Health Consultation

PUBLIC COMMENT RELEASE

Dupont DeLisle Plant

(a/k/a DuPont E I De Nemours and Company, Incorporated)

Pass Christian, Harrison County, Mississippi

EPA FACILITY ID: MSD096046792

APRIL 14, 2006

COMMENT PERIOD END DATE: MAY 26, 2006

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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Prepared by:

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Background and Statement of Issues

On August 29, 2005, Hurricane Katrina made landfall along the central Gulf Coast near Buras-Triumph, Louisiana, as a Category 4 storm. DuPont DeLisle, a titanium dioxide manufacturing plant located near Pass Christian, MS, was affected by Katrina's inundation (Figures 1 and 2). Mississippi Department of Environmental Quality (MSDEQ) and contractors from the United States Environmental Protection Agency (EPA) visited the plant and confirmed reports from the plant that containment of waste materials appeared to be intact [1]. Environmental groups sampled soils from the surrounding community and analyzed them for metals and dioxin-like compounds. These results were published on December 5, 2005, and widely reported in the media. After the hurricane, EPA also sampled near the plant [2]. This health consultation discusses the results of the EPA and Sierra Club sponsored testing.

Environmental Data Reviewed

Sierra Club 2005

The Sierra Club released results on their website (http://www.sierraclub.com/gulfcoast/testing/) of post hurricane Katrina and Wilma environmental testing. Three post-hurricane Katrina soil samples were collected in the DeLisle area [3]. These samples were analyzed for metals (EPA Methods 6010 and 7471) and for dioxin-like compounds (EPA Method 8290). Samples were analyzed by Pace Analytical Labs, which is accredited by National Environmental Laboratory Accreditation Conference (http://www.epa.gov/nelac/). Results of the sampling are shown in Tables 1 and 2. Sample SS-A was collected near the south end of Winding Way Drive, SS-B was collected north of the DeLisle plant on the right-of-way of an unnamed gravel road, and sample SS-C was collected on the grounds of the DeLisle Elementary School.

EPA Sampling

Three surface soil and two sediment samples were collected at five locations, as shown on Figure 3. These samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), metals, and dioxins. Tables 3, 4, 5, 6, and 7 in Appendix B summarize the results of these samples.

Discussion

ATSDR initially analyzed the environmental data using screening comparison values as outlined in ATSDR's Public Health Assessment Manual [4]. Details of which comparison values ATSDR used are in Appendix C. Chemicals detected at levels higher than their screening values, or chemicals detected for which no screening values exist, include:

Arsenic

Arsenic concentrations were higher than EPA's Preliminary Remediation Goal of 0.39 ppm, and an ATSDR Cancer Risk Evaluation Guide (CREG) of 0.5 ppm. All soil samples exceeded at least one of these screening values. However, arsenic is naturally found in soils throughout the United States at an average level of 7.2 ppm [5]. Eastern soils have average arsenic level of 4.4 ppm [5]. Researchers with Mississippi State University published a study of arsenic levels in soils throughout Mississippi in 2001 [6]. Arsenic levels in Mississippi soils averaged 8.25 ppm, with a range from 0.26 to 24.43 ppm [6]. Coastal flatwood soils, which would be expected to be encountered on the coast, have average arsenic levels of 4.42 ppm, with a range of 0.37 to 14.78 ppm [6]. Figure 4 contains data maps of arsenic soil levels typical for southern Mississippi obtained from the US Geological Survey (USGS). The EPA and Sierra Club data are consistent with previously published reports of arsenic levels regionally, and do not show that contaminants from the plant are present in the soils. ATSDR does not expect soils with naturally occurring arsenic levels to pose a risk to persons who contact them.

Arsenic concentration of 53 ppm in sample DUSD01 was higher than background soil levels expected for this area, but the result is similar to marine sediments sampled in St. Louis Bay. This sample may have been influenced by its close proximity to the St. Louis Bay, because suspended sediments in the St. Louis Bay ranged up to 37.8 ppm (dry weight) [7]. Levels of arsenic on the shoreline may have been greatly influenced by Katrina's inundation, because arsenic is known to be concentrated in some reducing marine sediment, which can contain up to 3,000 ppm of arsenic [8].

