



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

**61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960**

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4SD-SSB

MEMORANDUM

SUBJECT: Data Evaluation, Off-site Soil Sampling, Tronox (Kerr-McGee) Site, Columbus, Lowndes County, Mississippi

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N/A

Per your request, TSS has reviewed the available soil data collected for the investigation of off-site locations at the Tronox (Kerr-McGee) site, Columbus, Lowndes County, Mississippi. The data collected to date includes samples collected in 2010 by the RCRA Program, data collected in 2010 by the Superfund program, and additional data collected in 2011 by the Superfund Program.

Data Screening & Evaluation Methods

Detected semi-volatile organic compounds (SVOCs) were first compared to the applicable Regional Screening Levels (RSL). RSLs are conservative, long-term risk-based screening values developed by EPA to help identify contaminants of potential concern. If concentrations exceed

an RSL, it does not mean that a clean-up is necessary or that health risks are imminent. Rather, it highlights potential contaminants that should be investigated further.

If an SVOC exceeded an RSL, it was then compared to its Removal Action Level (RAL), RALs are risk-based screening values developed by EPA to determine whether sample concentrations are sufficiently elevated that they may warrant a removal action. Exceedance of an RAL by itself does not imply that adverse health effects will occur.

Dioxin data were converted into 2,3,7,8-TCDD toxicity equivalents (TEQ) and were compared first to the provisional residential soil screening value, a draft Preliminary Remediation Goal that is currently undergoing review for EPA approval. If the dioxin TEQ exceeded the provisional screening value, it was then compared to the EPA Office of Solid Waste and Emergency Response's (OSWER) currently existing residential soil action level.

The screening criteria that were used to evaluate the data are presented below:

Contaminant	Units (ug/kg)	
	RSL	RAL
Benzo(a)anthracene	150	15000
Benzo(a)pyrene	15	1500
Benzo(b)fluoranthene	150	15000
Benzo(k)fluoranthene	1500	150000
Chrysene	15000	1500000
Dibenzo(a,h)anthracene	15	1500
Indeno (1,2,3-cd) pyrene	150	15000
Pentachlorophenol	890	89000
Dioxin TEQ (in ng/kg)	72*	1000**

*Provisional screening value

**OSWER Policy Action Level

RCRA Data 2010

The RCRA Program collected soil/sediment samples collected from a school site, a church property, residential properties, and on-/off-site drainage ditches on April 27 and 28, 2010.

The screening results for soil sampled for semi-volatile organic compounds (SVOCs) are presented in Table 1. It was determined that the RSL was exceeded for a number of polycyclic aromatic hydrocarbons (PAHs) at several locations. However, the RAL was exceeded for only one contaminant, benzo(a)pyrene, in two samples. Sample TN09 and Sample TN09D (a duplicate sample at the same location) exceeded the RAL and were collected at a low-lying residence adjacent to a ditch that collects surface water runoff from the Tronox site.

Table 1. Screening Results for Soil 2010 RCRA Sampling Event: No. of samples that exceed screening criteria (out of 14 samples)

Contaminant	>RSL	>RAL
Benzo(a)anthracene	8	0
Benzo(a)pyrene	9	2
Benzo(b)fluoranthene	8	0
Benzo(k)fluoranthene	2	0
Dibenzo(a,h)anthracene	5	0
Indeno(1,2,3-cd)pyrene	4	0

Soil samples were also collected for dioxin analysis. The initial screening step indicates that four samples (including a duplicate) exceeded the provisional screening value for dioxin TEQ. None of the samples analyzed for dioxin exceeded the OSWER Action Level.

Sediment from some ditches was found to exceed the RALs for one or more PAHs in five samples. The sediment samples analyzed for dioxin did not exceed the provisional screening value or the OSWER action level for dioxin TEQ.

Based on these findings, the project was turned over to the Superfund Program for additional investigation. The data are presented in greater detail in the *Sampling Investigation Report, Tronox Inc., SESD Identification #10-0409, Conducted near 2300 14th Ave N., Columbus, MS 39701-2516, Final Report Issued September 7, 2010.*

Superfund Program Data 2010

During the week of October 25, 2010, EPA collected 49 soil samples from 39 properties. Samples were collected from residential and other properties (churches, cemetery, school) adjacent to the Tronox/Kerr-McGee site.

