

FOR INCLUSION IN THE ADMINISTRATIVE RECORD

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E X T E R N A L M E M O R A N D U M

TO: NECC Customer Group
FROM: Exponent/Limno-Tech
DATE: September 20, 2007
SUBJECT: Response to Dr. J. Ronald Hass and AMEC Earth and Environmental Inc., responses dated July 19, 2007, to Exponent/Limno-Tech April 4, 2007 memorandum regarding EPA's Conceptual Site Model for the Centredale Manor Restoration Project Superfund site.

This memorandum provides comments on Dr. J. Ronald Hass's and AMEC's July 2007 responses to our memorandum of April 4, 2007.

In his original report and his recent response to our and Limno-Tech's comments, Dr. Hass has put forth arguments attempting to refute the EPA's statements in its Remedial Investigation suggesting a clear link between Metro-Atlantic's (MA) production of hexachlorophene (HCP) at the site and the presence of 2,3,7,8-tetrachloro-p-dioxin (2,3,7,8-TCDD or "dioxin"), the primary contaminant of concern. He hypothesizes that the 2,3,7,8-TCDD could have been the result of the substances contained in drums received by the New England Container Company (NECC) and asks that EPA consider his alternative explanations for the sources of the contamination at the site.

The available information regarding the site activities, including past materials handling and waste disposal practices and the amounts and substances used or released by either party, is limited. However, when one considers what is known or at least reasonably certain about the site's history, MA's past production of hexachlorophene is clearly the most likely source of the 2,3,7,8-TCDD at the site. The following points support this contention:

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1. MA is known to have brought 2,4,5-trichlorophenol (2,4,5-TCP) containing the 2,3,7,8-TCDD to the site for use in its HCP manufacturing process, which operated in or around 1965.
2. MA's HCP process was not 100% efficient with respect to the processing of 2,4,5-TCP and by association the 2,3,7,8-TCDD which it contained. It is known that some of the 2,4,5-TCP used by MA would have been lost in the initial purification stage.
3. Material and waste handling procedures in the 1960s were largely unregulated, and there is testimonial evidence that MA used an on-site dump for waste disposal and also discharged wastewaters to the Woonasquatucket River.
4. Forensic analysis of site data shows that the 2,3,7,8-TCDD found in sediments at the site is consistent with past use of 2,4,5-TCP; 2,3,7,8-TCDD is poorly correlated with all other dioxin and furan congeners, but correlates with detected concentrations of 2,4,5-TCP.
5. Sampling results show high concentrations of 2,3,7,8-TCDD and 2,4,5-TCP in soils near the location of MA's former HCP manufacturing building in contrast to other parts of the site. High 2,3,7,8-TCDD concentrations are also seen at the area on the southern tip of the site, where it has been reported that MA trucked its wastes. Groundwater in the well near the former MA HCP manufacturing building also shows high 2,3,7,8-TCDD concentrations, whereas the groundwater sampled from monitoring wells in other areas of the site does not. These points will be discussed further in this document.
6. Sampling results indicate that detected 2,4,5-TCP and 2,3,7,8-TCDD concentrations correlate with each other in similar fashion to samples of Passaic River sediments (where MA's provider of the raw material 2,4,5-TCP operated and discharged the same two contaminants).

The following point-by-point responses are numbered to correspond to Dr. Hass's comments that start on page 2 of his report.

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Specific Comments on Dr. Hass' July 19, 2007 Response.

- 1.) and 16.) *2,4,5-trichlorophenol used in Metro-Atlantic's hexachlorophene process cannot have been the source of the PCDD/PCDF at the site.*

Dr. Hass states that the 2,4,5-TCP used by MA to produce hexachlorophene (HCP) at the site could not have been the source of the PCDD/PCDFs¹ at the CMRP site. He objects to the opposite conclusion reached by EPA in its Remedial Investigation report. His point that the HCP process is unlikely to have caused the PCDD/PCDF contamination at the site is misleading because it obscures the fact that the MA HCP process could have been the source of 2,3,7,8-TCDD, which is by far the most important member of the PCDD/PCDFs found at the site. The Remedial Investigation's discussion of the HCP process would have been more accurate if it had referred to 2,3,7,8-TCDD rather than the group PCDD/PCDF.²

The distinction between 2,3,7,8-TCDD and other PCDD/PCDFs is of particular importance at this site because of all the PCDD/PCDF congeners, 2,3,7,8-TCDD alone drives the site risks. The contribution of the other PCDD/PCDFs to risks is relatively insignificant. 2,3,7,8-TCDD alone accounts for virtually all of the PCDD/PCDF toxic equivalent (TEQ) concentrations at the site, as shown in the attached figures 1A and 1B.

The distinction between 2,3,7,8-TCDD and other PCDD/PCDFs is also necessary because forensic evaluation of site data by Limno-Tech has identified a signature for a historical source of pure 2,3,7,8-TCDD. This source is consistent with the use of 2,4,5-TCP (and by association, the HCP process). Separate fingerprints identified for the sources of mixed PCDD/PCDFs could be from a number of other sources, including, but not limited to, emissions from NECC's drum reconditioning process.

Dr. Hass also asserts that the relative magnitude of OCDD and 2,3,7,8-TCDD contradicts the interpretation that MA is the source of 2,3,7,8-TCDD. In fact, the relationship between these two contaminants cannot be interpreted with regard to a single source because their sources are different and independent. They correlate poorly in site data and behave differently with depth and in space. Fingerprinting results further support the interpretation

¹ PCDD = polychlorinated dibenzo-p-dioxins and PCDF = polychlorinated dibenzofurans

² This statement only applies to the HCP process and should not be construed to include all of MA's activities for which the generation of PCDD/PCDFs cannot be precluded. For example, the anecdotal evidence of frequent fires at the dumpsite used by MA suggests the possibility of combustion related generation of PCDD/PCDFs.

of separate sources, including the interpretation that MA is the source of 2,3,7,8-TCDD, as indicated by the fingerprint consisting of 2,3,7,8-TCDD only, and unassociated with other congeners that would be produced during combustion.

