G. W. Putman, EPA Hudson River Technical Committee

Comments on Phase I Report
Re: River discharge - Sediment Transport - PCB loading relations

The data of Figs. B.4-4 to 9 do not support much more of a conclusion than sediment loading commonly increases with discharge. Without normalizing the loading to discharge, there is no basis for concluding that suspended sediment levels show a time trend (p. B.4-10). Zimmie's "sills" (p. B.4-9) may exist as a flood peak event only, outlined by maximum sediment loads at given discharge. Obviously much lower loadings exist at the same discharge and are more common, with no simple relationship evident. Is there a data problem due to the timing of sampling after the peak discharge, and depth integration of suspended sediment?

I do not think the April 1979 event significantly eroded the Thompson Island pool as contrasted to the 1976 event and the remnant deposits in either event. Flood event maximum PCB concentrations at Ft. Edward in 1979, 1983, and 1987 equal or exceed all but one (data point) for the same events at Schuylerville (too little data for 1977; Fig. B.4-10). I think the apparent downstream loading increase reflects low flow desorption equilibration effects, i.e. the flow path through the remnant deposits is short compared to the 5-1/2 mile Thompson Island pool, and 11 mile reach to Schuylerville.

However, by 1983-84 PCB levels in the (exposed) sediment in this pool had declined to a point where little PCB was added by desorption at low flow. At high flow the situation is reversed, with sediment eroded from the remnant deposits being transported downstream as (1) immediate PCB loading, and (2) as a future desorption PCB source from "new" sediment, but with decreasing flux with time.

Significant naturally scoured sediment PCB loadings derived directly from the Thompson Island pool "hot spots" is not suggested for any flood event by the record of radionuclide "stratigraphy" in reported analyses of sediment cores, or the record of changes in river transect bottom topography with time (NAI and others, referred to in the 1987 Ft. Edward E.I.S. references; channel dredging effects excluded). This is especially true for sediment indicated to be older than 1973, which contains the bulk of the PCB hot spot mass. However, possible disturbed or scoured/redeposited sediment is not reflected in the core (segmented) analyses of record, and is an item that needs to be examined, as I suggested, for Phase II.

Other points

Figures B.4-10 and B.4-12. High flow - Total PCB in water (USGS) points do not match. In particular the 1979 high PCB loadings for Ft. Edward (B.4-10; > 2 ppb PCB) do not appear on Figure B.4-12. Figure B.4-12 lacks the parabolic (low to high discharge) envelope of the other plots (noted early on by Tofflemier, et al.) and apparently reflects only the high discharge portion (p. B.4-14).

p. B.4-15. A decline of PCB loading with time at low flow is more likely a reflection of (a) decrease in exposed area of contaminated sediment available for desorption, (b) decrease in average PCB concentration of such sediment in all reaches - due to losses by prior desorption and burial under cleaner, newer sediment. This can be checked by congener-specific PCB analyses from present and past low flow water samples (if the latter exist).

p. B.4-15 Last paragraph - Exactly! Remnant Deposits

A basic problem in many review interpretations of the Thompson Island pool PCB loading is that annual sediment contributions from the remnant deposits have not been resolved from the pre-1973, and buried, hot spot bearing sediments. The Phase I Report in discussing PCB loading (p. B.4-23), for example, makes a reasonable conclusion for 1983 at Ft. Edward, and is on target, top of page B. 4-26, but does not see any inconsistency in the data of earlier years.

There may be a Ft. Edward sampling point problem arising from a non-uniform PCB and sediment distribution close to the remnant deposits, and also how samples from the east and west channels were composited in reported results. As an example, note the following data (USGS water year 1987) for the flood event of April 1-2, 1987:

Station/Date	Discharge	Sediment Discharge Rate	Water Column PCB concentration	Equivalent Total (mass) PCB discharge rate of Hudson River
Waterford, April 2	38,600 $ft.^3/s$	95.1 Kg/s	0.11 μg/L	0.12 gm/s
Stillwater, April 1-2	35,100	157	0.15	0.15
Schuylerville, April 1	31,200	74	0.21	0.186
Ft. Edward, April 1	27,800	49	0.82	0.65
	27,800	53.5	0.05	--

