

GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

Project Name	<u>SANGAMO - WESTON</u>	ProjectID: 04-04
Last Updated:	04/28/00	
City:	Pickens	
County:	Pickens	
State:	SC	
Country:	USA	
Bodies of Water:	Twelvemile Creek; Hartwell Lake	
US EPA Region:	IV	
Status (Active, Complete, or Monitoring Only):	Monitoring Only	
Date On NPL:	1990	
ROD/ESD Date:	1994 (OU-2)	
Operable Unit:	OU-2	
Areas of Concern (length or acres):	24-mile Twelvemile Creek and 56,000 acre Hartwell Lake.	
Other Characteristics of Water Body:	Twelvemile Creek originates at 1920 feet above MSL and flows 24 miles into Hartwell Lake, at a normal pool elevation of 660 feet above MSL. Hartwell Lake is a man-made reservoir constructed by the USACOE between 1955-1963. Lake maximum depth is 50 feet. Approximately 80 tributaries flow into Twelvemile Creek. There are three masonry impoundments in Twelvemile Creek. Average daily creek flow is 198 cfs, with historical daily range from 30 to 5360 cfs. Sediment PCB concentrations in contaminated areas of the Twelvemile Creek (known as the Twelvemile Creek Arm, a 7-mile stretch extending from the confluence with the Keowee Arm to the lake headwaters) are typically in the 1 - 3 ppm range at the surface and slightly higher in deeper sediments. Portions of the 7-mile Twelvemile Creek Arm, a depositional area, exhibited PCBs up to 61 ppm. Maximum PCB concentrations measured in 1991/92 in sediment core samples from the upper section of Hartwell Lake (where Twelvemile Creek enters) exhibited concentrations of 5 to 11 ppm; PCB contamination in sediment in the lower part of the lake is typically below 1 ppm.	
Contaminants of Concern:	PCBs (1016/1242/1254)	
Source of Contamination:	Sangamo Weston, Inc. capacitor manufacturing plant historical wastewater discharges into Town Creek, a tributary of Twelvemile Creek.	
Contaminated Area Physical Characteristics:	730 acres of sediments at >1 ppm PCBs in the 7-mile Twelvemile Creek Arm, an estimated volume of 4,722,000 cy.	
Type of Regulatory Action:	Superfund. Final. Fund-Lead.	
Overall Status Summary:	USEPA-lead RI/FS. In 1994, natural recovery supplemented by institutional controls was selected as the only remedy. A cleanup level of 1 ppm PCBs (4.7 million cy) was judged to be technically infeasible to achieve. Natural recovery to below the FDA action level of 2 ppm PCBs was predicted, by modeling, to occur in largemouth bass in Hartwell Lake within 12 years (from 1992).	
	Both the USEPA and the public rejected as too costly (\$500 million minimum) remedies associated with removal, treatment, and disposal of an estimated 4.7 million cubic yards of PCB-contaminated sediment that is spread over approximately 730 acres. USEPA also rejected alternatives that involved aggressive engineering controls to contain or remove and dispose of PCB-contaminated sediment as being too costly (\$30-50 million) and not providing a significant reduction in overall risk. Firm public opposition also caused EPA to reject installation of a	

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fishery isolation barrier (fence) to prohibit movement of migratory fish into or out of the area of Hartwell Lake with the highest PCB concentrations in sediment.

The South Carolina Department of Health and Environmental Control has been performing annual studies of PCB levels in fish since 1976. In June 1994, the Final Record of Decision was issued for the site that required aquatic biota monitoring (primarily a comprehensive fish tissue study) and sediment sampling. Annually from 1995 to present, fish and sediment sampling and a bioaccumulation study using the Asian clam (*Corbicula fluminea*), have been performed. The general trend, when samples collected as recently as 1998 and 1999, are compared to samples collected in 1990, show that PCB levels in fish and sediment have reduced significantly and are continuing to go down.

Upon resolution of outstanding cost issues at the site, USEPA Region IV issued a Unilateral Administrative Order (UAO) on September 25, 1998, which required the PRP to implement a fish consumption advisory and public education program, to perform annual aquatic biota and sediment monitoring to determine PCB levels in fish and other aquatic life, and to periodically flush sediments from behind the three small hydroelectric dams to facilitate burial of PCB-impacted sediments further downstream.

USEPA is presently performing a 5-year review of the site required as part of the UAO natural recovery selection. To-date, the reduction of PCB levels in fish is progressing at a rate considered satisfactory to USEPA. One type of fish, a bass hybrid, appears to be remaining above the FDA recommended limit of 2 ppm PCBs in all areas of the lake, potentially impacting the ability to eliminate fish advisories from areas of the lake where other species of fish have consistently shown to have recovered to below the FDA limit. The bass hybrid tends to be very mobile and apparently consistently ranges over the entire lake, resulting in comparative PCB tissue levels regardless of the location of capture. In contrast, other fish tend to have a more limited range. PCB levels in tissue samples from these fish tend to reflect the relative concentration of PCBs in sediment in and around the area of capture. Because the hybrid bass is considered an important sports fish in the area and because the fish is a hybrid and cannot naturally reproduce, the fish is periodically restocked in Hartwell Lake to maintain a viable sports fishing population. USEPA has attempted to have the stocking of the hybrid bass discontinued in the lake, however this has been soundly rejected by the South Carolina State Fish Commission, citing potentially negative economic impact on the local sports fishing industry.

As part of the 5-year review, USEPA is evaluating methods to improve the ability to release trapped sediment from behind two of the three hydroelectric dams located on Twelvemile Creek. As part of the UAO, clean sediment trapped behind the dams is to be periodically flushed from behind the dams for transport downstream to promote the burial of sediments containing elevated levels of PCBs with clean sediments in areas of lower Twelvemile Creek and Hartwell Lake. This process is anticipated to facilitate the natural recovery process by burying the contaminated sediments beneath clean sediments.

Low-flow sluice gates presently installed in the dams are proving inadequate to effectively flush the sediment from behind the dams as a result of being limited to operation during low-flow conditions. Flushing during low-flow conditions results in incomplete removal of sediment from behind the dams and inadequate water flow to transport the sediment to the desired depositional areas. Hydraulic dredging from behind the dam and discharging the slurry to the creek downstream of the dam has been performed successfully during periods of high creek flow. However, this option has been rejected as a long term solution due to the dependence on dredge availability, the need to mobilize the dredge from dam to dam, and the difficulty in

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maneuvering the dredge behind the dam. USEPA is presently working with the PRP on a plan to install high-flow sluice gates in each of the dams to allow for more effective sediment flushing, and, in turn increase the amount of clean sediment deposited in downstream areas containing contaminated sediments.

No further remedial actions are being considered for the site at this time.