2.) *Waste 2,4,5-TCP purification procedures and fate of the lost 2,4,5-TCP*

Dr. Hass raises the point that the aqueous waste steam generated by MA from its first stage 2,4,5-TCP purification procedure would not have contained any dissolved 2,3,7,8-TCDD. We did not suggest that it did. Rather, we pointed out that 2,4,5-TCP containing 2,3,7,8-TCDD was lost from the HCP process in this stage, which he does not contest. In his later response to point #22, with reference to the centrifuge used for purification, Dr. Hass states that “essentially all the particulate matter remained with the solid material in the centrifuge,” suggesting that all the precipitate was captured. For Dr. Hass to assert there was in fact no loss of 2,4,5-TCP during purification is inconsistent with the 79% minimum yield and 88% maximum yield, or 21% and 12% losses, respectively, of 2,4,5-TCP from the purification stage.³

Dr. Hass cannot refute the loss of TCP in the purification stage, so the question becomes what was the final disposition of this TCDD-containing waste? Among the possibilities are its direct discharge to the river with the solids being entrained in the discharge, or its collection and disposal of on site, possibly involving the use of drums. Better information would be helpful, but the fact that 2,3,7,8-TCDD was generated in an MA waste stream is a persuasive argument for the presence of 2,3,7,8-TCDD at the site.

Putting aside the question of the amounts involved, with respect to the question posed by Dr. Hass, “what happened to all the 2,4,5-TCP?”, we have reviewed the data collected at the site, and indeed some samples show its presence. Attached Figure 2A depicts the maximum detected amounts of 2,4,5-TCP in and around the source area. Attached Figure 2B shows these detections and the detection limits (in gray) for samples where it was analyzed but not detected. There are a few low level detects on the boundaries of the Source Area and two much higher values from subsurface samples taken near the footprint of MA’s former HCP manufacturing building (from sample locations MW05S and CMS-451-F). Examining Figure 2B, one can see that apart from the two high concentration sample locations, the detected amounts are much lower than the typical detection limits in other locations. Thus,

³ Thomas Cleary deposition, February 10, 2003, Exhibit #8

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it is possible that there is more residual 2,4,5-TCP at the site. However, the detection limits are generally low enough to have detected 2,4,5-TCP if it was present at concentrations as high as those found in soils at MW05S and CMS-451-F.

The other obvious question is can we expect there to be any 2,4,5-TCP in environmental media 40 years after it was released? Mackay et al⁴ and the Hazardous Substances Databank⁵ provide numerous estimates from the literature of environmental half-lives for 2,4,5-TCP; these are typically on the order of days for soils and sediments and on the order of hours for release to surface water. It is a complicated matter to assess the appropriate site-specific degradation rate(s), but, generally, the short half lives reported in the literature combined with the long time elapsed since the 1960s suggest that residual levels of 2,4,5-TCP could be low.

If MA is the source of the 2,3,7,8-TCDD and if at least some of the 2,3,7,8-TCDD has entered the environment, then 2,4,5-TCP and 2,3,7,8-TCDD are expected to correlate in their occurrence in environmental samples as stated by Dr. Hass. This, indeed, they do. In fact, they correlate in a pattern similar to that found in the Passaic River, where dioxin contamination is associated with discharges from Diamond Alkali, the source of the 2,4,5-TCP used by MA. When comparing 2,4,5-TCP and 2,3,7,8-TCDD to each other in the two rivers for samples where both compounds were detected, a positive correlation emerges as seen in Figure 3 below.

⁴ Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Volume IV: Oxygen, Nitrogen, and Sulfur-Containing Compounds. Donald Mackay, Wan Ying Shiu, Kuo-Ching Ma. CRC Press, 1995.

⁵ Hazardous Substances Databank file for 2,4,5-trichlorophenol found at <http://ds.datastarweb.com/ds/products/datastar/sheets/hsdb.htm>; last accessed September 17, 2007

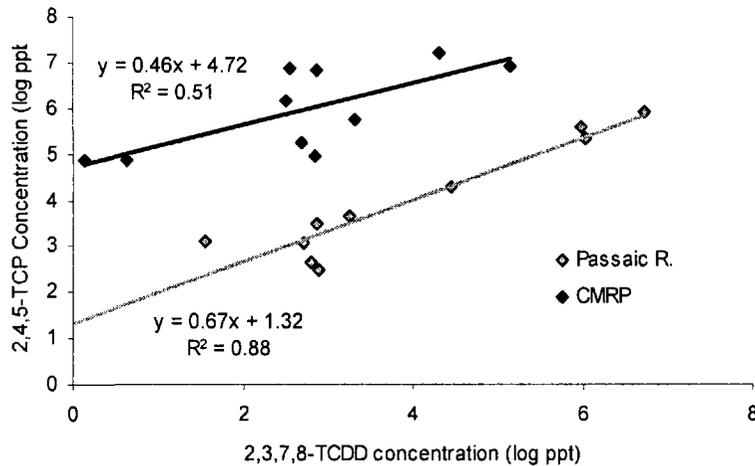


Figure 3. Plot of 2,4,5-TCP vs. 2,3,7,8-TCDD in Passaic River and CMRP site samples.

The pattern of high detection limits and low detection rate described above is also observed in Passaic River samples.

As is demonstrated above, 2,4,5-TCP never was emitted by MA is not one of the possible answers to Dr. Hass's question. The two compounds are likely to have been emitted together, which lends support to our stated hypothesis that the MA HCP process was not a "zero-emission" process, but rather resulted in some losses of its feedstock along with the dioxin impurities it contained.

3.) *Quantities involved in the manufacture of HCP.*

We acknowledge that the amounts we originally computed from the information we had at the time, which did not include all the Cleary deposition exhibits, are now open to question and may have been too high. As pointed out by Dr. Hass, in Exhibit 15 of his 2003 deposition, Dr. Cleary has stated his belief that at most 25,000 kg of 2,4,5-TCP may have been used by MA. This estimate may be reasonable, but it is unclear on what basis Mr. Cleary made this estimate since he was apparently only involved in setting up the HCP manufacturing process and did not have day-to-day knowledge of the process.⁶ If Mr.