The Ft. Edward samples were taken 5 minutes apart. Whether the spread in PCB values reflects separate sample points or variation at one point, the implications for PCB-sediment concentrations, PCB vs. flow and year, and mass transport estimates at Ft. Edward are obvious. In the above data it can be further noted that the Ft. Edward sampling was done somewhat after the peak flow, that for Schuylerville and Stillwater was approximately coincident, and Waterford was a day late from peak discharge. Detailed sampling for a single flood event (Barnes, U.S.G.S.) shows that the water column PCB concentrations commonly decline much more rapidly than does discharge rate after the flood peak, i.e. producing much of the scatter in total PCBs in water at high discharge (daily flow basis).

Flood Event Modelling

I have considerable reservation about using the indicated sediment transport modelling to estimate the erosion/scour potential of high discharge events for this reevaluation action. This reservation does not pertain to the effort itself, but to the significance or weight to be attached to modelling results as a basis for an evaluation of flood event PCB hazard in the Hudson. Some of the questions which lead to my reservation are:

a) Neither the flow velocity or the sediment properties are inherently uniformly distributed in any model cell or node. Flow velocity decreases via frictional drag with the bottom and banks; sediment character can vary in three dimensions. Perhaps the velocity distribution can be handled by a coefficient term in each cell (e.g. roughness?), but the nature of the sediment variation is yet to be determined.

b) Suspended sediment concentrations in reality are not uniform across the selected flow cross sections, and bed load transport (and interference) effects are not part of the sediment erosion/deposition paradigm.

c) Sediment deposition under flood event velocity does not follow Stokes Law in the bed load transport zone.

d) It is not clear whether or how the modelling will handle the input boundary condition of bed load + suspended sediment entering the Thompson Island pool during flood, or how this will be determined.

e) The sequential-iterative mode of calculation can lead to accumulated errors; careful calibration to sediment/bed parameter constraints mid stream and at the exit point is required, and it is not clear how this will be done.

f) It is not clear how confidence limits or an error assessment is to be made on models results.

g) During high discharge events an overall flow velocity of 25 mi/day in the Thompson Island pool is scaled to a discharge of 20,000 ft^3/sec. at Waterford, and discharge of 45,000 ft^3/sec. would correspond to an approximate 50 mi/day flow velocity if the linear relationship at lower discharges holds (NYSDEC data, extrapolated from U.S.G.S.). These overall velocities are 2-4 cm/sec, which in experimental work is not a range to suggest much sediment transport capacity or entrainment potential for normal sediments (Fine grained bedded sediments have higher cohesion and are not eroded).

Wood chips, sawdust, and organic pulp, of course, are not normal components, but neither are they represented proportionately in the bulk of Thompson Island pool sediments older than 1973. Other factors in sediment transport can, of course, be invoked, but the point is that these must all be recognized and evaluated.

h) If significant sediment scour in high discharge events occurs, it will not be limited to the Thompson Island pool and can be looked for generally in the sediment-radionuclide stratigraphy as eroded/truncated/disrupted bedding, "armor" layer winnowing, and other features. Deposition/erosion in the Thompson Island pool during the 1976 event is complicated by heavy sediment loading from the remnant deposits (The volume of this loading has been estimated), but an event of this magnitude will also be recorded in reaches below the Thompson Island pool if scour is of widespread significance. In short, sedimentation features and a sediment budget for the event of record itself can be used for a qualitative answer to the question of potential scour at high discharge.

Health Risk Assessment

The preliminary human health risk assessment, which is primarily a matter of fish consumption, is hampered by (1) a lack of congener specific characterization of the PCB in Hudson River fish; (2) an assumption of Aroclor 1260 as the PCB standard for health risk assessment of fish ingestion. While studies in progress suggest that mono- and dichlor PCBs may represent more specific neuro toxicity than previously believed, the concentrations involved are approximately 10^5 greater than those of present Hudson River water. Further, these congeners have low bioaccumulation factors and have not been reported as significant in analyses of fish; an obvious point to check.