Remedial Action Planned: ☒

Risk Assessment: ☒

Remedial Action Implemented: ☒

Status of Dredging ☐

PRPs: ☒

Contacts: ☒

References: ☒

Modeling: ☒

Fishing Advisory: ☒

Key Conditions: extended (> 1 mile) river, hydrodynamic modeling, more-harm-than-good, natural recovery

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Target Sediment Cleanup Standards (TSCS):	1 ppm PCBs	
How TSCS Established:	Technical feasibility. Sediment: A concentration of 1 ppm PCBs was selected based upon technical feasibility. The affected area covers approximately 730 acres with a total estimated volume of 4,722,000 cubic yards of sediment >1 ppm. Fish: The FDA safe tolerance level of 2 ppm PCBs was selected based upon technical feasibility. A carcinogenic risk-based approach was evaluated by determining the concentration levels in largemouth bass that would result in acceptable risk to anglers through ingestion of fish. Utilizing EPA risk assessment methods, a fish tissue concentration of 0.036 ppm is associated with a 10 ⁻⁴ risk. The risk-based fish cleanup goal of 0.036 ppm was determined to be technically impracticable.	
Target Bank and Floodplain Cleanup Levels (if applicable):	N/A (floodplains are generally absent)	
Other Target:	None	
Environmental Sample Data References:	<ul style="list-style-type: none">• Sediment: Reference A-82; also, Reference A-120 (Sections 5.2 and 5.3)• Water: Reference A-82; also, Reference A-120 (Sections 5.2 and 5.3)• Fish: Reference A-82; also, Reference A-120 (Sections 5.2 and 5.3)	
Estimated Target Volume:	730 acres at >1 ppm PCBs	
Planned Disposal Method:	N/A	
Estimated Calendar Time to Implement Remedy:	12 years, 1992 - 2004; natural recovery to FDA fish levels predicted.	
Estimated Time to Implement Remedy:	12 years estimated by modeling for largemouth bass fish levels to reduce to below the FDA limit of 2 ppm PCBs.	
Estimated Cost to Implement Remedy:	\$3.2 million	
Stated Remedial Action Objectives (and Source):	FINAL CLEANUP GOAL FOR SEDIMENT (Source: 1994 ROD) "Potential cleanup goals for PCB-contaminated sediment at the Sangamo OU2 Site were determined through an evaluation of available criteria and accepted techniques for calculating cleanup goals in sediment..." "From this evaluation, three representative sediment cleanup goals (1 ppm, 0.4 ppm and 0.05 ppm) were selected for further analysis. The analysis consisted of an evaluation of the long-term impacts of potential sediment cleanup goals on PCB concentrations in fish, and ultimately human health via ingestion of contaminated fish, given that the ingestion of fish is the principal exposure pathway of concern at the site. This evaluation was conducted utilizing (modeling). The rationale for selecting these values is presented below:	

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- 1 ppm - The most frequently selected sediment cleanup goal for PCBs at NPL sites based on a review of the EPA's ROD database. A concentration of 1 ppm also represents a reasonable lower limit considering technical feasibility and cost.
- 0.4 ppm - The mean value for the site-specific sediment quality criteria calculated using the EPA's equilibrium partitioning approach; also equal to the Effects Range-Median (ERM) criteria based on an evaluation of published criteria associated with biological effects on aquatic life as reported by the National Oceanic and Atmospheric Administration (NOAA).
- 0.05 ppm - Equal to the Effects Range-Low (ERL) from NOAA based on an evaluation of published criteria associated with biological effects on aquatic life; also representative of the more commonly reported background-based sediment criteria for PCBs."

"The time required for 2-8 year old largemouth bass in the Twelvemile Creek Arm of Lake Hartwell to achieve 2 ppm for the range of selected sediment cleanup goals was compared to a baseline condition. It was determined that fish PCB concentrations decline at about the same rate regardless of the sediment cleanup goal. Therefore, a final sediment cleanup goal of 1 ppm was selected based on technical feasibility rather than performance or risk-based considerations. This concentration identified the entire Twelvemile Creek Arm, a 7-mile stretch extending from the headwaters of the lake to the confluence with the Keowee Arm, as an area to be addressed. This area covers approximately 730 acres with a total estimated volume of 4,722,000 cy of contaminated sediment."

FINAL CLEANUP GOAL FOR FISH (Source: 1994 ROD)

"Fish ingestion was identified as the primary exposure pathway of concern at the Sangamo OU2 Site. Potential remediation goals include the FDA tolerance level of 2 ppm for PCBs in the edible portions of fish, and risk-based levels that consider the fish ingestion exposure pathway. Both of these options are described below."

"The FDA criterion was identified as a contaminant-specific Applicable or Relevant and Appropriate Requirement (ARAR). In addition, the existing health advisory for Lake Hartwell is based on the continuing presence of PCBs in fish in concentrations greater than 2 ppm. Selection of risk-based cleanup goals for fish were considered by determining the concentration levels in largemouth bass that would result in acceptable risk to anglers (through ingestion of the fish) based on EPA's target risk range of 1×10^{-4} to 1×10^{-6} . The acceptable concentrations were estimated using the same methodology used for the baseline human health risk assessment and for determining risk levels for the sediment cleanup goals. A fish tissue concentration of 0.036 ppm is associated with a 10^{-4} risk, 0.0036 ppm with a 10^{-5} risk, and so on."

"Using EPA's deterministic, reasonable maximum exposure (RME) approach and site-specific exposure parameters, the 30-year carcinogenic risk associated with the FDA criterion of 2 ppm results in an estimated risk of 6×10^{-3} . This is well above the upper end of EPA's target risk threshold of 1×10^{-4} . It is important to note that EPA considers the RME assumptions to be conservative, since they represent upper confidence limits for a given range of values for a particular risk input parameter or variable. It is also important to note that consumption of fish from Lake Hartwell (or other sources) is a strictly voluntary activity."

"Use of the risk-based concentrations for fish remediation goals (i.e., 0.036 ppm) was determined to be technically impracticable at SV-107 for several reasons (SV-107 is a fish sampling station). Fish bioaccumulate PCBs from both the water column and food chain; thus, PCB concentrations in sediment and surface water would likely have to be reduced to levels in the ranges of parts per

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billion (0.001 ppm) or parts per trillion (0.001 µg/L) to achieve risk-based levels in fish. Reducing surface water and sediment concentrations to these levels is beyond the capability of proven treatment technologies, particularly when the scale of the site is taken into consideration. Moreover, as shown by modeling, PCB cycling among fish, plankton, benthos, sediment, and surface water greatly complicates the removal of PCBs from a biological system once the contaminants have been introduced. Even if concentrations in sediment and surface water could be reduced to levels commensurate with the risk-based fish concentrations, it would be many years before the fish concentrations actually declined to acceptable levels."