Health effects from ingesting sediments containing 53 ppm of arsenic are unlikely. First, this sample was collected on the shoreline of St. Louis Bay in an area not accessible to the public. Second, bioavailability of arsenic from soil is reduced by low solubility and inaccessibility due to the presence of secondary reaction products or insoluble matrix components [9]. Even if this location were accessible, ATSDR calculates that a 16 kilogram child could receive a maximum dose of 6.6×10^{-4} mg/kg/day (see Appendix D). This dose is below the no-observed-adverse-effect-level (NOAEL) of 0.0008 mg/kg/day used to calculate ATSDR's Minimal Risk Level [9]. This dose was based on a study examining hyperkeratosis and hyperpigmentation in persons who drank water that contained high levels of arsenic in Taiwan [9,10]. This NOAEL has been observed in studies of other populations exposed to arsenic [9].

Calcium

Calcium was detected in the EPA samples, ranging from 230 to 1,500 ppm. Sierra Club did not analyze for calcium. No comparison values exist for calcium. However, detecting calcium in US soils in general is not unusual (See Figure 5). The levels detected are not unusual for this region.

Chromium

Chromium can exist in a variety of oxidative states, and the oxidative state of chromium influences its toxicity [11]. The analytic tests the Sierra Club used were not specific for

hexavalent chromium, although for screening purposes, Sierra Club assumed that all chromium detected was in fact in its +6 (hexavalent state). A review of typical levels of chromium in soils in the United States (see Figure 6) reveals that 53 ppm of chromium would constitute background levels for this region.

Mercury

Two samples, SS-A and SS-B detected mercury at 0.025 ppm and 0.015 ppm, respectively. Mercury is released to the environment by both natural processes (e.g., volcanic activity and weathering of mercury-containing rocks) and anthropogenic sources [12]. The levels detected, however, appear to be below levels typical for southern Mississippi (see Figure 7).

Potassium

Potassium was detected in the EPA samples, ranging from 82 to 1,600 ppm. Sierra Club did not analyze for potassium. No comparison values exist for potassium, which normally exists in US soils (see Figure 8). These levels are not atypical for this region.

Sodium

Sodium was detected in the EPA samples, ranging from 96 to 1,900 ppm. Sierra Club did not analyze for sodium. No comparison values exist for sodium which normally exists in up to percent levels in US soils (see Figure 9). These levels are not atypical for this region.

Dioxin-Like Compounds

The post hurricane concentrations of dioxin-like compounds near DeLisle are shown in Tables 2 and 7. Polychlorinated dibenzo-p-dioxins, referred to as dioxins, are a class of chemicals that share the same basic chemical structure, but which vary in the number and location of chlorine atoms. Dioxins have two benzene rings attached by oxygen bridges. On the dioxin molecule, chlorine can substitute for hydrogen in eight possible locations. The different dioxins are designated by noting the position of each chlorine atom and how many chorine atoms are attached. For example, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), has 4 chlorines — one each in positions 2, 3, 7, and 8 of the dioxin. Chlorodibenzofurans have a structure very similar to dioxins, with the exception that only one oxygen bridge connects the two benzene rings. The furans are similar to dioxins in their mode of generation, environmental fate, transport and health effects.

Scientists routinely find low levels of dioxin-like compounds in soils [13]. Researchers have measured dioxins in soils in southern Mississippi. In 36 soil samples from southern Mississippi counties, the I-TEQ concentration in soil ranged from 0.16 to 22.9 ppt dry mass [14]. The mean I-TEQ concentration was 3.1 ppt dry mass, and the median I-TEQ concentration was 0.8 ppt dry mass [14]. On a I-TEQ's basis, all of the Sierra Club dioxin

soil samples were within this range (Table 2). With the exception of sample DU2-SD-01, the EPA samples were within this range (Table 7). In 2004, researchers analyzed 13 sediment samples from St. Louis Bay and found dioxin levels ranging from 1.62 to 15.33 ppt WHO-TEQ [15].

