and for potential future adolescent trespassers is 7 x 10^{-6} (Table 9-9.2 and Table 9-9.4).). These values are within the CERCLA acceptable risk range. Carcinogenic risk is associated with the presence of HCB and DDTR in LMB fish fillets. Risk resulting from DDTR may be overestimated because the DDTR surface water and fish tissue data were collected prior to the implementation of two remedial efforts by the adjacent landowner to mitigate DDTR migration to OU-2.

9.5.4 Summary of Risk Characterization

Exposures to floodplain soils were not associated with unacceptable risks or hazards and are not carried through to the 9-10 summary tables. Table 9-10.1 RME summarizes the current risk and hazard for resident trespasser adults that are exposed through ingestion of LMB fish fillets to HCB, DDTR, and methylmercury. Exposures to surface water were not associated with unacceptable risks or hazards for current resident trespasser adults. Cumulative risk associated with ingestion of fish is 6×10^{-6}. The cumulative HI for adults is 1, which is equivalent to the target HI of 1.

Table 9-10.2 RME summarizes the potential future risk and hazard for resident trespasser adults that are exposed through ingestion of LMB fish fillets and surface water while swimming. Cumulative risk is estimated at 3×10^{-5}. The cumulative central nervous system HI for adults is 6, which exceeds the target HI of 1.

Table 9-10.3 RME summarizes the current risk and hazard for resident trespasser adolescents that are exposed through ingestion of LMB fish fillets to HCB, DDTR, and methylmercury. The cumulative HI is equal to 1. Therefore, systemic hazard is not unacceptable. The cumulative cancer risk estimate is 2×10^{-6}.

Table 9-10.4 RME summarizes the potential future risk and hazard for resident trespasser adolescents that are exposed through ingestion of LMB fish fillets. The cumulative central nervous system HI is equal to 4, which exceeds the target HI of 1. The cumulative cancer risk estimate is 7×10^{-6}.

Risks estimated for adult and adolescent trespassers are within the CERCLA acceptable risk range. However, cumulative HIs for potential future fish ingestion exposures exceed a target HI of 1.

9.6 UNCERTAINTY ANALYSIS

Uncertainty is inherent in the risk assessment process. Exposure is hypothetical, and the risk assessment calculations are based in large part on assumed conditions. An important part of the risk assessment process is characterizing the main underlying uncertainties. Understanding the uncertainties is important for the interpretation and ultimate use of the risk assessment results because actual risk may be underestimated or overestimated.

9.6.1 Uncertainties and Assumptions Associated With Data Collection and Data Evaluation

The goal of the sampling program is to determine the EPCs for exposure media. Estimated analytical results were included as reported although there is some degree of uncertainty with these concentrations. This assumption may underestimate or overestimate risk.

The data for HCB and DDTR for surface water are several years old and may not represent current conditions in the Basin and Round Pond. Risks and hazards associated with surface water and fish exposures may be either over- or underestimated.

Representative (95 percent UCLs) concentrations of HCB in sediment have decreased from 23 mg/kg when sample years are combined to 8.29 mg/kg in 2008 and 2009. For these same intervals and time frames, concentrations (95 percent UCLs) of DDTR in sediment have decreased from 18.7 mg/kg to 1.57 mg/kg. These downward trends for sediment concentrations indicate that fish concentrations of HCB and DDTR may have also decreased over time. Current and future potential risks associated with fish ingestion may be overestimated.

9.6.2 Uncertainties and Assumptions Associated with the Exposure Assessment

The use of UCLs of the arithmetic mean as a basis for estimating a reasonable maximum exposure or RME EPC is a conservative approach designed to assure that the mean is not underestimated. Actual EPCs may also vary with space and time.

Floodplain surface soil data were collected in 2010 and some of the data points were submerged. However, all the data points were used as if dry soil for purposes of the HHRA. Thus, inclusion of these wet soils may under- or overestimate soil exposures. However, inclusion of all sampling points is a conservative measure that models exposure to a mixture of soil and sediment.

Data collected during the 2009 annual monitoring show a decreasing trend for mercury concentrations in sediment and surface water. Concentrations in other exposure media (i.e., fish fillets) also may exhibit decreasing concentrations with time. Risks and hazards predicted for future site conditions may be overestimated.

Fish fillet tissues were analyzed for total mercury. A conservative assumption was made that all detected mercury in fish was methylmercury. While this approach is consistent with USEPA regulations, this assumption may cause overestimation of hazards associated with the fish ingestion pathway.

The actual exposure rate and duration at any given location may vary over time rather than remain stable. Assuming that exposures are stable and not subject to variation may underestimate or overestimate risk. Risks resulting from DDTR may be overestimated because the DDTR surface water and fish tissue data were collected prior to the implementation of two remedial efforts by the adjacent landowner to mitigate DDTR migration to OU-2.

It is assumed, for the majority of exposure pathways, that environmental fate mechanisms such as attenuation will not affect EPCs over time. In reality, environmental transformation processes may attenuate actual concentrations, especially in the context of a lifetime exposure.

The fish ingestion intakes assumed the ingestion of only one species of fish. LMB are upper trophic level fish with a long life span. LMB tend to bioaccumulate higher concentrations of mercury than other species such as sunfish or catfish. However, local fishermen reportedly eat a variety of fish from the surrounding area (WCC, 1993). Assuming ingestion of LMB only may overestimate risks and hazards associated with mercury, HCB, and DDTR. Assuming the local fishermen will obtain 50 percent of the fish ingested from OU-2 in the future also may overestimate exposures to mercury, HCB, and DDTR.

The receptor group of interest in the HHRA is offsite resident trespasser adults and adolescents. The Basin and Round Pond area is not readily accessible from the river because of the berm on three sides. Olin restricts access to this area and is committed to maintaining security at OU-2. The water level would

have to be several feet above the berm elevation of 12 feet NAVD88 to get a boat into OU-2 from the river. Fishermen reported that they do not fish during the flood season (WCC, 1993), when boat access is available. Olin is committed to maintaining restricted access to OU-2 currently and in the future based on its current economic investment at the manufacturing facility. Future exposures for OU-2, where Olin maintains access restrictions, are expected to be very similar to current exposures in regards to exposure frequency. Thus, assumptions developed in 1993 may overestimate current exposures because institutional controls cannot be assumed in the risk analysis. Future exposure assumptions required by USEPA assume unrestricted site access. Based on Olin's long term commitment to the facility and to maintenance of site security at OU-2, the potential future scenario significantly overestimates hazards and risks associated with fish ingestion. The current and future assumption that offsite residents trespass regularly to swim or fish tends to overestimate risks and hazards for OU-2.

9.6.3 Uncertainties and Assumptions Associated With the Toxicity Assessment

Substantial uncertainties are associated with use of toxicity data extrapolated from rats and mice to humans. In some instances, biological pathways and mechanisms of metabolism differ significantly between mammalian species. As a result of these differences, humans may be either more or less sensitive than the surrogate laboratory species. The application of uncertainty factors in USEPA's RfC/RfD assumes that humans may be more sensitive, although this is not always the case. This extrapolation will likely overestimate risk to some extent.

Incorporation of variability in response among individuals in the population is entirely appropriate to ensure that all members of the exposed population are protected. That portion of the uncertainty factor that represents true uncertainty, however, may result in overestimation of risk, even to individuals predisposed to an adverse response.

9.6.4 Uncertainties and Assumptions Associated With the Risk Characterization

The use of very conservative assumptions throughout the risk assessment tends to overestimate potential risks and hazards. By examination of uncertainties associated with the exposure assessment and the toxicity assessment, which are combined by multiplication in the risk characterization, it is likely that the RME hazards and risks reported are overestimated. USEPA intends for this approach to help ensure that risks are not underestimated.

USEPA requires a potential future scenario that assumes unrestricted access to OU-2 or unlimited recreational exposures to surface soil, surface water, or fish from the Basin (USEPA, 2010a; MACTEC, 2010). This unrestricted potential future scenario has been incorporated into the HHRA. However, these potential future increased exposures are unlikely to occur if the following conditions continue in the future:

- Olin operates a multi-million dollar manufacturing facility on property adjacent to OU-2. Olin has no plans to relinquish control of the Basin and surrounding property,

- Olin will continue to operate the facility and maintain site security, which will limit access to the Basin and Round Pond; therefore, exposures to floodplain soil, surface water, and fish tissues will also remain of low frequency; and

Estimated risks and hazards under the current use scenario are within acceptable limits. Assuming the plant continues operations, future potential exposures will likely remain similar to those predicted in the current scenario. The estimation of risk from a future exposure without access restrictions shows risk above a HI of 1.

9.7 CONCLUSIONS

This updated HHRA for OU-2 evaluates potential exposures pursuant to the scenario and parameters previously approved by USEPA. The HHRA was updated at the request of USEPA to take into account changes in risk assessment methodology and site information since the 1993 HHRA (WWC, 1993) was produced.

Exposure media include floodplain soil, surface water, and ingested fish fillets. COPCS in floodplain soil include mercury and DDTR. COPCs in surface water include total mercury and methylmercury, HCB, and DDTR. COPCs in fish tissue include mercury (assumed to be methylmercury), HCB, and DDTR.

This HHRA report provides a quantitative evaluation of potential risks currently for resident trespasser adults and adolescents. Exposure pathways considered in the HHRA include incidental ingestion of soil, dermal contact with soil, and inhalation of particulates while trespassing on OU-2. Additional exposure pathways include incidental ingestion of surface water during swimming, dermal contact with surface water during swimming, and ingestion of LMB fish fillets. OU-2 is wholly contained within Olin property and currently has limited access for on-site employees. Because site access is limited by local

topography, construction and operation of the berm and gate system, and Olin security, the frequency of current exposure for trespassers is expected to be low.

The HHRA is based on specific data collected from 1991 through 2010. In December 2009, USEPA Region 4 made recommendations concerning data to be used in the ERA. These recommendations were also implemented during the selection of data for the HHRA.

EPCs are based on UCLs of arithmetic means (Tables 9-3.1 through 9-3.3). Exposure intakes were calculated using exposure assumptions from USEPA risk guidance documents (USEPA, 1989; 2000; 2002b; 2004; 2009c), site-specific information, and professional judgment. The exposure assumptions and intake equations are listed in Tables 9-4.1 through 9-4.4.

Hazard estimates for current resident trespasser adults and adolescents exposed to floodplain soil, surface water and through fish ingestion do not exceed an HI of 1 (Tables 9-10.1 and 9-10.2). Hazard estimates for potential future resident trespasser adults and adolescents exposed soil and surface water are less than 1, but HIs for future fish ingestion exceed the target HI of 1. USEPA required a potential future exposure scenario that assumes unrestricted access to OU-2 or unlimited recreational exposures to surface soil, surface water, or fish from the Basin (USEPA, 2010a; MACTEC, 2010). This unrestricted potential future scenario has been incorporated into the HHRA.

If the plant continues to operate as it does now, the future exposures/risks will remain similar to those predicted in the current scenario. Olin plans to maintain current operations, as described above.

Cancer risks associated with resident trespasser adults and adolescent exposure scenarios do not exceed the acceptable risk range for site COPCs (Tables 9-10.1 through 9-10.4). The majority of risk observed is associated with HCB and DDTR in LMB fish fillets. However, conservative exposure assumptions for the fish ingestion pathway were used, including the assumption that receptors would only ingest LMB. Local fishing surveys conducted in 1993 indicated that fishermen would catch and ingest a variety of fish from multiple locations along the river (WWC, 1993). Therefore, the estimated risk associated with fish ingestion may be an overestimate. Risk resulting from DDTR may be overestimated because the DDTR surface water and fish tissue data were collected prior to the implementation of two remedial efforts by the adjacent landowner to mitigate DDTR migration to OU-2. Concentrations detected in sediment for DDTR and HCB have decreased with time, indicating that fish tissue concentrations may also have decreased.

10.0 REFERENCES FOR PART 3

MACTEC, 2010. *Response to USEPA Comments dated September 10, 2010 on Part 1: Remedial Investigation Addendum and Enhanced Sedimentation Pilot Project Annual Report, Year Two Results; Part 2: Updated Ecological Risk Assessment; Part 3: Updated Human Health Risk Assessment, Operable Unit 2, McIntosh, Alabama.* Prepared for Olin Corporation. October 12, 2010.

USEPA, 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A [RAGS/HHEM]*, United States Environmental Protection Agency Publication No. 540/1-89/002.

USEPA, 1994. Letter from Kenneth A. Lucas, USEPA Region 4, to James C. Brown, Olin Chemicals, Subject: Revisions to the Baseline Risk Assessment, McIntosh Plant Site Olin Corporation McIntosh, Alabama, February 23, 1994.

USEPA, 2000. Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins, USEPA Region 4.

USEPA, 2001. *Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*, United States Environmental Protection Agency.

USEPA, 2002a. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, OSWER 9285.6-10.* Office of Emergency and Remedial Response.

USEPA, 2002b, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, U.S. Environmental Protection Agency, December 2002.

USEPA, 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment*, OSWER 9285.7-02EP, July 2004.

USEPA, 2009a. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), Final.* OSWER 9285.7-82, January 2009.2009b. ProUCL Software Version 4.00.04 and User's Guide. EPA/600/R-07/038. February 2009.