The screening results of the soil sampled for semi-volatile organic compounds (SVOCs) are presented in Table 2. It was determined that the RSL was exceeded for a number of polycyclic aromatic hydrocarbons (PAHs) at several locations

Table 2. Screening Results for 2010 Superfund Sampling Event: No. of samples that exceed screening criteria (out of 49)

Contaminant	> RSL	>RAL
Benzo(a)anthracene	13	0
Benzo(a)pyrene	41	1
Benzo(b)fluoranthene	29	0
Benzo(k)fluoranthene	1	0
Dibenzo(a,h)anthracene	33	0
Indeno(1,2,3-cd)pyrene	18	0

Benzo(a)pyrene was the only contaminant that exceeded its Removal Action Level in this round of sampling. Sample Station 12462B (4,800 ug/kg) collected at the school property was the only sample to exceed an RAL. Three additional samples (including one split sample) were collected

adjacent to Station 12462B. Samples collected at Station 12462A (69 ug/kg) and Station 12462C (77 ug/kg, 87 ug/kg) were below the benzo(a)pyrene RAL. Additional sampling was recommended to determine the extent of an elevated benzo(a)pyrene concentration on the school property.

Seven samples exceeded the provisional screening value for dioxin TEQ in residential soil. However, no dioxin TEQ concentrations exceeded the OSWER residential action level for dioxin. The highest dioxin TEQ reported was 140 ng/kg at Station 12623.

It should be noted the data for the single congener 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) were flagged as non-detected and rejected in the data validation report for most of the dioxin sample results. The total Dioxin TEQ was still a valid calculation according to Region 4's data reporting protocols. However, in order to resolve concerns about the rejected congener data, EPA decided to resample all locations for dioxin. Additional discussion of the dioxin data issue will be presented later in this memorandum.

Additional information regarding this sampling event can be found in the *Site Investigation Report, Kerr-McGee Chemical (Columbus) Site (Formerly Tronox Residential Soil Sampling Investigation), Columbus, Mississippi, Project Identification Number: 11-0019, Final: February 4, 2011.*

Superfund Program Data 2011

During the week of February 14, 2011, EPA recollected dioxin soil samples from properties previously sampled in October, 2010. Twelve additional samples, including two from a waste pile, were collected for dioxin and SVOC analyses. The screening results of the soil sampled for SVOCs, excluding the waste pile, are presented in Table 3.

Table 3. Screening Results for 2011 Superfund Sampling Event: No. of samples that exceed screening criteria (out of 10)

Contaminant	> RSL	>RAL
Benzo(a)anthracene	1	0
Benzo(a)pyrene	7	0
Benzo(b)fluoranthene	1	0
Benzo(k)fluoranthene	0	0
Dibenzo(a,h)anthracene	1	0
Indeno(1,2,3-cd)pyrene	1	0

The waste pile sample was also determined to exceed RALs for a number of SVOCs. The pile was removed by EPA and a confirmation soil sample was collected from the remaining soil. The confirmation sample was determined to have concentrations of SVOCs below detection limits or below the RSLs.

Five samples had a dioxin TEQ that exceeded the provisional screening value for residential soil. None of the second round of samples exceeded residential OSWER action level.

Dioxin Data Discussion

EPA's lab data validation process flagged most of the concentrations of the congener 2,3,7,8-TCDD as rejected in the initial round of sampling completed by the Superfund Program in 2010. The data were flagged as due to the performance evaluation (PE) sample results being reported as "Action Low" based on the scoring procedure used EPA wide for all PE samples. (See Appendix A of the Site Investigation Report, February 2011 for more detailed discussion).

The results of the two rounds of dioxin TEQ data (October 2010 and February 2011) are presented side-by-side in Table 4. There are generally small differences in concentration between the two samples, which would typically be expected due to variability between samples.

Table 4. Dioxin TEQ: Sample comparison by location and date (in ng/kg)

Sample #	Oct 2010	Feb 2011	Sample #	Oct 2010	Feb 2011	Sample #	Oct 2010	Feb 2011
12131A2SF	18	23	12623A2SF	140	53	13758A2SF	38	15
12323A2SF	29	33	12624B2SF	7.2	40	13758A2SFX	38	54
12324A2SF	50	78	12624A2SB12	97	13	13759A2SF	26	29
12462A2SF	57	81	12629A2SF	79	65	13761A2SF	65	75
12462B2SF	88	60	12630A2SF	4.9	5.7	13762A2SF	24	6
12462C2SF	23	27	12633A2SF	4.9	4.7	13766A2SF	13	14
12462C2SFX	22	34	12634A2SF	13	11	13767A2SF	22	21
12470A2SF	110	71	13723A2SF	91	46	13774A2SF	4.2	3.2
12484A2SF	18	23	13743A2SF	13	8.3	13775A2SB12	4.8	1.5
12486A2SF	51	59	13744A2SF	61	38	13775A2SF	4	3.3
12490A2SF	7.3	5.9	13744B2SB12	59	1.8	13785A2SF	16	13
12490A2SFX	8	4.7	13744B2SF	110	78	13889A2SF	2.8	5.9
12491A2SF	11	4.4	13746A2SF	50	22	13890A2SF	9.1	2.7
12520A2SF	12	8.8	13750A2SF	19	17	13894A2SF	3.8	2.8
12522A2SF	11	13	13753A2SF	29	31	13900A2SF	20	8.9
12621A2SF	11	13	13755A2SF	20	20	Mean	33.8	25.9
12622A2SF	11	11	13756A2SF	30	8.9			

Overall the TEQs reported for the 2011 sampling investigation were similar to the values reported for the October 2010 sampling event, although the second round of sampling appears to yield lower concentrations when viewed as a whole. The arithmetic mean of dioxin sample round 1(2010) is 33.8, while the arithmetic mean of dioxin sample round 2 (2011) is 25.9.