⁶ Thomas Cleary deposition, February 10, 2003, Pages 35-37

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Cleary's estimate is accurate, the amount of 2,3,7,8-TCDD brought onto the site by MA was about 1.3 kg assuming a 50 ppm TCDD concentration in the 2,4,5-TCP.

Although it is clear from Mr. Cleary's deposition testimony and our conversation with him (which was designed to elicit facts) that he did not have any direct knowledge of day-to-day practices, he was knowledgeable as to the production capacity of the system at MA, including his understanding that the process had the capacity to run two batches per day and 24-hour operation. The article in the Providence Sunday Journal Business Weekly from May 30, 1965 (Cleary exhibit 3) also makes it clear that MA was prepared for full production of HCP at that time and had spent 3 years in product development. With respect to the US government's pressure on Diamond Alkali which Dr. Hass states would have restricted the supply of sodium 2,4,5-TCP, we note that, in 2002, Mr. Cleary provided a written correction to an EPA summary of an interview with him (in which he places emphasis on the word "after") stating, "co-option of the TCP supply began several months after Hex [sic] production began at Centredale."⁷ Mr. Cleary also told us that the reasons for purchasing sodium 2,4,5-TCP from Diamond Alkali included that MA knew people there, it was geographically close, the "price was right" and that Diamond Alkali was able to sell MA crude TCP "directly out of their reactor". He also stated that the product and the impure 2nd crop (sold to Kalo labs) "flew out the door" during the period of operation. Therefore, the evidence suggests that there was no impediment to MA producing as much HCP as it could over the span of the year or less before it stopped production.

4.) and 5.) *Efficacy of the carbon added to the HCP process to remove 2,3,7,8-TCDD*

Dr. Hass again ignores the 2,4,5-TCP loss in the first stage of the purification process prior to the addition of charcoal when he states that "[A]ny TCDD entering the MA HCP process either would have been bound to activated charcoal or shipped to Kalo Labs." This statement is also inconsistent with his belief that all the TCDD was captured by the charcoal, because if that were so, then none could have been shipped to Kalo Labs.

Dr. Hass has presented no data to support his assertion that all of the TCDD was removed by the charcoal. Despite the existing Diamond Alkali data that we referenced suggesting that TCDD at least in some tests was not completely removed, Dr. Hass argues that the method used may have incorrectly identified TCDD in the purified solution. He also calls into

⁷ Thomas Cleary deposition, February 10, 2003, Exhibit #15

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question the fact that the carbon may have been recycled, despite our report of Mr. Cleary's belief that carbon and filter media were washed through with solvent on-site.

- 6.) and 7.) *There is no evidence of spills of 2,4,5-TCP, solid waste was disposed off-site, and there were no bad batches.*

As demonstrated by the presence of 2,4,5-TCP in subsurface soils discussed under item #2 above in sample locations MW05S and CMS-451-F near the former HCP manufacturing building, spills in fact occurred on site. Likewise, mixed testimony exists on waste disposal in on-site dumps versus off-site.

With regard to the potential for bad batches, we remain convinced that these could have occurred either in the product development stage or during the full-scale production phase. Our reading of the deposition transcripts is that the deponents had little knowledge about the HCP process; to use these as a definitive basis for asserting no spills occurred or bad batches existed is questionable, at best, particularly with respect to the former production manager, who could have been more sensitive to the implication of negligence on his and MA's part in the operations of the facility.

- 8.) *"The [Hass] Report is not claiming a 630,000,000-fold reduction in TCDD; rather, it concluded that is the minimum reduction predicted,..."*

We agree that Dr. Hass's original report claimed *greater than* 630,000,000-fold reduction in TCDD.

- 9.) *"The patent [#4,102,816] presents no control data. That is, there are no data presented to show that the same results would not have been obtained in the absence of any charcoal. The ease of recovery is compelling evidence that the 2,3,7,8-TCDD was effectively blocked from contact with the activated charcoal by the polyurethane ("PUF)."*

Our original point was that the patent #4,102,816, originally cited by Dr. Hass, speaks to the potential for recovery of absorbed polynuclear compounds by solvent washing and that this activity may have occurred at the site. Dr. Hass contends that in this situation, the results can be explained by the polyurethane somehow blocking the charcoal's ability to adsorb TCDD. We do not understand this comment, because according to the patent, the polyurethane was coated in charcoal.

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10.) *“Exponent confuses risk assessment with forensics”*

We agree that risk assessment is not directly relevant to forensics, but it certainly can play a role in defining and prioritizing the meaningful questions to be addressed by the forensics evaluation. Our comment was to point out that Dr. Hass’s opinion - that furans could not have been associated with the HCP process - was largely inconsequential at a site where the risk from 2,3,7,8-TCDD, which could have come from the HCP process, predominates. No one has suggested that furans need be associated with MA HCP process in order for the MA HCP process to be responsible for the 2,3,7,8-TCDD contamination at the site.

11.) *Regarding hexachloroxanthene (HCX)*

We defer to EPA as to whether HCX was actually correctly identified at the site. Our point was that Dr. Hass’ claim of a lack of high variability in the HCP process would not preclude the lack of correlation between 2,3,7,8-TCDD and HCX in the environment. We simply pointed out that these compounds may have been released at different stages of the operation and that this could explain the patterns in the environment.

12.) 14.) and 15.) *Discharge to the river vs. on site dumping*

We did not intend to suggest that there was clear evidence of a discharge pipe from the MA HCP building to the river, although it is evident that the process would have had to dispose of wastewater and it was sited close to the river. The deposition information we cited spoke to MA’s discharge of wastewaters and wastes generally as examples of MA’s waste management practices, but it did not specifically implicate the HCP building.

