Health Consultation

WEYERHAEUSER COMPANY PLYMOUTH
WOOD TREATING PLANT

PLYMOUTH, MARTIN COUNTY, NORTH CAROLINA

EPA FACILITY ID: NCD991278540

AUGUST 7, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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Prepared By:
North Carolina Department of Health and Human Services
Under Cooperative Agreement with the
The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Summary

The Agency for Toxic Substances and Disease Registry (ATSDR) and the North Carolina Department of Health and Human Services (NCDHHS) were requested by USEPA Region IV to review environmental sampling data to identify contaminants of concern and health hazards associated with paper manufacturing contamination of sediments in Welch Creek. Welch Creek borders the eastern section of the Weyerhaeuser Paper Plant and is located west of the town of Plymouth, North Carolina. Historically, this creek has been the primary receiving waters of wastewater generated from the plant until 1988. The study area extends about 4.5 miles from Highway 64 Bridge to the confluence of the Roanoke River.

This public health consultation addresses sediment contamination in Welch Creek. The data necessary to determine a possible public health risk were available. Dioxin was detected at concentrations exceeding the ATSDR screening level at several locations along the study area. This data, along with dioxin levels detected in fish, indicate that dioxin contamination is widespread in this area. Although exposure may occur through ingestion of fish or contact with sediment, the site is so remote that potential exposure to children, recreational boaters, scientists and workers would be minimal.

The estimated exposure dose of 1.1×10^{-9} mg/kg/day slightly exceeds the ATSDR minimum risk level (MRL) of 1.0×10^{-9}mg/kg/day. However, based on the other factors such as accessibility, low potential for exposure, and posted warnings this site is considered **no apparent public health hazard.**

Recommendations include remediation strategies that would remove or contain dioxin in sediments. Furthermore, fish advisories have been posted to prevent or reduce consumption of dioxin-containing fish.

Background

Site Description and History

The Weyerhaeuser plant is an active facility which has been in operation since 1937. Current operations include the production of fine paper and fluff paper. The plant was owned by Weyerhaeuser from 1957 until 2007. Recently, Weyerhaeuser and another paper company, Domtar, agreed to merge some of their assets to create a new company. The Plymouth plant and some other facilities are now owned and operated by the new company ("Domtar"). The plant property covers about 2,400 acres and is located about 1.5 miles west of the town of Plymouth (Figure 1).

Figure 1. Plymouth North Carolina and Vicinity

Welch Creek is a slow moving stream that meanders through the eastern portion of the mill property. Low lying swamp is present along the banks of Welch Creek. Wastewater from plant operations was discharged to Welch Creek from 1957 until 1988 (Figure 2). Weyerhaeuser implemented improvements to its wastewater system after it purchased the plant. The discharges to Welch Creek were permitted by the State of North Carolina in 1969 and a later NPDES permit in 1975. Wastewater solids, which contain varying levels of dioxin, are present along the bed of certain stretches of the Creek and in some of the adjacent wetland soils. Weyerhaeuser modified its paper bleaching methods in the early 1990's. The plant switched from chlorine to chlorine dioxide which results in much lower levels of dioxin in their permitted discharge (1,2,3).

