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COMBUSTION HUMAN HEALTH RISK ASSESSMENT
FOR
WESTVACO CORPORATION
DERIDDER, LOUISIANA

Prepared by

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DRAFT

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FOREWORD

On May 18, 1993, the United States Environmental Protection Agency (EPA) announced a series of steps that the Agency would undertake, first, to achieve reductions in the amount of hazardous waste generated in this country and, second, to ensure the safety and reliability of hazardous waste combustion in incinerators, boilers, and industrial furnaces. With this announcement, EPA released its Draft Hazardous Waste Minimization and Combustion Strategy. Eighteen months later, EPA's released its Final Strategy which solidified the Agency's policy on "how best to assure the public of safe operation of hazardous waste combustion facilities." In short, EPA's Final Strategy specifically recognized the multi-pathway risk assessment as a valuable tool for evaluating and ensuring protection of human health and the environment in the permitting of hazardous waste combustion facilities.

In keeping with EPA's Final Strategy, Region 6 believes that those combustion facilities which are in close proximity to population centers can be evaluated by a multi-pathway risk assessment to ensure that permit limits are protective of human health. Furthermore, EPA Region 6 believes that multi-pathway risk assessments should consider the specific nature of process operations and the type of combustion units and air pollution control equipment utilized at each facility in order to be representative of actual facility operations. Therefore, although certain provisions of the Resource Conservation and Recovery Act (RCRA) program have since been delegated to the States, EPA Region 6 is committed to reviewing facilities on a site specific basis to evaluate the protectiveness of permits for combustion operations.

EPA Region 6, in partnership with the Louisiana Department of Environmental Quality (LDEQ), requested more comprehensive testing for boiler and industrial furnace (BIF) combustion facilities in the State of Louisiana as part of the regulatory trial burn testing conducted during early 1997 through 1998. Although the science of combustion risk assessments was still under development, BIF facilities agreed to conduct more comprehensive testing prior to EPA's completion of the revised national guidance documents for combustion emissions testing and risk assessment protocols. Based upon the nature of their operations, EPA allowed BIF facilities to demonstrate their performance at "normal operating conditions" during the trial burn by adding a separate "risk burn" test condition. The information from the risk burn was collected with the intent of EPA conducting facility-specific human health risk assessments.

In July 1998, EPA published its **Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-001 A, B, and C), commonly referred to as the HHRAP. In August 1998, EPA issued its **Guidance on Collection of Emissions Data to support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-002). In the following year, EPA staff worked through several implementation issues in applying these guidance documents and in July 1999, EPA issued an **Errata to the HHRAP** (EPA Memo, July 1999) which addressed issues specific to conducting human health risk assessments. EPA utilized the above listed guidance documents, along with facility specific information, to complete this human health risk assessment.

This risk assessment report documents the Agency's effort in ensuring protective permit limits and ensuring that normal combustion facility operations do not pose unacceptable risks to surrounding communities.

EXECUTIVE SUMMARY

The Westvaco Corporation ("Westvaco") applied to the LDEQ for a RCRA permit to burn hazardous waste in two BIF units at their facility located in DeRidder, Beauregard Parish, Louisiana ("DeRidder facility"). In order to assist LDEQ in identifying any additional permit conditions which might be necessary to ensure protection of human health, EPA has conducted this risk assessment. This assessment evaluates those potential emissions from the one RCRA point source at Westvaco's DeRidder facility, a common stack for Boilers No. 1, No. 2, No. 3, and No. 4 (Boiler No. 1 is closed and Boiler No. 4 is a non-hazardous waste boiler), as well as potential fugitive emissions associated with operation of the RCRA combustion units.

Data in lieu of Trial/Risk Burn Testing was proposed for use in the risk assessment by Westvaco in their "BIF Data Package" submittal, dated December 17, 1996. The data for dioxin/furans, particulate matter, particle size distribution, metals, chloride, and sulfur were accepted by EPA in correspondence dated January 31, 1997. All other data necessary for risk assessment purposes were collected during the Risk Burn Testing event and subsequent Certification of Compliance (COC) testing events. Upon comparison of the various data sets, EPA noted that the emission levels for dioxin and furan congeners demonstrated during the 2001 COC testing event were much higher than the congener emission levels demonstrated during the 1995 and 1998 COC testing events. Many variables may have contributed to this difference in results and are discussed in appropriate sections of this report along with their potential impact. In summary, the 1995/1998 data, corresponding to risk burn operating conditions, did not result in risk estimates above EPA levels of concern. However, the risk estimates associated with the 2001 COC operating conditions and emission rate levels do exceed EPA levels of concern.

EPA's risk assessment evaluates not only representative operating data, but also those risk-based permit limits that can be incorporated into the RCRA permit in order to *supplement* regulatory maximum allowable limits and ensure protection of human health over the long term. Specifically for Westvaco, EPA recommends risk-based waste feed limits for metals (necessitated by the evaluation of Tier 1 regulatory limits for metals). Based upon the variance in operating conditions and results from the 2001 COC test event, EPA also recommends a risk-based emission rate limit for incorporation into the RCRA permit of **4.24E-10** *grams per second* ***TCDDE*** (2,3,7,8-tetrachlorinated dibenzo-p-dioxin equivalencies). Recommended permit limits are provided in Executive Summary Tables ES-1 and ES-2. The risk assessment indicates that "normal operations" of the BIF hazardous waste combustion units at the DeRidder facility should not adversely impact human health, with incorporation of EPA's recommended permit limits and operating conditions.

Table ES-1: Waste Feed Rates (g/s)

Metals of Concern	Recommended Risk-Based[1] Permit Limit Annual Average	"Normal Operations" Data in Lieu of Risk Burn Testing (BIF Data Package [2])
Antimony	4.17E-01	ND [3] = 1.63E-03
Arsenic	3.33E-02	ND [3] = 1.63E-03
Barium	7.22E-01	6.53E-04
Beryllium	6.11E-03	ND [3] = 3.25E-04
Cadmium	1.61E-03	ND [3] = 3.25E-04
Chromium (Total)	1.19E-03 [4]	ND [3] = 3.25E-04
Lead	1.28E+00	9.78E-04
Mercury (Total)	2.60E-06 [5]	ND [3] = 6.19E-05
Nickel	5.58E-02	5.58E-05 [6]
Silver	8.34E-02	ND [3] = 3.25E-04
Selenium	1.39E-03	1.39E-06 [6]
Thallium	8.34E-02	ND [3] = 1.63E-03

NOTES:

1. Recommended RCRA Permit Limits are based upon an annual average stack gas temperature of 459 K and an annual average stack gas flow rate of 58 m^3/s as demonstrated during the risk burn and alternative COC sampling events. The recommended limits were also evaluated at those conditions demonstrated during the 2001 COC testing event (61 m^3/s @ 439 K) and found to still be protective.

2. Metals Emissions *Data in Lieu of* Trial/Risk Burn Testing was submitted by Westvaco in their " BIF Data Package", dated December 17, 1996, Table 5.

3. **ND** means that the metal was ***not detected*** in the waste feed; the detection limit was used to calculate the emission rate shown.

4. Recommended RCRA Permit Limit for Chromium is actually based upon the assumption that Hexavalent Chromium is equal to 100% of the Total Chromium measured in the waste feed.

5. Mercury is not believed to be present in the waste feed, but the analytical method used in the risk burn did not provide low enough detection limits for comparison with the Recommended RCRA Permit Limit. The Risk-Based Annual Average RCRA Permit Limit for mercury is based upon a reliable detection limit for mercury of 0.01 ppm and the volumetric flow rate demonstrated during the Risk Burn.

6. Nickel and Selenium were estimated from fly ash sampling, estimates provided in the " BIF Data Package" as data in lieu of testing.