With regard to the use of the southern dump by MA (and perhaps also by NECC) and NECC’s “damaged drum” storage area located to the south of NECC, we agree that the distinction between these sites is suggested by the deposition testimony and should be borne in mind. The deposition testimony to which we cited supports the use by MA of the lower dumpsite but not the NECC drum dumpsite 100 yards south of NECC. Dr. Hass was right to correct us on this point.

Attached Figures 3 and 4 show 2,3,7,8-TCDD impacts both near the MA HCP building and in the southern dumpsite. Dr. Hass’s use of the sample results from near the MA building (we did not say or imply that these were in the river) to refute the CSM finding of a direct discharge is not valid, as these data appear to be the result of spillage.

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Materials from the southern dump area could have impacted Allendale Pond especially in light of the statement by deponent Raymond Nadeau that the practice was “pushing everything in to the point ...where [the rivers] came together”.⁸

If one assumes, albeit speculatively, that the 2,4,5-TCP lost in the HCP process was not directly discharged to the river and that these liquids or perhaps the separated solids may have been disposed of in this dump, it could explain the presence of 2,3,7,8-TCDD in that area. The dump was reportedly often on fire, which suggests that if 2,4,5-TCP were dumped there, excess 2,3,7,8-TCDD could have been formed.

It is also worth noting that when Dr. Hass states that “[T]here is no evidence that any drum shipped to NECC by MA would have had any residual TCDD or any chemical likely to form TCDD under NECC recycling conditions,” the statement is equally true for every drum from the customers of NECC.

13.) *None of the 2,4,5-TCP used by MA could have been transferred to NECC.*

Dr. Hass’s response indicates that MA was a customer of NECC until around 1968 after which NECC operated on its own customer base for about three years. The deposition testimony of Vincent Buonanno we cited speaks to reduction of MA’s use of NECC in early 1967, prompting increased effort by NECC to acquire new customers. Our point was simply that if MA had drums containing 2,4,5-TCP that needed re-use, they would have sent them to NECC.

We did not imply that transfers between MA and NECC would need to be associated with the raw material supply as is assumed by Dr. Hass. Dr. Hass uses the statement made by Vincent Buonanno - that there were no drums involved in the MA HCP process - exclusively to support his contention that no 2,4,5-TCP from the MA process ever made its way to NECC.

14.) No comment.

15.) No comment.

⁸ Raymond Nadeau trial testimony September 14 and 15, 2006, Page 75, line 5-18

16.) *2,3,7,8-TCDD could be linked to combustion processes at NECC*

The hypothesis that 2,3,7,8-TCDD could be linked to combustion processes at NECC is contradicted by the nature of the congener associations. Correlations between each pair of congeners were computed. Whereas all PCDD/PCDF congeners correlated with each other very well, 2,3,7,8-TCDD stands out with very low correlation coefficients for every other PCDD/PCDF congener. On the other hand, 2,3,7,8-TCDD is well correlated with 2,4,5-TCP, based on the samples were both were detected (as pointed out in response 2). Thus, 2,3,7,8-TCDD does not associate with any other congener; instead, it best associates with 2,4,5-TCP.

The presence of small quantities of 2,4,5-TCP in incoming drums would generate a pattern that, besides 2,3,7,8-TCDD, also would include penta- and hexa-chlorinated dioxins⁹. If combustion of 2,4,5-TCP in drums had happened, the data would exhibit a strong association between 2,3,7,8-TCDD, penta- and hexa-chlorinated dioxins. This association is lacking. Thus, there is a rational explanation for the congener distribution, based on the MA HCP process contributing the 2,3,7,8-TCDD component of the dioxins found at the site. Consequently, the CSM is correct in associating the 2,3,7,8-TCDD component with MA as the source.

17.) *Formation of TCDD in combustion of 2,4,5-TCP or sodium 2,4,5-TCP*

In our response we challenged Dr. Hass's assertion that the *site data* supported his belief that the 2,3,7,8-TCDD could have come from burning of 2,4,5-TCP. 2,3,7,8-TCDD does form when burning 2,4,5-TCP. However, site data indicate that combustion was not the source of 2,3,7,8-TCDD, due to the missing association of 2,3,7,8-TCDD with other congeners that would form upon combustion and the actual association of 2,3,7,8-TCDD with 2,4,5-TCP as explained above. His response does not further explain his earlier assertion.

Again we note that NECC's oven may not have been the only source of combustion or open flame at the site, as is suggested by the reports of the dump frequently being on fire, to the

⁹ C. Briois, S. Ryan, D. Tabor, A. Touati and B.K. Gullett (2007) Formation of Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans from a Mixture of Chlorophenols over Fly Ash: Influence of Water Vapor. *Environ. Sci. Technol.* **41**: 850-856.

extent that local residents would spend their evenings watching it as a form of entertainment.

Leakage at the MA facility does not constitute a violation of principles of chemistry. Emission of 2,3,7,8-TCDD by MA and other congeners by NECC likewise does not violate principles of chemistry. However, formation of 2,3,7,8-TCDD without the concurrent formation of penta- and hexa-chlorinated dioxins does violate such principles.

18.) *Fingerprinting the 2,3,7,8-TCDD source.*

First, the citation given was incomplete and should have included the references listed below¹⁰, all of which were used for site data interpretation. Second, the references below do contain data for 2,4,5-TCP. Third, the 2,3,7,8-TCDD pattern and the combustion pattern are directly linked to CMRP activities, and the other patterns may be linked to CMRP or other possible sources to the river, including background. The uncertainty about the sources of these remaining patterns does not affect the interpretation of the 2,3,7,8-TCDD and the combustion pattern.

¹⁰ C. Briois, S. Ryan, D. Tabor, A. Touati and B.K. Gullett (2007) Formation of Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans from a Mixture of Chlorophenols over Fly Ash: Influence of Water Vapor. *Environ. Sci. Technol.* 41: 850-856.