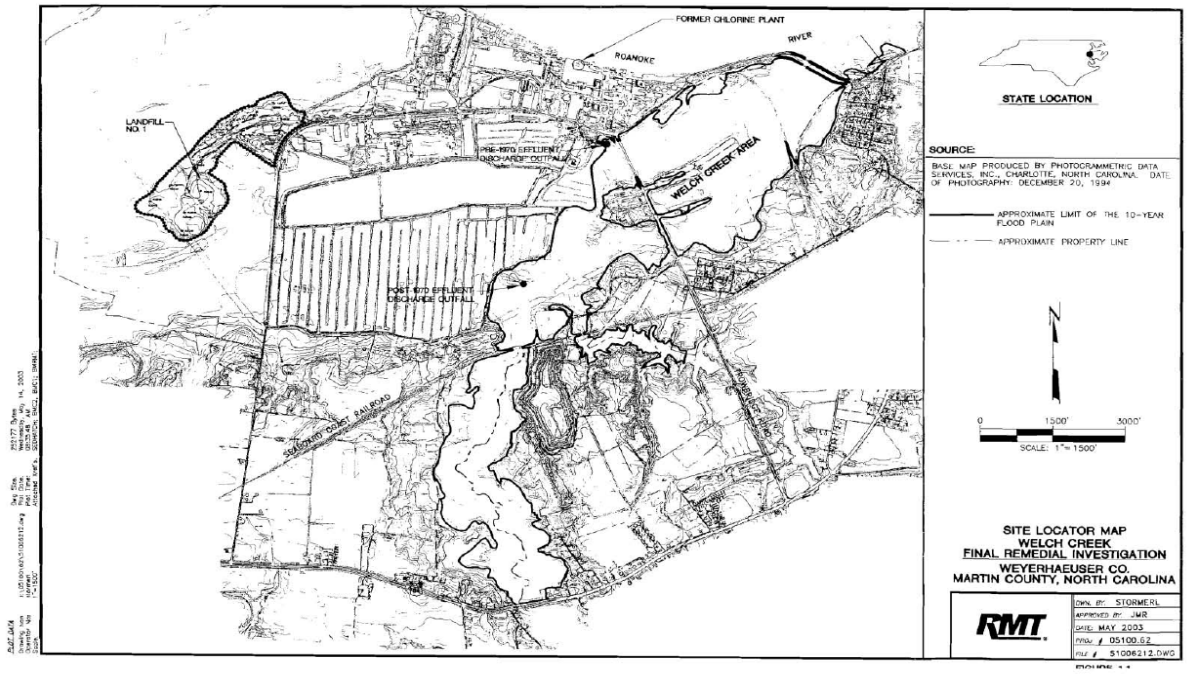

Figure 2. Welch Creek Area

Historically, fish dioxin levels have declined since the mid-1990s. In October 2001, the North Carolina's fish consumption advisory was lifted for sport fish at this site (Welch Creek). However, the fish consumption advisory due to dioxin in catfish and carp is still in effect (4). In 2006, the Domtar Pulp and Paper Mill funded a private consultant to conduct a fish dioxin study of Welch Creek, and other locations near the site. The result of this report was published in March of 2007 (5). Dioxin levels continue to decline, but are still present in catfish (channel and white). The North Carolina Department of Health and Human Services has recently completed a protocol for issuing fish consumption advisories due to dioxins (6).

Demographics

According to the 2000 United States census, 905 people live within a one mile perimeter of the facility, and 4,403 people live within a two mile perimeter of the facility. The city of Plymouth, North Carolina (population 4,107) is located directly east-northeast of the facility (2).

Environmental Data

Samples were collected by RMT, Inc\Weyerhaeuser and analyzed by WATS (Federal Way, Washington) from ten major transects (MT) and one general transect (GT) along a Welch Creek bed (7). The material sampled from the creek bottom include historic wastewater solids (1957 – 1987) and the underlying sediment. Dry weight sediment data were used for this health consultation.

Each dioxin congener concentration was converted to its 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxic equivalent by multiplying the level of a particular dioxin-like compound by its toxicity equivalency factor (TEF). The 2005 World Health Organization's human and mammalian TEFs for dioxins and dioxin-like compounds were used for the toxic equivalent calculations (8). The resulting TEQs are then added together to determine the total dioxin TEQ (see Table 1).

Total dioxin TEQs in sediments were compared to ATSDR screening level of 50 parts per trillion (ng/kg) in soil and to background levels (Table 2). The ATSDR screening level is defined as the minimal risk (non-cancer) level (MRL)-based environmental media evaluation guide (EMEG) for dioxin TEQ in soil (9). Total 2,3,7,8-TCDD TEQs exceeded background and ATSDR screening levels in transect locations M-4, M-5, and M-6. The maximum concentration of dioxins measured in Welch Creek sediments was 3493 ng/kg.

A MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration and route of exposure (5). The chronic-duration oral MRL of 1 picogram/kilogram body weight/day (pg/kg/day) for total dioxin TEQ is based on neurobehavioral effects in monkeys. Using the chronic MRL value (1 pg/kg/day), exposure assumptions for a child (soil ingestion rate of 200 mg/day and 10 kg body weight), and assumption of 100% bioavailability, an EMEG of 0.05 ppb (50 ppt) TEQ was derived as a screening value for residential soils contaminated with dioxins and dioxin-like compounds.

The maximum concentration of dioxins measured in Welch Creek sediments was 3493 ng/kg, the minimum concentration was 2.42 ng/kg, and the mean concentration was 671 ng/kg. The concentration of dioxins used to estimate the dose is 1110 ng/kg (calculated as the upper 95% confidence interval of the mean). The estimated exposure dose is calculated by multiplying the contaminant concentration (0.00111 mg/kg), intake rate of contaminated sediment (100 mg/day), exposure factor (0.68 unit-less), and a conversion factor (10^{-6} kg/mg). The product is divided by the body weight (70 kg). Therefore, the estimated dose of dioxins is 1.1 X 10^{-9} mg/kg/day. This dose slightly exceeds the ATSDR minimum risk level of 1.0 X 10^{-9}. There is not enough information to determine risk of illness through inhalation or dermal contact exposures.