Table ES-2: Comparison of TCDDE Emission Rates (g/s)

Source of Data/Limit	*TCDDE (g/s)*	*Comments*
Recommended Risk-Based Permit Limit (Long-Term Average Value[1])	**4.24E-10**	**Based upon an annual average stack gas temperature of 439 K and an annual average stack gas flow rate of 61 m^3/s as demonstrated during the 2001 COC. Compliance with this level was demonstrated during the 1998 COC testing event.**
December 2001 COC Testing (2002 COC Form)	**4.24E-09**	**Significant increase in value from historical data is assumed attributable to operational testing scheme changes (e.g., configuration of boilers tested, combination of waste feed streams, exit temp, etc.).**
June 1998 COC Testing (1998 COC Form)	**4.04E-10**	**Improved analytical capabilities from the 1995 COC testing event most probably account for the lower value obtained here in comparison to the 1995 test. Operational conditions were sufficiently similar.**
1995 COC Testing ("Data in Lieu of" Risk Burn Testing; 1996 BIF Data Package)	**7.584E-10**	**Congener-specific data not evaluated due to the older analytical method used for this testing event. This calculated value was taken from Table 1 of the BIF Data Package for comparative analysis only.**

NOTE:

1. A 3-year initial sampling frequency is recommended in order to effectively demonstrate compliance with the Risk-Based Permit Limit. Due to the long term nature of the risk assessment, an annual average emission rate value is not practical. Sampling every 3 years will provide data for determining a 9 year average value. If compliance is demonstrated for the first nine years, the sampling frequency may be lessened to every 5 years.

EPA back-calculated the risk-based annual average waste feed limits listed in Table ES-1 from the Tier I limit for each metal of concern and then *used the calculated limits in the risk assessment* in order to show permit protectiveness over the long term. For those metals where the Tier I limit did not result in risks above EPA levels of concern, EPA merely set the risk based limit at that tier limit evaluated in the risk assessment. For those metals not having regulatory maximum limits specified by the regulations (i.e., nickel and selenium), EPA calculated risk-based limits in consideration of the available data-in-lieu-of BIF Data Package as appropriate. Therefore, EPA recommends that LDEQ incorporate the annual average metal feed rate limits listed in Table ES-1 into the RCRA permit.

EPA calculated the risk-based TCDDE emission rate limit shown in Table ES-2 from evaluation of the individual dioxin and furan congener emission rates and assumed that the mix of individual congeners would not significantly change unless operations change. Given the need for a risk-based permit limit, EPA took into account the possible change in TCDD slope factor anticipated within the next year and set the recommended TCDDE limit at the corresponding congener levels necessary to not exceed a one in one hundred thousand (1E-5) carcinogenic risk level. This TCDDE level was compared with the most stringent dioxin and furan Hazardous Waste Combustion Maximum Achievable Control Technology (MACT) Interim Standard currently promulgated for incinerator systems, cement kilns, and light weight aggregate kilns (0.2 ng/dscm) since a MACT standard has not yet been promulgated for BIF units. However, the MACT Interim Standards are concentration-based and when converted to a mass basis for the Westvaco stack, the dioxin limit was higher than the risk-based limit being recommended. Since the calculated risk-based limit was virtually the same level demonstrated during the 1998 COC testing, and the original risk analysis did not result in TCDDE risks above EPA levels of concern, the *calculated TCDDE limit will ensure* permit protectiveness over the long term. Therefore, EPA recommends that LDEQ incorporate the TCDDE emission rate limit listed in Table ES-2 into the RCRA permit.

EPA evaluated the most current information available to estimate potential impacts to human health, both directly via inhalation and incidental soil ingestion, and indirectly via modeled deposition and uptake through the food chain. Ingestion of drinking water, via surface water intakes, was not considered since all drinking water comes from groundwater sources. Emissions data collected as part of the risk burn and subsequent data collected during Certification of Compliance (COC) testing events, operational data specific to the DeRidder facility, and site-specific information based upon the facility's location, were evaluated and considered in making assumptions and in predicting risks associated with long term operations. The risk estimates provided in this risk assessment are conservative in nature and represent possible future risks, based upon those operating conditions evaluated for issuance of a final RCRA combustion permit. If operations change significantly, or land use changes occur which would result in more frequent potential exposure to receptors, risks from facility operations may need to be reevaluated.

BACKGROUND INFORMATION

This risk assessment report presents a brief description of Westvaco's DeRidder facility and the emission sources evaluated, the air modeling effort conducted, the risk modeling effort conducted, and EPA's evaluation of risk estimates based upon the information presented. EPA utilized the Industrial Source Complex Short Term Version 3 Program (EPA, ISCST3 software) for air modeling and the Industrial Risk Assessment Program - Health (Lakes Environmental, IRAP-h View software Version 1.7) for risk modeling. EPA utilized the ArcView Program (Environmental Systems Research Institute, software Version 3.1), for desktop Geographical Information Systems (GIS), for all mapping efforts. All available information used to assess risks attributable to the DeRidder facility can be found in electronic format, converted mainly to pdf files, in appendices enclosed via compact disc with this risk assessment report as follows:

Appendix A: Air Modeling
- Audit Files
- Input and Output Air Files from the ISCT3 Model
- Plot Files
- ISC File (file built for import into the IRAP-h Project File)

Appendix B: Spreadsheets
- Surface Roughness Calculation
- Source Emission Rate Calculations
- Transport & Fate Parameters
- Total Organic Emissions (TOE) Factor

Appendix C: Mapping
- Background Maps
- Land Use Shape Files

Appendix D: Risk Modeling
- Source Information from the IRAP-h Project File
- Receptor Information from the IRAP-h Project File
- Risk Summary Information from the IRAP-h Project File

Appendix E: IRAP-h View Project Files
- Readme File
- Metals.ihb - Metals Only Run, Tier I limits for Westvaco facility evaluated
- Westvaco Original Run.ihb - All Chemicals Run, with metals adjusted to risk-based permit limits
- Metals-Compare.ihb - Revised air model incorporated to evaluate 2002 COC conditions for risk-based metal permit limits;
- Westvaco Comparison Run.ihb - Same as Metals-Compare.ihb, but metals were replaced with dioxin and furan congener emission rates reported in 2002 COC form. This run

necessary for the supplemental dioxin/furan risk evaluation.

Since The HHRAP provides generic discussions of the uncertainties associated with each major component of the risk assessment process, this report only discusses those uncertainties particular to the site specific results evaluated for Westvaco's DeRidder facility. References are provided at the end of this document.

Facility and Source Information

The DeRidder facility is located along Louisiana State Highway 2 near DeRidder, Beauregard Parish, Louisiana. The facility is bordered on the north and the east by forested land; on the south by Palmetto Creek; and on the west by residences, and forested land. Land use surrounding the facility consists primarily of rural land use, including residences, agricultural land, surface-water bodies, and wetlands.

Westvaco facility operations in DeRidder, Louisiana include tall oil refining and post refining operations which include solution resinates and hard resin manufacturing. Tall oil is fractionated into rosin and fatty acids that are used in the production of various rosin-based resins and resinates. Rosins and fatty acids are also used to produce adhesives, coatings, and wax compounds. In addition, the facility in DeRidder also has an acrylic resin manufacturing plant. This plant includes two major processes: an acrylic emulsion process and a styrenic-acrylic hard resin process.

The primary hazardous waste stream generated by facility operations is burned for fuel value in the on-site boilers. This waste stream is a toluene-ladened filter-aid, with a waste code designation of D001 (ignitability). Historically, this waste stream also carried an F005 (solvent wastes) listing, but this listing was dropped due to characterization and reclassification of the waste stream. The filter-aid is a cellulose base material. Other hazardous waste streams have historically included the following: the HC-920 Sparge Oil, a D001 waste; the Waste Laboratory Solvents, combination of D001, F003, and F005 wastes; and the Acrylic Hard Resin Spent Solvents, also a D001 waste. However, the facility no longer burns the Waste Laboratory Solvents stream (1995 decision). Therefore, current operations involve only those streams designated as D001 wastes. These components are mixed with either non-hazardous light ends or non-hazardous waste fuel prior to being fed to one of two onsite hazardous waste boilers. Based upon the low risk waste exemption in 40 CFR 266.109, the waste fuel blend may consist of at least 50% tall oil derived fuel (co-product known as “tall oil heads”) or fuel oil, and a maximum of 50% hazardous waste fuels (resinate filter cake, HC-920/sparge oil, acrylic process spent organics/acrylic process overheads). The DeRidder facility operations result in waste fuel normally consisting of approximately 85% primary fuel and 15% hazardous waste components.

