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GE Corporate Research and Development

Building K1, Room 3B19
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Research and Development Center
General Electric Company
P.O. Box 8, Schenectady, NY 12301
518 387- 7072

TO: Doug Tomchuk
EPA Region II

FROM: Daniel A. Abramowicz
Chairman
Scientific and Technical Committee

SUBJECT: Phase I EPA Report of RI/FS

Enclosed are my comments on the Phase I report on the Interim Characterization and Evaluation of the Hudson River PCB Reassessment. I have included general comments, as well as a more detailed analysis of the sections devoted to treatment feasibility (C.4 through C.7)

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General Issues:

In general, EPA and TAMS did a credible job in gathering the large volume of information displayed in the Phase I report. The report demonstrates a significant effort to be objective in listing all of the data gathered over the last fifteen years. This objectivity also represents one of the greatest weaknesses of the Phase I report. In general, data is supplied without any information concerning the quality or validity of the results. As such, the report becomes a "laundry list" of findings from many different organizations, without any rating or evaluation by the agency. The impact of this lack of analysis is an inability to determine directions for additional information that may be necessary or to critically address the report.

In the report, it is generally recognized that there exist sources of more highly chlorinated PCBs in the NYC area (page E-6; section A.3.1, page A.3-3), but no realization that it is therefore quite likely that even greater sources of Aroclor 1242 may exist from the same region. The likelihood of potentially significant contribution of even lightly chlorinated PCBs is based upon historical records of total PCB usage, demonstrating that approximately 70% of PCB usage involved Aroclor 1242-like PCBs.

The report recognizes (page E-8; section B.4.3.2) that the Thompson Island (TI) Pool is no longer contributing PCBs to the water column. Therefore the source of the background level PCBs in the water column must be a different source further upstream. This implies that any remediation of the TI pool would have no benefit on PCB levels in the river. Such a result may represent a fundamental change in the view of the Upper Hudson, with important implications for remedial actions already under consideration, although the connection with the potential lack of benefit from remediation of this area is not made.

The report is inconsistent in the definition of water quality for the Upper Hudson River. Section A.1.3.1 describes it as improving steadily; section A.1.4.3 (page A.1-28) describes the river as containing "one of the most diverse fisheries found throughout Atlantic coastal systems"; section B.1.2.1 rates the Upper Hudson water quality as poor, based on a circular argument about the fishing ban; section B.1.4 (page B.1-13) stating that the "Upper Hudson River between the Federal Dam and Fort Edward can support a diverse and high quality fishery resource", and a "qualitative improvement within the past twenty years"; section B.7.2.2 (page B.7-18) stating a slightly impacted system and "an increased representation of more pollution intolerant (sensitive) groups" in the Upper Hudson. Again the agency makes no attempt to evaluate the various reports to determine the actual water quality in the river.

The report is inconsistent in the contaminants listed as "above background" in sediments by the NYS DEC in section B.1.2.1 (only lead and mercury) and section B.3.2.5 where M. Brown reports high levels of lead, cadmium, chromium, and mercury.

Extreme variation in PCB spatial distribution (page E-7; section B.3.2.1, 1976 sampling; section B.3.2.2, page B.3-11, 1984 sampling; section B.3.2.4, 1983 USEPA study) is recognized in the report. There is, though, no mention of krieging statistics familiar to the contractors that could provide better estimates.

The data GE provided to demonstrate widespread dechlorination in the Upper Hudson River has not been recognized or acknowledged. In addition, this data is mistakenly represented (Table B.3-8; e.g. states that for 150 samples from the H7 site, min = 0.1 ppm, max = 2,118 ppm, and a mean of 118 ppm; the data show min = 0.02 ppm, max = 730 ppm, and a mean of 40.1 ppm).

Biodegradation (Sections C.4 through C.7)

In technical terms, this section may be the weakest part of the document. Poor, discredited studies are given equal weight with well designed, confirmed results. In addition, there is no mention of the widespread, pervasive dechlorination that is known to exist throughout the Upper Hudson River. The EPA acknowledges in this document that dechlorination is a possible, and even likely, explanation for the congener redistribution in the Upper Hudson (page C.4-6), but the extent of the transformation is not documented. The data provided by GE to demonstrate widespread dechlorination (reanalysis of the NYS DEC 1984 data, GE 1990 survey of less dechlorinated sites, GE 1990 survey of H7 site) was not evaluated for that purpose.

In section C.4.1, it is stated that capping may increase anaerobic activity. I don't think that is true, as sediments are naturally quite anaerobic. Moreover, it is unnecessary in the Upper Hudson where dechlorination has already extensively occurred.

In section C.4.2, the data GE provided on widespread dechlorination in the Upper Hudson is noticeably absent. In addition, anaerobic dechlorination is mentioned as only one possible explanation for the unusual Aroclor patterns in the Upper Hudson (section C.4.2.1).

In section C.4.2.2, it is stated that aerobic degradation in environmental samples will display Pattern A. This is not true in the Upper Hudson, where extensive anaerobic dechlorination has so dramatically shifted the congener distribution that subsequent aerobic degradation would not resemble Pattern A. In fact, it will be difficult to demonstrated aerobic degradation in dechlorinated sediments from the congener pattern alone, as the three major PCB

congeners that remain can all be aerobically degraded.

In section C.4.2.2, it is mistakenly stated that a 2,3-dioxygenase cannot degrade mono- and dichlorobiphenyls. All mono- and dichlorobiphenyls can be degraded by a 2,3-dioxygenase; no 3,4-dioxygenase is required.