"Given the existence of an ARAR for PCB concentrations in fish, the technical impracticability of establishing risk-based cleanup goals, and the classification of fish consumption as a voluntary exposure, the FDA tolerance level of 2 ppm was selected as the Final Cleanup Goal for Lake Hartwell fish."

Measures of Success to be Used:

Annual sediment (20 locations) and fish monitoring (six stations) for 15 years minimum. PCB data trends will be used to support decisions to modify the fish advisory.

Planned Monitoring and Restoration:

Annual sediment (20 locations) and fish monitoring (six stations) for 15 years minimum. PCB data trends will be used to support decisions to modify the fish advisory.

Agency Position on Sediment Removal (and Source):

Summaries of some alternatives follow (Source: summarized from 1994 ROD):

Capping:

- The 18-inch cap would be constructed using fine sand and would extend for 7 miles. The cap would cover 730 acres and would require 1.8 million cy of sand.

- Construction of the sediment control structure and placement of the cap would require a period of 2 - 3 years. Upstream of the weir, contaminated sediments are not isolated from the biota and thus PCB concentration in fish would continue to exceed the FDA limit of 2.0 ppm for an estimated 12 years. Downstream of the weir in the Twelvemile Creek Arm, cap placement would accelerate the reduction of PCB levels in fish to protective levels because contaminated sediments have been isolated, limiting further transfer of PCBs to biota. An estimated period of 3 to 4 years (after cap placement) is required for PCB concentrations to fall below the FDA limit of 2.0 ppm in the capped area as well as in the main body of Hartwell Lake. Cost \$31.7 million.

Dredging Alternative No. 1 (Confined Disposal):

This alternative involves removal by hydraulic dredging of contaminated sediment from the Twelvemile Creek Arm with PCB concentrations greater than 1 ppm followed by disposal of the dredged material in a Confined Disposal Facility (CDF). Cost: \$43.4 million.

Implementation would be a complex undertaking controlled through scheduling and rigid conformance to procedural requirements needed to minimize environmental impacts, and would include:

- Excavate channel - rerouting the Twelvemile Creek Arm would begin immediately south of the high-tension powerline crossing and would proceed due south for a distance of approximately 1,600 ft. where it would reconnect with the original lake channel. The rerouted channel would be approximately 50 ft. wide at the base with a maximum excavation depth for the channel at approximately 55 ft. Material excavated during the channeling operation would be used for construction associated with the CDF. Rerouting the channel in this area would only isolate one

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shoreline residence on the goose-neck bend.

- Construct Confined Disposal Facility- The COE commonly uses CDFs for disposal of dredged sediments. The goose-neck bend area between Maw and Madden Bridges was selected as the optimum location for the following reasons: 1) this area has most highly contaminated sediments avoiding the need to dredge approximately 1.3 million cy of material; 2) approximately 113 acres is available providing sufficient capacity for disposal of 5 million cy of material; and 3) minimal impacts on existing residents would occur.

- Dredge and pump dredged sediment into CDF - Sediments from entire Twelvemile Creek Arm with PCB concentrations >1 ppm would be removed via hydraulic dredging and transported to CDF via pipeline. Sediment would settle out in CDF, while water was returned to the lake.

- Compact/grade sediment to promote runoff followed by placement of soil cap over CDF.

- Dredged material characteristics, and design of the CDF would be required prior to implementation. Implementation of the dredging alternative is expected to require a period of 3 to 4 years (including treatability testing, design, procurement and construction). Once sediments with greater than 1 ppm of PCBs have been removed from the lake, the FGETS model predicts that the mean PCB concentration in largemouth bass fillets would fall below the FDA limit of 2 ppm in 5 to 6 years.

Dredging Alternative No.2 (Stabilization):

- This is a very complex and costly alternative that involves removal of contaminated sediments with PCB concentrations greater than 1 ppm via a combination of shallow water excavation and hydraulic dredging. Contaminated sediments in the middle and lower portions of Twelvemile Creek Arm would be dredged while the upper portion is dewatered and excavated. The dredged/excavated sediments would be treated by stabilization with cement and placed in a CDF as described under Alternative No.1. Fish and other biota in the upstream segment would be collected and destroyed as part of the dewatering operation. This alternative was evaluated in an attempt to satisfy the preference for treatment as a principal element for selected remedial alternatives at NPL sites.

- Implementation of this alternative would likely trigger a substantial number of ARARs, the most significant being the Clean Water Act and South Carolina Water Classification Standards. Based on a volume estimate of 4,722,000 cy for excavation and dredging, expected stabilization production rates, and the rate at which the confined disposal facility can be filled, implementation would entail a duration of 4 to 5 years. Once the contaminated sediment has been removed, fish PCB concentrations downstream of the Madden Bridge would decline at an accelerated rate, achieving the FDA tolerance level in approximately 5 to 6 years. The time to achieve protectiveness for this alternative therefore is 9 to 11 years. Cost: \$582 million.

Implementability:

- A limitation to capping concerns the availability and transportation logistics of as much as 1.8 million cy of capping material. The most difficult alternatives to implement, in terms of both technical and administrative feasibility, would both involve dredging, which is a widely used technology, but they would still require considerable predesign testing and evaluation to optimize operations and minimize environmental impacts. Construction of the confined disposal facility in what is currently a large body of open water and rechanneling the Twelvemile Creek Arm through a forested ridge would also present a number of technical challenges. While not

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insurmountable, the challenges do make implementation of either dredging alternative considerably more complex than the other remedial alternatives. These alternatives would also have the greatest administrative requirements due to the need to fulfill permit-related requirements related to Clean Water Act dredge-and -fill permits, South Carolina NPDES permits, and possibly other permitted activities.

RISK ASSESSMENT

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RA Type: Human Health and Ecological

RA Status: Complete

RA Objectives:

Company Bechtel Environmental

Performing RA:

RA Reference Report: Not available

***RA Summary and
Conclusions:*** Summary:

The primary human health exposure pathway of concern at the Sangamo OU2 Site is the ingestion of fish contaminated with PCBs. Exposures associated with ingestion of fish caught from all sampling locations resulted in unacceptable carcinogenic risks ranging from 10^{-2} to 10^{-4} and HQs greater than 1. As discussed, PCB concentrations in sediment are predicted to decrease over time. The impact of decreasing sediment concentrations on overall risk was evaluated for the ingestion of largemouth bass at SV-107. The output from the food-chain bioaccumulation model was utilized in this analysis. It was found that the total modeled risk over a 30-year time frame (2×10^{-3}) was not substantially different from the calculated deterministic RME risk of 1×10^{-2} . This was largely because risk over this time period is dominated by the very high risks calculated for the first eight years of exposure. In actuality, a period of approximately 22 years appears to be required for one-year risks to drop to the 10^{-6} risk level. It would require more than 22 years for the entire 30-year risks to decline to $< 10^{-6}$. With respect to noncancer risks, a period of approximately 20 years appears to be required for the HQ to drop below one. After the next 20-30 years, long-term risk associated with the consumption of fish harvested from Lake Hartwell should be substantially lower. (Source: 1994 ROD)