Sediment data for chromium, chromium VI, copper, mercury, nickel, phenanthrene, pyrene, and zinc were reviewed and screened using ATSDR comparison values (10). Although chromium, copper, mercury, nickel, phenanthrene, and zinc were present in the sediments, the concentrations were below the ATSDR comparison values (Table 3).

Discussion

The contaminant of concern for Welch Creek sediments is dioxin. Dioxins are a group of chlorinated chemicals with similar structures and chemical properties. Dioxins are not naturally-occurring compounds, but are commonly- formed during the bleaching process at pulp and paper mills. Dioxins are released in the wastewaters and settle to the bottom sediment in water. Dioxins may build up in aquatic food chains, resulting in measurable levels in fish and other animals (11, 12).

A mixture of the various types of dioxins may be found in sediments. The most toxic type of dioxin is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). However, not all dioxins are as toxic as 2,3,7,8-TCDD. For this reason, toxic equivalency factors (TEF) have been developed to compare the relative toxicity of these other dioxins to 2,3,7,8-TCDD. The levels of other dioxin-like compounds measured in the environment are multiplied by the TEF to produce a 2,3,7,8-TCDD toxic equivalent concentration (TEQ). The resulting TEQ for all dioxins measured in the environmental sample (in this case sediments) are then added together to determine the total dioxin TEQ for that sample (9).

People exposed to large amounts of dioxins develop chloracne, a severe skin disease with acne like pimples occurring on the upper body and face. Exposure to high concentrations of dioxins may also alter glucose metabolism (blood sugar) and cause subtle changes in hormone levels (11).

In certain animal studies, dioxins may cause weight loss, liver damage, disruption of the endocrine system, weakening of the immune system, reproductive damage, miscarriages, and birth defects. Other animals studies have demonstrated an increase in several types of cancer from exposure to 2,3,7,8-TCDD. It is not known whether or not people will experience these same types of health effects as seen in animal studies. However, 2,3,7,8-TCDD and dioxin mixtures are considered human carcinogens (likely to cause cancer) (11).

An important consideration when evaluating dioxin levels in sediments is the level of exposure from all sources of dioxin. This is referred to as background exposure. People can be exposed to dioxins from a variety of sources including diet, living or work near a site containing dioxins, waste incinerators, or manufacturing facilities that produce dioxins as a by-product. In exposed people, dioxins are absorbed and accumulate in fatty body tissues where they can persist for many years (half-life for 2,3,7,8-TCDD range from 5 to 14 years). This accumulation of dioxins over time is referred to as the body burden. Health effects can occur many years after exposure (12).

ATSDR categorizes exposures pathways as complete, potential, and eliminated. A completed exposure pathway requires all of the following elements to be present: (1) a source of contamination; (2) transport through an environmental medium; (3) a point of exposure; (4) a route of human exposure; and (5) an exposed population. Completed pathways indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future.

A potential exposure pathway is defined as one where exposure could be possible except that one or more of the five elements listed above is missing. In some cases, this means that the exposure is not possible now but may be possible in the future. In other cases, an exposure may be possible but cannot be confirmed because data are not available.

Eliminated exposure pathways are defined when exposure is unlikely and that one or more of the five elements (1) a source of contamination; (2) transport through an environmental medium; (3) a point of exposure; (4) a route of human exposure; and (5) an exposed population.) is missing. This means that the exposure is not possible now and it is not likely to be possible in the future.

Potential pathways of exposure at this site to dioxins include skin contact, incidental ingestion of sediment, and ingestion of dioxin-containing fish. Contaminants in sediment adhering to the skin may be absorbed by the body. However, the ability of the skin to absorb dioxins (bioavailability) is low except during occupational exposures. For the general public, the predominant source of exposure to dioxins is ingestion. Furthermore, fish can accumulate dioxins. When people eat the fish they in turn absorb the dioxins contained in the fish (12). See Table 4 for evaluation of all exposure pathways. This health consultation focuses on the sediments located in Welch Creek.

It should be kept in mind that migration of dioxins from sediments into the area may occur during major storm events with stream bed erosion.