The Boiler House generates steam for use throughout the DeRidder facility. The boilers within the Boiler House are designated as Boilers 1, 2, 3, and 4 and all share a common Electrostatic Precipitator (ESP) and common exhaust stack (Common Stack). Boiler 1 is not currently in service and Boiler 4 only burns non-hazardous waste (e.g., tall oil pitch, natural gas, or small quantities of other non-hazardous fuels). Boilers 2 and 3 are identical 60 to70 million BTU per hour Combustion Engineering Stirling type boilers (Model VA-X) with Coen burners. These two units are water-tube, single wall-fired boilers with design ratings of approximately 60,000 pounds of steam per hour. *__The__* *operating conditions of Boilers 2 and 3 are the same, but only one boiler at a time burns hazardous waste*. The temperature in the firebox of Boiler 2/3 is approximately 2200°F during normal conditions.

Westvaco operates each unit under a Tier I status, which simply means that all of the metals fed to the unit are assumed to be emitted in the stack gas. Therefore, the regulations limit stack metal emissions based on the hourly feed rate of individual metals into the combustion unit. A destruction and removal efficiency (DRE) test for organic compounds was not performed on Boiler 2/3 because operations meet the exemption from DRE testing in accordance with Title 40 of the Code of Federal Regulations (CFR) 266.109. The 1997 Risk Burn provides speciated organic emissions data for use in the risk assessment, as does Westvaco's 1995 COC test–requested by Westvaco to be used as data in lieu of testing for the Risk Burn (metals and dioxins and furans were allowed by EPA to be used in lieu of testing at the time of the Risk Burn). Subsequent COC testing events in 1998 and 2001 also provide updated speciated organic emissions data for dioxins and furans during operations that simulate operations measured during the Risk Burn testing. EPA has utilized all of the available speciated emissions data in conducting this risk assessment, although some of the data needed separate evaluation in consideration of corresponding "operational" conditions for each set of data collected. Some of the differences in test conditions outlined below, but how the data from these various test events were used in this risk assessment are discussed in the appropriate sections of this report.

A risk burn is considered an additional operating condition of the trial burn during which data are collected to demonstrate that the hazardous waste-burning boiler unit does not pose an unacceptable health risk when operating at typical (or normal) operating conditions over the long term. Based upon the fact that Boiler 3 is only used when Boiler 2 is down for maintenance and the fact that both boilers are similar in construction and design capacity, the risk burn was conducted as follows: Boiler 3 burned only tall oil pitch ("TOP", designated a non-hazardous waste fuel) while Boiler 2 burned a "worst case waste" fuel blend (about 19 to 21% hazardous waste fuel blended with 79 to 81% tall oil heads). In order to ensure a "reasonably worst case" waste feed and maintain consistency for all 3 runs of the risk burn, the facility developed a waste fuel blend for Boiler 2 consisting of all available waste fuel components. Since the Acrylic Hard Resin Spent Solvents (ASO) waste stream was not generated during the six months preceding the Risk Burn, Westvaco generated a surrogate ASO stream for the risk burn testing. This surrogate stream closely resembled the actual ASO stream, which mainly consists of isopropanol and/or dipropylene glycol monomethyl ether. The ASO stream is considered hazardous due to its ignitability.

Prior to December of 2001, all COC tests were conducted in a manner similar to the risk burn tests with only Boiler 2 burning hazardous waste components (the 1998 COC documented a waste feed at about the same ratio as the risk burn, and at about the same mix of specific waste streams). Conversely, the more recent COC testing conducted in December of 2001 provided emissions test data for Boiler 3 hazardous waste feed operations. Boiler 2 was not operated during the December 2001 testing event, but TOP was fed to Boiler 4 instead. The 2001 COC test ran a waste fuel blend of lower content hazardous waste components (about 10 to 16%), yet included a portion of the actual Acrylic Hard Resin Spent Solvents (ASO) waste stream and an increased portion of the HC-920 waste stream (i.e., as opposed to including a portion of the Resinate Filter Cake stream) in some of the batches fed to the boiler.

During the COC testing events, waste feed for all 3 runs of each event did not maintain consistency as was done in the Risk Burn. Rather, batches were used that differed in available waste fuel components for the various runs. In some of these runs, the actual ASO stream was used in the fuel blend as discussed above. Also, as already noted for the December 2001 testing, tall oil pitch was fed to Boiler 4 (non-hazardous unit) rather than operating both of the hazardous waste boilers as was done in the Risk Burn testing. However, this operational set-up is typical of normal operating conditions since only one hazardous waste unit can be operated at any time.

The normal waste fuel feed rate at the DeRidder facility typically ranges from 27 to 30 lb/min. The waste fuel feed rate during the risk burn ranged from 33.2 to 51.0 lb/min, while the waste fuel feed rate during the 1998 COC test and the 2001 COC test ranged from 46.0 to 50.6 lb/min. Measurements taken during the risk burn and the 1998 COC test demonstrated a stack gas flow rate of 57 cubic meters per second (m^3/sec), a stack gas exit velocity of 4.22 meters per second (m/sec), and an exit temperature of 459 K (about 367°F) for normal operating conditions. Although measurements taken during the 2001 COC test demonstrated similar stack parameters for the flow and exit velocity, the 2001 COC test demonstrated a much lower stack exit temperature of 439 K (about 331°F). LDEQ and EPA provided oversight at the risk burn testing in September of 1997 for Boiler 2 at the Westvaco facility. LDEQ provided limited oversight at both COC testing events in 1998 and 2001. Due to the variations noted for the 2001 COC test, EPA calculated two different sets of air modeling parameters and corresponding emission rates for use in assessing risks.

Table 1: Westvaco Data Comparison

Common Stack for Boilers 2, 3, 4 (B2, B3, B4)

Average % of Waste Fed

Specific Waste Streams Fed to Boilers	Waste Designation	Risk Burn	1998COC	2001COC[1] Ba 1&2	2001COC[1] Ba 3&4	Comments
Tall Oil Heads (TOH, Co-Product)	*Non-Hazardous Waste Fuel*	81% B2	82% B2	90%	85% B3	
Resinate Filter Cake	D001 (F005 list dropped)	13% B2	13% B2	10%	0% B3	
HC-920 Sparge Oil	D001	3% B2	5% B2	0%	8% B3	
Waste Lab Solvents	F003, F005, D001	0% B2	0% B2	0%	0% B3	*Last Burned in January 1996*
Acrylic Hard Resin Spent Solvents (ASO)	D001	3% B2	0% B2	0%	7% B3	*Surrogate used in RB Test*
	Total Hz Waste Fuel	19% B2	18% B2	10%	15% B3	Low Risk Waste Exemption[2]
Tall Oil Pitch (TOP)	*Non-Hazardous Fuel*	100% B3	100% B3	100%	100% B4	B4 specs unknown[3]

NOTES:

1. 2001 COC Test split batches of different make-up across runs: Batches 1&2 were used for Runs 1&2; Batches 3&4 were used for Run3.

2. Low Risk Waste Exemption limits HWF to 50%; Typical Operations were identified in the RBR as 15% with 85% nonhazardous TOHs.

3. Boiler 4 is a non-hazardous waste boiler and may or may not be identical in construction/operations to Boiler 2/3.

However, use of Boiler 4 is more in line with actual operations--with only one of the hazardous waste boilers operating at any one time.

Air Modeling

EPA used the ISCST3 for determining air dispersion and deposition of compounds resulting from operations at the Westvaco facility in accordance with the HHRAP. EPA evaluated emission sources using primarily the data and information provided in the Westvaco Risk Burn Report dated September 1997, and the BIF Data Package dated December 1996. In addition, EPA utilized data provided in both the 1998 and the 2002 Certification of Compliance Test Reports and supplemental information requested by EPA and provided by Westvaco in the "Fugitive Emission Estimating Data Report" dated October, 1998.