USEPA, 2009c. Exposure Factors Handbook: 2009 Update. U.S. Environmental Protection Agency, EPA/600/R-09/052A, External Review Draft, July 2009.

USEPA, 2009d. National Recommended Water Quality Criteria, Office of Water, U.S. Environmental Protection Agency, 2009.

USEPA, 2010a. *USEPA Comments on Part 1: Remedial Investigation Addendum and Enhanced Sedimentation Pilot Project Annual Report, Year Two Results; Part 2: Updated Ecological Risk Assessment; Part 3: Updated Human Health Risk Assessment, Operable Unit 2, McIntosh, Alabama.* September 10, 2010.

USEPA, 2010b. Regional Screening Level Tables, May 2010.

WCC, 1993. Olin McIntosh Remedial Investigation Report for OU-1 and OU-2 (including Section 6.0, Baseline Risk Assessment) with updates from February 10, 1994.

TABLES

TABLE 9-1

SELECTION OF EXPOSURE PATHWAYS

Olin McIntosh Operable Unit 2, McIntosh, Alabama

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Soil	Floodplain Soil	Trespassing in OU-2	Trespasser	Adult	Ingestion	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
				Trespasser	Adult	Dermal	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
				Trespasser	Adolescent	Ingestion	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
				Trespasser	Adolescent	Dermal	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
		Particulates	Fugitive Dust	Trespasser	Adult	Inhalation	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
				Trespasser	Adolescent	Inhalation	Onsite	Quant	Assumes infrequent access to areas around Basin and Round Pond
	Surface Water	Surface Water	Swimming or Fishing in the Basin	Trespasser	Adolescent	Ingestion	Onsite	Quant	Assumes infrequent contact with surface water in the Basin and Round Pond.
				Trespasser	Adolescent	Dermal	Onsite	Quant	Assumes infrequent contact with surface water in the Basin and Round Pond.
				Trespasser	Adolescent	Inhalation	Onsite	None	No volatiles related to the site.
				Trespasser	Adult	Ingestion	Onsite	Quant	Assumes infrequent contact with surface water in the Basin and Round Pond.
				Trespasser	Adult	Dermal	Onsite	Quant	Assumes infrequent contact with surface water in the Basin and Round Pond.
				Trespasser	Adult	Inhalation	Onsite	None	No volatiles related to the site.
	Fish Tissue	Fish Tissue	Infrequent Fishing in the Basin	Trespasser	Adolescent	Ingestion	Onsite	Quant	Assumes infrequent fishing in the Basin area.
				Trespasser	Adult	Ingestion	Onsite	Quant	Assumes infrequent fishing in the Basin area.

Prepared by: LMS 11/1/10
Checked by: LWC 11/4/10

TABLE 9-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF SURFACE WATER CHEMICALS OF POTENTIAL CONCERN
Olin McIntosh Operable Unit 2, McIntosh, Alabama

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water

Exposure Point	Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency			NRWQC (a)	Constituent of Potential Concern?
Surface Water	Metals								
	Mercury	0.0044	0.36	ug/L	42	/	42	--	yes
	Methylmercury	0.000613	0.00553	ug/L	42	/	42	(0.3 mg/kg)	yes
	Volatile Organic Compounds (VOCs)								
	Hexachlorobenzene	0.0215	0.0442	ug/L	6	/	15	0.00029	yes
	Pesticides								
	DDTR (b)	0.0964	0.214	ug/L	6	/	15	0.00022 (c)	yes

ug/L micrograms per liter
NRWQC = National Recommended Water Quality Criteria
ND = Not Detected
(a) National Recommended Water Quality Criteria - Human Health - Consumption of Fish. Methylmercury value is based on fish concentration.
(b) DDTR is the sum of 2,4' and 4,4'-isomers of DDT, DDD, DDE.
(c) The NRWQC for 4,4'-DDT used as a a surrogate.
Constituent of Potential Concern - The maximum detected concentrations of HCB and DDTR excced the NRWQC. Mercury and methylmercury selected because mercury is a COPC for fish fillets.

PREPARED/DATE: MKB 5/11/10
CHECKED/DATE: LMS 5/11/10

TABLE 9-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN LARGEMOUTH BASS TISSUE (FILET)
Olin McIntosh Operable Unit 2, McIntosh, Alabama

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Fish Tissue

Exposure Point	Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency			NRWQC (a)	Regional Screening Level for Fish (b)	Constituent of Potential Concern?
Fish Tissue	Metals									
	Mercury	1.6	3	mg/kg	20	/	20	NA	0.0406 (d)	(c)
	Methylmercury (c)	1.6 (c)	3 (c)	mg/kg	20	/	20	0.3	0.0135 (d)	yes
	Volatile Organic Compounds (VOCs)									
	Hexachlorobenzene (HCB)	0.0362	0.135	mg/kg	20	/	20	NA	0.00197	yes
	Pesticides									
	DDTR (e)	0.075	0.598	mg/kg	7	/	7	NA	0.00928 (f)	yes

mg/kg = milligrams per kilogram

NA = Not Available
ND = Not Detected
(a) National Recommended Water Quality Criteria for the consumption of fish.
(b) USEPA, Regional Screening Level (RSL) Fish Table, December 2009.
(c) Only total mercury was analyzed in fish tissue. For the purposes of this risk assessment 100% of the total mercury detected is attributed to methylmercury.
(d) Value divided by 10 to account for HI < 1.
(e) DDTR is the sum of 2,4' and 4,4'-isomers of DDT, DDD, DDE.
(f) The NRWQC for 4,4'-DDT used as a a surrogate.
Constituent of Potential Concern - Maximum detected concentration exceeds the fish RSLs

PREPARED/DATE: MKB 5/11/10
CHECKED/DATE: LMS 5/11/10

TABLE 9-2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN IN 2010 FLOODPLAIN SOIL
Olin McIntosh - McIntosh, Alabama

Scenario Timeframe:	Current/Future
Medium:	Floodplain Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical	Minimum Concentration	Maximum Concentration	Units	Detection Frequency			Regional Screening Level for Residential Soil, mg/kg	Constituent of Potential Concern?	Greater than Background?
Floodplain Soil	Metals									
	Mercury (Inorganic Salts)	0.061	8.9	mg/kg	39	/	39	2.3 (b)	yes	NA
	Methylmercury	0.000367	0.00822	mg/kg	11	/	12	0.78 (b)	no	NA
	Volatile Organic Compounds (VOCs)									
	Hexachlorobenzene (HCB)	0.0011	0.275	mg/kg	7	/	9	0.3	no	NA
	Pesticides									
	DDTR (c)	0.00375	2.23	mg/kg	14	/	15	1.7 (d)	yes	NA

mg/kg = milligrams per kilogram
NA = Not Available
(a) USEPA, Regional Screening Level Table, May 2010.
(b) Value divided by 10 and is equivalent to HI of 0.1.
(c) DDTR is the sum of 2,4' and 4,4'-isomers of DDT, DDD, DDE.
(d) DDTR concentration screened using DDT residential soil screening level.

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

Constituent of Potential Concern - Maximum detected concentration exceeds the soil RSLs.

TABLE 9-3.1 RME

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

OLIN - MCINTOSH OPERABLE UNIT 2

MCINTOSH, ALABAMA

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Receptor: Resident/Trespasser

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean (a)	95% UCL (Distribution)	Maximum Detected Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Basin Surface Water Incidental Contact	Mercury	ug/L	0.052	0.169	0.36	0.169	ug/L	99% Chebyshev (Mean, Sd) UCL	ProUCL
	Methylmercury	ug/L	0.0019	0.0027	0.0053	0.0027	ug/L	95% Chebyshev (Mean, Sd) UCL	ProUCL
	Hexachlorobenzene	ug/L	0.0335	0.0396	0.0442	0.0396	ug/L	95% KM (Percentile Bootstrap) UCL	ProUCL
	DDTR	ug/L	0.089	0.135	0.214	0.135	ug/L	95% KM (t) UCL	ProUCL

Statistics: Max Maximum Detected Concentration; KM Nonparametric Kaplan Meier Method;

ProUCL - ProUCL Software, Version 4.0.04

NA Not applicable

ug/L = Micrograms/liter

UCL = Upper Confidence Limit

RME = Reasonable maximum exposure

(a) Mean calculated with 1/2 detection limit for non-detections.

PREPARED BY/DATE: MKB 5/11/10

CHECKED BY/DATE: LMS 5/11/10

TABLE 9-3.2RME

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

OLIN - MCINTOSH OPERABLE UNIT 2

MCINTOSH, ALABAMA

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Fish Tissue
Receptor: Resident/Trespasser

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean (b)	95% UCL (Distribution)	Maximum Detected Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Basin Surface Water Incidental Contact	Methylmercury (a)	mg/kg	2.34	2.47	3	2.47	mg/kg	95% Student's-t UCL	ProUCL
	Hexachlorobenzene	mg/kg	0.067	0.077	0.135	0.077	mg/kg	95% Approximate Gamma UCL	ProUCL
	DDTR	mg/kg	0.246	0.397	0.598	0.397	mg/kg	95% KM (t) UCL	ProUCL

Statistics: Max Maximum Detected Concentration; KM Nonparametric Kaplan Meier Method;

ProUCL - ProUCL Software, Version 4.0.04

(a) 100% of total mercury analyzed assumed to be methylmercury.

(b) Mean calculated with 1/2 the detection limit for non-detections.

NA Not applicable

ug/L = Micrograms/liter

UCL = Upper Confidence Limit

RME = Reasonable maximum exposure

PREPARED BY/DATE: MKB 5/11/10

CHECKED BY/DATE: LMS 5/11/10

TABLE 9-3.3RME

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

OLIN - MCINTOSH

MCINTOSH, ALABAMA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Floodplain Soil
Receptor: Resident/Trespasser

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean (a)	95% UCL (Distribution)	Maximum Detected Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Floodplain Soil	Mercury	mg/kg	0.98	1.58	8.9	1.58	mg/kg	95% H-UCL	ProUCL
	DDTR	mg/kg	0.38	1.23	2.23	1.23	mg/kg	95% KM (Chebyshev) UCL	ProUCL

Statistics: KM Nonparametric Kaplan Meier Method;
ProUCL - ProUCL Software, Version 4.0.05
(a) Mean calculated with 1/2 the detection limit for non-detections.
NA Not applicable
mg/kg = milligrams per kilogram
UCL = Upper Confidence Limit
RME = Reasonable maximum exposure

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2, MCINTOSH, ALABAMA

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Current Value	Future Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Res/Trepasser	Adult	Swimming in Basin	CW	Chemical Concentration in Water	Table 9-3.1	Table 9-3.1	mg/L	Table 9-3.1	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	0.02	0.02	L/hr	USEPA, 2009 (1)	$\frac{CW \times IR \times ET \times EF \times ED}{BW \times AT}$
				ET	Exposure Time	2	2	hr/day	Professional judgment	
				EF	Exposure Frequency	12	45	days/year	Site-Specific	
				ED	Exposure Duration	30	30	years	USEPA, 2004	
				BW	Body Weight	70	70	kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
		Preadolescent/ Adolescent (7-16)	Swimming in Basin	CW	Chemical Concentration in Water	Table 9-3.1	Table 9-3.1	mg/L	Table 9-3.1	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	0.05	0.05	L/hr	USEPA, 2009 (1)	$\frac{CW \times IR \times ET \times EF \times ED}{BW \times AT}$
				ET	Exposure Time	2	2	hr/day	Professional judment	
				EF	Exposure Frequency	12	45	days/year	Site-Specific	
				ED	Exposure Duration	10	10	years	Site-Specific	
				BW	Body Weight	48	48	kg	USEPA, 2009 (3)	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	3,650	3,650	days	USEPA, 1989	
Dermal	Res/Trepasser	Adult	Swimming in Basin	CW	Chemical Concentration in Water	Table 9-3.1	Table 9-3.1	mg/L	Table 9-3.1	Dermally Absorbed Dose (DAD) (mg/kg-day) =
				SA	Surface Area of Exposed Skin	18,000	18,000	cm^2	USEPA, 2004	$\frac{DA_{event} \times SA \times EF \times ED}{BW \times AT}$
				PC	Dermal Permeability Constant	CS	CS	cm/hr	Chemical-specific	
				ET	Exposure Time	2	2	hr/day	Professional judgment	DA_{event} is chemical-specific (USEPA, 2004)
				EF	Exposure Frequency	12	45	days/year	Site-Specific	
				ED	Exposure Duration	30	30	years	USEPA, 2004	
				BW	Body Weight	70	70	kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
				CF	Conversion Factor	0.001	0.001	L/cm^3	USEPA, 2004	
		Preadolescent/ Adolescent (7-16)	Swimming in Basin	CW	Chemical Concentration in Water	Table 9-3.1	Table 9-3.1	mg/L	Table 9-3.1	Dermally Absorbed Dose (DAD) (mg/kg-day) =
				SA	Surface Area of Exposed Skin	14,110	14,110	cm^2	USEPA, 2009 (2)	$\frac{DA_{event} \times SA \times EF \times ED}{BW \times AT}$
				Kp	Dermal Permeability Coefficient	CS	CS	cm/hr	Chemical-specific	
				ET	Exposure Time	2	2	hr/day	Professional judgment	DA_{event} is chemical-specific (USEPA, 2004)
				EF	Exposure Frequency	12	45	days/year	Site-Specific	
				ED	Exposure Duration	10	10	years	Site-Specific	
				BW	Body Weight	48	48	kg	USEPA, 2009 (3)	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	3,650	3,650	days	USEPA, 1989	
				CF	Conversion Factor	0.001	0.001	L/cm^3	USEPA, 2004	

(1) Ingestion of water while swimming (rounded) from Table ES-1.
(2) Age-adjusted surface area. Based on Table ES-1. Assumes total body exposure
(3) Age-adjusted body weight. Based on Table ES-1.

USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A OERR EPA/540/1-89/002.
USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.
USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E OSWER 9285.7-02 EP.
USEPA, 2009. Exposure Factors Handbook: 2009 Update. EPA/600/R-09/052A. July 2009

PREPARED/DATE: LMS 5/18/09
CHECKED/DATE: MKB 5/7/10
REVISED/DATE: LMS 11/1/10

TABLE 9-4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2, MCINTOSH, ALABAMA

Scenario Timeframe: Current/Future
Medium: Fish Tissue
Exposure Medium: Fish Tissue

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Current Value	Future Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Fisher	Adult	Fishing in Basin	C	Concentration in Fish Tissue	Table 9-3.2	Table 9-3.2	mg/kg	See Table 9-3.2	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-F	Ingestion Rate of Fish	31.9	31.9	grams/day	USEPA, 2009 (1)	C x IR-F x EF x ED x FI x CF
				EF	Exposure Frequency	365	365	days/year	USEPA, 1989	BW x AT
				ED	Exposure Duration	30	30	years	USEPA, 2002	
				FI	Fraction Ingested from Site	0.125	0.5	fraction	Site-Specific	
				BW	Body Weight	70	70	kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT - N	Averaging Time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
				CF	Conversion Factor	0.001	0.001	kg/g	--	
		Preadolescent/ Adolescent (7-16)	Fishing in Basin	C	Concentration in Fish Tissue	Table 9-3.2	Table 9-3.2	mg/kg	See Table 9-3.2	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-F	Ingestion Rate of Fish	17	17	grams/day	USEPA, 2009 (1)	C x IR-F x EF x ED x FI x CF
				EF	Exposure Frequency	365	365	days/year	USEPA, 1989	BW x AT
				ED	Exposure Duration	10	10	years	Site-Specific	
				FI	Fraction Ingested from Site	0.125	0.5	fraction	Site-Specific	
				BW	Body Weight	48	48	kg	USEPA, 2009	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT - N	Averaging Time - Non-Cancer	3,650	3,650	days	USEPA, 1989	
				CF	Conversion Factor	0.001	0.001	kg/g	--	

(1) Table 10-13. 95th percentile intake for uncooked fish weight in grams per day. Freshwater and Estuarine source. Age adjusted for Adolescents.

USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A OERR EPA/540/1-89/002.
USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.
USEPA, 2009. Exposure Factors Handbook: 2009 Update. EPA/600/R-09/052A. July 2009

PREPARED/DATE: LMS 5/18/09
CHECKED/DATE: MKB 5/7/10
REVISED/DATE: LMS 11/1/10

TABLE 9-4.3.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Floodplain Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Current Value	Future Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Res/Trespasser	Adult	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate for Soil	100	100	mg/day	USEPA, 2002	CS x IR-S x EF x ED x FI x CF
				EF	Exposure Frequency	12	45	days/year	Site-Specific/Region 4	BW x AT
				ED	Exposure Duration	30	30	years	USEPA, 2004	
				FI	Fraction ingested from site	50	50	percent	Professional Judgment	
				BW	Body Weight	70	70	kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
				CF	Conversion Factor	1.00E-06	1.00E-06	kg/mg	--	
		Preadolescent/ Adolescent (7-16)	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	100	mg/day	USEPA, 2002	CS x IR-S x EF x ED x FI x CF
				EF	Exposure Frequency	12	45	days/year	Site-Specific/Region 4	BW x AT
				ED	Exposure Duration	10	10	years	Site-Specific	
				FI	Fraction ingested from site	50	50	percent	Professional Judgment	
				BW	Body Weight	48	48	kg	USEPA, 2009	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging time - Non-Cancer	3,650	3,650	days	USEPA, 1989	
				CF	Conversion Factor	1.00E-06	1.00E-06	kg/mg	--	
Dermal	Res/Trespasser	Adult	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Dermally Absorbed Dose (DAD) (mg/kg-day) =
				SA	Surface Area of Exposed Skin	5,700	5,700	cm^2/event	USEPA, 2004 (a)	DAevent x SA x EF x ED x FA
				SAF	Soil to Skin Adherence	0.07	0.07	mg/cm^2	USEPA, 2004	BW x AT
				AE	Absorption Efficiency	Chemical-Specific	Chemical-specific	percent	USEPA, 2004/Region 4	
				EF	Exposure Frequency	12	45	events/year	Site-Specific/Region 4	DA_{event} = CS x CF x SAF x AE
				ED	Exposure Duration	30	30	years	USEPA, 2004	
				FA	Fraction Absorbed from Site	50	50	percent	Professional Judgment	
				BW	Body Weight	70	70	kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
				CF	Conversion Factor	1.00E-06	1.00E-06	kg/mg	--	
		Preadolescent/ Adolescent (7-16)	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Dermally Absorbed Dose (DAD) (mg/kg-day) =
				SA	Surface Area of Exposed Skin	4,050	4,050	cm^2/event	USEPA, 2004 (a)	DAevent x SA x EF x ED x FA
				SAF	Soil to Skin Adherence	0.2	0.2	mg/cm^2	USEPA, 2004	BW x AT
				AE	Absorption Efficiency	Chemical-Specific	Chemical-specific	percent	USEPA, 2004/Region 4	
				EF	Exposure Frequency	12	45	events/year	Site-Specific/Region 4	DA_{event} = CS x CF x SAF x AE
				ED	Exposure Duration	10	10	years	Site-Specific	
				FA	Fraction Absorbed from Site	50	50	percent	Professional Judgment	
				BW	Body Weight	48	48	kg	USEPA, 2009	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging time - Non-Cancer	3,650	3,650	days	USEPA, 1989	
				CF	Conversion Factor	1.00E-06	1.00E-06	kg/mg	--	

(a) Value for surface area of hand, forearms, feet, and lower legs.

USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A OERR EPA/540/1-89/002.
USEPA, 2000. Region 4 Supplement to RAGS, Human Health Bulletins.
USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.
USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E OSWER 9285.7-02 EP.
USEPA, 2009. Exposure Factors Handbook: 2009 Update. EPA/600/R-09/052A. July 2009

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-4.4RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe: Current/Future
Medium: Floodplain Surface Soil
Exposure Medium: Particulates

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Current Value	Future Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Res/Trepasser	Adult	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Daily Inhalation Intake (mg/m^3) =
				EF	Exposure Frequency	12	45	days/year	Site-Specific/Region 4	$\frac{CS \times EF \times ED \times FI}{AT \times PEF}$
				ED	Exposure Duration	30	30	years	USEPA, 2004	
				FI	Fraction Inhaled at Site	50	50	percent	Professional Judgment	
				PEF	Particulate Emission Factor	1.36E+09	1.36E+09	m^3/kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	10,950	10,950	days	USEPA, 1989	
Inhalation	Res/Trepasser	Preadolescent/ Adolescent (7-16)	OU-2	CS	Concentration in Soil	Table 9-3.3	Table 9-3.3	mg/kg		Daily Inhalation Intake (mg/m^3) =
				EF	Exposure Frequency	12	45	days/year	Site-Specific/Region 4	$\frac{CS \times EF \times ED \times FI}{AT \times PEF}$
				ED	Exposure Duration	10	10	years	Site-specific	
				FI	Fraction Inhaled at Site	50	50	percent	Professional Judgment	
				PEF	Particulate Emission Factor	1.36E+09	1.36E+09	m^3/kg	USEPA, 2002	
				AT-C	Averaging Time - Cancer	25,550	25,550	days	USEPA, 1989	
				AT-N	Averaging Time - Non-Cancer	3,650	3,650	days	USEPA, 1989	

USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A OERR EPA/540/1-89/002.
USEPA, 2000. Region 4 Supplement to RAGS, Human Health Bulletins.
USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.
USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E OSWER 9285.7-02 EP.

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
OLIN MCINTOSH
MCINTOSH, ALABAMA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed Dermal RfD (2)		Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ
		Value	Units		Value	Units			
Mercury (Inorganic Salts)	Chronic	3.0E-04	mg/kg-day	0.07	2.1E-05	mg/kg-day	Immune	1000 / 1	I
Methylmercury	Chronic	1.0E-04	mg/kg-day	1.0	1.0E-04	mg/kg-day	CNS	10 / 1	I
Hexachlorobenzene	Chronic	8.0E-04	mg/kg-day	1.0	8.0E-04	mg/kg-day	Liver	100/ 1	I
DDTR (a)	Chronic	5.0E-04	mg/kg-day	1.0	5.0E-04	mg/kg-day	Liver	100 / 1	I

(a) DDT used as a surrogate.
mg/kg-d = milligrams per kilogram per day
I = Integrated Risk Information System
CNS = Central Nervous System
(1) Source: RSL Table
(2) Reference Dose times Efficiency

PREPARED BY/DATE: MKB 5/11/10
PREPARED BY/DATE: LMS 5/11/10

TABLE 9-5.2
NON-CANCER TOXICITY DATA -- INHALATION
OLIN MCINTOSH
MCINTOSH, ALABAMA

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ
Mercury (Inorganic Salts)	Chronic	NA	mg/m^3	NA	NA	I
Methylmercury	Chronic	NA	mg/m^3	NA	NA	I
Hexachlorobenzene	Chronic	NA	mg/m^3	NA	NA	I
DDTR (a)	Chronic	NA	mg/m^3	NA	NA	I

PREPARED BY/DATE: MKB 5/11/10
PREAPRED BY/DATE: LMS 5/11/10

(a) DDT used as a surrogate.
NA = Not Applicable / Not Available
mg/m^3 = milligrams per cubic meter

I = Integrated Risk Information System

TABLE 9-6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
OLIN MCINTOSH
MCINTOSH, ALABAMA

Chemical of Potential Concern	Oral Cancer Slope Factor	Units	Oral Absorption Efficiency for Dermal (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence	Source
Mercury (Inorganic Salts)	NA	$mg/kg\text{-}day^{-1}$	0.07	NA	$mg/kg\text{-}day^{-1}$	C	I
Methylmercury	NA	$mg/kg\text{-}day^{-1}$	1.0	NA	$mg/kg\text{-}day^{-1}$	C	I
Hexachlorobenzene	1.60E+00	mg/kg-day-1	1.0	1.60E+00	mg/kg-day-1	B2	I
DDTR (a)	3.40E-01	mg/kg-day-1	1.0	3.40E-01	mg/kg-day-1	B2	I

(a) DDT used as a surrogate.
NA = Not Available
$mg/kg\text{-}day^{-1}$ = reciprocal of milligrams per kilogram per day
(1) Source: RSL Table
(2) Slope Factor / Efficiency
I = Integrated Risk Information System
EPA Group:
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen

PREPARED BY/DATE: MKB 5/11/10
PREAPRED BY/DATE: LMS 5/11/10

TABLE 9-6.2
CANCER TOXICITY DATA -- INHALATION
OLIN MCINTOSH
MCINTOSH, ALABAMA

Chemical of Potential Concern	Unit Risk	Units	Weight of Evidence	Source
Mercury (Inorganic Salts)	NA	$(mg/m3)^{-1}$	C	I
Methylmercury	NA	$(mg/m3)^{-1}$	C	I
Hexachlorobenzene	4.6E-01	$(mg/m3)^{-1}$	B2	I
DDTR (a)	9.7E-02	$(mg/m3)^{-1}$	B2	I

(a) DDT used as a surrogate.
NA = Not Available
$(mg/m^3)^{-1}$ = reciprocal of milligrams per cubic meter

PREPARED BY/DATE: MKB 5/11/10
PREPARED BY/DATE: LMS 5/11/10

I = Integrated Risk Information System
EPA Group:
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen

TABLE 9-7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timefram Current
Receptor Populatio Resident/Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface water	Swimming in Basin	Incidental Ingestion	Mercury	1.7E-01	ug/L	1.4E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	3.2E-09	mg/kg-day	3.0E-04	mg/kg-day	1.E-05
				Methylmercury	2.7E-03	ug/L	2.2E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	5.1E-11	mg/kg-day	1.0E-04	mg/kg-day	5.E-07
				Hexachlorobenzene	4.0E-02	ug/L	3.2E-10	mg/kg-day	1.6E+00	1/(mg/kg-day)	5.1E-10	7.4E-10	mg/kg-day	8.0E-04	mg/kg-day	9.E-07
				DDTR	1.4E-01	ug/L	1.1E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	3.7E-10	2.5E-09	mg/kg-day	5.0E-04	mg/kg-day	5.E-06
			Exp. Route Total								9E-10					2.E-05
Surface Water	Surface water	Swimming in Basin	Dermal	Mercury	3.4E-10	mg/cm2-event	1.2E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	2.9E-09	mg/kg-day	2.1E-05	mg/kg-day	1.E-04
				Methylmercury	5.4E-12	mg/cm2-event	2.0E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	4.6E-11	mg/kg-day	1.0E-04	mg/kg-day	5.E-07
				Hexachlorobenzene	3.7E-08	mg/cm2-event	1.3E-07	mg/kg-day	1.6E+00	1/(mg/kg-day)	2.2E-07	3.1E-07	mg/kg-day	8.0E-04	mg/kg-day	4.E-04
				DDTR	3.2E-07	mg/cm2-event	1.2E-06	mg/kg-day	3.4E-01	1/(mg/kg-day)	4.0E-07	2.7E-06	mg/kg-day	5.0E-04	mg/kg-day	5.E-03
			Exp. Route Total								6E-07					6.E-03
		Exposure Point Total									6E-07					6.E-03
	Exposure Medium Total										6E-07					6.E-03
Surface Water Total											6E-07					6.E-03