The estimated exposure dose of 1.1×10^{-9} mg/kg/day does exceed the ATSDR minimum risk level (MRL) of 1.0×10^{-9}mg/kg/day. However, exposure is limited due to low bridges across Welch Creek, downed trees, and other obstructions, the area which are not conducive to water sports such as skiing. Therefore, recreational sport fishermen and trespassers (adolescent and adult) would be considered groups infrequently exposed to contaminated sediments. The only group that has a higher potential for exposure to the dioxin-contaminated sediments are remediation professionals. Taking in all the above factors, which include slight dose exceedence, access, in-place institutional controls, fish advisories for dioxins and the fact that

remediation workers would use protective gear, this site is considered **no apparent public health hazard**.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

At this site, adolescent children would be exposed to dioxins in sediments via trespassing. In addition, children may also be exposed to dioxins through consumption of bottom-feeding fish such as catfish and carp. Pregnant women should avoid consuming fish caught from this area. In animal studies, exposure to dioxin caused miscarriages and birth defects (12).

Conclusions

The result of this health consultation indicates that dioxin is the main contaminant in the sediments along portions of the bed of Welch Creek, and would pose a concern if people were routinely exposed to sediments in this area. The location of the contaminated waterway is located on Weyerhaeuser property and should be considered remote. Exposure to the general populations who do not have access to this location is not likely. If a hurricane or other extreme adverse conditions were to occur in the area, dioxins in the sediment could be suspended making exposure more likely if contact were made with the water. Media, press coverage, public awareness, institutional controls, and state fish advisories have all effectively reduced the likelihood of exposure to dioxins and dioxin-contaminated sediments at this site. However, recreational trespassers, worker exposures, as well as potential future exposures at the site are all-possible and indicate the need to reduce or remediate the high levels of dioxin to protect public health.

Recommendations

- This site should be remediated to prevent future exposures to dioxin.

- Post-remediation monitoring may be necessary to document any migration of contaminated sediments into surface waters, adjacent wetlands, other areas of the creek bed, and the biota (i.e. fish).

- Continue health education efforts to prevent exposure, including fish advisory awareness.

Public Health Action Plan

USEPA is presently soliciting comments on a proposed remediation plan. This plan deals with the contaminated sediments along Welch Creek. In addition, the plan outlines the rationale for preferred cleanup alternatives (1).

Dioxin concentrations in fish have been declining. However, before a fish advisory can be removed by the North Carolina Department of Health and Human Services there must be two years of fish sampling data showing the average TCDD TEQ levels. This includes all 17 2,3,7,8-substituted tetra- through octa-chlorinated dibenzo-p-dioxins and dibenzofurans for a given species to be at or below 3 parts per trillion (ppt) or 3 ng/kg total TEQs (6).

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References

1. USEPA, Superfund Proposed Plan Fact Sheet, Weyerhaeuser Site Plymouth, North Carolina, July 2007.

2. ATSDR, Health Consultation: Weyerhaeuser Company Plymouth Wood Treating Plant, Plymouth, Martin County, North Carolina, EPA Facility ID: NCD991278540, OCTOBER 17, 2003.

3. RMT, Final Remedial Investigation Report, Welch Creek Area, Weyerhaeuser Company, Martin County, North Carolina, May 2003.

4. North Carolina Department of Health and Human Services Fish Advisories 2007 http://www.epi.state.nc.us/epi/fish/current.html.

5. CZR Incorporated, Roanoke, Chowan River/HWY17, Welch Creek, and Albemarle Sound Fish Dioxin NPDES Study, Willington, North Carolina March 2007.

6. NCDHHS, Protocol for Issuing Fish Consumption Advisories Due to Chlorinated Dibenzo-p-dioxins (CDDs) and Chlorinated Dibenzo-p-furans (CDFs) Found in Fish, September 2006.

7. RMT/Weyerhaeuser, Final Remedial Investigation Report – Welch Creek Area, Weyerhaeuser Company, Martin County, North Carolina, May 2003.

8. WHO, The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds, 2005.

9. ATSDR, Update – ASTDR Policy Guideline for Dioxins and Dioxin-Like Compounds in Residential Soil (Draft for Federal Register), November 2006.