EPA modeled two separate emission sources for Westvaco's DeRidder facility: one stack source (Common Stack) for the onsite boilers; and one volume area source to account for fugitive emissions associated with the waste feed storage area. EPA evaluated emissions from the Common Stack for 365 days per year. EPA believes that this is a reasonable approximation of emissions from both boilers since hazardous waste can only be burned in one hazardous waste boiler at a time, both boilers are similar in design capacity and construction, burn exactly the same waste under identical operating conditions, and share a common air pollution control system. EPA modeled fugitives associated with ancillary equipment to both boilers.

Stack location and parameters were provided by Westvaco and building heights were taken from plot plans provided by Westvaco (No. E38-708-04). The Universal Transverse Mercator (UTM) projection coordinates in North American Datum revised in 1983 (NAD83) for each source are as follows: for the Common Stack (472662.9498, 3410300.8892); and for fugitive emissions (472652.72, 3410292.76). EPA ran two separate air models due to a difference in operating conditions (i.e., mainly temperature) noted for the 2001 COC testing versus the 1998 COC testing and the 1997 Risk Burn. Each air model was used independently to assess any impact from dioxin/furan emissions data collected at the corresponding set of operating conditions. Differences in emission rates are discussed in the Compounds of Potential Concern (COPC) Section. Results from the comparative risk analysis are provided in the Risk Characterization Section of this report.

For the first air model run ("Risk Burn/1998 COC Operating Conditions Run"), EPA used a stack gas flow rate of 57.57 cubic meters per second (m^3/sec), a stack gas exit velocity of 4.22 meters per second (m/sec), and a stack gas exit temperature of 459 Kelvin (approximately 367 ^{o}F) for the Common Stack as input to ISCST3. The stack height is 76.2 meters (250 feet) above grade. EPA used a height of 5 meters (assumed midpoint of height of equipment) and an area of approximately 3610 square meters (m^2) for evaluation of fugitive emissions. For the second air model run ("2001 COC Operating Conditions Run"), EPA used a stack gas flow rate of 60.52 m^3/sec, a stack gas exit velocity of 4.44 m/sec, and a stack gas exit temperature of 439 Kelvin (approximately 331 $^{\circ}$F) for the Common Stack as input to ISCST3. Fugitive parameters were left unchanged.

Modeling for Westvaco's DeRidder facility was based upon an array of receptor grid nodes at 100-meter spacing out to a distance of 3 kilometers from the facility and an array of receptor grid nodes at 500-meter spacing between a distance of 3 kilometers and out to a distance of 10 kilometers from the facility. Unitized concentration and deposition rates were determined by the ISCST3 model for each receptor grid node for use in assessing risks. Consistent with the HHRAP, water body and watershed air parameter values were obtained from the single receptor grid node array without need for executing values to a separate array.

Terrain elevations based on 90-meter spaced USGS digital elevation data were specified for all receptor grid nodes. Other site-specific information used to complete the ISCST3 models included the most current surrounding terrain information, surrounding land use information, facility building characteristics, and meteorological data available. Meteorological data collected over a 5-year period from representative National Weather Service (NWS) stations near the facility were used as inputs to the ISCST3 models. The surface and upper air data was collected from the Lake Charles NWS station.

Model runs were executed for accurate evaluation of partitioning of all compounds specific to vapor phase, particle phase, and particle-bound phase runs. In addition, particle diameter size distributions and mass fractions for the Common Stack were based on Westvaco's May 1987 particle size test on the stack gases to design an electrostatic precipitator (ESP) to control particulate matter emissions. EPA adjusted the particle size based upon the ESP graph submitted by Westvaco to account for the presence of the ESP.

Appendix A contains all air modeling information utilized and generated for the Westvaco facility. The files found in the "ISC_Original" subdirectory correspond to the Risk Burn/1998 COC Operating Conditions Run. The files found in the "ISC_Compare" subdirectory correspond to the 2001 COC Operating Conditions Run. Under the "Source" subdirectory, the Common Stack also has one subdirectory dedicated to the Risk Burn/1998 COC files ("Common") and one directory for the 2001 COC files ("Common02" since the COC testing conducted in December 2001 was documented in forms dated 2002).

Compounds of Potential Concern (COPCs)

EPA identified Compounds of Potential Concern (COPCs) in accordance with the HHRAP. Although the Westvaco facility does not burn plastics or materials with phthalate plasticizers, certain phthalate compounds were detected during various risk burn runs. Therefore, EPA did not drop phthalate compounds from the risk analysis. However, EPA eliminated certain other compounds from the quantitative risk analysis based upon availability of toxicity data and/or transport and fate data. Those few chemicals which were detected, but dropped from the risk analysis, are qualitatively discussed in the Uncertainty Section of this report. **Appendix B** contains EPA-calculated COPC-specific emission rates used in the risk assessment for each source, including the fugitives areas, and provides justification for all chemicals dropped from the risk analysis. EPA input these COPC-specific emission rates directly into the risk model, which allowed calculation of compound-specific media concentrations and corresponding risk estimates.

EPA initially evaluated Tier 1 Feed Rate Limits (i.e., maximum allowable regulatory limits) for the Westvaco boilers and found that the limits for several metals would need to be supplemented with lower annual average limits (risk-based limits) in order for the *permit* to be protective of human health. In addition, EPA estimated stack emissions for inorganic compounds from the waste feed data reported in a letter from the facility entitled "BIF Risk Assessment Information", dated January 31, 1997. This data was proposed and accepted as *data in lieu of* risk burn testing since the data were collected during a 1995 COC testing event. A subsequent COC form on file for the Westvaco facility, dated 1998, was reviewed in order to compare the Tier I levels with operations data collected subsequent to the 1995 COC testing event. EPA used an upset factor of 1 for calculating inorganic compound emission rates since operation under Tier I status means evaluation of waste feed measurements and not collection of actual emissions data (i.e., all of the metals fed to the unit are assumed to be emitted in the stack gas). Since the risk burn data as well as the COC forms for the Westvaco facility show that typical operations result in emission rates which are orders of magnitude below the maximum allowable regulatory limits, EPA back-calculated risk-based annual average permit limits from the Tier I limit for each metal of concern.

EPA next calculated emission rates from stack emissions data for organic compounds collected during the risk burn conducted between September 9 and 12, 1997. Dioxin data from the COC testing in 1995 was originally intended for use as *data in lieu of* risk burn testing for these particular compounds (similar to the metals, above discussion). However, EPA evaluated and utilized the more recent dioxin/furan emissions data collected during the 1998 COC testing event since operating conditions were sufficiently similar to both the 1995 COC and the 1997 Risk Burn test events. Of special note, an updated analytical method was used in the 1998 data collection effort that provided more accuracy in reporting of individual congener results than was possible for the 1995 data. EPA used an upset factor of 1.01 in calculation of COPC-specific emission rates for organic compounds, in consideration of the letter report from the Louisiana Chemical Association (LCA) representing liquid burning BIFs in the State of Louisiana, dated October 27, 1999 (letter report presents adequate rationale and example calculation for the upset factor of 1.01 for organic compounds).

Finally, in order to properly assess fugitive emissions associated with Westvaco 's typical operations, EPA evaluated supplemental information provided by Westvaco in the "Fugitive Emission Estimating Data Report" dated October 15, 1998. This document provided historical information on the typical mix of specific compounds in the waste feed and the engineering details for equipment in the areas being evaluated.

Upon completion of EPA's preliminary risk analysis, a subsequent COC test event was completed in December of 2001. This most recent test was conducted in a manner that differed from the Risk Burn and historical COC tests (See Facility and Source Information Section of this Report). Therefore, prior to completing this risk assessment report, EPA conducted a comparative evaluation of all of the various test events for these particular compounds in order to account for differences in both operating conditions and data results between the risk burn and 1998/1995 COC testing events versus the 2001 COC testing event.