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/11/10

TABLE 9-7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe:	**Future**
Receptor Population:	**Resident/Trespasser**
Receptor Age:	**Adult**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface water	Swimming in Basin	Incidental Ingestion	Mercury	1.7E-01	ug/L	5.1E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	1.2E-08	mg/kg-day	3.0E-04	mg/kg-day	4.E-05
				Methylmercury	2.7E-03	ug/L	8.2E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	1.9E-10	mg/kg-day	1.0E-04	mg/kg-day	2.E-06
				Hexachlorobenzene	4.0E-02	ug/L	1.2E-09	mg/kg-day	1.6E+00	1/(mg/kg-day)	1.9E-09	2.8E-09	mg/kg-day	8.0E-04	mg/kg-day	3.E-06
				DDTR	1.4E-01	ug/L	4.1E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.4E-09	9.5E-09	mg/kg-day	5.0E-04	mg/kg-day	2.E-05
			Exp. Route Total								3E-09					6.E-05
Surface Water	Surface water	Swimming in Basin	Dermal	Mercury	3.4E-10	mg/cm2-event	4.6E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	1.1E-08	mg/kg-day	2.1E-05	mg/kg-day	5.E-04
				Methylmercury	5.4E-12	mg/cm2-event	7.3E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	1.7E-10	mg/kg-day	1.0E-04	mg/kg-day	2.E-06
				Hexachlorobenzene	3.7E-08	mg/cm2-event	5.1E-07	mg/kg-day	1.6E+00	1/(mg/kg-day)	8.1E-07	1.2E-06	mg/kg-day	8.0E-04	mg/kg-day	1.E-03
				DDTR	3.2E-07	mg/cm2-event	4.4E-06	mg/kg-day	3.4E-01	1/(mg/kg-day)	1.5E-06	1.0E-05	mg/kg-day	5.0E-04	mg/kg-day	2.E-02
			Exp. Route Total								2E-06					2.E-02
		Exposure Point Total									2E-06					2.E-02
	Exposure Medium Total										2E-06					2.E-02
Surface Water Total											2E-06					2.E-02

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Current
Receptor Population: Resident/Trespasser
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface water	Swimming in Basin	Incidental Ingestion	Mercury	1.69E-01	ug/L	1.7E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	1.2E-08	mg/kg-day	3.0E-04	mg/kg-day	4.E-05
				Methylmercury	2.70E-03	ug/L	2.6E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	1.8E-10	mg/kg-day	1.0E-04	mg/kg-day	2.E-06
				Hexachlorobenzene	3.96E-02	ug/L	3.9E-10	mg/kg-day	1.60E+00	1/(mg/kg-day)	6E-10	2.7E-09	mg/kg-day	8.0E-04	mg/kg-day	3.E-06
				DDTR	1.35E-01	ug/L	1.3E-09	mg/kg-day	3.40E-01	1/(mg/kg-day)	4E-10	9.2E-09	mg/kg-day	5.0E-04	mg/kg-day	2.E-05
			Exp. Route Total								1E-09					6.E-05
Surface Water	Surface water	Swimming in Basin	Dermal	Mercury	3.38E-10	mg/cm2-event	4.7E-10	mg/kg-day	NA	1/(mg/kg-day)	NA	3.3E-09	mg/kg-day	2.1E-05	mg/kg-day	2.E-04
				Methylmercury	5.40E-12	mg/cm2-event	7.5E-12	mg/kg-day	NA	1/(mg/kg-day)	NA	5.2E-11	mg/kg-day	1.0E-04	mg/kg-day	5.E-07
				Hexachlorobenzene	3.72E-08	mg/cm2-event	5.1E-08	mg/kg-day	1.60E+00	1/(mg/kg-day)	8E-08	3.6E-07	mg/kg-day	8.0E-04	mg/kg-day	4.E-04
				DDTR	3.22E-07	mg/cm2-event	4.5E-07	mg/kg-day	3.40E-01	1/(mg/kg-day)	2E-07	3.1E-06	mg/kg-day	5.0E-04	mg/kg-day	6.E-03
			Exp. Route Total								2E-07					7.E-03
		Exposure Point Total									2E-07					7.E-03
	Exposure Medium Total										2E-07					7.E-03
Surface Water Total											2E-07					7.E-03

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/11/10

TABLE 9-7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe:	**Future**
Receptor Population:	**Resident/Trespasser**
Receptor Age:	**Pre-Adolescent/Adolescent**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface water	Swimming in Basin	Incidental Ingestion	Mercury	1.69E-01	ug/L	6.2E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	4.3E-08	mg/kg-day	3.0E-04	mg/kg-day	1.E-04
				Methylmercury	2.70E-03	ug/L	9.9E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	6.9E-10	mg/kg-day	1.0E-04	mg/kg-day	7.E-06
				Hexachlorobenzene	3.96E-02	ug/L	1.5E-09	mg/kg-day	1.60E+00	1/(mg/kg-day)	2E-09	1.0E-08	mg/kg-day	8.0E-04	mg/kg-day	1.E-05
				DDTR	1.35E-01	ug/L	5.0E-09	mg/kg-day	3.40E-01	1/(mg/kg-day)	2E-09	3.5E-08	mg/kg-day	5.0E-04	mg/kg-day	7.E-05
			Exp. Route Total								4E-09					2.E-04
Surface Water	Surface water	Swimming in Basin	Dermal	Mercury	3.38E-10	mg/cm2-event	1.8E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	1.2E-08	mg/kg-day	2.1E-05	mg/kg-day	6.E-04
				Methylmercury	5.40E-12	mg/cm2-event	2.8E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	2.0E-10	mg/kg-day	1.0E-04	mg/kg-day	2.E-06
				Hexachlorobenzene	3.72E-08	mg/cm2-event	1.9E-07	mg/kg-day	1.60E+00	1/(mg/kg-day)	3E-07	1.3E-06	mg/kg-day	8.0E-04	mg/kg-day	2.E-03
				DDTR	3.22E-07	mg/cm2-event	1.7E-06	mg/kg-day	3.40E-01	1/(mg/kg-day)	6E-07	1.2E-05	mg/kg-day	5.0E-04	mg/kg-day	2.E-02
			Exp. Route Total								9E-07					3.E-02
		Exposure Point Total									9E-07					3.E-02
	Exposure Medium Total										9E-07					3.E-02
Surface Water Total											9E-07					3.E-02

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe Current
Receptor Population Fishermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Fish Tissue	Fish Tissue	Fishing in Basin	Ingestion	Methylmercury	2.5E+00	mg/kg	6.0E-05	mg/kg-day	NA	1/(mg/kg-day)	NA	1.4E-04	mg/kg-day	1.0E-04	mg/kg-day	1.4E+00
				Hexachlorobenzene	7.7E-02	mg/kg	1.9E-06	mg/kg-day	1.6E+00	1/(mg/kg-day)	3E-06	4.4E-06	mg/kg-day	8.0E-04	mg/kg-day	5.5E-03
				DDTR	4.0E-01	mg/kg	9.7E-06	mg/kg-day	3.4E-01	1/(mg/kg-day)	3E-06	2.3E-05	mg/kg-day	5.0E-04	mg/kg-day	4.5E-02
			Exp. Route Total								6E-06					1.E+00
	Exposure Point Total										6E-06					1.E+00
	Exposure Medium Total										6E-06					1.E+00
Fish Tissue Total											6E-06					1.E+00

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 11/1/10

TABLE 9-7.6.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe Future
Receptor Population Fishermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Fish Tissue	Fish Tissue	Fishing in Basin	Ingestion	Methylmercury	2.5E+00	mg/kg	2.4E-04	mg/kg-day	NA	1/(mg/kg-day)	NA	5.6E-04	mg/kg-day	1.0E-04	mg/kg-day	6E+00
				Hexachlorobenzene	7.7E-02	mg/kg	7.5E-06	mg/kg-day	1.6E+00	1/(mg/kg-day)	1E-05	1.8E-05	mg/kg-day	8.0E-04	mg/kg-day	2E-02
				DDTR	4.0E-01	mg/kg	3.9E-05	mg/kg-day	3.4E-01	1/(mg/kg-day)	1E-05	9.1E-05	mg/kg-day	5.0E-04	mg/kg-day	2E-01
			Exp. Route Total								3E-05					6.E+00
		Exposure Point Total									3E-05					6.E+00
	Exposure Medium Total										3E-05					6.E+00
Fish Tissue Total											3E-05					6.E+00

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Current
Receptor Population: Fishermen
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Fish Tissue	Fish Tissue	Fishing in Basin	Ingestion	Methylmercury	2.47E+00	mg/kg	1.6E-05	mg/kg-day	NA	1/(mg/kg-day)	NA	1.1E-04	mg/kg-day	1.0E-04	mg/kg-day	1.E+00
				Hexachlorobenzene	7.70E-02	mg/kg	4.9E-07	mg/kg-day	1.60E+00	1/(mg/kg-day)	8E-07	3.4E-06	mg/kg-day	8.0E-04	mg/kg-day	4.E-03
				DDTR	3.97E-01	mg/kg	2.5E-06	mg/kg-day	3.40E-01	1/(mg/kg-day)	9E-07	1.8E-05	mg/kg-day	5.0E-04	mg/kg-day	4.E-02
			Exp. Route Total								2E-06					1.E+00
		Exposure Point Total									2E-06					1.E+00
	Exposure Medium Total										2E-06					1.E+00
Fish Tissue Total											2E-06					1.E+00

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/11/10

TABLE 9-7.8.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Future
Receptor Population: Fishermen
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Fish Tissue	Fish Tissue	Fishing in Basin	Ingestion	Methylmercury	2.5E+00	mg/kg	6.2E-05	mg/kg-day	NA	1/(mg/kg-day)	NA	4.4E-04	mg/kg-day	1.0E-04	mg/kg-day	4.E+00
				Hexachlorobenzene	7.7E-02	mg/kg	1.9E-06	mg/kg-day	1.6E+00	1/(mg/kg-day)	3E-06	1.4E-05	mg/kg-day	8.0E-04	mg/kg-day	2.E-02
				DDTR	4.0E-01	mg/kg	1.0E-05	mg/kg-day	3.4E-01	1/(mg/kg-day)	3E-06	7.0E-05	mg/kg-day	5.0E-04	mg/kg-day	1.E-01
			Exp. Route Total								7E-06					5.E+00
		Exposure Point Total									7E-06					5.E+00
	Exposure Medium Total										7E-06					5.E+00
Fish Tissue Total											7E-06					5.E+00

PREPARED/DATE: LMS 10/26/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.9
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	**Current**
Receptor Population:	**Trespasser**
Receptor Age:	**Adult**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Floodplain Soil	Onsite	Ingestion	Mercury	1.6E+00	mg/kg	1.6E-08	mg/kg-day	NA	1/(mg/kg-day)	NA	3.7E-08	mg/kg	3.0E-04	mg/kg-day	1.E-04
				DDTR	1.2E+00	mg/kg	1.2E-08	mg/kg-day	3.4E-01	1/(mg/kg-day)	4.E-09	2.9E-08	mg/kg	5.0E-04	mg/kg-day	6.E-05
			Exp. Route Total								4.E-09					2.E-04
			Dermal	Mercury	1.1E-10	mg/cm2-event	6.3E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	1.5E-10	mg/kg-day	2.1E-05	mg/kg-day	7E-06
				DDTR	2.6E-09	mg/cm2-event	1.5E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	5.E-10	3.5E-09	mg/kg-day	5.0E-04	mg/kg-day	7E-06
			Exp. Route Total								5.E-10					1E-05
			Inhalation of Fugitive Dust	Mercury	1.6E+00	mg/kg	8.2E-12	mg/m^3	NA	$(mg/m^3)^{-1}$	NA	1.9E-11	mg/m^3	NA	mg/m3	NA
				DDTR	1.2E+00	mg/kg	6.4E-12	mg/m^3	9.7E-02	$(mg/m^3)^{-1}$	6.E-13	1.5E-11	mg/m^3	NA	mg/m3	NA
			Exp. Route Total								6.E-13					NA
		Exposure Point Total									5.E-09					2E-04
	Exposure Medium Total										5.E-09					2E-04
Soil Total											5.E-09					2E-04

NA No toxicity values for this exposure pathway.