10. ATSDR, Soil Comparison Values, 2007.

11. ATSDR, Chlorinated Dibenzo-p-Dioxins (CDDs), ToxFAQs, February 1999.

12. ATSDR, Chlorinated Dibenzo-p-Dioxins (CDDs), Toxicological Profiles, December 1998.

Table 1

Toxic Equivalency Conversion of Dioxin Congener Dry-Weight Concentrations to Total 2,3,7,8-TCDD Toxicity Equivalence - Sediments

	Toxic	MT-1		MT-2		MT-4		MT-5		MT-5		MT-5		MT-5	
	Equivalency	WCSD-01		MT02MP-30-1N		MT04MP-40-3S		MT05LB-20-00-05		MT05LB-20-05-10		MT05LB-20-MP		MT05LB-20-N	
Congener[1]	Factor[2]	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ
2,3,7,8-TCDD	1	<1.19[3]	0.60	2.25	2.25	1778	1778.00	1024	1024	1656 Ej	1656	3383.3 Ej	1	<0.51	0.255
1,2,3,7,8-PECDD	1	<0.909	0.46	<1.16	0.58	49	49.00	20.2	20.2	23.3	23.3	38.1	38.1	4.3	1.9565
1,2,3,4,7,8-HXCDD	0.1	<2.56	0.13	3.74	0.37	<3.26	0.16	<2.11	0.1055	<1.78	0.089	<5.38	0.269	8.75	1.12
1,2,3,6,7,8-HXCDD	0.1	<2.24	0.11	6.95	0.70	495	49.50	98.6	9.86	110	11	122	12.2	22.6	2.5312
1,2,3,7,8,9-HXCDD	0.1	<2.23	0.11	14.8	1.48	222	22.20	58.7	5.87	52	5.2	69.6	6.96	24.3	2.7216
1,2,3,4,6,7,8-HPCDD	0.01	16	0.16	317	3.17	1430	14.30	663 B	6.63	615 B	6.15	1565 B	0.01	905 B	0.16
OCDD	0.0003	893	0.27	12849 Ej	3.86	14318 Ej	4.30	9743 EBj	2.9229	21542 EBj	6.46	6501 EBj	0.0003	38003 EBj	0.268
2,3,7,8-TCDF	0.1	2.26	0.23	14.4	1.44	11839 Ej	1183.90	8883 Ej	888.3	17505 Ej	1750.5	10748 Ej	0.1	10.5	2.373
1,2,3,7,8-PECDF	0.03	<1.63	0.02	<0.44	0.01	62.3	1.87	45.8	1.374	79.6	2.388	76.9	2.307	5.38	0.13181
2,3,4,7,8-PECDF	0.3	<1.21	0.18	<0.48	0.07	70.2	21.06	53.2	15.96	99.8	29.94	103	30.9	<0.89	0.1335
1,2,3,4,7,8-HXCDF	0.1	<0.955	0.05	<0.37	0.02	11.5	1.15	8.62	0.8662	9.37	0.937	18.6	1.86	8.26	0.394828
1,2,3,6,7,8-HXCDF	0.1	<0.882	0.04	<0.32	0.02	4.6	0.46	3.54	0.354	4.08	0.408	10.9	1.09	6.03	0.265923
1,2,3,7,8,9-HXCDF	0.1	<0.983	0.05	<0.34	0.02	<1.90	0.10	<1.18	0.059	<1.02	0.051	<1.67	0.0835	<0.80	0.04
1,2,3,4,6,7,8-HPCDF	0.01	<0.603	0.01	2.04	0.02	71.3	0.71	53.4	0.534	57.2	0.572	229	2.29	60.2	0.72842
1,2,3, 4,7,8,9-HPCDF	0.01	<0.716	0.00	<0.42	0.00	8.2	0.08	5.84	0.0584	<1.51	0.00755	18	0.18	5.44	0.0544
OCDF	0.0003	<1.31	0.00	4.06	0.00	233	0.07	310	0.093	617	0.1851	1154	0.3462	132	0.0264
Total 2,3,7,8-TCDD TEQ			**2.42**		**14.00**		**3126.86**		**1977.19**		**3493.19**		**97.70**		**13.16**

Continuation Table 1. Toxic Equivalency Conversion of Dioxin Congener Dry-Weight Concentrations to Total 2,3,7,8-TCDD Toxicity Equivalence - Sediments