As part of the comparative evaluation, EPA first assessed the recommended metal permit limits at the corresponding 2001 COC test conditions and found the limits to still be protective. Next, EPA calculated the emission rates of individual dioxin and furan congeners demonstrated during the 2001 COC testing event and determined that a separate risk evaluation was warranted for dioxins and furans. The new emission rate calculations were added as a separate table to the workbook already containing the risk burn and 1998 COC emission rate calculations in **Appendix B**. In effect, EPA conducted multiple air modeling and risk modeling efforts to evaluate the differences and potential impacts from dioxin and furan congener-specific emissions. In summary, the comparative evaluation of emission rates for dioxins and furans based upon the results of the 2001 COC testing event led EPA to consider the need for an emission rate limit for dioxin/furan compounds in the RCRA permit. Therefore, EPA back-calculated the recommended emission rate limit of **4.24E-10** *grams per second* ***TCDDE*** (2,3,7,8-tetrachlorinated dibenzo-p-dioxin equivalencies) from the 2001 COC test results in order to sufficiently reduce those risks identified in the comparative risk evaluation for the 2001 COC test data.

In back-calculating the recommended TCDDE limit, EPA did take into account the 6-fold increase in slope factor for TCDD that is anticipated in the near future. In addition, the recommended TCDDE level was compared with the most stringent dioxin and furan Hazardous Waste Combustion MACT Interim Standard currently promulgated for incinerator systems, cement kilns, and light weight aggregate kilns (0.2 ng/dscm) since a MACT standard has not yet been promulgated for BIF units. However, the MACT Interim Standards are concentration-based and when converted to a mass basis for the Westvaco stack, the TCDDE limit was higher than the risk-based limit being recommended and demonstrated by actual emissions data collected during all the various testing events (Table 3).

In summary, *EPA used the calculated (or "recommended risk-based") permit limits for metals in the final risk assessment model–along with actual emissions data for all the other COPCs being evaluated–in order to show permit protectiveness over the long term.* Westvaco's *data in lieu of* testing show that feed rates during "normal operations" fall below the recommended permit feed rate limits, or in the case of mercury, can achieve the limit and demonstrate compliance during future sampling events (Table 2). In addition, Westvaco's historical data shows that dioxin and furan emission levels achieve the recommended permit emission rate limit (Table 3). Since the calculated TCDDE limit is virtually the same level as demonstrated during the 1998 COC testing, and the original risk analysis did not result in TCDDE risks above EPA levels of concern, the *calculated (or "recommended TCDDE") limit will ensure permit protectiveness over the long term.*

Table 2: Metals Waste Feed Rates (g/s)

Metals of Concern	Regulatory Tier I Permit Limit Maximum Allowable	Recommended Risk-Based [1] Permit Limit Annual Average	"Normal Operations" Data in Lieu of Risk Burn Testing (BIF Data Package [2])
Antimony	4.17E+00	4.17E-01	ND [3] = 1.63E-03
Arsenic	3.33E-02	3.33E-02	ND [3] = 1.63E-03
Barium	7.22E+02	7.22E-01	6.53E-04
Beryllium	6.11E-02	6.11E-03	ND [3] = 3.25E-04
Cadmium	8.06E-02	1.61E-03	ND [3] = 3.25E-04
Chromium (Total)	1.19E-02 [4]	1.19E-03 [4]	ND [3] = 3.25E-04
Lead	1.28E+00	1.28E+00	9.78E-04
Mercury (Total)	4.17E+00	2.60E-06 [5]	ND [3] = 6.19E-05
Nickel	N/A	5.58E-02	5.58E-05 [6]
Silver	4.17E+01	8.34E-02	ND [3] = 3.25E-04
Selenium	N/A	1.39E-03	1.39E-06 [6]
Thallium	4.17E+00	8.34E-02	ND [3] = 1.63E-03

NOTES:

1. Recommended RCRA Permit Limits are based upon an annual average stack gas temperature of 459 K and an annual average stack gas flow rate of 58 m^3/s as demonstrated during the risk burn and alternative COC sampling events. The recommended limits were also evaluated at those conditions demonstrated during the 2001 COC testing event (61 m^3/s @ 439 K) and found to still be protective.

2. Metals Emissions *Data in Lieu of* Trial/Risk Burn Testing was submitted by Westvaco in their "BIF Data Package", dated December 17, 1996, Table 5.

3. **ND** means that the metal was ***not detected*** in the waste feed; the detection limit was used to calculate the emission rate shown.

4. Recommended RCRA Permit Limit for Chromium is actually based upon the assumption that Hexavalent Chromium is equal to 100% of the Total Chromium measured in the waste feed.

5. Mercury is not believed to be present in the waste feed, but the analytical method used in the risk burn did not provide low enough detection limits for comparison with the Recommended RCRA Permit Limit. The Risk-Based Annual Average RCRA Permit Limit for mercury is based upon a

reliable detection limit for mercury of 0.01 ppm and the volumetric flow rate demonstrated during the Risk Burn.

6. Nickel and Selenium were estimated from fly ash sampling, estimates provided in the " BIF Data Package" as data in lieu of testing.

Table 3: TCDDE Emission Rates (g/s)

Test Conditions	*MACT Interim Standard [1] @ Test Conditions*	*Recommended Risk-Based [2] Permit Limit*	*TCDDE Operations Data [3] Demonstrated @ each Test Condition*
December 2001 COC Testing (2002 COC Form)	**7.62E-09 g/s**	**4.24E-10 g/s**	**0.07 ng/dscm = 4.24E-09 g/s**
June 1998 COC Testing (1998 COC Form)	**7.36E-09 g/s**		**0.01 ng/dscm = 4.04E-10 g/s**
1995 COC Testing (1996 BIF Data Package, Table 1)	**7.40E-09 g/s**		**0.21 ng/dscm = 7.58E-10 g/s**

NOTES:

1. Most Stringent MACT Interim Standard (i.e., new combustion unit) of 0.2 ng/dscm is converted to a mass basis at each set of operating conditions.

2. Recommended RCRA Permit Limit is based upon an annual average stack gas temperature of 439 K and an annual average stack gas flow rate of 61 m^3/s as demonstrated during the 2001 COC testing event. This limit is achievable at those conditions noted for the Risk Burn and 1998 COC testing events and falls close to the 1995 COC Test level, where an older analytical method was used for reporting of results.

3. TCDDE levels shown are average values from 3 runs of data collected per test condition. A 3-year initial sampling frequency is recommended in order to effectively demonstrate compliance with the Risk-Based Permit Limit. Due to the long term nature of the risk assessment, an annual average emission rate value is not practical. Sampling every 3 years will provide data for determining a 9 year average value. If compliance is demonstrated for the first nine years, the sampling frequency may be lessened to every 5 years.

EXPOSURE ASSESSMENT

Exact locations where people can potentially be exposed to contaminants in the air, surface water, or soil are determined by the grid spacing used in the air model and subsequently imported into the risk model. These specific locations can be used for assessing exposure for a particular type of receptor based upon the land use type being evaluated (i.e., farming or residential). Since plants or animals can also be exposed to contaminants at these coordinate points, possible uptake through the food chain can be assessed based upon the type of land use designated.

The potential exposure scenarios evaluated in this risk assessment include both adult and child receptors for the following land use types: residential, subsistence farming, and subsistence fishing. In all cases, EPA used default values for receptor specific parameters, as outlined in the HHRAP. However, for dioxins and furans, EPA used updated bioaccumulation factors and toxicity equivalency values based upon the results of the External Peer Review of the HHRAP Guidance (External Peer Review Meeting, May 2000). Please see the Uncertainty Section of this risk assessment for a discussion of those parameters modified for specific dioxin/furan cogeners. Current land use was considered in determining those receptors potentially impacted by identified emission sources, while potential future land use was assumed to be the same as current land use.

Study Area Characterization

Although the study area for air modeling purposes extends out approximately 10 kilometers from the Common Stack, the risk assessment evaluated possible exposure based upon potential receptors located closer to the facility where the ***reasonable maximum risks*** to various types of receptors might occur. Specifically, discrete land use areas where results of the air modeling indicated maximum air concentration or maximum deposition of COPCs might occur typically fell within a 3 kilometer radius from the Common Stack. EPA then evaluated multiple locations within each discrete land use area potentially impacted, in accordance with the HHRAP. This ensured that all possible receptors were evaluated for identifying reasonable maximum risks for each exposure scenario type.