In addition:

Human Risk: Exposures associated with ingestion of fish caught from all sampling stations resulted in unacceptable risks ranging from 10^{-2} to 10^{-4} and HQs greater than one. The highest cancer risk of 3×10^{-2} was calculated for anglers exclusively consuming largemouth bass caught in the Twelvemile Creek watershed. The highest cancer risk for ingestion of all species combined, 1×10^{-2} , was calculated for the Twelvemile Creek Arm. The lake-wide risk associated with ingestion of all species combined was 5×10^{-3} . Adverse human health risks resulting from direct contact or incidental ingestion with the sediment are unlikely to occur, however, sediments are a continuing source of contamination in the aquatic biota of the study area.

Ecological Risk: An ecological risk assessment was conducted to evaluate the impact PCBs may be having on the aquatic receptors of the study area. The biological investigations clearly document PCB contamination in all levels of the aquatic food web. However, although PCBs appear to be impacting the fish and macroinvertebrate communities in Twelvemile Creek, habitat degradation from man's influence is likely causing greater adverse impacts at the population and community levels. The health of fish in Lake Hartwell does not appear to be affected at the population level for fish that have PCB concentrations around 5 ppm. However, there is evidence that as concentrations increase to greater than 20 ppm, fish health can be affected." (Source: EPA Proposed Plan, April 1994)

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Physical Target:	24 miles of Twelvemile Creek and 50,000 acre Hartwell Lake.	
Goals:	Natural recovery to FDA fish levels.	
Primary Contractor:		
Other Contractors:		
Generic Remediation Method:	Natural recovery (with institutional controls)	
Equipment:	N/A	
Material Handling:		
Volume Removed:	None (natural recovery)	
Calendar Time:	Natural recovery to FDA PCB limit for fish of 2.0 ppm in largemouth bass predicted, by modeling, to occur in Hartwell Lake within 12 years (from 1992).	
Time To Implement:	N/A	
Total Cost:	N/A	
Dredging Cost:		
Disposal of Sediment:	N/A	
Volume of Water:	N/A	
Method of Water Treatment:		
Water Discharge Limit:		
Air Monitoring During Remediation:		
Water Monitoring During Remediation:		
Outcome:	Natural recovery in-progress along with (1) continuation of fish advisory, (2) annual monitoring, and (3) more controls on the periodic flushing of sediments from behind three impoundments. Modeling predicts FDA levels in largemouth bass will be reached in Hartwell Lake in 12 years.	
Restoration and Post-Monitoring:	<p>Monitoring is required for aquatic biota (primarily a comprehensive fish tissue study) and sediment as described in the June 1994 OU2 ROD. The ROD requirements are annual sediment sampling (20 locations) and fish monitoring (6 stations) for 15 years minimum. PCB data trends are to be used to support decisions to modify the fish advisory. In addition to fish and sediment sampling, an exposure assessment is performed annually using Asian clams (<i>Corbicula</i>).</p> <p>To-date, results of fish and sediment samples through 2003 show a general reduction in PCB concentrations when compared to 1990 data. Sample results for 1990 (approximated from graphed data), and for years 1998 through 2003 are summarized below.</p>	

FISH CONCENTRATIONS

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Mean PCB concentrations are listed for the six sampling locations for largemouth bass (LMB), hybrid bass (HB), and channel catfish (CC), in general from nearest (vicinity of the Twelvemile Creek Embayment) to farthest (nearest the lake dam) from the original source of contamination (Sangamo-Weston facility/Twelvemile Creek).

LMB (1990): >14.0 ppm; ~6 ppm (1991); 2.0 ppm; >0.5 ppm; >0.5 ppm; ~0.5 ppm (1991)
LMB (1998): 8.69 ppm; 4.19 ppm; 1.86 ppm; 0.75 ppm; 0.16 ppm; 0.13 ppm
LMB (1999): 11.96 ppm; 2.45 ppm; 1.67 ppm; 0.70 ppm; 0.07 ppm; 0.27 ppm
LMB (2000): 11.00 ppm; 3.16 ppm; 0.68 ppm; 0.25 ppm; 0.05 ppm; 0.11 ppm
LMB (2001): 6.93 ppm; 2.40 ppm; 0.67 ppm; 0.17 ppm; 0.16 ppm; 0.14 ppm
LMB (2002): 4.51 ppm; 1.99 ppm; 0.44 ppm; 0.15 ppm; 0.03 ppm; 0.12 ppm
LMB (2003): 4.54 ppm; 3.16 ppm; 1.17 ppm; 0.39 ppm; 0.06 ppm; 0.11 ppm

HB (1990): ~2.30 ppm (1992); 6.0 ppm (1991); 5.20 ppm (1991); 1.10 ppm; 1.30 ppm; 3.0 ppm (1991)
HB (1998): 2.46 ppm; 3.18 ppm; 3.58 ppm; 2.87 ppm; 2.68 ppm; 2.04 ppm
HB (1999): 2.07 ppm; 4.36 ppm; 3.67 ppm; 1.10 ppm; 1.67 ppm; 0.99 ppm
HB (2000): 3.68 ppm; 2.15 ppm; 2.78 ppm; 1.89 ppm; 3.25 ppm; 2.84 ppm
HB (2001): 6.29 ppm; 3.54 ppm; 2.60 ppm; 3.04 ppm; 2.51 ppm; 2.46 ppm
HB (2002): 2.58 ppm; 1.28 ppm; 1.76 ppm; 1.26 ppm; 1.71 ppm; 2.56 ppm
HB (2003): 5.40 ppm; 7.90 ppm; 2.69 ppm; 2.21 ppm; 3.10 ppm; 3.01 ppm

CC (1990): 3.90 ppm; 3.00 ppm (1991); 0.30 ppm; 0.70 ppm; 0.30 ppm (1991); 0.30 ppm (1991)
CC (1998): 1.17 ppm; 2.53 ppm; 0.77 ppm; 0.58 ppm; 0.06 ppm; 0.27 ppm
CC (1999): 2.27 ppm; 1.40 ppm; 0.92 ppm; 0.35 ppm; 0.08 ppm; 0.38 ppm
CC (2000): 0.57 ppm; 1.31 ppm; 0.63 ppm; 0.42 ppm; 0.58 ppm; 0.18 ppm
CC (2001): 1.91 ppm; 0.97 ppm; 0.90 ppm; 0.94 ppm; 0.58 ppm; 0.19 ppm
CC (2002): 0.36 ppm; 0.74 ppm; 0.78 ppm; 0.08 ppm; 0.58 ppm; 0.06 ppm
CC (2003): 1.55 ppm; 1.49 ppm; 0.53 ppm; 0.31 ppm; 0.05 ppm; 0.13 ppm

