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Mr. Douglas Tomchuk
USEPA – Region 2
290 Broadway – 20th Floor
New York, NY 10007-1866

Dear Mr. Tomchuk:

As a member of the EPA Science and Technical Committee (STC) for the Hudson River Superfund Site, I have reviewed the TAMS/EPA Responsiveness Summaries of books 1-3, PMCR and DEIR; December (1998) and of the Low Resolution Coring Report (LRCR, February 1999); especially with reference to comments in my letters of November 13, 1996; April 11, 1997; and October 29, 1998, as well as those by other respondents on the same or related topics. I am disappointed by the results, for my overall impression is that in too many instances scientific impartiality in the RI/FS has suffered in favor of preconceived notions of how the Hudson River works, and therefore how data must be interpreted.

Another profound shortcoming is the lack of consistent and timely hypothesis testing within the RI/FS process on issues of uncertainty, or on conflicting data/opinions raised during the investigation; a perfect example being the omission of a direct comparison of PCB GCMS analysis methods that was needed for variance analysis and testing of results in the loss resolution core retrospective comparison. This step is absolutely necessary in establishing scientific credibility in the comparison of core data (and not the only step omitted), yet apparently not required or seen as necessary by EPA RS/FS protocol, even in retrospect, and the total variance issue has been dismissed in the Response as merely "interesting" (LRSCR response summary 1999; reply to LG-1-38D,G).

It is indeed "interesting" that the EPA would ignore an accepted mode of scientific proof in addressing multivariate data and instead embark on a largely ad-hoc and self-rationalized procedure of uncertain application and standards of proof.

The Hudson River is a multivariate system; perhaps the most complex of any Superfund site. Science has devised a means to describe and test such systems, but only under very carefully prescribed conditions in order to identify and evaluate the behavior of each variable, and test the nature of any mutual relationships (or lack of) among or between variables as a prelude to constructing a model and testing (it) as a hypothesis. This procedure generally contains an analysis of variance (ANOVA) component, and requires that a systematic hierarchical or "nested" sampling/observation plan initially be used in collecting data.

Had this approach been followed for the low-resolution core study, the conclusions could have been formally tested for significance, and confidence levels estimated, before issuing the LRC report. As it was, studies by G.E. had identified many of the sources of variance inherent (and neglected) in the report data, and others can be added. The net results is that the report conclusions cannot be verified or

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rigorously tested as they stand, as required for scientific acceptance. TAMS/EPA may feel they are correct, but until all the variance aspects of the LRC data are identified and tested by accepted multivariate methods the report conclusions are problematic.

This situation has two very negative outcomes; first, for lack of testing the LRC study conclusions are reduced to matters of speculation or opinion rather than science, and are not quantifiable; secondly, even if the conclusions have merit, this cannot now be credibly demonstrated by the accepted methods of proof in multivariate parametric statistics and probability (Switzer: Appendix A, vol. 2 C-A, Book 2). Nevertheless, the EPA considers the LRC conclusion of PCB mass loss as fact, as is clear from citations in the Response Summaries, and therefore they will be incorporated as part of the quantitative description of ongoing processes in the TAMS Hudson River models, i.e. become a critical part of the conceptual framework.

At the present time two models have been proposed (TAMS and GE) to describe the Hudson River and its PCB problem, and provide estimates of future conditions. These models reflect differing viewpoints and data interpretations, and it is, and should be, the task of science to resolve the difference by testing each (or any) model for consistency, accord with the facts, and predictive power; i.e. an overall hypothesis test.

However, the divergence of viewpoints and inference represented in the comments on, and assertions of, the LRC study is so large and unresolved, that even a common ground of the rules of evidence and acceptable proof appear to be lacking. This situation is scientifically intolerable for it calls into question the very basis of how to conduct science, at least as practiced in my experience. By analogy, this is equivalent to saying we are not all on the same playing field or playing the same RI/FS game by the same rules. Make no mistake, a resolution of the LRC situation is critical to the conceptual health of this investigation, let alone any model and any claim of validity; and as a corollary, no further model work should be done until resolution.

Science long ago provided the rules for judging the validity of "experiments"; i.e. observers must be impartial and not have a vested interest in the outcome. Methods used must be clear and not so unique as to be impossible to duplicate; results must be reproducible, and other observers must be able to duplicate them using their own "apparatus" (in this case an accepted means of observation and experimental design).

This LRC matter should immediately be referred to peer review for an opinion; one possible resolution is to try to recover enough variance information from both the TAMS data and that of G.E. to permit at least a partial multivariate analysis screening. For this the variance of the comparison of GCMS methods must also be obtained. Otherwise, the option of repeating the LRC study by an independent laboratory selected by peer review and using an accepted multivariate analysis plan and experimental design should be kept open.

Whatever model for the Hudson is constructed or adopted, its predictions and conclusions must be able to be tested for significance and relate to a stated degree of confidence. In this process a multivariate system model must combine or "pool" the variances among all components (of the model) in an appropriate manner, i.e. as determined by their mutual relationships. In general this principle is recognized by both models, however, it is the details of the basic conceptual format and calibration (which LRC will potentially impact) that raise my concern about the TAMS/EPA model and provoke these remarks.

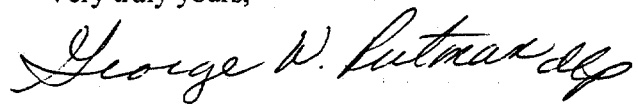
I do not know if the STC was ever intended to arbitrate any part of the model testing, however it is one of my major gripes that the Committee now seems to have little or no mandate, and even less impact on the conduct of the RI/FS if the responsiveness volumes are any indication. Yes, the STC has been well

briefed on the plans and progress of the investigation, but that is the point; we are briefed on the results and decisions presented as fait accompli in a process that now begins with public media announcements of conclusions, premature or not.

This is not science, gentlemen, and it still remains to be seen how the final predictive Hudson River model (hypothesis) is to be tested and by whom, because no party to the model can be impartial. Ideally this function should also be submitted to a peer review (with a budget) for selection of their own independent consultant/examiner.

I request that a copy of this letter be provided to the standing peer review panel, and I would appreciate an acknowledgment of same. My comments on the Human Health/Ecological Risk Assessment SOW Response will be forward in a separate letter.

Very truly yours,

A handwritten signature in cursive script, reading "George W. Putman". The signature is written in dark ink and is positioned above the printed name.

George W. Putman, Ph.D.
Emeritus Faculty