Potentially impacted water bodies and their associated effective watershed areas were also evaluated as part of the risk assessment. Although DeRidder Pond may not currently be used for fishing, EPA evaluated this pond for fishing consumption based upon the potential for fishing to occur. Although this assumption may have been overly conservative for evaluation of current use, further evaluation is not warranted since resulting risks for the fish consumption pathways were well below EPA levels of concern. Additionally, because DeRidder currently obtains its drinking water from deep wells rather than any surface water bodies within the study area, EPA did not evaluate the drinking water consumption pathway for any of the receptor scenarios.

EPA contractors conducted a site visit to verify information shown on digitized land use land cover maps, topographic maps, and aerial photographs. EPA also visited the site and utilized the internet to locate and verify local schools and daycare facilities on the topographic maps. EPA also requested and obtained input from LDEQ and facility representatives on actual land use designations used. **Appendix C** contains the topographic, land use, and watershed maps which show the specific areas evaluated as part of the study area–as well as those effective watershed areas specific to this risk assessment.

Exposure Scenario Locations

The exposure scenario locations in this risk assessment were chosen to be representative of potential maximally exposed individuals, or receptors, within each representative land use type. Infant potential exposure to dioxins and furans via the ingestion of their mother's breast milk is evaluated at corresponding adult scenario locations (i.e., locations where the mother may live). Receptor locations for a child's potential exposure to lead in soil and air are the same as the various child scenario locations. Fisher receptors were placed at residential scenario locations near each water body evaluated. All exposure scenario locations are shown on those topographic maps provided in **Appendix C**, and are also provided via a coordinate list exported from the risk model project file in **Appendix D**.

Transport and Fate Parameters

EPA used transport and fate equations presented in the HHRAP to determine air, soil, and surface water COPC-specific concentrations. Those equations which determine uptake of specific COPCs in the food chain (i.e., COPC concentrations in fish, pork, milk, eggs, etc.) allow the use of parameters derived as either default values, also provided in the HHRAP, or facility/site-specific values, as available and appropriate. Site-specific transport and fate parameters utilized for the Westvaco facility include universal soil loss constants, delineation of water body and effective watershed areas potentially impacted by facility sources, water body depth, and average annual total suspended solids concentration.

Of special note is EPA's decision to use 40 years for the time of COPCs deposition (i.e., facility operational time), rather than the 100 years recommended by the HHRAP. EPA Region 6 considerations in using 40 years as opposed to 100 years include the following: 1) the longest receptor exposure duration is 40 years; and 2) RCRA permit renewals are required every 10 years so risks can be reevaluated at any time utilizing the most current transport and fate information available at that time.

Site-specific transport and fate parameters are provided in the spreadsheet provided in **Appendix B**. COPC-specific chemical and physical parameters are not provided in this risk assessment report since they can be found in Appendix A of the HHRAP and also in EPA's July 1999 Errata to the HHRAP. The IRAP-h View Version 1.7 utilizes all updated information found in EPA's Errata to the HHRAP.

RISK CHARACTERIZATION

In this risk assessment, EPA evaluated chronic excess risk estimates for both ***direct exposure pathways***, or those pathways where contact may occur with a contaminated media (i.e, inhalation, incidental soil ingestion), and also ***indirect pathways*** (i.e., those risks associated with uptake through the food chain). EPA also evaluated the potential for non-carcinogenic health effects to occur by calculation of hazard indices (HIs) for the various COPCs identified at the Westvaco facility. In addition, EPA assessed the following: 1) potential acute effects (i.e., risks associated with short-term emissions) from inhalation; 2) potential impacts from possible accumulation of dioxin and furan compounds in breastmilk; and 3) potential adverse impacts for small children (i.e., children under 6 years old) who are susceptible to lead exposure in surface soils and ambient air.

Of special consideration, and as indicated in prior sections of this report, EPA conducted multiple air and risk modeling efforts in order to evaluate different test results for the Westvaco facility. Overall, the final risk model runs "Original" and "Comparison" incorporated those adjusted metal emission rates determined to be protective from preliminary risk evaluations on a "Metals" only model run (i.e., recommended metal permit limits were incorporated into the risk assessment prior to evaluation of organic emissions). Consequentially, final risk estimates are not driven by any of the metals evaluated. In the case of dioxins and furans, the Comparison risk model run resulted in elevated emission rates and consequently, risks exceeding EPA's level of concern. However, the Original risk model run corresponding to test events prior to the 2001 COC test utilized emission levels a bit lower than the TCDDE recommended permit limit. Therefore, the Original risk model run demonstrates that dioxin and furan risk estimates fall below EPA levels of concern *if the recommended TCDDE limit is incorporated into the RCRA permit.*

Although metal waste feed rate limits can easily be incorporated into the RCRA permit, reduction of dioxin emissions may require more complex engineering evaluation due to the nature of testing conducted to date that demonstrates "normal operating conditions" at the Westvaco facility. Therefore, EPA has tailored the following risk characterization discussions to document those risks that could potentially occur if the dioxin emission rate limit is not incorporated into the RCRA permit or if dioxin emissions are not reduced by process operational refinements in some manner (i.e., Comparison risk model run results are discussed in addition to the Original risk model run results).

In general, for those chemicals detected in stack gas emissions or quantified as fugitive source emissions at the Westvaco facility, EPA found that RCRA operations could potentially pose adverse impacts for certain receptors evaluated. For those chemicals not actually detected in stack gas emissions or not detected in the waste feed analysis, as well as for those chemicals detected that need further discussion due to uncertainties associated with resulting risk estimates, please see the Uncertainty Section of this report. EPA used target action levels identified in the **Region 6 Risk Management Addendum -** ***Draft Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*** (EPA-R6-98-002, July 1998) to evaluate resulting risk estimates.

Excess Cancer Risks

For those COPCs detected in stack gas emissions or quantified as fugitive source emissions at the Westvaco facility, chronic excess cancer risk estimates attributed to both ***direct exposure pathways*** and ***indirect exposure pathways*** fell above EPA's 1×10^{-5} level of concern for certain receptors evaluated. This excess cancer risk was attributable to dioxins and furans and certain phthalate compounds.

Risk associated with dioxins and furans emissions during the 2001 COC test were estimated at 3×10^{-5} for certain farmer receptors. Although non-dioxin/furan organics data were not collected during the 2001 COC testing event, risk attributable to phthalate compounds were estimated at 3×10^{-5} for farmer receptors based upon emissions data collected during the Risk Burn. With the anticipated six-fold increase of the slope factor for dioxins, the total excess risk for combustion operations would then easily exceed the 1×10^{-4} level, predominately being driven by dioxin and furan emissions data. This means that there would be more than one chance in ten thousand of a person getting cancer from possible exposure to RCRA combustion emissions associated with the Westvaco facility. Conversely, if recommended risk-based permit limits for dioxins and furans are incorporated into the RCRA permit, and operations are similar to those demonstrated during the Risk Burn testing event, risk estimates attributable to dioxins and furans drop well below EPA's 1×10^{-5} level of concern–even in consideration of the slope factor change, and total risk estimates are reduced significantly. Due to the uncertainties associated with calculation of risks from phthalate compounds (please see the Uncertainty Section of this report), EPA contends that the recommended reduction of dioxin and furan emission rates is sufficient for protection of human health.

Excess cancer risk estimates for each receptor, delineated by source and specific COPC, are provided via a summary table exported from the Original and Comparison runs of the risk model project file, "copc_risk" in **Appendix D**. In addition, excess cancer risk estimates for each receptor, delineated by pathway, are provided in a summary table exported from each risk model project file, "pathway" in **Appendix D**. The next to last column of each table contains the excess cancer risk estimates. Two differences between the Original and Comparison risk model runs can be summarized as follows: 1) each risk model uses an independent air model imported in order to evaluate the difference between the Risk Burn and 1995/1998 operating conditions; and 2) each risk model uses independent dioxin/furan congener emission rates based upon the difference in data results reported in association with the Risk Burn and 1995/1998 COC test events versus the 2001 COC test event.

<u>Non-Carcinogenic Health Effects</u>

For those COPCs detected in stack gas emissions or quantified as fugitive source emissions, the HIs associated with both direct and indirect pathways are all well below EPA's 0.25 level of concern for all receptors evaluated. This means that a person's health should not be adversely effected by possible exposure to RCRA combustion emissions at the Westvaco facility.