The sampling of three species of forage fish (bluegill, threadfin shad, and gizzard shad) was started in 1995 and samples are being collected at three of the six sampling locations. Maximum concentrations for each fish from each year beginning in 1999 are:

1999: bluegill: 2.19 ppm; threadfin shad: 5.01 ppm; and gizzard shad: 4.49.
2000: bluegill: 3.70 ppm; threadfin shad: 3.48 ppm; and gizzard shad: 4.74.
2001: bluegill: 3.37 ppm; threadfin shad: 2.99 ppm; and gizzard shad: 6.16.
2002: bluegill: 1.01 ppm; threadfin shad: 4.8 ppm; and gizzard shad: 3.65.
2003: bluegill: 1.29 ppm; threadfin shad: 1.63 ppm; and gizzard shad: 3.97.

For each sampling event, the maximum concentration was recorded at the sampling location in the Twelvemile Creek Embayment.

SEDIMENT CONCENTRATIONS

Surface sediment samples (top 6 inches) have been collected at 21 sampling locations annually beginning in 1995. In 1998, surface sediment concentrations ranged from a high of 2.83 ppm at two locations within the Twelvemile Creek Arm to non-detect near the lake dam. In general, sediment PCB concentrations appear to continue to decline. In 1999, sediment samples collected from the upper Twelvemile Creek Arm ranged from 0.137 to 5.78 ppm. These values are considerably lower

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than those reported by the State and USEPA from 1976 to 1985 (ranged from 1.7 to 48 ppm) or those reported by ERM in 1995 (ranged from 0.943 to 8.46 ppm). The lower Twelvemile Creek Arm area, historically containing the most contaminated sediments, was where the maximum sediment concentration of 5.78 ppm PCBs was found. This was lower than sediment samples collected from 1995-97 (8.26 to 23.3 ppm) but higher than the 1998 level of 2.25 ppm PCBs. The sampling location where the maximum recorded PCB sediment concentration (5.78 ppm) was collected is located in an area of the Twelvemile Creek Embayment that historically is subject to higher levels of deposition than other areas sampled. The higher 1999 levels were thought to be the result of both man-made and natural sediment flushing events that occurred upstream of this location in 1998.

The following is a summary of historic sediment sample data collected in the same area and sediment sample data collected from 2000 through 2003:

(A) Upper Twelvemile Creek Arm:

Historic: 1976 through 1985: 1.7 ppm to 48.0 ppm; 1995: 0.94 ppm to 3.66 ppm

2000: <0.06 ppm to 2.71 ppm (4 samples)

2001: 0.22 ppm to 2.5 ppm (4 samples)

2002: <0.063 ppm to 4.26 ppm (4 samples)

2003: <0.063 ppm to 3.25 ppm (4 samples)

(B) Middle Twelvemile Creek Arm

Historic: 1976 through 1988: 0.84 ppm to 64.3 ppm; 1995: 8.56 ppm to 16.0 ppm

2000: 2.08 ppm and 12.5 ppm (2 samples)

2001: 2.3 ppm and 2.6 ppm (2 samples)

2002: 3.3 ppm and 5.55 ppm (2 samples)

2003: .331 ppm and 2.27 ppm (2 samples)

(C) Lower Twelvemile Creek Arm

Historic: 1977 through 1985: 0.39 ppm to 55.62 ppm; 1991: 0.16 ppm to 11.51 ppm

2000: 1.33 ppm and 1.97 ppm (2 samples)

2001: 3.98 ppm and 5.73 ppm (2 samples)

2002: 1.92 ppm and 9.68 ppm (2 samples)

2003: 1.77 ppm and 5.51 ppm (2 samples)

(D) Seneca R. Arm/Upper Hartwell Lake

Historic: 0.01 ppm to 14.26 ppm; 1991: 0.04 ppm to 5.26 ppm

2000: 1.18 ppm and 0.52 ppm (2 samples)

2001: 0.445 ppm and 0.814 ppm (2 samples)

2002: 0.539 ppm and 0.896 ppm (2 samples)

2003: 0.642 ppm and 1.61 ppm (2 samples)

(E) Lower Hartwell Lake (Station SD-106 near Martins Creek)

Historic: 1976: 0.01 ppm to 6.59 ppm; since 1995: 0.514 ppm (1998) to 8.92 ppm (1995)

2000: 2.36 ppm (1 sample)

2001: 0.487 ppm (1 sample)

2002: 2.93 ppm (1 sample)

2003: 1.25 ppm (1 sample)

EXPOSURE ASSESSMENT

REMEDIAL ACTION IMPLEMENTED

Project Name: SANGAMO - WESTON

ProjectID: 04-04

Last Updated: 08/18/04

Studies are performed using Asian clams (*Corbicula*) by placing 50 clams each in seven baskets and placing them in creek water at different locations throughout the creek areas for 28 days. Results of the assessment indicated that exposure to PCBs decreased substantially from 1997 (maximum concentration: 7.59 ppm) to 1998 (maximum concentration: 2.88 ppm-duplicate). PCB concentrations increased slightly from 1998 to 1999 (maximum concentration: 6.41 ppm), but generally remained well below maximum concentrations recorded for all locations in 1995-96. PCB concentration ranges in *Corbicula* for 2000 through 2003 are:

2000: <0.0522 ppm to 2.56 ppm
2001: <0.0508 ppm to 2.40 ppm
2002: <0.0510 ppm to 2.52 ppm
2003: <0.0527 ppm to 2.601 ppm

Site-Specific Difficulties:

- EPA Region IV initially issued a Proposed plan for the site identifying Fisheries Isolation as the preferred alternative for the site. The alternative featured a submerged physical barrier (fish fence) that would restrict the movement of migratory fish into and out of the most contaminated portions of Hartwell Lake. The barrier was expected to accelerate the decline in PCB concentrations in migratory fish in the main body of the lake (representing greater than 90% of the area), which would allow for rescinding of existing fish advisories. Bioaccumulation modeling predicted a period of only 3-4 years for PCB levels to drop below the FDA action level, after which time the existing advisories would be rescinded. However, during the public comment period the local community expressed such strong opposition to the barrier based on safety, interference with lake usage, and potential for decreased property values that EPA removed this alternative from the remedy.
- The three impoundments are small privately-owned hydroelectric dams. Part of the institutional controls for the natural recovery remedy is to periodically flush collected sediments from behind the dams. Flushing is problematic; at least as reported in early 1996. Some existing "low-flow" sluice gates are silted shut. In late 1995, flushing was attempted on one dam. The sluice gate stuck open causing loss of control of the flush rate. The resultant excessive silt/solids loading caused some fish kills. EPA is attempting (early 2000) to have the PRPs upgrade the sluice gates in the three dams to "high-flow" sluice gates as part of the Consent Order being negotiated. The high-flow sluice gates would reportedly allow flushing of sediment from behind the dam during periods of high flow, resulting in greater efficiency and control over the sediment flushing process. The PRPs are resisting on principle.