PREPARED BY/DATE: LMS 10/29/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.10
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	**Future**
Receptor Population:	**Trespasser**
Receptor Age:	**Adult**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Floodplain Soil	Onsite	Ingestion	Mercury	1.6E+00	mg/kg	6.0E-08	mg/kg-day	NA	1/(mg/kg-day)	NA	1.4E-07	mg/kg	3.0E-04	mg/kg-day	5.E-04
				DDTR	1.2E+00	mg/kg	4.6E-08	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.E-08	1.1E-07	mg/kg	5.0E-04	mg/kg-day	2.E-04
			Exp. Route Total								2.E-08					7.E-04
			Dermal	Mercury	1.1E-10	mg/cm2-event	2.4E-10	mg/kg-day	NA	1/(mg/kg-day)	NA	5.6E-10	mg/kg-day	2.1E-05	mg/kg-day	3E-05
				DDTR	2.6E-09	mg/cm2-event	5.6E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.E-09	1.3E-08	mg/kg-day	5.0E-04	mg/kg-day	3E-05
			Exp. Route Total								2.E-09					5E-05
			Inhalation of Fugitive Dust	Mercury	1.6E+00	mg/kg	3.1E-11	mg/m^3	NA	$(mg/m^3)^{-1}$	NA	7.2E-11	mg/m^3	NA	mg/m3	NA
				DDTR	1.2E+00	mg/kg	2.4E-11	mg/m^3	9.7E-02	$(mg/m^3)^{-1}$	2.E-12	5.6E-11	mg/m^3	NA	mg/m3	NA
			Exp. Route Total								2.E-12					NA
		Exposure Point Total									2.E-08					7E-04
	Exposure Medium Total										2.E-08					7E-04
Soil Total											2.E-08					7E-04

NA No toxicity values for this exposure pathway.

PREPARED BY/DATE: LMS 10/29/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.11
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	**Current**
Receptor Population:	**Trespasser**
Receptor Age:	**Adolescent (Age 7-16)**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Floodplain Soil	Onsite	Ingestion	Mercury	1.6E+00	mg/kg	7.7E-09	mg/kg-day	NA	1/(mg/kg-day)	NA	5.4E-08	mg/kg	3.0E-04	mg/kg-day	2.E-04
				DDTR	1.2E+00	mg/kg	6.0E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.E-09	4.2E-08	mg/kg	5.0E-04	mg/kg-day	8.E-05
			Exp. Route Total								2.E-09					3.E-04
			Dermal	Mercury	3.2E-10	mg/cm2-event	6.3E-11	mg/kg-day	NA	1/(mg/kg-day)	NA	4.4E-10	mg/kg-day	2.1E-05	mg/kg-day	2E-05
				DDTR	7.4E-09	mg/cm2-event	1.5E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	5.E-10	1.0E-08	mg/kg-day	5.0E-04	mg/kg-day	2E-05
			Exp. Route Total								5.E-10					4E-05
			Inhalation of Fugitive Dust	Mercury	1.6E+00	mg/kg	2.7E-12	mg/m^3	NA	$(mg/m^3)^{-1}$	NA	1.9E-11	mg/m^3	NA	mg/m3	NA
				DDTR	1.2E+00	mg/kg	2.1E-12	mg/m^3	9.7E-02	$(mg/m^3)^{-1}$	2.E-13	1.5E-11	mg/m^3	NA	mg/m3	NA
			Exp. Route Total								2.E-13					NA
		Exposure Point Total									3.E-09					3E-04
	Exposure Medium Total										3.E-09					3E-04
Soil Total											3.E-09					3E-04

NA No toxicity values for this exposure pathway.

PREPARED BY/DATE: LMS 10/29/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-7.12
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE

Scenario Timeframe:	**Future**
Receptor Population:	**Trespasser**
Receptor Age:	**Adolescent (Age 7-16)**

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Floodplain Soil	Onsite	Ingestion	Mercury	1.6E+00	mg/kg	2.9E-08	mg/kg-day	NA	1/(mg/kg-day)	NA	2.0E-07	mg/kg	3.0E-04	mg/kg-day	7.E-04
				DDTR	1.2E+00	mg/kg	2.3E-08	mg/kg-day	3.4E-01	1/(mg/kg-day)	8.E-09	1.6E-07	mg/kg	5.0E-04	mg/kg-day	3.E-04
			Exp. Route Total								8.E-09					1.E-03
			Dermal	Mercury	3.2E-10	mg/cm2-event	2.3E-10	mg/kg-day	NA	1/(mg/kg-day)	NA	1.6E-09	mg/kg-day	2.1E-05	mg/kg-day	8E-05
				DDTR	7.4E-09	mg/cm2-event	5.5E-09	mg/kg-day	3.4E-01	1/(mg/kg-day)	2.E-09	3.8E-08	mg/kg-day	5.0E-04	mg/kg-day	8E-05
			Exp. Route Total								2.E-09					2E-04
			Inhalation of Fugitive Dust	Mercury	1.6E+00	mg/kg	1.0E-11	mg/m^3	NA	$(mg/m^3)^{-1}$	NA	7.2E-11	mg/m^3	NA	mg/m3	NA
				DDTR	1.2E+00	mg/kg	8.0E-12	mg/m^3	9.7E-02	$(mg/m^3)^{-1}$	8.E-13	5.6E-11	mg/m^3	NA	mg/m3	NA
			Exp. Route Total								8.E-13					NA
		Exposure Point Total									1.E-08					1E-03
	Exposure Medium Total										1.E-08					1E-03
Soil Total											1.E-08					1E-03

NA No toxicity values for this exposure pathway.

PREPARED BY/DATE: LMS 10/29/10
CHECKED/DATE: LWC 11/4/10

TABLE 9-9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Olin McIntosh
McIntosh, Alabama

Scenario Timeframe: Current
Receptor Population: Resident/Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Swimming in Basin	Mercury	NA	NA	NA	NA	Immune	1.E-05	NA	1.E-04	1.E-04
			Methylmercury	NA	NA	NA	NA	CNS	5.E-07	NA	5.E-07	1.E-06
			Hexachlorobenzene	5.E-10	NA	2.E-07	2.E-07	Liver	9.E-07	NA	4.E-04	4.E-04
			DDTR	4.E-10	NA	4.E-07	4.E-07	Liver	5.E-06	NA	5.E-03	5.E-03
			Chemical Total	9.E-10	--	6.E-07	6.E-07		2.E-05	--	6.E-03	6.E-03
		Exposure Point Total					6.E-07					6.E-03
Surface Water Total							6.E-07					6.E-03
Fish Tissue	Fish Tissue	Fishing in Basin	Methylmercury	NA	NA	NA	NA	CNS	1.E+00	NA	NA	1.E+00
			Hexachlorobenzene	3.E-06	NA	NA	3.E-06	Liver	5.E-03	NA	NA	5.E-03
			DDTR	3.E-06	NA	NA	3.E-06	Liver	5.E-02	NA	NA	5.E-02
			Chemical Total	6.E-06	--	--	6.E-06		1.E+00	--	--	1.E+00
		Exposure Point Total					6.E-06					1.E+00
Fish Tissue Total							6.E-06					1.E+00
Surface Soil	Floodplain Soil	OU-2 Floodplain	Mercury	NA	NA	NA	NA	Immune	1.E-04	NA	7.E-06	1.E-04
			DDTR	4.E-09	6.E-13	5.E-10	5.E-09	Liver	6.E-05	NA	7.E-06	6.E-05
			Chemical Total	4.E-09	6.E-13	5.E-10	5.E-09		2.E-04	NA	1.E-05	2.E-04
		Exposure Point Total					5.E-09					2.E-04
Floodplain Soil Total							5.E-09					2.E-04
Receptor Total							7.E-06					1.E+00

Total Risk Across All Media	7.E-06	Total Hazard Across All Media	1.E+00

Liver HI Across All Media =	6.E-02
CNS HI Across All Media =	1.E+00
Immune HI Across All Media =	3.E-04

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Olin McIntosh
McIntosh, Alabama

Scenario Timeframe: Future
Receptor Population: Resident/Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Swimming in Basin	Mercury	NA	NA	NA	NA	Immune	4.E-05	NA	5.E-04	5.E-04
			Methylmercury	NA	NA	NA	NA	CNS	2.E-06	NA	2.E-06	4.E-06
			Hexachlorobenzene	2.E-09	NA	8.E-07	8.E-07	Liver	3.E-06	NA	1.E-03	1.E-03
			DDTR	1.E-09	NA	1.E-06	1.E-06	Liver	2.E-05	NA	2.E-02	2.E-02
			Chemical Total	3.E-09	--	2.E-06	2.E-06		6.E-05	--	2.E-02	2.E-02
		Exposure Point Total					2.E-06					2.E-02
Surface Water Total							2.E-06					2.E-02
Fish Tissue	Fish Tissue	Fishing in Basin	Methylmercury	NA	NA	NA	NA	CNS	6.E+00	NA	NA	6.E+00
			Hexachlorobenzene	1.E-05	NA	NA	1.E-05	Liver	2.E-02	NA	NA	2.E-02
			DDTR	1.E-05	NA	NA	1.E-05	Liver	2.E-01	NA	NA	2.E-01
			Chemical Total	3.E-05	--	--	3.E-05		6.E+00	--	--	6.E+00
		Exposure Point Total					3.E-05					6.E+00
Fish Tissue Total							3.E-05					6.E+00
Surface Soil	Floodplain Soil	OU-2 Floodplain	Mercury	NA	NA	NA	NA	Immune	5.E-04	NA	3.E-05	5.E-04
			DDTR	2.E-08	2.E-12	2.E-09	2.E-08	Liver	2.E-04	NA	3.E-05	2.E-04
			Chemical Total	2.E-08	2.E-12	2.E-09	2.E-08		7.E-04	NA	5.E-05	7.E-04
		Exposure Point Total					2.E-08					7.E-04
Floodplain Soil Total							2.E-08					7.E-04
Receptor Total							3.E-05					6.E+00

Total Risk Across All Media: 3.E-05

Total Hazard Across All Media: 6.E+00

Liver HI Across All Media = 2.E-01
CNS HI Across All Media = 6.E+00
Immune HI Across All Media = 1.E-03

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Current
Receptor Population: Resident/Trespasser
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Swimming in Basin	Mercury	NA	NA	NA	NA	Immune	4.E-05	NA	2.E-04	2.E-04
			Methylmercury	NA	NA	NA	NA	CNS	2.E-06	NA	5.E-07	2.E-06
			Hexachlorobenzene	6.E-10	NA	8.E-08	8.E-08	Liver	3.E-06	NA	4.E-04	5.E-04
			DDTR	4.E-10	NA	2.E-07	2.E-07	Liver	2.E-05	NA	6.E-03	6.E-03
			Chemical Total	1.E-09	--	2.E-07	2.E-07		6.E-05	--	7.E-03	7.E-03
		Exposure Point Total					2.E-07					7.E-03
Surface Water Total							2.E-07					7.E-03
Fish Tissue	Fish Tissue	Fishing in Basin	Methylmercury	NA	NA	NA	NA	CNS	1.E+00	NA	NA	1.E+00
			Hexachlorobenzene	8E-07	NA	NA	8.E-07	Liver	4.E-03	NA	NA	4.E-03
			DDTR	9E-07	NA	NA	9.E-07	Liver	4.E-02	NA	NA	4.E-02
			Chemical Total	2.E-06	--	--	2.E-06		1.E+00	--	--	1.E+00
		Exposure Point Total					2.E-06					1.E+00
Fish Tissue Total							2.E-06					1.E+00
Surface Soil	Floodplain Soil	OU-2 Floodplain	Mercury	NA	NA	NA	NA	Immune	2.E-04	NA	2.E-05	2.E-04
			DDTR	2.E-09	2.E-13	5.E-10	3.E-09	Liver	8.E-05	NA	2.E-05	1.E-04
			Chemical Total	2.E-09	2.E-13	5.E-10	3.E-09		3.E-04	NA	4.E-05	3.E-04
		Exposure Point Total					3.E-09					3.E-04
Floodplain Soil Total							3.E-09					3.E-04
Receptor Total							2.E-06					1.E+00

Total Risk Across All Media	2.E-06	Total Hazard Across All Media	1.E+00
		Liver HI Across All Media =	5.E-02
		CNS HI Across All Media =	1.E+00
		Immune HI Across All Media =	4.E-04

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Future
Receptor Population: Resident/Trespasser
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Swimming in Basin	Mercury	NA	NA	NA	NA	Immune	1.E-04	NA	6.E-04	7.E-04
			Methylmercury	NA	NA	NA	NA	CNS	7.E-06	NA	2.E-06	9.E-06
			Hexachlorobenzene	2.E-09	NA	3.E-07	3.E-07	Liver	1.E-05	NA	2.E-03	2.E-03
			DDTR	2.E-09	NA	6.E-07	6.E-07	Liver	7.E-05	NA	2.E-02	2.E-02
			Chemical Total	4.E-09	--	9.E-07	9.E-07		2.E-04	--	3.E-02	3.E-02
		Exposure Point Total					9.E-07					3.E-02
Surface Water Total							9.E-07					3.E-02
Fish Tissue	Fish Tissue	Fishing in Basin	Methylmercury	NA	NA	NA	NA	CNS	4.E+00	NA	NA	4.E+00
			Hexachlorobenzene	3E-06	NA	NA	3.E-06	Liver	2.E-02	NA	NA	2.E-02
			DDTR	3E-06	NA	NA	3.E-06	Liver	1.E-01	NA	NA	1.E-01
			Chemical Total	7.E-06	--	--	7.E-06		5.E+00	--	--	5.E+00
		Exposure Point Total					7.E-06					5.E+00
Fish Tissue Total							7.E-06					5.E+00
Surface Soil	Floodplain Soil	OU-2 Floodplain	Mercury	NA	NA	NA	NA	Immune	7.E-04	NA	8.E-05	8.E-04
			DDTR	8.E-09	8.E-13	2.E-09	1.E-08	Liver	3.E-04	NA	8.E-05	4.E-04
			Chemical Total	8.E-09	8.E-13	2.E-09	1.E-08		1.E-03	NA	2.E-04	1.E-03
		Exposure Point Total					1.E-08					1.E-03
Floodplain Soil Total							1.E-08					1.E-03
Receptor Total							7.E-06					5.E+00