The HI estimates for each receptor, delineated by source and specific COPC, are provided via a summary table exported from the original and comparison runs of the risk model project file, "copc_risk" in **Appendix D**. In addition, HI estimates for each receptor, delineated by pathway, are provided in a summary table exported from each risk model project file, "pathway" in **Appendix D**. The last column of each table contains the HI estimates.

<u>Other Risks</u>

Acute Hazard Quotients are all less than 1.0 for those receptors evaluated. This means that a person's health should not be adversely effected from direct inhalation of the maximum 1-hour concentration of vapors and/or particulates associated with RCRA combustion emissions at the Westvaco facility. An acute adverse health effect is defined here as a concentration intended to protect the general public from discomfort or mild adverse health effects over 1 hour of possible exposure. See the summary tables exported from each risk model project file, "acute" in **Appendix D**.

For dioxin-like compounds, calculations show that projected possible intakes for babies who are breastfed are all below the average infant intake target level of 60 pg/kg-day of 2,3,7,8-TCDD Equivalents. See the summary table exported from each risk model project file, "b-milk" in **Appendix D**. More detailed information relating to dioxins and potential exposure and risk characterization for dioxin and furan congenrs can be found at the EPA website http://www.epa.gov/nceawww1/dioxin.htm (contains documents generated as part of the Dioxin Reassessment Initiative).

For lead, calculations show that projected possible concentrations in surface soils and ambient air should not exceed EPA target levels of 100 mg/kg and 0.2 µg/m^3, respectively. This means that concentrations of lead predicted to occur in soils and ambient air from RCRA combustion emissions at the Westvaco facility are at levels which should not adversely impact the health of children under the age of 6 years old (i.e., those children who are susceptible to health impacts from lead exposure). See the summary table exported from each risk model project file, "lead" in **Appendix D**.

UNCERTAINTY DISCUSSION

Uncertainty is inherent in any risk assessment process, and in the case of combustion risk assessments, can become complex in consideration of the necessary integration of various data, process parameters, and modeling efforts undertaken. Uncertainties and limitations of the risk assessment process are discussed in general in Chapter 8 of the HHRAP and in more detail in each separate chapter of the HHRAP. Therefore, this risk assessment will not reiterate that lengthy discussion, but will complement it by addressing specific key areas of interest which were identified during EPA's evaluation of resulting risk estimates at the Westvaco facility. Some, if not all, of these areas of interest have been identified by other EPA regions and/or State partners conducting risk assessments at similar combustion facilities across the country.

Modified Parameters for Dioxins/Furans

Please see the "Modified Parameters" file in **Appendix D** for an all-inclusive parameter list of chemical-specific values used in this human health risk assessment (i.e., a side-by-side comparison of the modified value versus the original default value for each COPC-specific parameter). For the Westvaco facility, the only compounds where chemical-specific values were modified include individual dioxin/furan cogeners. Modifications are based upon input from the External Peer Review of EPA's HHRAP and Errata (External Peer Review Meeting, May 2000).

In determining the bioaccumulation factors for chickens ($Ba_{chicken}$) and eggs (Ba_{egg}), as published in the July 1999 Errata to the HHRAP, EPA assumed that the bioconcentration factors (BCFs) presented in the 1995 Stephens, Petreas, and Hayward paper were calculated as the ratio of the dioxin/furan concentration in tissue to the concentration in soil. However, the BCFs were actually calculated as the ratio of dioxin/furan concentration in tissue to the concentration in feed. Therefore, since the soil/feed mixture fed to the chickens was one part soil and nine parts feed (1:9), the bioaccumulation factors presented in the Errata would appear to be ten-fold too high. Therefore, EPA reduced the $Ba_{chicken}$ and BA_{egg} values provided in the Errata by a factor of 10 for those cogeners evaluated ("Biotransfer and Bioaccumulation of Dioxins and Furans from Soil: Chickens as a Model for Foraging Animals"; Stephens, Petreas, and Hayward, 1995).

Additionally, since publication of the July 1999 Errata to the HHRAP, EPA's Office of Solid Waste has recommended use of the 1997 World Health Organization (WHO, 1997) Toxicity Equivalency Factors (TEFs) for dioxin/furan cogeners. Therefore, EPA Region 6 changed appropriately those three cogeners where TEFs specified in the HHRAP were different than the WHO values recommended for human health risk assessments (i.e., 1997 WHO TEFs for fish, mammals, and birds).

Comparison Risk Model Evaluation for Dioxins/Furans

As discussed in the Facility and Source Information Section, many different factors may have contributed to the elevated emission levels of dioxin and furan congeners during the 2001 COC testing event. Both the Original and Comparison air models and risk models were identical, with exception of the changes to stack parameters and emission rates as outlined in appropriate sections of this report. Given the particular uncertainty associated with the source of elevated emissions of dioxins and furans during the 2001 COC testing event, EPA took a conservative approach in calculating the risk-based TCDDE permit limit. If the recommended risk-based permit limit for dioxins and furans are not incorporated into the RCRA permit, and operations are similar to those demonstrated during the 2001 COC testing event, risk estimates attributable to dioxins and furan congeners exceed EPA's level of concern by a factor of about 3. However, if the slope factor for dioxin is increased by a factor of 6 (i.e., anticipated change within the next year for this group of

COPCs), risk estimates would increase proportionally and the end result would be risks above the one in ten thousand level (1 x 10^{-4}). Therefore, EPA decreased the value demonstrated during the 2001 COC by one order of magnitude. The calculated value is slightly higher than the level demonstrated in the company's 1998 COC. Thus, even given the uncertainties discussed above, the company should be able to determine the source of dioxin and furan emissions and be able to maintain those levels demonstrated in the 1998 COC–thereby complying with the recommended permit limit quite easily.

<u>Bio-Transfer Factors</u>

In completing the evaluation of risk estimates for the Westvaco facility, EPA has noted that biotransfer factors are primarily responsible for artificially high risk estimates for certain compounds. Two types of compounds, polycyclic aromatic hydrocarbons (PAH) and phthalates, were identified for further evaluation when resulting risk estimates seemed disproportionate for the low level emission rates (e.g., rates based upon non-detected levels for the PAHs) used in the Westvaco risk assessment:

indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene,
di-n-octylphthalate

Cumulative risk estimates for the two PAH compounds fell just above EPA's 1E-5 level of concern for evaluation of carcinogenic risks for certain farmer receptors. In a similar trend, although di-n-octylphthalate was detected in only one of three runs, and even though the emission rate was similar to that of other phthalate compounds measured during the risk burn, excessive hazard quotients resulted for both adult and child farmer receptors.

The farmer scenario uses beef, pork, and milk biotransfer factors based upon the *n*-octanol/water partition coefficient (K_{ow}), as specified in the HHRAP. However, the HHRAP also provides discussion about the possibility of decreasing (rather than increasing) biotransfer values with increasing K_{ow} values. The two PAH compounds in question and di-n-octylphthalate all fall within the range cited (log K_{ow} between 6.5 and 8.0). The HHRAP suggests that this trend may be due to a greater rate of metabolism of higher K_{ow} compounds (HHRAP, Volume 2, Appendix A pages A-3-25 thru A-3-26). In addition, other literature sources acknowledge that PAHs (Gorelova and Cherepanova, 1970; Gorelova et al., 1970) and phthalates (ATSDR, 1987; U.S. EPA, 1995) with large K_{ow} values are readily metabolized by the mixed function oxidase metabolic pathway in mammals to water-soluble substances, which are then excreted. Therefore, the resulting risk estimates for these two PAHs and di-n-octylphthalate may be biased high. In fact, the EPA Office of Research and Development has currently estimated that the metabolism factor for di-n-octylphthalate may be overestimated by at least a factor of 100. With this consideration, the risk estimates attributable to this compound are consequently overestimated by a factor of 100. In other words, EPA believes that the potential risk from exposure to these three compounds is not of concern since they tend not to bioaccumulate in animal or human tissue, but rather to be metabolized and excreted.