To evaluate potential health risks, ATSDR compared the EPA and Sierra Club dioxin sample results to ATSDR's "Environmental Media Evaluation Guideline (EMEG)," of 50 ppt WHO-TEQ for soils [16]. The EMEG is a screening level that assumes routine exposure of children directly to the soil and is based on ATSDR's Minimal Risk Level (MRL) for dioxin-like compounds (1 picogram/kilogram/day), which is over 90 times lower than any dose associated with toxic effects in either animals or humans [13].

What is Toxic Equivalence?

Dioxins, furans, and co-planar PCBs are believed to have similar health effects. The different congeners of these chemicals are, however, believed to have varying strength or potency to contribute to health effects. The toxic equivalence (TEQ) is a tool in which all forms of dioxin are added together, where the most toxic forms contribute greatly to the sum, and the less toxic forms contribute very little to the sum. This tool is used to give relative perspective to the potency of any given dioxin mixture. Different systems are used for calculating TEQ's. For details and discussion of TEQ's see ATSDR's Toxicological Profile for Chlorinated Dibenzo-p-dioxins, page 256-261 [12].

Although the analysis of all soil and sediment (0.585 – 36.5 ppt WHO-TEQ) samples were below ATSDR's EMEG level, some sample results suggest that some of the dioxin-like compounds present in the post-hurricane Katrina soil sampling near DeLisle are not typical for this area. A concentration of 2,700 ppt octachlorodibenzofuran (OCDF) was detected in Sierra Club's sample SS-B, which was taken on a gravel road near the plant. OCDF was also detected in significant levels (4,800 ppt) in EPA's sediment sample DUSD01, which was taken near a drainage ditch by the site. Because of its low toxicity equivalence factor, OCDF does not contribute significantly to the total TEQ's; however, it is present at levels higher than two background soil samples that were analyzed near the plant in 2002 (Table 8, Figures 10,11). Given the high chlorinated furan content of samples taken near two of DuPont DeLisle's solid waste units (Figures 12,13), this type of dioxin may have possibly come from the plant. Previous studies of dioxins in soils in southern Mississippi have noted the predominance of octachlorodibenzodioxin, and these soils had a high ratio of polychlorinated dibenzo-p-dioxins to polychlorinated dibenzofurans [14,17]. The OCDF levels in EPA's sample DUSD01 and Sierra Club's sample SS-B, are not typical of sediments in St. Louis Bay, which contains levels of OCDF ranging from 0.769 to 40.6 ppt [15].

Most human exposure to dioxin-like compounds is through food chain bioaccumulation [18]. ATSDR has previously recommended further testing of crab in St. Louis Bay [19]. This is because crab can magnify the concentrations of certain types of dioxin-like compounds present in the waste streams of the DuPont DeLisle plant [20]. Recent Sierra Club soils data and EPA sampling data further support ATSDR's sampling recommendation.

Conclusions

1. Concentrations of contaminants detected in soil and sediment samples collected in the DeLisle area pose no apparent public health hazard to persons living in the area.
2. One soil sample and one sediment sample contain some dioxin-like compounds at levels that are not normally detected in area soils and sediments.

Recommendations

1. ATSDR recommends testing of biota in St. Louis Bay for dioxin-like compounds, particularly in crabs.

Public Health Action Plan

The Public Health Action Plan for the site contains a description of actions ATSDR has taken or will take, or actions taken by other government agencies at the site, individually or in combination. The purpose of the Public Health Action Plan is to ensure that this public health consultation not only identifies public health hazards, but also provides a plan of action designed to mitigate and to prevent adverse human health effects resulting from exposure to hazardous substances. Included is a commitment on the part of ATSDR to follow up on this plan to ensure its implementation.

Actions Completed

Because of a petition from a concerned resident, ATSDR has been involved with this site for more than 3 years. ATSDR published a final health consultation addressing concerns about groundwater contamination and a public comment health consultation addressing dioxin concerns at the plant in 2004 [19,21]. EPA contractors and MSDEQ representatives visited the plant after hurricane Katrina. ATSDR also received updates from the plant as did EPA and MSDEQ. ATSDR also examined multiple sets of aerial images to see what the plant's status and condition was.