	Toxic	MT-6		MT-6		MT-6		MT-6		MT-06		MT-7		MT-7	
	Equivalency	MT06MP-40-00-05		MT06MP-40-05-10		MT06MP-40-MP		WCSD-02		MT06MP-40-09N		MT07MP-40-01S		MT07MP-40-06S	
Congener[1]	Factor[2]	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ
2,3,7,8-TCDD	1	880	880	1338	1338	30.4	30.4	565	565	<0.77	0.385	3.8	3.8	4.17	4.17
1,2,3,7,8-PECDD	1	13.3	13.3	18.8	18.8	<2.90	1	<4.20	2.1	<1.09	0.545	<2.45	1.225	<0.96	0.48
1,2,3,4,7,8-HXCDD	0.1	6.14	0.614	<3.65	0.1825	25.2	2.52	<4.53	0.2265	5.96	0.596	<1.46	0.073	5.04	0.504
1,2,3,6,7,8-HXCDD	0.1	51.2	5.12	43.4	4.34	124	12.4	89.2	8.92	10.5	1.05	6.07	0.607	71.2	7.12
1,2,3,7,8,9-HXCDD	0.1	41.3	4.13	34.2	3.42	32.3	3.23	42.3	4.23	18.1	1.81	4.92	0.492	15.6	1.56
1,2,3,4,6,7,8-HPCDD	0.01	546 B	5.46	939 B	9.39	3095 B	30.95	1404	14.04	544 B	5.44	142	1.42	3050	30.5
OCDD	0.0003	13626 EBj	4.0878	18441 EBj	5.5323	10207 EBj	3.0621	25026	7.5078	28729 EBj	8.6187	4544	1.3632	60587 Ej	18.1761
2,3,7,8-TCDF	0.1	5050 Ej	505	6002 Ej	600.2	89.8	8.98	2507	250.7	4.07	0.407	21	2.1	13.1	1.31
1,2,3,7,8-PECDF	0.03	24.2	0.726	35	1.05	23.6	0.708	<5.24	0.262	<0.56	0.0084	13.9	0.417	1.23	0.0369
2,3,4,7,8-PECDF	0.3	38.5	11.55	49.7	14.91	10.2	3.06	<16.7	0.3	<0.59	0.0885	6.08	1.824	1.44	0.432
1,2,3,4,7,8-HXCDF	0.1	7.61	0.761	<2.53	0.1	44.4	4.44	41	4.1	<0.64	0.032	19.7	1.97	16.7	1.67
1,2,3,6,7,8-HXCDF	0.1	3.58	0.358	<3.19	0.1595	12.8	1.28	<4.31	0.2155	<0.59	0.0295	5.46	0.546	5.94	0.594
1,2,3,7,8,9-HXCDF	0.1	<1.45	0.0725	<3.00	0.15	10.7	1.07	<4.26	0.213	<0.67	0.0485	<0.66	0.033	<0.81	0.0405
1,2,3,4,6,7,8-HPCDF	0.01	49.4	0.494	118	1.18	931	9.31	234	2.34	2.49	0.0249	36	0.36	728	7.28
1,2,3, 4,7,8,9-HPCDF	0.01	5.5	0.055	7.21	0.0721	52	0.52	<3.94	0.0197	<0.66	0.0033	7.88	0.0788	50.3	0.503
OCDF	0.0003	322 B	0.0966	2243 B	0.6729	2885 B	0.8655	808	0.2424	5.68 Bu	1704	64.8	0.01944	1225	0.3675
Total 2,3,7,8-TCDD TEQ			**1431.82**		**1998.16**		**113.80**		**860.42**		**1723.09**		**16.33**		**74.74**

Continuation Table 1. Toxic Equivalency Conversion of Dioxin Congener Dry-Weight Concentrations to Total 2,3,7,8-TCDD Toxicity Equivalence - Sediments