Harnly, M.; Stephens, R.; McLaughlin, C.; Marcotte, J.; Petreas, M.; Goldman, L. (1995) Polychlorinated dibenzo-*p*-dioxin and dibenzofuran contamination at metal recovery facilities, open burn sites, and a railroad car incineration facility. *Environ. Sci. Technol.* 29(3):677-684

Hutzinger, O; Essers, U.; Hagenmaier, H. (1992) Untersuchungen zur Emission Halogenerter Dibenzodioxine und Dibenzofurane aus Verbrennungsmotoren beim Betrieb mit handelsüblichen Betriebsstoffen. Universities of Bayreuth, Stuttgart and Tübingen, Germany. GSF-Forschungszentrum, Munich, Germany, ISSN 0937-9932.

Oehme, M.; Larssen, S.; Brevik, E.M. (1991) Emission factors of PCDD/CDF for road vehicles obtained by a tunnel experiment. *Chemosphere* 23:1699-1708.

Rappe, C., H.R. Buser, and H-P. Bosshardt (1979) Dioxins, dibenzofurans and other polyhalogenated aromatics: Production, use, formation and destruction. *Annals of the New York Academy of Sciences* 320 (1), 1-18.

Rappe, C, H.R. Buser, and H-P. Bosshardt. Identification and quantification of polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) in 2,4,5-T-ester formulations and herbicide orange (1978) *Chemosphere*. 5: 431-438.

Schwind, K-H.; Thoma, H.; Hutzinger, O.; Dawidowsky, N.; Weberuss, U.; Hagenmaier, H.; Buehler, U.; Greiner, R.; Essers, U.; Bessey, E. (1991) Emission halogenerter dibenzodioxine (PXDD) und dibenzofurane (PXDF) aus verbrennungsmotoren. UWSFZ. Umweltchem. Oekotox. 3, 291-298. [English translation]

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Crude 2,4,5-TCP contains only 2,3,7,8-TCDD, while a combustion source would contain penta and hexa-chlorinated congeners as well¹¹. In addition, combustion would not lead to the observed correlation between 2,4,5-TCP and 2,3,7,8-TCDD.

There is no “dearth of congener data” for the source area. Dr. Hass needs to be more specific of which unsampled areas he speaks.

In short, based upon relationships among the congeners, there is one non-combustion source responsible for the 2,3,7,8-TCDD and a combination of combustion and other sources responsible for the other PCDD/PCDF congeners. The combustion pattern is unrelated to 2,3,7,8-TCDD, since it does not contain the 2,3,7,8-TCDD congener.

19.) and 20.) *Origin of 2,3,7,8-TCDD and other congeners at CMRP*

Dr. Hass continues to treat all congeners as a unit, as if they were all emitted concurrently by the same source. Both correlation analysis and fingerprinting show that this is not the case. While NECC may be one possible source of the PCDD/PCDF congeners other than 2,3,7,8-TCDD, the evidence (congener correlations, correlation with 2,4,5-TCP, spatial occurrence of 2,4,5-TCP and 2,3,7,8-TCDD, fingerprint analysis and known source of 2,4,5-TCP feedstock) indicates that MA is the likely source of 2,3,7,8-TCDD. (Also, see response 1.)

21.) No comment.

22.) See responses to 2, 6, 7 and 12-15

¹¹ Ahling, B., A. Lindskog, B. Jansson, and G. Sundstrom (1977) Formation of polychlorinated dibenzo-*p*-dioxins and dibenzofurans during combustion of a 2,4,5-T formulation. *Chemosphere*, 8: 461-468.

C. Briois, S. Ryan, D. Tabor, A. Touati and B.K. Gullett (2007) Formation of Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans from a Mixture of Chlorophenols over Fly Ash: Influence of Water Vapor. *Environ. Sci. Technol.* 41: 850-856.

Stehl, Lamparski (1977) Combustion of several 2,4,5-Trichlorophenoxy Compounds: Formation of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin. *Science* 197: 1008-1009.

Rappe, C, H.R. Buser, and H-P. Bosshardt. Identification and quantification of polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs) in 2,4,5-T-ester formulations and herbicide orange (1978) *Chemosphere*, 5: 431-438.

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23.) *NECC likely received 2,4,5-TCP and pentachlorophenol (PCP) from its customers*

Dr. Hass has asserted that some of the NECC customers dealt specifically with 2,4,5-TCP and PCP. It is interesting that no footnotes are cited to supply the basis for the three assertions regarding NECC. The NECC 104(e) responses reveal that industry trade publications indicate that some of the NECC customers used 2,4,5-TCP as a raw material and/or that it could be in one or more products that they manufactured. These publications, however, address the companies' manufacturing and products on a company-wide basis and do not address plants on an individual basis that may have had their drums refurbished at NECC. Consequently, to assume that the customers' plants that used NECC contributed 2,4,5-TCP and PCP to the site is wholly speculative on Dr. Hass' part.

The combustion fingerprint implicates NECC as the source of 2,3,7,8-TCDD

The combustion pattern identified in the fingerprinting does not include 2,3,7,8-TCDD, and thus does not indicate that NECC would be a source of this congener. PCP combustion does generate highly chlorinated congeners, mostly OCDD and HpCDD¹², present in the fingerprint, and combustion of some PCP cannot be excluded.

24.) *Location of CMS-451-F*

Dr. Hass has agreed with us that this sample is not located at the head of the NECC fire pit. He suggests, however, that it is in an area that was used by NECC for incoming drum storage. We have mapped this point using GIS software and believe that it lies at the front (east side) of the former MA HCP manufacturing building (see Figures 1-4). Dr. Hass bases his conclusion that it is the area used by NECC on the deposition of Kenneth Neri during which Neri pointed to an area on a map which was marked "7". We do not have this marked up map, nor did Dr. Hass apparently provide it, and therefore we cannot comment further at this stage. The location and data, however, are strongly suggestive of a spill, possibly from transfer operations from the tanker trucks used to supply sodium 2,4,5-TCP to MA.