Actions Ongoing

ATSDR will perform an Exposure Investigation that will sample crabs in St. Louis Bay. ATSDR will work with regulatory and public health agencies to develop a plan to perform this additional sampling in St. Louis Bay.

Actions planned

ATSDR is planning one more health consultation that will address concerns about air emissions from this site. The final health consultation addressing dioxin-like compounds associated with the plant is drafted and is planned for release after completion of ATSDR's Exposure Investigation.

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Appendix B:Tables

Table 1: Sierra Club Company Mississippi Sampling near DeLisle – Metals (ppm ; mg/kg)

Sample	Collection Date	Metals						
		Arsenic	Barium	Cadmium	Chromium	Lead	**Mercury**	Selenium
SS-A	10/1/2005	**<0.52**	5.4	<0.10	53	2.3	**0.025**	<0.52
SS-B	10/1/2005	**1.3**	13	<0.097	8.7	5.9	**<0.0057**	<0.49
SS-C	10/1/2005	**0.90**	11	<0.092	0.81	5.0	**0.015**	<0.46
EPA Region IX PRG		**0.39**	5400	37	100,000	400	**N/A (elemental)**	390
ATSDR CV		**20 (0.5 CREG)**	10000	10	80,000 (trivalent chromium)	N/A	**N/A**	300
CV Source		**Chronic EMEG Child**	Child RMEG	Chronic EMEG Child	Child RMEG	N/A	**N/A**	Chronic EMEG Child

Table 2: Sierra Club 2005 Dioxins and Furans Analytical Results near DeLisle (ppt ; ng/kg)

Sample	EPA Equivalence	WHO Equivalence	2,3,7,8-TCDD	Total TCDD	2,3,7,8-TCDF	Total TCDF	1,2,3,7,8-PCDF	2,3,4,7,8-PeCDF	Total PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	Total HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	Total HxDCC	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	Total HpCDF	1,2,3,4,6,7,8-HpCDD	Total HpCDD	OCDF	OCDD
SS-A	0.5	1.31	<0.25 A	<0.21	<0.21	<0.21	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	3.1 J	7.7	<2.1	96
SS-B	5.61	14.15	<0.22	<0.22	2.8 A	11.0	10.0	2.2 J	42.0	<1.10	59.0	9.7	4.2 J	* 13 I	97.0	<1.10	<1.10	<1.10	6.4	140.0	68.0	270.0	38	120	2700	1200
SS-C	0.4	1.02	<0.150	<0.150	<0.150	0.31 J	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	1.00 J	<0.730	<0.730	<0.730	3.20 J	1.90 J	<0.730	3.8	7.70	18.00	3.70 J	120
Blank	0.37	1.21	<0.190	0.20 J	<0.190	<0.190	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.97	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<0.970	<1.900	<1.900

A – Detection limit based on signal to noise ratio
I – Indicates interference
J – The concentration is below the calibration range
* - Maximum probable concentration

Abbreviations

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,7,8-PeCDD	1,2,3,4,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin

Table 3: EPA Sample Locations and Rationale

Sample ID	Grab or Composite	Location	Rationale
DU2-SD-01	Grab (0-3”)	Dirt road and canal southwest of site	Evaluate potential for hazardous constituents to have drained from site via ditch.
DU2-SD-02	Grab (0-3”)	Dirt road at well south of site	Evaluate potential for hazardous constituents to have drained from site via ditch.
SU2-SF-03	3 point composite (0-3”)	South of swale along Kiln DeLisle Rd.	Evaluate potential for hazardous constituents to have moved North with storm surge.
DU2-SF-04	3 point composite (0-3”)	South of swale along Kiln DeLisle Rd.	Evaluate potential for hazardous constituents to have moved North with storm surge.
DU2-SF-05	3 point composite (0-3”)	South of swale along Kiln DeLisle Rd.	Evaluate potential for hazardous constituents to have moved North with storm surge.