	Toxic	MT-8		MT-8		MT-8		MT-08		MT-8	
	Equivalency	MT08MP-70-00-05		MT08MP-70-05-10		MT08MP-70-MP		WCSD-03		MT08MP-70-NAT	
Congener[1]	Factor[2]	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ
2,3,7,8-TCDD	1	20.4	20.4	31.7	31.7	<2.70	1.35	53.8	53.8	<0.70	0.35
1,2,3,7,8-PECDD	1	<6.52[3]	3.26	<7.16	3.58	<4.67	2.335	<6.18	3.09	<1.31	0.655
1,2,3,4,7,8-HXCDD	0.1	6.46	0.646	<5.07	0.2535	<5.88	0.294	<8.78	0.439	4.09	0.409
1,2,3,6,7,8-HXCDD	0.1	16.5	1.65	21.9	2.19	<6.41	0.3205	<7.53	0.3765	6.89	0.689
1,2,3,7,8,9-HXCDD	0.1	19.8	1.98	18.5	1.85	<5.89	0.2945	11.6	1.16	13.2	1.32
1,2,3,4,6,7,8-HPCDD	0.01	324 B	3.24	461 B	4.61	296 B	2.96	436	4.36	412 B	4.12
OCDD	0.0003	7493 B	2.2479	8161 B	2.4483	7232 B	2.1696	8063	2.4189	23069 EBj	6.9207
2,3,7,8-TCDF	0.1	68.8 B	0.1	138 B	0.1	21.5	2.15	220	22	<0.28	0.014
1,2,3,7,8-PECDF	0.03	8.74	0.2622	7.82	0.2346	<2.59	0.03885	<4.33	0.06495	<0.46	0.0069
2,3,4,7,8-PECDF	0.3	8.96	2.688	<1.65	0.2475	<2.39	0.3585	<4.07	0.6105	<0.47	0.3
1,2,3,4,7,8-HXCDF	0.1	15.2	1.52	12.1	1.21	15.8	1.58	<9.21	0.4605	<0.43	0.0215
1,2,3,6,7,8-HXCDF	0.1	<1.94	0.097	6.26	0.626	7.42	0.742	<8.73	0.4365	<0.39	0.0195
1,2,3,7,8,9-HXCDF	0.1	<7.59	0.3795	<3.56	0.178	<3.13	0.1565	<9.94	0.497	<0.44	0.022
1,2,3,4,6,7,8-HPCDF	0.01	66.5	0.665	65.7	0.657	61.3	0.613	87.1	0.871	1.82	0.0182
1,2,3, 4,7,8,9-HPCDF	0.01	15.6	0.156	<4.26	0.0213	<3.71	0.01855	<4.32	0.0216	<0.47	0.00235
OCDF	0.0003	174	0.0522	134	0.0402	123 B	0.0369	167	0.0501	2.87 Bu	0.00086
Total 2,3,7,8-TCDD TEQ			**39.34**		**49.95**		**15.42**		**90.66**		**14.87**

Continuation Table 1. Toxic Equivalency Conversion of Dioxin Congener Dry-Weight Concentrations to Total 2,3,7,8-TCDD Toxicity Equivalence - Sediments

	Toxic	GT-22		CC-6		CC-6		CC-8	
	Equivalency	GT22-030-5N		CC6-40-0N		CCSD-01		CCSD-02	
Congener[1]	Factor[2]	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ	(ng/kg)	TEQ
2,3,7,8-TCDD	1	27.5	27.5	2.03	2.03	<9.87	4.935	5.18	5.18
1,2,3,7,8-PECDD	1	3.38	3.26	5.5	3.58	<13.2	6.6	<11.4	5.7
1,2,3,4,7,8-HXCDD	0.1	<1.59	0.0795	17	0.2535	15.8	0.294	1301	0.439
1,2,3,6,7,8-HXCDD	0.1	22.1	2.21	43.5	4.35	35.6	0.3205	30.6	0.3765
1,2,3,7,8,9-HXCDD	0.1	11.2	1.12	66.4	6.64	57.4	0.2945	70.2	7.02
1,2,3,4,6,7,8-HPCDD	0.01	551	5.51	2647	26.47	2246	22.46	1792	17.92
OCDD	0.0003	44396 Ej	13.3188	146520 Ej	43.956	92718 j	27.8154	100971 j	30.2913
2,3,7,8-TCDF	0.1	90.9	9.09	1.54 Bu	0.154	1.52	0.152	<6.61	0.3305
1,2,3,7,8-PECDF	0.03	4.22	0.1266	<0.40	0.006	<4.59	0.06885	<5.41	0.08115
2,3,4,7,8-PECDF	0.3	1.35	0.405	<0.42	0.063	<3.63	0.5445	<4.92	0.738
1,2,3,4,7,8-HXCDF	0.1	8.83	0.883	<0.74	0.037	<3.52	0.176	<3.28	0.0164
1,2,3,6,7,8-HXCDF	0.1	4.76	0.097	<0.63	0.0315	<3.22	0.161	<2.96	0.148
1,2,3,7,8,9-HXCDF	0.1	<0.86	0.043	<0.71	0.0355	<2.99	0.1495	<3.22	0.161
1,2,3,4,6,7,8-HPCDF	0.01	69.5	0.695	1.72	0.0172	<21.0	0.105	19.1	0.191
1,2,3, 4,7,8,9-HPCDF	0.01	5.39	0.0539	<0.31	0.00155	<3.36	0.0168	<4.46	0.0223
OCDF	0.0003	186	0.0558	5.19	0.00156	33.7	0.01011	50.9	0.01527
Total 2,3,7,8-TCDD TEQ			**64.45**		**87.63**		**64.10**		**68.63**

Notes:

(1) Congeners analyzed.