Total Risk Across All Media	7.E-06	Total Hazard Across All Media	5.E+00
		Liver HI Across All Media =	2.E-01
		CNS HI Across All Media =	4.E+00
		Immune HI Across All Media =	1.E-03

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Current
Receptor Population: Resident/Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish Tissue	Fish Tissue	Ingestion	Methylmercury	NA	NA	NA	NA	CNS	1.E+00	NA	NA	1.E+00
			Hexachlorobenzene	3.E-06	NA	NA	3.E-06	Liver	5.E-03	NA	NA	5.E-03
			DDTR	3.E-06	NA	NA	3.E-06	Liver	5.E-02	NA	NA	5.E-02
			Chemical Total	6.E-06	--	--	6.E-06		1.E+00	--	--	1.E+00
		Exposure Point Total					6.E-06					1.E+00
Fish Tissue Total							6.E-06					1.E+00
Receptor Total							6.E-06					1.E+00

Total Risk Across All Media: 6.E-06
Total Hazard Across All Media: 1.E+00

Liver HI Across All Media = 5.E-02
CNS HI Across All Media = 1.E+00

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-10.2.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Future
Receptor Population: Resident/Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Swimming in Basin	Mercury	NA	NA	NA	NA	Immune	4.E-05	NA	5.E-04	5.E-04
			Methylmercury	NA	NA	NA	NA	CNS	2.E-06	NA	2.E-06	4.E-06
			Hexachlorobenzene	2.E-09	NA	8.E-07	8.E-07	Liver	3.E-06	NA	1.E-03	1.E-03
			DDTR	1.E-09	NA	1.E-06	1.E-06	Liver	2.E-05	NA	2.E-02	2.E-02
			Chemical Total	3.E-09	--	2.E-06	2.E-06		6.E-05	--	2.E-02	2.E-02
		Exposure Point Total					2.E-06					2.E-02
Surface Water Total							2.E-06					2.E-02
Fish Tissue	Fish Tissue	Ingestion	Methylmercury	NA	NA	NA	NA	CNS	6.E+00	NA	NA	6.E+00
			Hexachlorobenzene	1.E-05	NA	NA	1.E-05	Liver	2.E-02	NA	NA	2.E-02
			DDTR	1.E-05	NA	NA	1.E-05	Liver	2.E-01	NA	NA	2.E-01
			Chemical Total	3.E-05	--	--	3.E-05		6.E+00	--	--	6.E+00
		Exposure Point Total					3.E-05					6.E+00
Fish Tissue Total							3.E-05					6.E+00
Receptor Total							3.E-05					6.E+00

Total Risk Across All Media	3.E-05	Total Hazard Across All Media	6.E+00
		Liver HI Across All Media =	2.E-01
		CNS HI Across All Media =	6.E+00
		Immune HI Across All Media =	5.E-04

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-10.3.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Current
Receptor Population: Resident/Trespasser
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish Tissue	Fish Tissue	Ingestion	Methylmercury	NA	NA	NA	NA	CNS	1.E+00	NA	NA	1.E+00
			Hexachlorobenzene	8E-07	NA	NA	8.E-07	Liver	4.E-03	NA	NA	4.E-03
			DDTR	9E-07	NA	NA	9.E-07	Liver	4.E-02	NA	NA	4.E-02
			Chemical Total	2.E-06	--	--	2.E-06		1.E+00	--	--	1.E+00
		Exposure Point Total					2.E-06					1.E+00
Fish Tissue Total							2.E-06					1.E+00
Receptor Total							2.E-06					1.E+00

Total Risk Across All Media	2.E-06	Total Hazard Across All Media	1.E+00
		Liver HI Across All Media =	4.E-02
		CNS HI Across All Media =	1.E+00

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

TABLE 9-10.4.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
OLIN MCINTOSH OPERABLE UNIT 2
MCINTOSH, ALABAMA

Scenario Timeframe: Future
Receptor Population: Resident/Trespasser
Receptor Age: Pre-Adolescent/Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Fish Tissue	Fish Tissue	Ingestion	Methylmercury	NA	NA	NA	NA	CNS	4.E+00	NA	NA	4.E+00
			Hexachlorobenzene	3E-06	NA	NA	3.E-06	Liver	2.E-02	NA	NA	2.E-02
			DDTR	3E-06	NA	NA	3.E-06	Liver	1.E-01	NA	NA	1.E-01
			Chemical Total	7.E-06	--	--	7.E-06		5.E+00	--	--	5.E+00
		Exposure Point Total					7.E-06					5.E+00
Fish Tissue Total							7.E-06					5.E+00
Receptor Total							7.E-06					5.E+00

Total Risk Across All Media	7.E-06	Total Hazard Across All Media	5.E+00
		Liver HI Across All Media =	2.E-01
		CNS HI Across All Media =	4.E+00

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/12/10
REVISED BY/DATE: LMS 11/1/10

APPENDIX Q

DERMAL EXPOSURE POINT CALCULATIONS

TABLE Q.1 RME
DERMAL CONTACT EQUATION SELECTION FOR ORGANIC COMPOUNDS
SURFACE WATER

Receptor	Constituents of Potential Concern	Time to reach steady-state (t*) (hr) (a)	Event Duration (t_{event}) (hrs/event)	$t_{event} > t^*$?	DA_{event} Equation (b)
Adult/ Preadolescent/ Adolescent	Hexachlorobenzene	16.21	2	NO	Equation 1
	DDT (c)	42.51	2	NO	Equation 1

Notes:

(a)	From USEPA (2004), Exhibit B-3, "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)", Final. EPA/540/R/99/005.
(b)	Based on whether t_{event} is less than or greater than t* , different equations for DA_{event} are used (USEPA, 2004).
(c)	DDT used as a surrogate
hr	hours
hrs/event	hours per event
mg/cm^2-event	milligrams per square centimeter per event
DA_{event}	Dermally absorbed dose per event

PREPARED BY/DATE: MKB 5/11/10
CHECKED BY/DATE: LMS 5/11/10

TABLE Q.2 RME
ESTIMATE OF DERMALLY ABSORBED DOSE PER EVENT FOR METALS - SURFACE WATER

Constituent	Dermal Permeability Coefficient (Kp), cm/hr (a)	Exposure Point Concentration (EPC), µg/L (b)	Unit Conversion Factor (UCF) (mg/cm^3 per µg/L)	Constituent Concentration in Water (Cw), mg/cm^3 (c)	Event Duration (t_{event}), hrs/event (d)	Dermally Absorbed dose per Event (DA_{event}) (mg/cm^2-event) (e)
Mercury (mercuric chloride)	1.00E-03	1.69E-01	1.00E-06	1.69E-07	2	3.38E-10
Methylmercury	1.00E-03	2.70E-03	1.00E-06	2.70E-09	2	5.40E-12

Notes

(a) USEPA, 2004. 1E-3 used as surrogate for iron
(b) From Table 3.1
(c) EPC x UCF
(d) Assumed for swimming in the basin.
(e) Kp x Cw x t_{event}, per RAGS E for inorganic chemicals

cm/hr centimeters per hour
µg/L micrograms per liter
mg/cm^3 per µg/L milligrams per cubic centimeter per micrograms per liter
µg/L micrograms per liter
mg/cm^3 milligrams per cubic centimeter
hrs/event hours per event
mg/cm^2-event milligrams per square centimeter per event

PREPARED/DATE: MKB 5/11/10
CHECKED/DATE: LMS 5/11/10

TABLE Q.3 RME
ESTIMATE OF DERMALLY ABSORBED DOSE PER EVENT FOR ORGANIC COMPOUNDS - SURFACE WATER

Receptor	Constituents of Potential Concern	Fraction Absorbed (FA) (a)	Dermal Permeability Coefficient (Kp), cm/hr (a)	Exposure Point Concentration, µg/L (b)	Unit Conversion Factor (UCF) (mg/cm^3 per µg/L)	Chemical Concentration in Water (Cw), mg/cm^3 (c)	Event Duration (t_{event}), hrs/event (b)	Lag time per event (τ_{event}), hr (a)	Dermally Absorbed Dose per Event (DA_{event}) (mg/cm^2-event) (d)
Adult/									
Pre-Adolescent	**Equation 1**								
Adolescent	Hexachlorobenzene	0.9	1.30E-01	3.96E-02	1.00E-06	3.96E-08	2.00	4.22E+00	3.72E-08
	DDTR	0.7	2.70E-01	1.35E-01	1.00E-06	1.35E-07	2.00	1.05E+01	3.22E-07

Notes

(a) Values from USEPA, 2004.

(b) Table 3.1

(c) EPC x UCF.

(d) $DA_{event} = 2\ FA \times Kp \times Cw\ ((6\tau_{event} \times t_{event}/\pi)^{0.5}$

cm/hr centimeters per hour

µg/L micrograms per liter

mg/cm^3 per µg/L milligrams per cubic centimeter per micrograms per liter

mg/cm^3 milligrams per cubic centimeter

hrs/event hours per event

mg/cm^2-event milligrams per square centimeter per event

PREPARED BY/DATE: MKB 5/11/10

CHECKED BY/DATE: LMS 5/11/10

TABLE Q.4
ESTIMATE OF DERMALLY ABSORBED DOSE PER EVENT FOR TRESPASSING ONSITE RECEPTORS

Resident/Trespasser Adult

Constituent	Exposure Point Concentration (EPC), mg/kg	Conversion Factor (CF) (1E-6 kg/mg)	Adherence Factor of soil/sediment to Skin (mg/cm2-event)	Dermal Absorption Fraction (unitless)	Source for Dermal Absorption Faction	Dermally Absorbed dose per Event (DA_{event}) (mg/cm^2-event)
Mercury	1.58E+00	1.00E-06	7.00E-02	0.001	Region 4 (a)	1.11E-10
DDTR	1.23E+00	1.00E-06	7.00E-02	0.03	USEPA 2004 (b)	2.58E-09

Resident/Trespasser Adolescent

Constituent	Exposure Point Concentration (EPC), mg/kg	Conversion Factor (CF) (1E-6 kg/mg)	Adherence Factor of soil/sediment to Skin (mg/cm2-event)	Dermal Absorption Fraction (unitless)	Source for Dermal Absorption Faction	Dermally Absorbed dose per Event (DA_{event}) (mg/cm^2-event)
Mercury	1.58E+00	1.00E-06	2.00E-01	0.001	Region 4 (a)	3.16E-10
DDTR	1.23E+00	1.00E-06	2.00E-01	0.03	USEPA 2004 (b)	7.38E-09

(a) Region 4 Supplement to RAGS, 2000.
(b) Value for DDT

PREPARED BY/DATE: LMS 10/29/10
CHECKED/DATE: LWC 11/4/10

APPENDIX R

DATA AND UPPER CONFIDENCE LIMIT CALCULATIONS WITH ProUCL

Basin Surface Water DDTR UCL with ND Constituents Equal to Half the PQL for 1991 and 1994

Sample ID	Date	Detected	DDTR (ng/L)
OWG0101-0694	6/27/1994	1	141.73
OWG0202-0694	6/27/1994	1	142.85
OWG0303-0694	6/27/1994	1	213.71
OWG0107-0894	8/18/1994	1	96.375
OWG0208-0894	8/18/1994	1	184.31
OWG0303-0894	8/18/1994	1	98.86
WGC901-0891	8/29/1991	0	100
WGC902-0891	8/29/1991	0	100
WGF201-0891	8/29/1991	0	100
WGH901-0891	8/29/1991	0	100
WGH902-0891	8/29/1991	0	100
WGG601-0891	8/30/1991	0	100
WGG602-0891	8/30/1991	0	100
WGH501-0891	8/30/1991	0	100
WGH502-0891	8/30/1991	0	100

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 3/22/10

CHECKED BY/DATE: HEF 4/1/10

SW DDTR 91-94 RL/2

General Statistics

Number of Valid Data	15	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	9
		Percent Non-Detects	60.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	96.38	Minimum Detected	4.568
Maximum Detected	213.7	Maximum Detected	5.365
Mean of Detected	146.3	Mean of Detected	4.943
SD of Detected	46.4	SD of Detected	0.321
Minimum Non-Detect	100	Minimum Non-Detect	4.605
Maximum Non-Detect	100	Maximum Non-Detect	4.605

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.92	Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	88.52	Mean	4.324
SD	56.16	SD	0.557
95% DL/2 (t) UCL	114.1	95% H-Stat (DL/2) UCL	93.8

Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	41.8	Mean in Log Scale	4.716
SD	100.1	SD in Log Scale	0.318
95% MLE (t) UCL	87.31	Mean in Original Scale	117.3
95% MLE (Tiku) UCL	127.3	SD in Original Scale	40.16
		95% Percentile Bootstrap UCL	134.7
		95% BCA Bootstrap UCL	136.5

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	6.069	Data appear Normal at 5% Significance Level	
Theta Star	24.11		
nu star	72.83		
A-D Test Statistic	0.329	Nonparametric Statistics	
5% A-D Critical Value	0.698	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.698	Mean	117.1
5% K-S Critical Value	0.332	SD	35.88
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	10.17
		95% KM (t) UCL	135
Assuming Gamma Distribution		95% KM (z) UCL	133.8
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	134.1
Minimum	96.38	95% KM (bootstrap t) UCL	140.1
Maximum	213.7	95% KM (BCA) UCL	156.2
Mean	143.4	95% KM (Percentile Bootstrap) UCL	150.3
Median	141.7	95% KM (Chebyshev) UCL	161.4
SD	28.59	97.5% KM (Chebyshev) UCL	180.6
k star	22.24	99% KM (Chebyshev) UCL	218.3
Theta star	6.448		
Nu star	667.3	Potential UCLs to Use	
AppChi2	608.4	95% KM (t) UCL	135
95% Gamma Approximate UCL	157.3	95% KM (Percentile Bootstrap) UCL	150.3
95% Adjusted Gamma UCL	159.1		

Note: DL/2 is not a recommended method.