Table 4: EPA Surface Soil Sampling Metal Results, DuPont DeLisle (ppm ; mg/kg)

	DU-SD-01	***DU-SD-01D***	***DU-SD-02***	***DU-SF-03***	***DU-SF-04***	***DU-SF-05***	***ATSDR CV***	***SOURCE***	***EPA REGION IX PRG***
Aluminum	1,200	9,000	4,800	6,500	5,100	4,000	100,000	Intermediate EMEG – Child	76,000
Arsenic	**53 J**	**35 J**	**1 R**	**1.4**	**1.5**	**1 R**	**20 / 0.5**	**Chronic EMEG Child / CREG**	**0.39**
Barium	140 J	87 J	400	27	17 J	15 J	10,000	RMEG – Child	5,400
Beryllium	2	1.3	0.22 UJ	0.12 UJ	0.1 UJ	0.04 UJ	100	Chronic EMEG Child	150
Calcium	**1,500 J**	**1,400 J**	**330 J**	**1,100**	**230 J**	**540 J**	**N/A**	**N/A**	**None**
Chromium	22 J	18 J	7.3 J	11 J	9.1 J	5.6 J	80,000	RMEG – Child	100,000
Cobalt	8.3 J	7.9 J	0.83 J	1.2 J	0.74 J	0.45 J	500	Intermediate EMEG – Child	900
Copper	33 J	22 J	2.6 J	2.7 J	2 J	1.9 J	500	Intermediate EMEG – Child	3,100
Iron	13,000 J	13,000 J	2,900 J	9,900 J	7,900 J	4,300 J	N/A	N/A	23,000
Lead	18 J	15 J	16 J	16 J	26 J	13 J	N/A	N/A	400
Magnesium	1,100	1,200	470 J	150 J	140 J	140 J	N/A	N/A	N/A
Manganese	96 J	130 J	12 J	380 J	180 J	36 J	3,000	RMEG-Child	1,800
Nickel	18 J	14 J	1.6 J	2.5 J	1.6 J	1.3 J	1,000	RMEG-Child	1,600
Potassium	**1,600**	**1,200 J**	**240 J**	**88 J**	**82 J**	**85 J**	**N/A**	**N/A**	**N/A**
Selenium	0.88 J	0.73 R	4.6 U	4 U	0.48 R	4 U	300	Chronic EMEG Child	390
Sodium	**1,800**	**1,900**	**630 J**	**110 UJ**	**110 UJ**	**96 UJ**	**N/A**	**N/A**	**N/A**
Thallium	1.9 J	0.53 R	3.3 U	2.8 U	2.8 U	2.8 U	N/A	N/A	5.2
Vanadium	50	38	11	16	14	9.2	200	Intermediate EMEG – Child	78
Zinc	56	49 J	15	21	14	11	20,000	Chronic EMEG Child	23,000

U-Analyte not detected at or above reporting limit.
J-Identification of analyte is acceptable; reported value is an estimate.
UJ-Analyte not detected at or above reporting limit. Reporting limit is an estimate.
R-Presence or absence of analyte can not be determined from data due to severe quality control problems. Data are rejected and considered unusable.

Table 5: EPA Surface Soil Sampling Semi-Volatile Results, DuPont DeLisle (ppb ; µg/kg)

	DU-SD-01	*DU-SD-01D*	*DU-SD-02*	*DU-SF-03*	*DU-SF-04*	*DU-SF-05*	*ATSDR CV*	*SOURCE*	*EPA REGION IX PRG*
1,1-Biphenyl	660 U	660 U	1100	380 U	380 U	370 U	N/A	N/A	3,000,000
2-Methylnapthalene	660 U	660 U	4100	380 U	380 U	370 U	3,000,000	Chronic EMEG Child	N/A
Anthracene	660 U	660 U	110 J	380 U	380 U	370 U	20,000,000	RMEG Child	22,000,000
Naphthalene	660 U	660 U	1100	380 U	380 U	370 U	1,000,000	RMEG-Child	56,0000
Phenanthrene	660 U	660 U	1200	380 U	380 U	370 U	N/A	N/A	N/A
Pyrene	660 U	660 U	130 J	380 U	380 U	370 U	2,000,000	RMEG-Child	2,300,000

U-Analyte not detected at or above reporting limit.
J-Identification of analyte is acceptable; reported value is an estimate.