(2) Reference - Van den Berg et al: The 2005 World Health Organisation Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds.

(3) Concentration less than quantitation limit; 1/2 of this value used to approximate concentration for TEQ conversions.

TEQ = Toxicity Equivalence

E = Exceeded calibration range of instrument

j = when specific quality control criteria are outside the established control limits, the reported concentration or the quantitation limit is approximate.

B = analyte was present in the method blank.

u = Analyte was present at thess than 10 times the blank concentration for common laboratory constituents or less than 5 times the concentration in the associated calibration, method, atmosperic, and/or field blank for other organic constituents, and is therefore qualified as nondetectable according to USEPA data validation procedures.

Table 2. Total 2,3,7,8-TCDD TEQ (ng/kg) in Welch Creek Sediments (dry-weight basis) by Location and Comparisons to ATSDR Policy Guideline for Dioxins

Location (Identification #)	Total 2,3,7,8-TCDD TEQ[1] (ng/kg)
MT-1 (WCSD-01)	2.42
MT-2 (MT02MP-30-1N)	14.00
MT-4 (MT04MP-40-3S)	3126.86
MT-5 (MT05LB-20-00-05)	1977.19
MT-5 (MT05LB-20-05-10)	3493.19
MT-5 (MT05LB-20-MP)	97.70
MT-5 (MT05LB-20-N)	13.16
MT-6 (MT06MP-40-00-05)	1431.82
MT-6 (MT06MP-40-05-10)	1998.16
MT-6 (MT06MP-40-MP)	113.80
MT-6 (WCSD-02)	860.42
MT-6 (MT06MP-40-09N)	1723.09
MT-7 (MT07MP-40-01S)	16.33
MT-7 (MT07MP-40-06S)	74.74
MT-8 (MT08MP-70-00-05)	39.34
MT-8 (MT08MP-70-00-10)	49.95
MT-8 (MT08MP-70-MP)	15.42
MT-8 (WCSD-03)	90.66
MT-8 (MT08MP-70-NAT)	14.87
GT-22 (GT22-030-5N)	64.45
CC-6 (CC6-40-0N)[2]	87.63
CC-6 (CCSD-01)[2]	64.10
CC-8 (CCSD-02)[2]	68.63

Notes:

(1) ATSDR Policy Guideline (Non-Cancer) for Dioxins and Dioxin-Like Compounds in Residential Soil; Total 2,3,7,8-TCDD TEQ = 5.0 ng/kg.

(2) Background sites.

Shaded values greater than ATSDR Guideline and background concentrations.

Table 3. Comparison Value Screening of Possible Comtaminants of Concern - Welch Creek Sediments

Contaminant	Maximum[1] Concentration	Comparison[2,3] Value	Comparison Value Reference	Contaminant of Concern
Chromium[4]	2740	80,000 mg/kg	RMEG	NO
Chromium VI	BDL	200 mg/kg	RMEG	NO
Copper	125	500 mg/kg	Intermediate EMEG	NO
Mercury[5]	15.1	20 mg/kg	Chronic EMEG	NO
Nickel	64.5	1,000 mg/kg	RMEG	NO
Phenanthrene[6]	0.62	None	None	NO
Pyrene	BDL	2,000 mg/kg	RMEG	NO
Zinc	399	20,000 mg/kg	Chronic EMEG	NO

Notes:

1. Maximum concnetration measured over study area.
2. ASTDR Soil Comparison Values
3. Child exposure, body weight of 10 kg and soil ingestion rate of 200 mg/day.
4. Comparison value, trivalent chromium.
5. Comparison value, methyl mercury.
6. Based on pyrene; similar toxicity.

BDL, Below Detection Limit

Table 4. Exposure Pathways - Dioxins

Source	Medium	Point of Exposure	Route of Exposure	Exposed Population	Time	Status
Weyerhaeuser	Sediment	Welch Creek	Ingestion Skin Contact	Environmental Professionals	Past Present	Potential Potential
Weyerhaeuser	Fish	Welch Creek	Ingestion	Sport Enthusiasts Tresspassers	Future Past Present Future	Potential Potential Potential Potential

CERTIFICATION

This Weyerhaeuser Company Health Consultation was prepared by the North Carolina Department of Health and Human Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health assessment was begun. Editorial review was completed by the cooperative agreement partner.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.

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