APPENDIX P
CALCULATIONS USED TO DETERMINE CUMULATIVE PCB LOADS PREDICTED BY EPA MODEL SIMULATIONS CONDUCTED TO SET THE RESUSPENSION LOAD STANDARD

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The Resuspension Performance Standard specifies allowable polychlorinated biphenyl (PCB) resuspension load limits of 650 kg of Total PCBs and 220 kg of Tri+ PCBs. These limits reflect daily resuspension loads at the first far-field station downstream of dredging of 600 g/d for Total PCBs and 200 g/d for Tri+ PCBs. They were judged reasonable limits because the U.S. Environmental Protection Agency's (EPA's) PCB fate model showed that this much resuspension would not eliminate the benefit of the remedy to the lower Hudson River (EPA 2004; EPS v.2, p. 25-26).

The results of the simulations supporting the load standard are presented in Attachment D of the Engineering Performance Standards Volume 2 (EPA 2004). This attachment presents the cumulative Tri+ PCB loads in kg for Monitored Natural Attenuation (MNA) and the Record of Decision (ROD) dredging program (REM 3/10/Select) with PCB export to the first far-field station of zero (i.e., no resuspension) or 200 g/d. Table 28 lists the loads for Thompson Island Dam and Table 30 lists the loads for Waterford. The values from these tables are reproduced here in Tables P-1 and P-2.

Table P-1
Cumulative Tri+ PCB Loads in kg at Thompson Island Dam Computed by the EPA Model Simulations for the ROD Remedy and Monitored Natural Attenuation
(EPS v.2 Attachment D Table 28)

Scenario	2006	2007	2008	2009
Dredging with export of 200 g Tri+ PCB/d	77	169	237	279
Dredging with no resuspension	56	106	133	154
MNA	57	114	152	190

Table P-2
Cumulative Tri+ PCB Loads in kg at Waterford Computed by the EPA Model Simulations for the ROD Remedy and Monitored Natural Attenuation
(EPS v.2 Attachment D Table 30)

Scenario	2006	2007	2008	2009	2010	2011
Dredging with export of 200 g Tri+ PCB/d	110	227	287	342	451	524
Dredging with no resuspension	102	201	245	285	353	397
MNA	102	205	254	301	393	464

The cumulative Tri+ PCB loads were converted to Total PCB loads using the conversion factors on page 67 of Attachment D, which are reproduced here in Table P-3. For year 2009 of the simulation, in which dredging was split equally between Thompson Island Pool and River Section 2, the incremental Tri+ load was converted to Total PCB load using the average of the Thompson Island Pool and River Section 2 conversion factors. The same approach was used for 2010, in which dredging was split equally between River Section 2 and River Section 3.

Table P-3
Ratio of Total PCB to Tri+ PCB for PCBs from the Three River Sections
(EPS v.2 Attachment D, p. 67)

Thompson Island Pool	3.2
River Section 2	3.4
River Section 3	2.7

The cumulative Total PCB loads are presented in Tables P-4 and P-5.

Table P-4
Cumulative Total PCB Loads in kg at Thompson Island Dam Computed by the EPA Model Simulations for the ROD Remedy and Monitored Natural Attenuation
(Calculated from Values in Table P-1)

Scenario	2006	2007	2008	2009
Dredging with export of 600 g Total PCB/d	246	541	758	893
Dredging with no resuspension	179	339	426	493
MNA	182	365	486	608

Table P-5
Cumulative Total PCB Loads in kg at Waterford Computed by the EPA Model Simulations for the ROD Remedy and Monitored Natural Attenuation
(Calculated from Values in Table P-1)

Scenario	2006	2007	2008	2009	2010	2011
Dredging with export of 600 g Total PCB/d	352	726	918	1100	1432	1629
Dredging with no resuspension	326	643	784	916	1123	1242
MNA	326	656	813	968	1249	1440

The values in Tables P-4 and P-5 were used to calculate Total PCB resuspension loads and net loads associated with the resuspension load standards of 600 g/d and 650 kg for the entire project. Resuspension load is the load produced by resuspension during dredging (i.e., the difference between the PCB loads computed by the simulations of dredging with and without 600 g/d of Total PCB export to the first far-field station). Net load is the incremental load produced by resuspension above what would have existed without dredging (i.e., the baseline condition). It is the difference between the loads computed by the simulations of dredging with 600 g/d of Total PCB export to the first far-field station and MNA.

Dredging in the Thompson Island Pool, which occurs for the first 3½ seasons of dredging, produces a resuspension load of 400 kg at the Thompson Island Dam by the end of 2009 (Table P-4; 893 kg – 493 kg). Resuspension load at Waterford is lower. At the end 2009 it is 184 kg (Table P-5; 1,100 kg – 916 kg). This load reflects 3½ seasons of dredging in Thompson Island Pool and ½ season of dredging in River Section 2. The contribution from the Thompson Island dredging was calculated as the 2008 load of 134 kg (Table P-5; 918 kg – 784 kg) plus half of the 2009 incremental load of 50 kg (Table P-5; [1,100 kg – 916 kg] – 134 kg), yielding a load of 159 kg (i.e., 134 kg + 25 kg). This procedure was used to determine the contributions of dredging in each River Section to the load at Waterford. The results are shown in Table P-6.

Table P-6
Cumulative Total PCB Resuspension Loads in kg at Waterford Contributed by Dredging in each of the River Sections

River Section	2006	2007	2008	2009	2010	2011
Thompson Island Pool	26	83	134	159	159	159
River Section 2				25	87	87
River Section 3					63	141
Total	**26**	**83**	**134**	**184**	**309**	**387**

The Waterford resuspension load at the end of the dredging project of 387 kg (which can also be calculated from Table P-5; 1,629 kg – 1,242 kg) is lower than the load that reached the first far-field station, which totals to 656 kg, because of the declination that occurs during transport to Waterford.

Net load at Waterford is calculated by subtracting the MNA load from the load for dredging with an export of 600 g/d. Whereas the resuspension load is 387 kg, the net load is only 189 kg (Table P-5; 1,629 kg – 1,440 kg).

P.1 REFERENCES

EPA, 2004. *Final Engineering Performance Standards for the Hudson River PCBS Superfund Site (Hudson EPS).* Prepared by Malcolm Pirnie, Inc. and TAMS Consultants, Inc. for USACE on behalf of EPA. April 2004.