Table 6: EPA Surface Soil Sampling Volatile Organic Compounds Results, DuPont DeLisle (ppb ; µg/kg)

	DU-SD-01	*DU-SD-01D*	*DU-SD-02*	*DU-SF-03*	*DU-SF-04*	*DU-SF-05*	*ATSDR CV*	*SOURCE*	*EPA REGION IX PRG*
Acetone	34 UJ	50 J	68 J	12 UJ	53 J	95 J	100,000,000	Intermediate EMEG – Child	14,000,000
Benzene	34 U	38 U	24 J	12 U	11 U	11 U	10,000	CREG	640
Ethyl Benzene	34 U	38 U	230 J	12 U	11 U	11 U	5,000,000	RMEG-Child	400
Isopropylbenzene	34 U	38 U	140 J	12 U	11 U	11 U	5,000,000	RMEG-Child	570,000
Methylcyclohexane	34 U	38 U	140 J	12 U	11 U	11 U	N/A	N/A	2,600,000
Toluene	34 U	38 U	23 J	12 U	11 U	11 U	1,000,000	Intermediate EMEG – Child	520,000
Total Xylenes	34 U	38 U	760 J	12 U	11 U	11 U	10,000,000	Intermediate EMEG– Child	270,000

U-Analyte not detected at or above reporting limit.
J-Identification of analyte is acceptable; reported value is an estimate.

Table 7: EPA Soil and Sediment Post Hurricane Katrina Sample Results, DuPont DeLisle (ppt ; ng/kg)

Medium	Sample	TEQ EPA Equivalence (ND=0)	TEQ WHO Equivalence (ND=0)	2,3,7,8-TCDD	2,3,7,8-TCDF	1,2,3,7,8-PCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD
Sediment	EPA DU2-SD-01	46.96	36.5	0.53 J	8.2 U	23	5.8 J	2.3 J	140	17	9.2 J	38 U	5.1 J	13 J	19	220	120	460	4800	8100
	DU2-SD-01D (duplicate)	45.4	32.2	0.55 U	8.9 U	22	5.2 J	2.3 J	140	17	8.7 J	32 U	5.2 J	12 J	20	210	110	450	4500	8100
	EPA DU2-SD-02	2.5769	1.22	0.18 U	0.23 U	0.5 J	0.35 U	0.31 U	0.55 J	0.25 J	0.31 U	0.55 U	1.0 J	1.9 J	3.8 U	2.5 U	0.35 J	67	8.4 J	1500
Soil	EPA DU2-SF-03	2.6428	2.335	0.14 U	0.22 U	0.24 J	0.43 J	0.63 J	0.73 J	0.57 J	0.87 U	0.46 U	1.2	2.5	2.7	14 U	0.88 J	63	52	640
	EPA DU2-SF-04	3.56	3.0775	0.15 U	0.18 U	0.21 J	0.25 J	0.57J	0.69 J	0.75 J	1.2 U	0.30 U	1.6 J	3.4 J	3.4 J	32	1.3 J	97	80	770
	EPA DU2-SF-05	0.6039	0.585	0.64 U	0.20 U	0.20 J	0.24 J	0.18 J	0.36 U	0.23 U	0.29 U	0.24 U	0.27 J	0.56 J	0.46 J	3.0 J	0.39 J	10	11	110

U-Analyte not detected at or above reporting limit.
J-Identification of analyte is acceptable; reported value is an estimate.

Abbreviations

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,7,8-PeCDD	1,2,3,4,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin

Table 8: 2 Soil background boring samples (0-2 feet), Dupont DeLisle (ppt ; ng/kg)

Sample	TEQ EPA Equivalence (ND=LOD MPC = MPC)	TEQ WHO Equivalence (ND=LOD MPC=MPC)	2,3,7,8-TCDD	2,3,7,8-TCDF	1,2,3,7,8-PCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD
SSBKG22	0.636	0.606	(0.0682)	(0.0588)	(0.247)	0.457	(0.0845)	0.697	(0.247)	0.267	(0.123)	0.126)	(0.126)	0.143)	0.779 J	0.518 J	1.21 J	11.4	69.7
SSBKG23	0.681	0.487	(0.0766)	(0.0778)	(0.232)	(0.201)	(0.0607)	0.547 J	(0.242)	0.271 J	(0.076)	(0.169)	(0.172)	(0.19)	0.529 J	[0.383] MPC	2.92	9.35	240