¹² Cull, M.R.; Dobbs, A.J.; Goudot, M.; Schultz, N. (1984) Polychlorodibenzo-p-dioxins and dibenzofurans in technical pentachlorophenol-results of a collaborative analytical exercise. Chemosphere 13(10):1157-1165

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25.) *MA's HCP production was not the source of 2,3,7,8-TCDD and PCDD/PCDF at the site.*

Again we note that the grouping together of 2,3,7,8-TCDD and other PCDD/PCDFs allows Dr. Hass to make factual statements regarding the MA HCP process which cannot be made when speaking to 2,3,7,8-TCDD alone (see response #1). We have commented above on his recent response and find that the MA HCP process remains the most likely source of the 2,3,7,8-TCDD contamination at the site. Even Vincent J. Buonanno, formerly of NECC, agrees.

"I am sure that it is easier for me than anyone less familiar with the case to have the confidence in my conviction that dioxin is totally and fully the by product of hexachlorophene. Hexachlorophene was produced in a separate riverside building away from the main operations of Metro Atlantic Chemical and with no connection to New England Container. New England Container never received any raw material from hexachlorophene operations since the raw materials were not in containers, and I know that we sold them no finished containers for filling since it was not packaged in steel containers. I am confident and we have scientific support of the belief that 100% of the reason for the dioxin in the Woonasquatucket River is hexachlorophene."

V.J. Buonanno letter to R. Felton, April 9, 2001.

In addition to testimony, the hypothesis that 2,4,5-TCP combustion is the source of the 2,3,7,8-TCDD found on site is contradicted by the lack of association of 2,3,7,8-TCDD with penta- and hexa-chlorinated dioxins.

Response to AMEC report on PCBs

We object to the assumption made by AMEC that the PCBs are *solely* the responsibility of NECC. It is not clear that EPA's Remedial Investigation report identified NECC as the "most likely source" of PCBs in source area soils as reported by AMEC. We find no reason to preclude the use of PCBs by MA. PCBs were widely used in the past and may have been present at the MA facility or otherwise used at the site.

AMEC reports the incremental risks from PCBs from EPA's baseline human health risk assessment and states that they exceed action levels for remediation. However this discussion is pointless, for the simple reasons that PCBs are not the only contaminants at the site and the human health risk from 2,3,7,8-TCDD is much greater.^{13,14}

With regard to AMEC's comment that there were labels from drums found at the site indicating PCBs, we believe based on the EPA field investigation reports, there was only one of these found, labeled "Monsanto Aroclor 1221." This can hardly be construed as "strong evidence" that NECC was the source of PCBs at the site.

¹³ For example, the risks posed to a adult recreational angler at Allendale pond indicates that the risk from exposure to dioxins and furans (primarily associated with 2,3,7,8-TCDD alone) is about 10 times higher than the risk for Aroclor 1254 (BHHRA 2005 table 7.13).

¹⁴ A similar comparison of the risks for non-cancer cannot be made as EPA did not quantitatively evaluate the non-cancer risk from dioxins and furans or 2,3,7,8-TCDD.

Figure 1A. Contribution of 2,3,7,8-TCDD to TEQ dioxin/furan Concentrations Allendale Pond

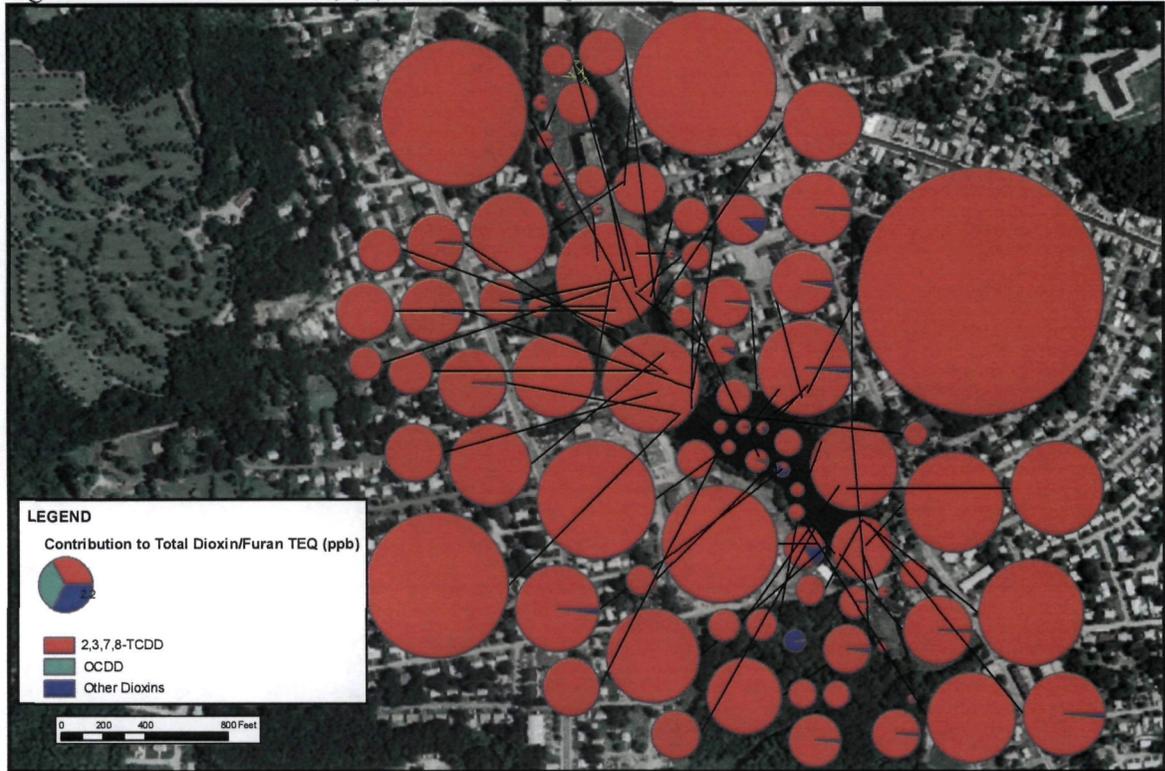


Figure 1B. Contribution of 2,3,7,8-TCDD to TEQ dioxin/furan Concentrations Lyman Mill Pond