Use of Non-Detected Compounds

Compounds which were quantified as not present at or above a laboratory specified reporting limit but could possibly be formed as products of incomplete combustion, were used in calculation of risk estimates. For example, PAHs are semi-volatile compounds typically associated with combustion sources. Therefore, EPA retained and considered these compounds in the risk assessment in accordance with the HHRAP even though they were not detected in any of the analyses conducted.

Additionally, EPA followed the HHRAP in determining the appropriate detection limits to use in estimating emission rates for non-detected compounds. However, since the HHRAP does not address the appropriate detection limit for waste feed samples, EPA used Sample Quantitation Limits (SQLs) to calculate emission rates for non-detected compounds, as reported by the laboratory. Conceptually, SQLs are the most appropriate detection limit to use for waste matrices where compounds are suspected to be present but interferences may occur to obscure the detection of certain compounds as presented in EPA's **Guidance for Data Useability in Risk Assessment** (Publication 9285.7-090A; April 1992).

Although using non-detected compounds may tend to overestimate risks to some degree, all compounds which were retained in the Westvaco risk assessment resulted in risk estimates well below EPA levels of concern with the exception of two PAH compounds. The same two PAH compounds discussed in the prior section were not detected in stack emissions, but were assumed to be present at their Reliable Detection Level (RDL). In other words, in addition to risk estimates for these two compounds being biased high due to use of biotransfer factors which do not account for metabolization, the risk estimates may also be biased high due to use of emission rates based upon non-detected values. Therefore, EPA believes that these two PAH compounds do not actually pose adverse health impacts–even assuming the compounds are present at their RDLs.

Compounds Dropped from Quantitative Analysis

Of those compounds dropped from the risk analysis due to a lack of toxicity or transport and fate information, only the following chemicals were actually detected in the emissions data:

> bromobenzene, n-propylbenzene, 1,2,4-trimethylbenzene, sec-butylbenzene, p-cymene, and n-butylbenzene

All of these compounds are volatile organic compounds. Bromobenzene was detected only in one tenax portion of the train for one particular run. The other compounds were detected in multiple portions of the train for each run or multiple runs. Since these compounds do not have toxicity data and/or transport and fate information, they can not be quantitatively evaluated in the risk assessment. However, EPA did examine the data for each of these chemicals in relation to their corresponding Region 6 "Risk-Based Screening Level" benchmark values as available for Ambient Air, Residential Scenario (please see EPA's website http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm for more information on the benchmark values). Although p-cymene does not have a benchmark value, it is similar in chemical structure to benzene, which does have a benchmark value for qualitative comparison. All of the detected values were well below the corresponding screening level values, which would indicate that further evaluation of risk is unnecessary based upon the low levels emitted.

Unidentified Organic Compounds

Westvaco conducted Total Organic Emissions (TOE) testing in accordance with the HHRAP. Permitting authorities need this information to address concerns about the unknown fraction of organic emissions from combustion units. Using the TOE test results, and the speciated data from the Risk Burn, EPA calculated a TOE factor which falls at the low end of the range anticipated in the HHRAP (2 -40). Based upon these results, and the process information available for the Westvaco facility, EPA believes that unidentified organic compounds do not contribute significantly to those risk estimates calculated in this risk assessment.

CONCLUSION & RECOMMENDATIONS

EPA's risk assessment indicates that "normal operations" of the BIF units at the Westvaco facility should not adversely impact human health, with incorporation of recommended risk-based permit limits and/or operating limits. Overall, EPA's risk assessment shows that the appropriate regulatory maximum permit limits (i.e., Tier 1 Waste Feed Limits) for the Westvaco hazardous waste combustion units should be supplemented with lower annual average risk-based waste feed limits for metals as well as a dioxin/furan emission rate limit (i.e., TCDDE Recommended Limit) in order for *the permit* to be protective of human health. A summary of the recommended permit limits is provided in the Table 4 below:

Table 4: Recommended Risk-Based [1] Permit Limits

COPCs	Waste Feed Rates (g/s)	Emission Rates (g/s)
Antimony	4.17E-01	NA
Arsenic	3.33E-02	NA
Barium	7.22E-01	NA
Beryllium	6.11E-03	NA
Cadmium	1.61E-03	NA
Chromium (Total)	1.19E-03 [2]	NA
Lead	1.28E+00	NA
Mercury (Total)	2.60E-06 [3]	NA
Nickel	5.58E-02	NA
Silver	8.34E-02	NA
Selenium	1.39E-03	NA
Thallium	8.34E-02	NA
TCDDE [4] (Dioxins & Furans)	NA	4.24E-10

NOTES:

1. Recommended RCRA Permit Limits are based upon an annual average stack gas temperature of 459 K and an annual average stack gas flow rate of 58 m^3/s as demonstrated during the risk burn and alternative COC sampling events. The recommended limits were also evaluated at those conditions demonstrated during the 2001 COC testing event (61 m^3/s @ 439 K) and found to still be protective.

2. Recommended RCRA Permit Limit for Chromium is actually based upon the assumption that Hexavalent Chromium is equal to 100% of the Total Chromium measured in the waste feed.

3. Mercury is not believed to be present in the waste feed, but the analytical method used in the risk burn did not provide low enough detection limits for comparison with the Recommended RCRA Permit Limit. The Risk-Based Annual Average RCRA Permit Limit for mercury is based upon a reliable detection limit for mercury of 0.01 ppm and the volumetric flow rate demonstrated during the Risk Burn.

4. TCDDE refers to 2,3,7,8-tetrachlorinated dibenzo-p-dioxin equivalencies and is based upon the assumption that the mix of individual congeners will not change. A 3-year initial sampling frequency is recommended in order to effectively demonstrate compliance with the Risk-Based Permit Limit. Due to the long term nature of the risk assessment, an annual average emission rate value is not practical. Sampling every 3 years will provide data for determining a 9 year average value. If compliance is demonstrated for the first nine years, the sampling frequency may be lessened to every 5 years.

The recommended TCDDE level was compared with the Hazardous Waste Combustion MACT Interim Standards currently promulgated for incinerator systems, cement kilns, and light weight aggregate kilns since a MACT standard has not yet been promulgated for BIF units. However, the MACT Interim Standards are concentration-based and when converted to a mass basis for Westvaco's operations, even the most stringent standard currently in place was higher than the risk-based limit being recommended and demonstrated by actual emissions data collected during all the various testing events.

EPA evaluated the most current information available to estimate potential impacts to human health, both directly via inhalation, incidental soil ingestion, and indirectly via modeled deposition and uptake through the food chain. Emissions data collected as part of the risk burn, operational data specific to the Westvaco facility, and site-specific information based upon the facility's location, were evaluated and considered in making assumptions and in predicting risks associated with long term operations. The risk estimates provided in this risk assessment are conservative in nature and represent possible future risks, based upon those operating conditions evaluated for issuance of a final RCRA combustion permit. If operations change significantly, or land use changes occur which would result in more frequent potential exposure to receptors, risks from facility operations may need to be reevaluated.

References

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2. **Guidance on Collection of Emissions Data to Support Site-Specific Risk Assessments at Hazardous Waste Combustion Facilities, Peer Review Draft** (EPA530-D-98-002; August 1998).

3. **Risk Burn Report for Westvaco Corporation** (February 1998).

4. **BIF Data Package for Westvaco Corporation** (December 1996).

5. **"Fugitive Emission Estimating Data Report"** for Westvaco Corporation (October 1998).

6. **Certificates Of Compliance** for the Westvaco facility (1987, 1995, 1998, 2002).

7. **Louisiana Chemical Association (LCA)** ***Letter Report on Upset Factors*** (October 27, 1999).

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11. **World Health Organization (WHO)** *Meeting on the Derivation of Toxicity Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs, and other Dioxin-like Compounds for Human Health & Wildlife, June 15 - 18, 1997.* Institute of Environmental Medicene, Karolinska Institute, Stockholm, Sweden. Draft Report dated July 30, 1997.

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15. **EPA Region 6 Human Health Medium Specific Screening Levels** (EPA November 2001).

16. **Guidance for Data Useability in Risk Assessment (Part A) Final** (EPA 9285.7-09A, April 1992).