Mercury	IethylmercuMethylmerc	2,4'-DDD	2,4'-DDE	2,4'-DDT	4,4'-DDD	4,4'-DDE	4,4'-DDT	DDTR	D_DDTR	HCB	D_HCB
0.31	2.98 1	90.7	312	92.4	184	1240	290	2209.1	1	12.4	1
0.43	1.8 1	6.7	6.8	1.9	25	26	20.7	87.1	1	1.2	1
0.78	4.79 1	4	4.2	1.7	10.2	16.6	11.8	48.5	1	3.5	1
0.12	2.21 1	0.44	0.44	0.44	1.3	1.1	7.4	11.12	1	1	0
0.38	2.57 1	0.5	0.5	0.5	1	1	1	4.5	0	1.1	1
0.35	1.66 1	277	606	79.2	248	913	107	2230.2	1	5.7	1
0.37	0.367 1	71.6	54.1	3.3	104	98.9	3.3	335.2	1	0.76	0
0.36	0.767 1	6.2	4.6	0.65	19.6	10.3	52.6	93.95	1	275	1
0.2	7.03 1	9.6	8.3	11.5	29.7	18.6	138	215.7	1	135	1
0.14	8.22 1	5.2	7	4.2	14.3	19	5.6	55.3	1		
0.22	0.442 1	36.3	31.1	5.7	83.5	74	64.1	294.7	1		
0.93	0.176 0	1	3.4	1	3.1	6.6	1	16.1	1		
0.061		1	0.55	0.55	0.55	0.55	0.55	3.75	1		
0.11		4.9	7.7	0.435	7.8	14.6	0.435	35.87	1		
0.14		0.68	0.85	0.38	1.3	0.95	1.8	5.96	1		
0.082											
2.4											
2.1											
2.8											
3.6											
0.36											
0.14											
0.19											
0.17											
0.69											
8.9											
1.6											
0.2											
0.47											
0.16											
1.1											
0.15											
0.84											
0.13											
1											
0.42											
1.6											
1.7											
2.5											

Basin Surfacewater HCB UCL 1991 and 1994

Sample ID	Date	Detected	HCB (ng/L)
OWG0101-0694	6/27/1994	1	40.2
OWG0107-0894	8/18/1994	1	24.7
OWG0202-0694	6/27/1994	1	44.2
OWG0208-0894	8/18/1994	1	28.9
OWG0303-0694	6/27/1994	1	41.2
OWG0309-0894	8/18/1994	1	21.5
WGC901-0891	8/29/1991	0	10000
WGC902-0891	8/29/1991	0	10000
WGF201-0891	8/29/1991	0	10000
WGG601-0891	8/30/1991	0	10000
WGG602-0891	8/30/1991	0	10000
WGH501-0891	8/30/1991	0	10000
WGH502-0891	8/30/1991	0	10000
WGH901-0891	8/29/1991	0	10000
WGH902-0891	8/29/1991	0	10000

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 3/22/10

CHECKED BY/DATE: HEF 4/14/10

1991-94 SW HCB

General Statistics

Number of Valid Data	15	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	900.00%
		Percent Non-Detects	60.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.15E+01	Minimum Detected	3.068
Maximum Detected	4.42E+01	Maximum Detected	3.789
Mean of Detected	3.35E+01	Mean of Detected	3.473
SD of Detected	9.605	SD of Detected	0.302
Minimum Non-Detect	10000	Minimum Non-Detect	9.21
Maximum Non-Detect	10000	Maximum Non-Detect	9.21

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.886	Shapiro Wilk Test Statistic	0.888
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3013	Mean	6.5
SD	2519	SD	2.564
95% DL/2 (t) UCL	4159	95% H-Stat (DL/2) UCL	876047

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	3.473
		SD in Log Scale	2.94E-01
		Mean in Original Scale	3.36E+01
		SD in Original Scale	9.67E+00
		95% Percentile Bootstrap UCL	3.75E+01
		95% BCA Bootstrap UCL	37.5

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	6.99E+00	Data appear Normal at 5% Significance Level	
Theta Star	4.783		
nu star	83.92		
A-D Test Statistic	0.441	Nonparametric Statistics	
5% A-D Critical Value	0.698	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.698	Mean	3.35E+01
5% K-S Critical Value	0.332	SD	8.77E+00
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	3.92E+00
		95% KM (t) UCL	4.04E+01
Assuming Gamma Distribution		95% KM (z) UCL	3.99E+01
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	4.08E+01
Minimum	1.55E+01	95% KM (bootstrap t) UCL	4.18E+01
Maximum	4.49E+01	95% KM (BCA) UCL	3.95E+01
Mean	3.33E+01	95% KM (Percentile Bootstrap) UCL	3.96E+01
Median	3.50E+01	95% KM (Chebyshev) UCL	5.05E+01
SD	9.338	97.5% KM (Chebyshev) UCL	5.79E+01
k star	9.48E+00	99% KM (Chebyshev) UCL	72.46
Theta star	3.51		
Nu star	284.5	Potential UCLs to Use	
AppChi2	2.46E+02	95% KM (t) UCL	4.04E+01
95% Gamma Approximate UCL	3.84E+01	95% KM (Percentile Bootstrap) UCL	39.63
95% Adjusted Gamma UCL	39.12		

Note: DL/2 is not a recommended method.

Basin Largemouth Bass Filet Mercury UCL for 2008

Sample ID	Date	Detect	Mercury (mg/kg)
MCI-0016-08F-NE	10/15/2008	1	2.1
MCI-0017-08F-NE	10/15/2008	1	2.5
MCI-0018-08F-NE	10/15/2008	1	2.5
MCI-0019-08F-NE	10/15/2008	1	2.2
MCI-0020-08F-NE	10/15/2008	1	2.4
MCI-0011-08F-NW	10/15/2008	1	2.4
MCI-0012-08F-NW	10/15/2008	1	2.5
MCI-0013-08F-NW	10/15/2008	1	2.7
MCI-0014-08F-NW	10/15/2008	1	2.2
MCI-0015-08F-NW	10/15/2008	1	2.9
MCI-0006-08F-SE	10/15/2008	1	2.3
MCI-0007-08F-SE	10/15/2008	1	1.6
MCI-0008-08F-SE	10/15/2008	1	2
MCI-0009-08F-SE	10/15/2008	1	2.1
MCI-0010-08F-SE	10/15/2008	1	2.2
MCI-0001-08F-SW	10/15/2008	1	2
MCI-0002-08F-SW	10/15/2008	1	2.5
MCI-0003-08F-SW	10/15/2008	1	3
MCI-0004-08F-SW	10/15/2008	1	2.7
MCI-0005-08F-SW	10/15/2008	1	2

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 3/25/10

CHECKED BY/DATE: HEF 3/29/10

2008 LMB Filet Mercury

General Statistics			
Number of Valid Observations	20	Number of Distinct Observations	10
Raw Statistics		Log-transformed Statistics	
Minimum	1.6	Minimum of Log Data	0.47
Maximum	3	Maximum of Log Data	1.099
Mean	2.34	Mean of log Data	0.84
Median	2.35	SD of log Data	0.148
SD	0.339		
Coefficient of Variation	0.145		
Skewness	0.0212		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.974	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.471	95% H-UCL	2.486
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.68
95% Adjusted-CLT UCL	2.465	97.5% Chebyshev (MVUE) UCL	2.827
95% Modified-t UCL	2.471	99% Chebyshev (MVUE) UCL	3.116
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	41.54	Data appear Normal at 5% Significance Level	
Theta Star	0.0563		
MLE of Mean	2.34		
MLE of Standard Deviation	0.363		
nu star	1662		
Approximate Chi Square Value (.05)	1568	Nonparametric Statistics	
Adjusted Level of Significance	0.038	95% CLT UCL	2.465
Adjusted Chi Square Value	1561	95% Jackknife UCL	2.471
		95% Standard Bootstrap UCL	2.461
Anderson-Darling Test Statistic	0.271	95% Bootstrap-t UCL	2.474
Anderson-Darling 5% Critical Value	0.739	95% Hall's Bootstrap UCL	2.469
Kolmogorov-Smirnov Test Statistic	0.104	95% Percentile Bootstrap UCL	2.46
Kolmogorov-Smirnov 5% Critical Value	0.193	95% BCA Bootstrap UCL	2.455
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2.671
		97.5% Chebyshev(Mean, Sd) UCL	2.814
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.095
95% Approximate Gamma UCL	2.48		
95% Adjusted Gamma UCL	2.491		
Potential UCL to Use		Use 95% Student's-t UCL	2.471

Basin Largemouth Bass Filet HCB for 2008

Sample ID	Date	Detect	HCB (mg/kg)
MCI-0016-08F-NE	10/15/2008	1	0.0496
MCI-0017-08F-NE	10/15/2008	1	0.037
MCI-0018-08F-NE	10/15/2008	1	0.065
MCI-0019-08F-NE	10/15/2008	1	0.107
MCI-0020-08F-NE	10/15/2008	1	0.048
MCI-0011-08F-NW	10/15/2008	1	0.0526
MCI-0012-08F-NW	10/15/2008	1	0.0663
MCI-0013-08F-NW	10/15/2008	1	0.0445
MCI-0014-08F-NW	10/15/2008	1	0.0539
MCI-0015-08F-NW	10/15/2008	1	0.0572
MCI-0006-08F-SE	10/15/2008	1	0.0548
MCI-0007-08F-SE	10/15/2008	1	0.135
MCI-0008-08F-SE	10/15/2008	1	0.0662
MCI-0009-08F-SE	10/15/2008	1	0.0652
MCI-0010-08F-SE	10/15/2008	1	0.0362
MCI-0001-08F-SW	10/15/2008	1	0.0598
MCI-0002-08F-SW	10/15/2008	1	0.103
MCI-0003-08F-SW	10/15/2008	1	0.0924
MCI-0004-08F-SW	10/15/2008	1	0.0736
MCI-0005-08F-SW	10/15/2008	1	0.0724

Detected: 1=detected, 0 = not detected

HCB-Hexachlorobenzene

PREPARED BY/DATE: EJS 3/25/10

CHECKED BY/DATE: HEF 3/29/10

LMB HCB 2008

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	20

Raw Statistics		Log-transformed Statistics	
Minimum	0.0362	Minimum of Log Data	-3.319
Maximum	0.135	Maximum of Log Data	-2.002
Mean	0.067	Mean of log Data	-2.762
Median	0.0624	SD of log Data	0.343
SD	0.0251		
Coefficient of Variation	0.374		
Skewness	1.315		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.883	Shapiro Wilk Test Statistic	0.964
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.0767	95% H-UCL	0.0777
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0895
95% Adjusted-CLT UCL	0.078	97.5% Chebyshev (MVUE) UCL	0.0993
95% Modified-t UCL	0.077	99% Chebyshev (MVUE) UCL	0.119

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.443	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.009		
MLE of Mean	0.067		
MLE of Standard Deviation	0.0246		
nu star	297.7		
Approximate Chi Square Value (.05)	258.7	Nonparametric Statistics	
Adjusted Level of Significance	0.038	95% CLT UCL	0.0762
Adjusted Chi Square Value	255.9	95% Jackknife UCL	0.0767
		95% Standard Bootstrap UCL	0.076
Anderson-Darling Test Statistic	0.462	95% Bootstrap-t UCL	0.0797
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	0.0793
Kolmogorov-Smirnov Test Statistic	0.167	95% Percentile Bootstrap UCL	0.0766
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	0.0783
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.0914
		97.5% Chebyshev(Mean, Sd) UCL	0.102
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.123
95% Approximate Gamma UCL	0.0771		
95% Adjusted Gamma UCL	0.0779		

Potential UCL to Use			
		Use 95% Approximate Gamma UCL	0.0771

Basin Largemouth Bass Filet DDTR with Non-detect Isomers Being Equal to Half the PQL for 2001