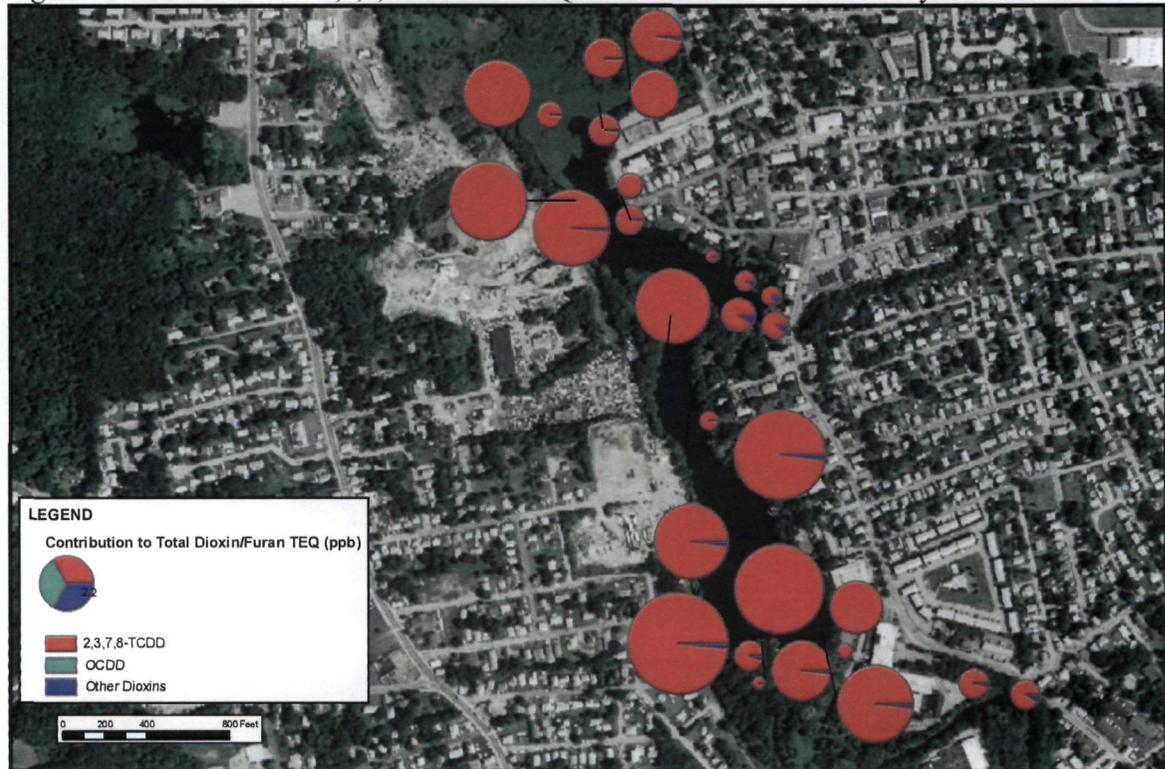


Figure 2A. 2,4,5-TCP In Sediment and Soil – detects only

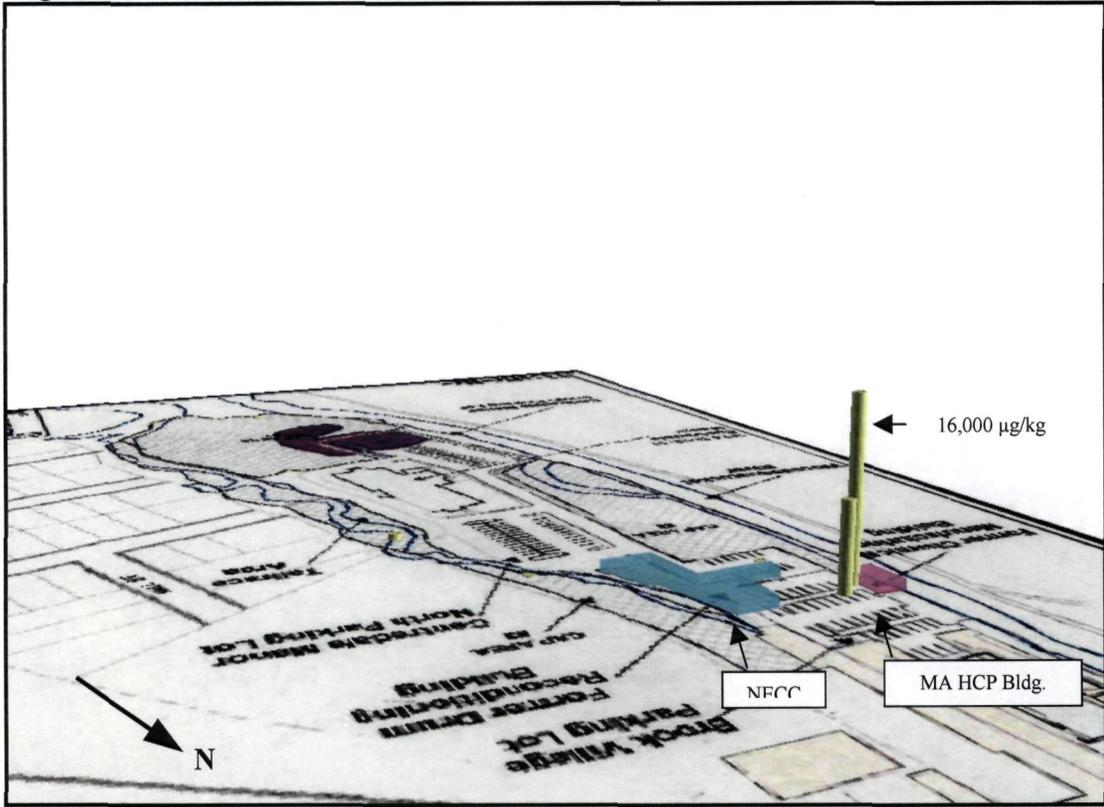


Figure 2B. 2,4,5-TCP In Sediment and Soil – detects & non-detects