Monitoring Data

Not available

References:

- *Sediment*
- *Water:*
- *Fish:*

POTENTIALLY RESPONSIBLE PARTIES

Project Name **SANGAMO - WESTON**

ProjectID: 04-04

PRP Name: PRP INFORMATION NOT RELEASED

PRPID:

Street Address:

City:

State:

KEY CONTACTS

Project Name **SANGAMO - WESTON**

ProjectID: 04-04

Last Name: KEY CONTACT INFORMATION NOT RELEASED

Contact ID:

First Name:

Title:

Company:

Address:

City:

State:

Postal Code:

Work Phone # :

Other Phone #:

Fax # :

Email Address:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: A

ReferenceID: 82

Title: *PCBs and Related Compounds in Lake Hartwell*

Location: AEM

Category: Site Update

Prepared by/Author: Environmental Systems Engineering

Preparer/Author Address: Clemson University
Clemson, SC 29634-0919

Prepared For: US Department of the Interior, US Geological Survey, Reston VA 22092

Date Published: March 1991

Key Words and Phrases:

Reference Type: A

ReferenceID: 119

Title: *Superfund Proposed Plan Fact Sheet: Sangamo Weston / Twelve Mile Creek / Lake Hartwell PCB Contamination Superfund Site - Operable Unit Two*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IV

Preparer/Author Address: 345 Courtland Street
Atlanta, GA 30365

Prepared For: General Public

Date Published: April 1994

Key Words and Phrases:

Reference Type: A

ReferenceID: 120

Title: *EPA Superfund Record of Decision: Sangamo Weston / Twelvemile Creek / Lake Hartwell Site, Pickens, SC (OU-2)*

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region IV (ROD/R04-94/178)

Preparer/Author Address: 345 Courtland Street
Atlanta, GA 30365

Prepared For: General Public

Date Published: June 1994

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: A

ReferenceID: 121

Title: *EPA Superfund Record of Decision: Sangamo / Twelve-Mile / Hartwell PCB, SC (OU-1)*

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region IV (ROD/R04-91/100)

Preparer/Author Address: 345 Courtland Street
Atlanta, GA 30365

Prepared For: General Public

Date Published: December 1990

Key Words and Phrases:

Reference Type: A

ReferenceID: 556

Title: *Lake Hartwell 1998 Fish and Sediment Study; Operable Unit 2 ROD Monitoring Program*

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: RMT, Inc.

Preparer/Author Address: Stafford, TX

Prepared For: Environmental Resources Management
7106 Crossroads Boulevard, Suite 228
Brentwood, TN 37027

Date Published: August 1998

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: A

ReferenceID: 557

Title: *Lake Hartwell 1999 Fish and Sediment Study;
Operable Unit 2 ROD Monitoring Program*

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: RMT, Inc.

**Preparer/Author
Address:** Stafford, TX

Prepared For: Environmental Resources Management
7106 Crossroads Boulevard, Suite 228
Brentwood, TN 37027

Date Published: October 1999

**Key Words and
Phrases:**

Reference Type: A

ReferenceID: 599

Title: *Lake Hartwell 1997 Fish and Sediment Study: Operable Unit 2
ROD Monitoring Program*

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: Environmental Resources Management

**Preparer/Author
Address:** 7106 Crossroads Blvd., Suite 228
Brentwood, TN 37027

Prepared For: Schlumberger Industries, Inc.

Date Published: August 1997

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: A

ReferenceID: 600

Title: ***Lake Hartwell 2000 Fish and Sediment Study: Operable Unit 2
ROD Monitoring Program***

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: Environmental Resources Management

**Preparer/Author
Address:** 7106 Crossroads Blvd., Suite 228
Brentwood, TN 37027

Prepared For: RMT, Inc.

Date Published: December 2000

**Key Words and
Phrases:**

Reference Type: A

ReferenceID: 881

Title: ***Lake Hartwell 2001 Fish and Sediment Study: Operable Unit 2
ROD Monitoring Study***

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: Environmental Resources Management

**Preparer/Author
Address:** 7106 Crossroads Boulevard, Suite 228
Brentwood, TN 37027

Prepared For: Schlumberger Limited

Date Published: November 2001

**Key Words and
Phrases:**

Reference Type: A

ReferenceID: 1060

Title: ***Unilateral Administrative Order for Remedial Design / Remedial
Action***

Location: AEM

Category: Legal

Prepared by/Author: US EPA Region IV

**Preparer/Author
Address:**

Prepared For:

Date Published: September 25, 1998

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: A

ReferenceID: 1095

Title: ***Lake Hartwell 2002 Fish and Sediment Study: Operable Unit 2
ROD Monitoring Program***

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: Environmental Resources Management

**Preparer/Author
Address:** 7106 Crossroads Blvd., Suite 228
Brentwood, TN 37027

Prepared For: RMT, Inc.

Date Published: October 2002

**Key Words and
Phrases:**

Reference Type: A

ReferenceID: 1096

Title: ***Lake Hartwell 2003 Fish and Sediment Study: Operable Unit 2
ROD Monitoring Program***

Location: AEM

Category: Monitoring Plan/Report

Prepared by/Author: Environmental Resources Management

**Preparer/Author
Address:** 7106 Crossroads Blvd., Suite 228
Brentwood, TN 37027

Prepared For: RMT, Inc.

Date Published: September 2003

**Key Words and
Phrases:**

Reference Type: B

ReferenceID: 91

Title: ***Fax re: Cost Estimate***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IV

**Preparer/Author
Address:** 345 Courtland Street, N.E.
Atlanta, GA 30365

Prepared For: AEM, Inc.