Sample ID	Date	Detect	DDTR (mg/kg)
BF-B10-100201-01	10/1/2001	1	0.075
BF-B1-100101-01	10/1/2001	0	0.05
BF-B2-100101-01	10/1/2001	1	0.175
BF-B3-100101-01	10/1/2001	1	0.173
BF-B4-100101-01	10/1/2001	1	0.25
BF-B5-100201-01	10/1/2001	1	0.423
BF-B6-100201-01	10/2/2001	1	0.598

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 3/25/10

CHECKED BY/DATE: HEF 4/1/10

LMB 2001 DDTR ND/2
General UCL Statistics for Data Sets with Non-Detects
Confidence Coefficient 95%
Number of Bootstrap Operations 2000

DDTR

General Statistics

Number of Valid Data	7	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	1
		Percent Non-Detects	14.29%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.075	Minimum Detected	-2.59
Maximum Detected	0.598	Maximum Detected	-0.514
Mean of Detected	0.282	Mean of Detected	-1.475
SD of Detected	0.193	SD of Detected	0.735
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	0.05	Maximum Non-Detect	-2.996

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.913	Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.246	Mean	-1.791
SD	0.202	SD	1.073
95% DL/2 (t) UCL	0.394	95% H-Stat (DL/2) UCL	1.381
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.233	Mean in Log Scale	-1.739
SD	0.206	SD in Log Scale	0.968
95% MLE (t) UCL	0.385	Mean in Original Scale	0.247
95% MLE (Tiku) UCL	0.385	SD in Original Scale	0.2
		95% Percentile Bootstrap UCL	0.366
		95% BCA Bootstrap UCL	0.388

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.378	Data appear Normal at 5% Significance Level	
Theta Star	0.205		
nu star	16.54		
A-D Test Statistic	0.238	Nonparametric Statistics	
5% A-D Critical Value	0.703	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.703	Mean	0.253
5% K-S Critical Value	0.335	SD	0.179
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.074
		95% KM (t) UCL	0.397
Assuming Gamma Distribution		95% KM (z) UCL	0.374
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.394
Minimum	0.00789	95% KM (bootstrap t) UCL	0.551
Maximum	0.598	95% KM (BCA) UCL	0.388
Mean	0.243	95% KM (Percentile Bootstrap) UCL	0.377
Median	0.175	95% KM (Chebyshev) UCL	0.575
SD	0.205	97.5% KM (Chebyshev) UCL	0.715
k star	0.7	99% KM (Chebyshev) UCL	0.989
Theta star	0.347		
Nu star	9.802	**Potential UCLs to Use**	
AppChi2	3.818	**95% KM (t) UCL**	**0.397**
95% Gamma Approximate UCL	0.624	95% KM (Percentile Bootstrap) UCL	0.377
95% Adjusted Gamma UCL	0.858		

Note: DL/2 is not a recommended method.

Basin Surface Water-Combined Total MethylmercuryUCL 2008 and 2009 at 6 ft. NAVD88

Sample ID	Date	Detected	Methylmercury (ng/L)	Sample Depth (ft)
OU2R-SW-101DS-08	6/3/2008	1	4.84	1
OU2R-SW-101DS-09	6/3/2009	1	0.825	2.2
OU2R-SW-101DD-09	6/3/2009	1	0.788	8.8
OU2R-SW-101DD-08	6/3/2008	1	5.53	4.5
OU2B-SW-105DS-08	6/3/2008	1	2.28	1
OU2B-SW-205DS-08	6/3/2008	1	2.36	1
OU2B-SW-301DS-08	6/3/2008	1	3.11	0.80
OU2B-SW-303DS-08	6/3/2008	1	1.91	1
OU2B-SW-304DS-08	6/3/2008	1	2.38	1
OU2B-SW-101DS-08	6/4/2008	1	3.08	2
OU2B-SW-103DS-08	6/4/2008	1	2.49	3
OU2B-SW-201DS-08	6/4/2008	1	2.57	1
OU2B-SW-203DS-08	6/4/2008	1	2.71	2
OU2B-SW-301DS-09	6/3/2009	1	0.786	2
OU2B-SW-201DS-09	6/3/2009	1	0.748	2.20
OU2B-SW-303DS-09	6/3/2009	1	0.918	2
OU2B-SW-304DS-09	6/3/2009	1	0.791	2
OU2B-SW-DHDS-09	6/4/2009	1	0.735	9
OU2B-SW-103DS-09	6/4/2009	1	0.734	4
OU2B-SW-101DS-09	6/4/2009	1	0.782	3.5
OU2B-SW-203DS-09	6/4/2009	1	0.767	3
OU2B-SW-105DS-09	6/8/2009	1	1.19	1.20
OU2B-SW-205DS-09	6/8/2009	1	0.87	1
OU2B-SW-105DD-08	6/3/2008	1	2.45	4
OU2B-SW-205DD-08	6/3/2008	1	3.1	4
OU2B-SW-301DD-08	6/3/2008	1	4.03	3.20
OU2B-SW-303DD-08	6/3/2008	1	3.45	4
OU2B-SW-304DD-08	6/3/2008	1	2.69	4
OU2B-SW-101DD-08	6/4/2008	1	3.01	9
OU2B-SW-103DD-08	6/4/2008	1	2.91	10
OU2B-SW-201DD-08	6/4/2008	1	3.16	4
OU2B-SW-203DD-08	6/4/2008	1	2.38	7
OU2B-SW-301DD-09	6/3/2009	1	0.714	8
OU2B-SW-201DD-09	6/3/2009	1	0.756	8.8
OU2B-SW-303DD-09	6/3/2009	1	0.652	8
OU2B-SW-304DD-09	6/3/2009	1	0.833	8
OU2B-SW-DHDD-09	6/4/2009	1	1.08	36
OU2B-SW-103DD-09	6/4/2009	1	0.613	15
OU2B-SW-101DD-09	6/4/2009	1	0.693	13
OU2B-SW-203DD-09	6/4/2009	1	0.702	12
OU2B-SW-105DD-09	6/8/2009	1	1.71	4.8
OU2B-SW-205DD-09	6/8/2009	1	1.06	4

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 5/6/10
CHECKED BY/DATE: RMP 5/6/10

08-09 TMeHg combined

General Statistics

Number of Valid Observations	42	Number of Distinct Observations	41

Raw Statistics		Log-transformed Statistics	
Minimum	0.613	Minimum of Log Data	-0.489
Maximum	5.53	Maximum of Log Data	1.71
Mean	1.885	Mean of log Data	0.412
Median	1.45	SD of log Data	0.681
SD	1.263		
Coefficient of Variation	0.67		
Skewness	0.924		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.794	Shapiro Wilk Test Statistic	0.797
Shapiro Wilk Critical Value	0.942	Shapiro Wilk Critical Value	0.942
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.213	95% H-UCL	2.364
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.83
95% Adjusted-CLT UCL	2.236	97.5% Chebyshev (MVUE) UCL	3.236
95% Modified-t UCL	2.218	99% Chebyshev (MVUE) UCL	4.035

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.246	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.839		
MLE of Mean	1.885		
MLE of Standard Deviation	1.258		
nu star	188.7		
Approximate Chi Square Value (.05)	157.9	Nonparametric Statistics	
Adjusted Level of Significance	0.0443	95% CLT UCL	2.206
Adjusted Chi Square Value	156.9	95% Jackknife UCL	2.213
		95% Standard Bootstrap UCL	2.196
Anderson-Darling Test Statistic	2.274	95% Bootstrap-t UCL	2.239
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL	2.241
Kolmogorov-Smirnov Test Statistic	0.208	95% Percentile Bootstrap UCL	2.204
Kolmogorov-Smirnov 5% Critical Value	0.138	95% BCA Bootstrap UCL	2.253
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2.735
		97.5% Chebyshev(Mean, Sd) UCL	3.103
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.825
95% Approximate Gamma UCL	2.253		
95% Adjusted Gamma UCL	2.267		

Potential UCL to Use			
		Use 95% Chebyshev (Mean, Sd) UCL	2.735

Basin Surface Water-Deep and Shallow Total MercuryUCL 2008 and 2009 at 6 ft. NAVD88

Sample ID	Date	Detected	Mercury (ng/L)	Sample Depth (ft)
OU2R-SW-101DD-08	6/3/2008	1	83.4	4.5
OU2R-SW-101DD-09	6/3/2009	1	13.9	8.8
OU2R-SW-101DS-08	6/3/2008	1	44.3	1
OU2R-SW-101DS-09	6/3/2009	1	7.31	2.2
OU2B-SW-105DS-08	6/3/2008	1	91.4	1
OU2B-SW-205DS-08	6/3/2008	1	94.2	1
OU2B-SW-301DS-08	6/3/2008	1	181	0.8
OU2B-SW-303DS-08	6/3/2008	1	131	1
OU2B-SW-304DS-08	6/3/2008	1	83.8	1
OU2B-SW-101DS-08	6/4/2008	1	137	2
OU2B-SW-103DS-08	6/4/2008	1	264	3
OU2B-SW-201DS-08	6/4/2008	1	180	1
OU2B-SW-203DS-08	6/4/2008	1	360	2
OU2B-SW-301DS-09	6/3/2009	1	9.61	2
OU2B-SW-201DS-09	6/3/2009	1	8.7	2.2
OU2B-SW-303DS-09	6/3/2009	1	11.4	2
OU2B-SW-304DS-09	6/3/2009	1	12.1	2
OU2B-SW-DHDS-09	6/4/2009	1	34.7	9
OU2B-SW-103DS-09	6/4/2009	1	12.8	4
OU2B-SW-101DS-09	6/4/2009	1	10.6	3.5
OU2B-SW-203DS-09	6/4/2009	1	11.9	3
OU2B-SW-105DS-09	6/8/2009	1	87.9	1.2
OU2B-SW-205DS-09	6/8/2009	1	56.3	1
OU2B-SW-101DD-08	6/4/2008	1	12.1	9
OU2B-SW-101DD-09	6/4/2009	1	14.2	13
OU2B-SW-103DD-08	6/4/2008	1	10.9	10
OU2B-SW-103DD-09	6/4/2009	1	12.4	15
OU2B-SW-105DD-08	6/3/2008	1	12.1	4
OU2B-SW-105DD-09	6/8/2009	1	12.9	4.8
OU2B-SW-201DD-08	6/4/2008	1	19	4
OU2B-SW-201DD-09	6/3/2009	1	12.7	8.8
OU2B-SW-203DD-08	6/4/2008	1	15.8	7
OU2B-SW-203DD-09	6/4/2009	1	14.7	12
OU2B-SW-205DD-08	6/3/2008	1	11.1	4.0
OU2B-SW-205DD-09	6/8/2009	1	8.24	4
OU2B-SW-301DD-08	6/3/2008	1	20.9	3.2
OU2B-SW-301DD-09	6/3/2009	1	4.44	8
OU2B-SW-303DD-08	6/3/2008	1	24.9	4
OU2B-SW-303DD-09	6/3/2009	1	6.93	8
OU2B-SW-304DD-08	6/3/2008	1	14.1	4
OU2B-SW-304DD-09	6/3/2009	1	5.79	8.0
OU2B-SW-DHDD-09	6/4/2009	1	11.7	36

Detected: 1=detected, 0 = not detected

PREPARED BY/DATE: EJS 5/6/10
CHECKED BY/DATE: RMP 5/6/10

THg combined 08-09

General Statistics			
Number of Valid Observations	42	Number of Distinct Observations	40

Raw Statistics		Log-transformed Statistics	
Minimum	4.44	Minimum of Log Data	1.491
Maximum	360	Maximum of Log Data	5.886
Mean	51.72	Mean of log Data	3.187
Median	14	SD of log Data	1.163
SD	76.19		
Coefficient of Variation	1.473		
Skewness	2.473		

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.623	Shapiro Wilk Test Statistic	0.828
Shapiro Wilk Critical Value	0.942	Shapiro Wilk Critical Value	0.942
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	71.51	95% H-UCL	75.64
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	90.54
95% Adjusted-CLT UCL	75.85	97.5% Chebyshev (MVUE) UCL	109.6
95% Modified-t UCL	72.25	99% Chebyshev (MVUE) UCL	147.1
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.744	Data do not follow a Discernable Distribution (0.05)	
Theta Star	69.49		
MLE of Mean	51.72		
MLE of Standard Deviation	59.95		
nu star	62.51		
Approximate Chi Square Value (.05)	45.33	Nonparametric Statistics	
Adjusted Level of Significance	0.0443	95% CLT UCL	71.06
Adjusted Chi Square Value	44.81	95% Jackknife UCL	71.51
		95% Standard Bootstrap UCL	70.73
Anderson-Darling Test Statistic	3.515	95% Bootstrap-t UCL	81.84
Anderson-Darling 5% Critical Value	0.788	95% Hall's Bootstrap UCL	79.44
Kolmogorov-Smirnov Test Statistic	0.278	95% Percentile Bootstrap UCL	72.73
Kolmogorov-Smirnov 5% Critical Value	0.142	95% BCA Bootstrap UCL	75.8
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	103
		97.5% Chebyshev(Mean, Sd) UCL	125.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	168.7
95% Approximate Gamma UCL	71.33		
95% Adjusted Gamma UCL	72.16		

Potential UCL to Use			
		Use 99% Chebyshev (Mean, Sd) UCL	168.7