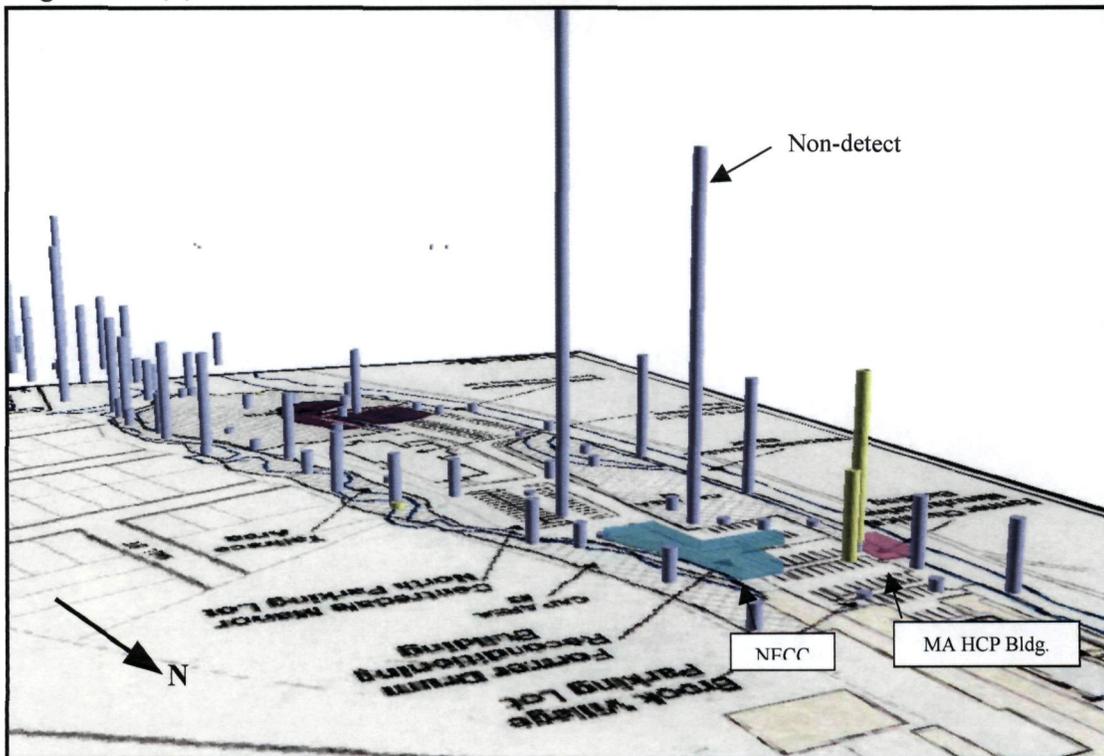


Figure 3. 2,3,7,8-TCDD In Sediment and Soil – detects only

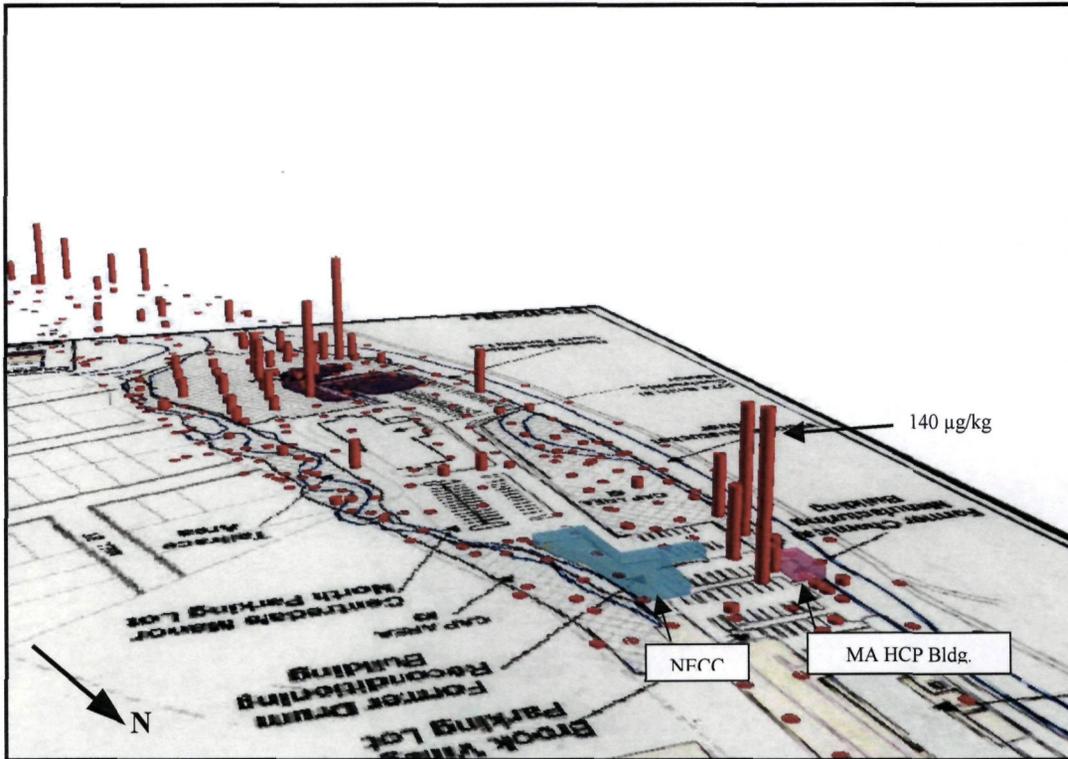


Figure 4. 2,3,7,8-TCDD In Groundwater – detects only