Date Published: May 13, 1994

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: B

ReferenceID: 553

Title: *DNR Changes to New Fish Consumption Guidelines System*

Location: AEM

Category: Fish/Biota

Prepared by/Author: Georgia DNR

Preparer/Author Address: Social Circle, GA

Prepared For: Distribution

Date Published: February 22, 1995

Key Words and Phrases: Coosa River

Reference Type: B

ReferenceID: 1088

Title: *Natural Recovery of PCB-Contaminated Sediments*

Location: AEM

Category: Site Update

Prepared by/Author: (1) Richard Brenner, (2) Victor Magar

Preparer/Author Address: (1) US EPA NRMRL
(2) Battelle

Prepared For: Tech Trends

Date Published: March 2001

Key Words and Phrases:

Reference Type: B

ReferenceID: 1089

Title: *Environmental Protection Agency- Region IV, Fiscal Year 1988 Enforcement & Compliance Assurance Accomplishments Report (Partial)*

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region IV

Preparer/Author Address:

Prepared For: Distribution

Date Published: 1998

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: C

ReferenceID: 82

Title: *Lake Hartwell to get institutional controls*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: July 15, 1994

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 83

Title: *EPA unlikely to propose Lake Hartwell fix*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: March 18, 1994

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 84

Title: *Sangamo vendor selection nears*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: July 9, 1993

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: C

ReferenceID: 90

Title: *Sangamo Weston moves closer to fix*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: March 18, 1994

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 91

Title: *Soil sampling begins at Sangamo PCB site*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: October 16, 1992

**Key Words and
Phrases:**

Reference Type: C

ReferenceID: 92

Title: *Design to begin at Sangamo*

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author

Address:

Prepared For: Superfund Week

Date Published: April 17, 1992

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: D

ReferenceID: 20

Title: *Study reaffirms danger of eating fish from portion of Hartwell Lake*

Location: AEM

Category: Site Update

Prepared by/Author:

**Preparer/Author
Address:**

Prepared For: The Charlotte (NC) Observer

Date Published: May 26, 1993

**Key Words and
Phrases:**

Reference Type: E

ReferenceID: 130

Title: *Sediment Management Seminar 2000 Proceedings (Reference E-121)*

Location: AEM

Category: Dredging; Remedial (Contaminated Sediments)

Prepared by/Author: Blasland, Bouck & Lee, Inc.

**Preparer/Author
Address:** 6723 Towpath Road
P.O. Box 66
Syracuse, NY 13214

Prepared For: Attendees

Date Published: February 10-11, 2000

**Key Words and
Phrases:**

Reference Type: E

ReferenceID: 146

Title: *Monitored Natural Attenuation Lake Hartwell, South Carolina*

Location: AEM

Category: Site Update

Prepared by/Author: David G. Nichols

**Preparer/Author
Address:** Kestrel Management Services

Prepared For: BBL's Sediment Management Seminar 2000 Proceedings, Tampa, FL
(Reference E-121)

Date Published: February 10-11, 2000

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: E

ReferenceID: 188

Title: *Field Measurements of PCB Volatilization From Contaminated Lake Sediments and Surface Waters*

Location: AEM

Category: Miscellaneous

Prepared by/Author: (1) Eric Foote; (2) Victor Magar; (3) James Abbott; (4) Carol Peven-McCarthy; (5) Makram Suidan; (6) Shuang Qi; (7) Paul de Percin; (8) Craig Zeller

Preparer/Author Address: (1), (2), (3), (4) Battelle Memorial Institute
(5), (6) University of Cincinnati
(7), (8) USEPA

Prepared For: First International Conference on Remediation of Contaminated Sediments, Venice, Italy

Date Published: October 10-12, 2001

Key Words and Phrases:

Reference Type: E

ReferenceID: 189

Title: *Natural Recovery of PCB-Contaminated Sediments at the Sangamo-Weston/Lake Hartwell Superfund Site*

Location: AEM

Category: Monitored Natural Attenuation

Prepared by/Author: (1) Victor S. Magar; (2) Jennifer A. Ickes; (3) James E. Abbott; (4) Richard C. Brenner; (5) Greg S. Durell; (6) Carole Peven-McCarthy; (7) Glenn W. Johnson; (8) Eric A. Crecelius; (9) Linda S. Bingler

Preparer/Author Address: (1), (2), (3) Battelle, Columbus, OH
(4) USEPA, Cincinnati, OH
(5), (6) Battelle, Duxbury, MA
(7) University of Utah, Salt Lake City, UT
(8), (9) Battelle, Sequim, WA

Prepared For: First International Conference on Remediation of Contaminated Sediments, Venice, Italy

Date Published: October 10-12, 2001

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: G

ReferenceID: 55

Title: *Natural Recovery of PCB-Contaminated Sediments at the Sangamo-Weston/Twelvemile Creek/Lake Hartwell Superfund Site (for complete presentation see Reference G-41)*

Location: AEM

Category: Monitored Natural Attenuation

Prepared by/Author: (1) Victor S. Magar, (2) Richard Brenner, (3) Glenn Johnson, (4) Greg Durell, (5) Eric Crecelius, (6) James Abbott, (7) Jennifer Ickes, (8) Carole Peven-McCarthy

Preparer/Author Address: (1), (6), (7) Battelle
Columbus, OH
(2) US EPA NRMRL
Cincinnati, OH
(4), (8) Battelle
Duxbury, MA
(3) University of Utah
Salt Lake City, UT
(5) Battelle
Sequim, WA

Prepared For: EPA Forum on Managing Contaminated Sediments at Hazardous Waste Sites

Date Published: May 30 - June 1, 2001

Key Words and Phrases:

Reference Type: L

ReferenceID: 63

Title: *Memo re: Status of Three Contaminated Sediment Sites: Sangamo-Weston; Solutia-Anniston, AL; and Onondaga Lake*

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

Preparer/Author Address: Malvern, PA 19355

Prepared For: Distribution

Date Published: April 18, 2000

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: L

ReferenceID: 66

Title: *Memo re: Summary of Feasibility Determination at Sangamo-Weston (SC) Superfund Site*

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

Preparer/Author Address: Malvern, PA 19355

Prepared For: Distribution

Date Published: July 21, 2000

Key Words and Phrases:

Reference Type: L

ReferenceID: 126

Title: *Contaminated Sediment Projects in the U.S. Using Monitored Natural Recovery*

Location: AEM

Category: Capping/Placement

Prepared by/Author: AEM, Inc.

Preparer/Author Address:

Prepared For: Distribution

Date Published: September 25, 2001

Key Words and Phrases:

Reference Type: L

ReferenceID: 139

Title: *Maximum Baseline Cancer Risks for Contaminated Sediment Sites*

Location: AEM

Category: Risk Assessment

Prepared by/Author: AEM, Inc.

Preparer/Author Address:

Prepared For: Distribution

Date Published: October 22, 2001

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: L

ReferenceID: 167

Title: *Summary of Major Revisions to RODs and Proposed Plans -
Sediment Sites*

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: AEM, Inc.

**Preparer/Author
Address:** Malvern, PA 19355

Prepared For: Internal Distribution

Date Published: April 13, 2001

**Key Words and
Phrases:**

Reference Type: L

ReferenceID: 176

Title: *EPA's Evolving Position on Remedial Dredging*

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: AEM, Inc.