In section C.4.2.3, confirmation of dechlorination with Hudson River sediments first observed in Tiedje's lab fails to mention Bopp's sampling of the Upper Hudson where dechlorination was found in every sample (mentioned on page B.3-12), Woods (Oregon State University), Reeves (Oak Ridge National Laboratory), or Celgene (Warren, NJ). In addition, EPA's own research laboratory in Gulf Breeze has begun dechlorination research. The widespread environmental dechlorination of chlorinated organics is also not mentioned in the report (Parsons, Univ. Amsterdam, PCDDs and PCDFs; Beurskens, Institute of Inland Water Mgt., PCP and chlorinated benzenes; Suflita, Univ. Oklahoma, pesticides; Neilson, Swedish Env. Res. Inst., chlorinated phenols in Baltic sediments; Brown, GE, PCBs in river sediments; Lake, EPA-Narraganset, PCBs in marine sediments).

In section C.4.2.3 (page C.4-6), the use of the term biodegradation in Chen et al. should be mineralization, per the EPA's definition in C.4.4.3 (page C.4-25).

In section C.4.2.3 (page C.4-6) the report states the Rhee et al. (1990, should be 1989) result where no dechlorination was observed in Moreau sediments in situ for seven months. The comments neglects to mention that the experiment covered a time period (Nov-June) where environmental temperatures are too low to detect significant dechlorination. The same experiment in the summer-fall months would have probably been successful. The report therefore suggests that in situ dechlorination will not be possible, ignoring Rhee's later confirmation of our results and the mountain of evidence demonstrating that natural in situ dechlorination has already occurred on a wide scale.

In section C.4.4.1 (page C.4-13), the calculated extraction efficiencies for the B.E.S.T. process are incorrect. Using the residual values given, extraction efficiencies with three extraction stages are above 97%.

In section C.4.4.2 (page C.4-18), it is incorrectly stated that PCBs can be converted to dioxins, whereas dibenzofurans are the partial oxidation product from PCBs.

In section C.4.4.3, the report states that PCBs pose greater challenges to bioremediation than other contaminants (e.g. petroleum products). In fact, PCBs and petroleum products are very similar in terms of there biodegradation potential (both are complex mixtures of hydrophobic compounds, both can be degraded by

organisms found commonly in the environment, in each case the higher molecular weight material is more difficult to degrade, and widespread environmental degradation of petroleum products and PCBs are documented). In spite of these similarities, oils are considered easy to bioremediate in the report, while PCBs pose "greater challenges". In addition, it is incorrectly stated that successful PCB bioremediation requires the identification of a microbial population capable of degrading a large number of different PCB congeners. In the Upper Hudson River (the subject of the current study), natural anaerobic dechlorination to a few lightly chlorinated PCBs has removed this requirement.

In section C.4.4.3 (page C.4-26), the report states that organisms like H850 cannot mineralize PCBs and therefore accumulate chlorobenzoates. In fact, H850 and LB400 can metabolize lightly chlorinated benzoates (Bedard and Haberl, Microb. Ecol., 20, 87-102, 1990). Primarily monochlorinated benzoates would be formed as intermediates in the degradation of the lightly chlorinated PCBs currently found in the Upper Hudson. In addition, many other organisms capable of degrading these monochlorinated benzoates are present in environmental samples.

In section C.4.4.3 (page C.4-27), optimal conditions for anaerobic activity with Hudson River sediments are listed. This summary fails to mention that none of the listed amendments (inhibitors, high PCB concentrations, inorganic nutrients, supplemental carbon source, or elevated temperatures) are necessary for PCB dechlorination. In fact, sediments with **no amendments at environmental temperatures** will dechlorinate PCBs with rates nearly as great as the optimal conditions described. The report's description mistakenly implies that anaerobic PCB dechlorination requires a very narrow set of controlled conditions to be effective. This is disproven by the widespread natural dechlorination occurring in the Upper Hudson River and ignored by the report.

In section C.4.4.3 (page C.4-28ff), it is accurately mentioned that in situ anaerobic dechlorination could be easily accomplished, but it would not reduce the total molar PCB concentration. No mention is given to the promising ortho dechlorination recently discovered that may overcome this limitation (Van Dort and Bedard, Appl. Env. Microb. 57, 1576-1578, 1991) or to the significant detoxification demonstrated by meta and para removal alone (Quensen et al., GE Report, 1990). Moreover, the report fails to mention the dramatic effect this widespread dechlorination would have on the bioaccumulation of PCBs. The less chlorinated PCBs are significantly less hydrophobic and are metabolized and/or cleared from fish and humans much more readily than the more highly chlorinated congeners. This fact may have important implications on the risk assessment of PCBs for the Upper Hudson, although this connection is not made.

On the same page, the EPA fails to mention that anaerobic conditions would be difficult to maintain during dredging operations, especially the cutterhead hydraulic pipeline dredge where large volumes of oxygenated water must be removed with the sediments. Moreover, the report fails to mention the rapid progress of bioremediation, as evidenced by Ecova's recent completion of the largest bioremediation cleanup to date (Genetic Engineering News, September 20, 1991).

In section C.4.4.3 (page C.4-31), the report mentions results from a DETOX study that have been discredited by the scientific community. Their work on aerobic Aroclor 1260 degradation is also referred to in the report on page C.4-26, although the report itself states on page C.4-26 that "no aerobic strain has shown the ability to degrade Aroclor 1260"

In section C.7, the report states that propane extraction is being brought forward for further consideration, although this technology was ruled out for remediation of New Bedford Harbor sediments (page C.4-16).

There is no mention of the negative ecological and environmental impacts of large scale sediment removal. This is a critical parameter that is not acknowledged in this report.