Numbers in parenthesis are the detection limit. No congener was detected.
MPC = Maximum Probable Concentration
J = The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

Abbreviations

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,7,8-PeCDD	1,2,3,4,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin

Table 9: SWMU 8 Soil boring samples (0-2 feet), DuPont DeLisle (ppt ; ng/kg)

Sample	TEQ EPA Equivalence (ND=LOD MPC=MPC)	TEQ WHO Equivalence (ND=LOD MPC=MPC)	2,3,7,8-TCDD	2,3,7,8-TCDF	1,2,3,7,8-PCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD
SS09-02	107	93.6	(0.613)	21.8	93.2	17.4	[0.303] MPC	495	78.6	29.5	[35] MPC	[0.615] MPC	1.12 J	1.06 J	706	427	21.5	13100	1930
SS098-03	23.4	15.3	(0.264)	3.3	13	3.04	(0.37)	74.2	8.9	3.68	[7.21] MPC	(0.414)	(0.376)	(0.427)	83.7	67.3	22.7	1940	7240
SS098-03 Duplicate	23.2	15.6	(0.607)	3.35	12.9	3.08	(0.417)	73.9	10.8	3.95	[4.96] MPC	(0.47)	(0.455)	(0.524)	81.1	65.4	20.1	1930	6800
SS08-04	17.6	11.0	(0.253)	2.44	9.73	2.23	(0.61)	47.3	7.57	2.47	[4.72] MPC	(0.489)	(0.448)	(0.506)	46	38.3	31.6	873	6800
SS08-05	2.64	2.59	(0.239)	(0.287)	1.5 J	0.684 J	(0.385)	8.8	1.18 J	[0.484] MPC	[1.07] MPC	(0.489)	(0.472)	(0.529)	9.45	7.87	1.27	245	26.4
SS08-06	2.56	1.97	(0.199)	(0.341)	0.852 J	[0.597] MPC	(0.209)	5.66	0.915 J	0.478 J	[0.753] MPC	(0.541)	(0.496)	(0.554)	7.22	5.53	4.1	179	593
SS08-07	3.62	2.14	(0.304)	(0.349)	1.21 J	0.631 J	(0.193)	4.96	0.99 J	0.499 J	[0.71] MPC	(0.436)	(0.414)	(0.482)	4.73	4.07	11.9	90.9	1660

Numbers in parenthesis are the detection limit. No congener was detected.
MPC = Maximum Probable Concentration
J = The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

Abbreviations

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,7,8-PeCDD	1,2,3,4,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin

Table 10: SWMU 28 Soil boring samples (0-2 feet), DuPont DeLisle (ppt ; ng/kg)

Sample	TEQ EPA Equivalence (ND=LOD)	TEQ WHO Equivalence (ND=LOD)	2,3,7,8-TCDD	2,3,7,8-TCDF	1,2,3,7,8-PCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD
SSSP01	3.79	2.38	(0.27)	(0.357)	1.53	0.855	(0.227)	4.47	1.2 J	0.866 J	[0.173] MPC	(0.5)	0.604 J	(0.501)	7.04	3.52	24	116	1570
SSSP02	5.11	3.26	(0.199)	0.624	2.26	[0.836] MPC	(0.248)	9.8	1.6 J	1.17 J	(1.29)	0.662)	0.589)	0.681)	18.5	9.21	14.4	550	1640
SSSP03	3.52	2.52	(0.377)	(0.321)	(0.61)	0.511 J	(0.525)	4.12	0.811 J	0.757 J	[0.702] MPC(	(0.48)(	(0.433)(	(0.481)	12.7	4.45	21.2	231	1170

Numbers in parenthesis are the detection limit. No congener was detected.
MPC = Maximum Probable Concentration
J = The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

Abbreviations

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,7,8-PeCDD	1,2,3,4,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin

Appendix C: Explanation of ATSDR Screening Values

Environmental Media Evaluation Guides (EMEGs)
EMEGs are estimated contaminant concentrations that are not expected to result in adverse noncarcinogenic health effects based on ATSDR evaluation. EMEGs are based on ATSDR Minimum Risk Levels (MRL's) and conservative assumptions about exposure, such as intake rate, exposure frequency and duration, and body weight.