**Preparer/Author
Address:** Malvern, PA 19355

Prepared For: Internal Distribution

Date Published: Undated

**Key Words and
Phrases:**

Reference Type: L

ReferenceID: 230

Title: *Memo re: Lake Hartwell, SC Sediment PCB*

Location: AEM

Category: Monitored Natural Attenuation

Prepared by/Author: QEA, LLC

**Preparer/Author
Address:**

Prepared For: Distribution

Date Published: March 15, 2001

**Key Words and
Phrases:**

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: M

ReferenceID: 25

Title: *Innovative Use of Biotic Barriers for Isolation of PCB-Contaminated Fish*

Location: AEM

Category: Site Update

Prepared by/Author: (1) Jeffrey B. Cange, (2) Robert R. Spurling, (3) Craig M. Zeller and (4) C. Michael Alexander

Preparer/Author Address: (1 and 2) Bechtel,
(3) US EPA Region IV, and
(4) U.S. Army Corps of Engineers

Prepared For: Superfund XV Conference and Exhibition

Date Published: 1994

Key Words and Phrases:

Reference Type: M

ReferenceID: 69

Title: *Modeling PCB Fate and Accumulation in Fish in Twelvemile Creek / Hartwell Lake, South Carolina*

Location: AEM

Category: Site Update

Prepared by/Author: Michelle Woolfolk and Gary Drendel

Preparer/Author Address: ICF Kaiser Engineers

Prepared For: Superfund XIV Conference and Exhibition

Date Published: November 30/December 1, 1993

Key Words and Phrases:

Reference Type: R

ReferenceID: 4

Title: *Letter to PRP re: Case Histories: Contaminated Sediment Sites (with response from Olin Corporation)*

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc. with response from Olin Corporation

Preparer/Author Address: Malvern, PA 19355

Prepared For: Schlumberger Industries, Inc., submitted to

Date Published: August 17, 1998

Key Words and Phrases:

REFERENCES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Reference Type: R

ReferenceID: 32

Title: ***Letter to PRP re: Case Histories: Contaminated Sediment Sites***

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

Preparer/Author Malvern, PA 19355

Address:

Prepared For: RMT, Incorporated, submitted to

Date Published: May 13, 1999

Key Words and
Phrases:

MODELING

Project Name: SANGAMO - WESTON

ProjectID: 04-04

Last Updated: 08/11/98

Modeling Performed: Two models were constructed to study the fate of PCBs, a water quality model and a bioaccumulation model. Sediment transport model USACOE HEC-6 was used to define sediment transport and results were used as input to the water quality model, the EPA Water Quality Analysis Simulation Program (WASP), Version 5.0. The aquatic bioaccumulation model used was the EPA Food and Gill Exchange of Toxic Substances (FGETS) program, Version 3.0.

Modeling Objectives: Determine the fate and transport of PCBs in Twelvemile Creek/Hartwell Lake sediment, and predict the PCB uptake into indigenous fish.

Modeling Description: Determines the fate and transport of PCBs in Twelvemile Creek/Hartwell Lake sediment, and predicts the PCB uptake into indigenous fish. See Reference M-69.

Company Performing Modeling: ICF Kaiser Engineers

Modeling Status: Completed

Modeling Summary: (Source: Reference M-69)

Two long-term models of the fate and bioaccumulation of PCBs were constructed for the Twelvemile Creek/Hartwell Lake system, as part of the Sangamo OU-2 Remedial Investigation. PCBs in the benthic sediments of the system are resuspended into the water column. Once in the water column, PCBs are transported downstream where they may be deposited onto the sediment bed. Continual uncontaminated sediment deposition would eventually bury the PCBs, thus making them unavailable for bioaccumulation. A water quality model was constructed to determine the fate of PCBs in the system. Under the assumption that the conditions of the lake would remain the same (i.e., no remedial action would occur), the water quality model indicated that chemical concentrations in surface water and sediment would generally decrease over time. The primary removal mechanisms of PCB-contaminated sediment available for accumulation in the food chain were boundary transport and burial. A bioaccumulation model was constructed for Hartwell Lake for species occurring in the lake system. Bioaccumulation modeling results indicated that if no action were taken, fish tissue concentrations in largemouth bass weighing greater than 3.4 kilograms would decrease below the FDA action level of 2 ppm PCBs in 12 years. To evaluate a human ingestion exposure scenario, fish tissue concentrations were used to calculate human health risks. Based on the results of this analysis, it would take more than 22 years for cancer risks to drop to 10^{-6} or one in one million, assuming a person eats fish from Hartwell Lake for one year.

FISH ADVISORIES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Advisory: Lake Hartwell

AdvisoryID: 1002

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: bass-largemouth

Population: NCSP

Population Definition: No Consumption-Subpopulation(s): Advises against consumption for populations that are potentially at greater risk, e.g., pregnant or nursing women, and small children.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Lake Hartwell

AdvisoryID: 1001

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: bass-largemouth

Population: RGP

Population Definition: Restricted Consumption-General Population: Advises the general population to restrict the size of the organisms and/or the frequency of meals consumed.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Lake Hartwell

AdvisoryID: 1003

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: bass-striped

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

FISH ADVISORIES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Advisory: Lake Hartwell

AdvisoryID: 1004

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: bass-striped hybrid

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Lake Hartwell

AdvisoryID: 1006

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: catfish-channel

Population: NCSP

Population Definition: No Consumption-Subpopulation(s): Advises against consumption for populations that are potentially at greater risk, e.g., pregnant or nursing women, and small children.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Lake Hartwell

AdvisoryID: 1005

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: catfish-channel

Population: RGP

Population Definition: Restricted Consumption-General Population: Advises the general population to restrict the size of the organisms and/or the frequency of meals consumed.

Advisory Type: Lake

Advisory Number: 828

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

FISH ADVISORIES

Project Name SANGAMO - WESTON

ProjectID: 04-04

Advisory: Lake Hartwell

AdvisoryID: 126

Extent: Remainder of Lake Hartwell

Pollutant: PCBs (total)

Species: all fish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Lake

Advisory Number: 9705

Status (Active or Rescinded): Rescinded

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Lake Hartwell

AdvisoryID: 127

Extent: Seneca River arm of Lake Hartwell and Twelvemile Creek, Pickens County

Pollutant: PCBs (total)

Species: all fish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: Lake

Advisory Number: 827

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399

Advisory: Twelvemile Creek

AdvisoryID: 1228

Extent: Near Lake Hartwell

Pollutant: PCBs (total)

Species: all fish

Population: NCGP

Population Definition: No Consumption-General Population: Advise against consumption by the general population.

Advisory Type: River

Advisory Number: 300109

Status (Active or Rescinded): Active

Date Rescinded:

Contact Name: Edward "Butch" Younginer

Contact Number: 803-898-4399