Data visualization tools (EPA's [ProUCL 4.1.00](#)) were also used to compare the two data sets. Figure 1 shows a box plot of the two data sets, with the 2010 data on the left and the 2011 data on the right. The non-parametric comparison shows that the means of the two data sets are fairly close, but the 2010 data set shows greater spread among values with at least two potential outliers.

Figure 2 is a Q-Q Plot, a non-parametric approach to comparing underlying distributions of two samples of data. The plot shows that the distribution of the two data sets is generally similar, except that the 2010 data have a greater spread at higher concentrations.

Evaluation of the data shows that the 2010 sample data is generally consistent with, if slightly higher than, the 2011 dioxin TEQ data. The 2010 data may be useful in the on-going investigation of the Tronox site and adjacent properties. It is recommended that the 2010 dioxin data should be maintained and carefully considered in the decision making processes for the Tronox site.

Soil Removals Completed

In direct response to the analytical findings and data evaluation conducted to date, several removal actions have been undertaken by the Emergency Response & Removal Branch.

Approximately 12-15" of soil was removed at the residence at sample location TN09 resulting in the removal of approximately 150 tons of soil. This action addressed soil that exceeded the RAL for benzo(a)pyrene as well as the highest detected concentrations of dioxin TEQ. The area was backfilled and sodded.

Soil exceeding the RAL for benzo(a)pyrene on the school property was excavated resulting in shipment of approximately 100 tons of soil. The area backfilled and seeded.

The waste pile sampled at the church property was also removed to address concentrations that exceeded the RALs for several PAHs.

These actions address all of the soil with concentrations greater than an RAL that have been identified to date. In addition a fence has been installed on the church property to prevent access to sediments in the ditch where children reportedly play. Additional investigation of the sediments will be conducted by the Superfund Remedial Branch.

Conclusions

All soil concentrations that have been found to exceed an RAL have been addressed by removal actions carried out by the Emergency Response & Removal Branch. Although a number of sediment samples collected by the RCRA program were determined to exceed one or more RALs, further actions in the ditches have been deferred pending further investigation by the Superfund Remedial Branch to determine the full nature and extent of potential contamination. A complete understanding of the contaminant sources, drainage systems, and site hydrology is necessary to adequately design efficient and effective long-term remedial actions as necessary. Potential exposures to sediments are generally lower than those for soils. However, a fence has been installed on the church property to prevent or minimize access to sediments in the ditch where children reportedly play.

It is recommended that soil concentrations that exceed RSLs should be carried forward for additional investigation by the Superfund Remedial Branch. Table 5 presents the number of samples that exceed one or more RSL (or provisional screening level for dioxin) by contaminant. An additional column has been added to visualize how many samples exceed a lifetime cancer risk (ELCR) of 1×10^{-5} . The 1×10^{-5} value represents the midpoint of EPA's acceptable risk range between the RALs at the high end (1×10^{-4}) and the RSLs at the low end (1×10^{-6})

Table 5. Number of remaining samples that exceed an RSL

Contaminant	# > RSL	# > ELCR 10-5
Benzo(a)anthracene	17	1
Benzo(a)pyrene	58	20
Benzo(b)fluoranthene	33	2
Benzo(k)fluoranthene	0	0
Dibenzo(a,h)anthracene	45	6
Indeno(1,2,3-cd)pyrene	19	0
Chrysene	0	0

None of the samples collected to date exceed the OSWER residential soil action level for dioxin TEQ. However, some of the soil samples that exceeded the dioxin TEQ residential soil provisional screening value have been removed as a result of the removal actions that have been performed to address other chemicals that exceeded an RAL. The remaining soil samples that exceed the dioxin TEQ residential soil provisional screening value include: seven collected by Superfund in October 2010, and five collected by the Superfund Program in April 2010. Only two of the samples collected by Superfund exceeded the provisional screening value in both rounds of sampling, which leaves a total of ten remaining soil sample locations altogether that exceed the provisional screening value for dioxin TEQ.

Sediment from some ditches was found to exceed the RALs for one or more PAHs in five samples. The sediment samples analyzed for dioxin did not exceed the provisional screening value or the OSWER action level for dioxin TEQ.

Depending upon the results of the on-going investigation by the Superfund Remedial Branch, additional sampling may be required to fully delineate the nature and extent of contamination. The need for any additional actions will be determined accordingly.

Figure 1.



Figure 2.