Cancer Risk Guides (CREGs)
CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). ATSDR's CREGs are calculated from EPA's cancer slope factors (CSFs) for oral exposures or unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure.

Reference Dose Media Evaluation Guides (RMEGs)
ATSDR derives RMEGs from EPA's oral reference doses, which are developed based on EPA evaluations. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects.

Appendix D: ATSDR Dose Calculation Report

Soil Ingestion Exposure Dose Equation: ED = (C x IR x EF x CF) / BW

** Equation and all default values are taken from ATSDR's Public Health Assessment Guidance Manual.

Contaminant: ARSENIC | CAS No: 007440382 | Mol Wt.: 74.92 g/mol

C = Contaminant Concentration: 53 mg/kg | Value Source: Maximum

IR = Intake Rate of Contaminated Soil:

- Calculate Rate Based on Amount of Soil Ingested Per Da: mg/day
- Use Standard Intake Rate: 200 mg/day - Child average

EF = Exposure Factor (unitless): 1

CF = Conversion Factor (10**-6 kg/mg): 1.0E-6

BW = Body Weight: 16 kg -OR- Population Group: CHILDREN AGES 1-6 16 kg

Optional: enter a health guideline value to use in calculating a margin of exposu

Margin of Exposure:

RESULTS

ED = Exposure Dose: 6.60E-04 (mg/kg/day)

Daily Intake: 0.011 mg/day

Notes

ATSDR Health Guidelines

Chronic Oral MRL:	Intermediate Oral MRL:	Acute Oral MRL:
0.0003 mg/kg/day	mg/kg/day	0.005 mg/kg/day

EPA Health Guidelines

Oral RfD:	Oral Slope Factor:	RfD Soil:
0.0003 mg/kg/day	1.5 (mg/kg/day) -1	mg/kg/day

Health Guideline Comments

The acute oral MRL is considered provisional because it is based on a serious LOAEL.

ATSDR Comparison Values

Hierarchy Level 1 CVs*		Hierarchy Level 2 CVs*		Additional CVs*	
Chronic EMEG Child:	20 ppm	Intermediate EMEG Child:	ppm	Acute EMEG Pica Child:	10 ppm
Chronic EMEG Adult:	200 ppm	Intermediate EMEG Adult:	ppm	Intermediate EMEG Pica Child:	ppm
CREG:	0.5 ppm	Chronic RMEG Child:	20 ppm	ATSDR Soil Action Level:	ppm
		Chronic RMEG Adult:	200 ppm		

Cancer Classes

DHHS (NTP): 1 - Known to be carcinogenic

IARC: 1 - Carcinogenic to humans

EPA: A - Human carcinogen

Soil Comments

The CREG for arsenic in soil (0.5 ppm) is below background levels, so the recommended soil CV is 20 ppm.

Alternate CVs - See Welcome page regarding use of these values.

			Last Download:
EPA Region III RBC (residential soil):	0.43	mg/kg	11/21/2005
EPA Region III SSL (soil, for groundwater migration, DAF 1):	0.0013	mg/kg	12/1/2005
EPA Region III SSL (soil, forgroundwater migration, DAF 20):	0.026	mg/kg	12/1/2005
EPA Region IX PRG (residential soil):	0.39	mg/kg	12/1/2005
EPA Region IX CAL-Modified PRG (residential soil):		mg/kg	
EPA Region IX SSL (soil, for groundwater migration, DAF 1):	1	mg/kg	12/1/2005
EPA Region IX SSL (soil, forgroundwater migration, DAF 20):	29	mg/kg	12/1/2005

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TopHat Toxicological Profile and Health Assessment ToolKit