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ENVIRONMENTAL ASSESSMENT

JOHN SEVIER FOSSIL PLANT (JSF) INTAKE DEBRIS REMOVAL

Hawkins County, Tennessee

TENNESSEE VALLEY AUTHORITY

DECEMBER 2005

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The Proposed Decision and Need

The John Sevier Fossil Plant (JSF) is a part of TVA's fleet of fossil power generating stations and supplies approximately five million megawatt hours of electricity to power consumers in the TVA power service area. JSF is experiencing decreased plant efficiency due to accumulation of debris and partial blockage of the trash racks on the raw water intake structure supplying condenser cooling water. TVA proposes to remove the debris from in front of the trash racks. If not addressed, the reduced efficiency would require unit deratings in order to meet thermal water discharge limits. In addition, equipment could be damaged. TVA must decide whether to address the current problem and to establish protocols for future routine maintenance necessary to maintain JSF as an efficient, low cost generator of electricity in the TVA power service area.

Background

The John Sevier Fossil (JSF) plant began commercial operation in 1955. It is located at approximate Holston River Mile (HRM) 106 on the Cherokee Reservoir, the most downstream and largest impoundment of the Holston River. One feature of JSF is a concrete gravity overflow detention dam located at HRM 106.3. The drainage area at the JSF detention dam is approximately 3,008 square miles. The dam creates a backwater storage pool approximately 10 miles long and over 20 feet deep at the dam, with a mean depth of 6 feet. Crest elevation of the dam is 1,080 ft mean sea level (msl), and the length of the dam is approximately 1,100 feet. At normal pool elevations (elevation 1070-1080 ft msl) the backwater pool was designed to have a useful storage of approximately 5,500 ac-ft. The backwater reservoir is maintained to provide flows for JSF's condenser cooling water and raw water systems and to meet minimum requirements for downstream aquatic life. The average unregulated flow at the detention dam is 3,952 cfs. The average hydraulic residence time for water is less than one day. The mouth of the intake channel for JSF is approximately 1,000 feet upstream of the detention dam on the Holston River. The intake channel is approximately 1,000 feet long. The discharge channel is approximately 1,400 feet to the Holston River, approximately 200 feet downstream of the detention dam.

TVA previously removed debris from this location in April 1992 as part of JSF's routine operation and maintenance procedure. Approximately 20 cubic yards of large logs, water-logged trees and untreated wood products were removed and burned on site. Approximately 30 cubic yards of solid non-hazardous material (i.e., large plastic jugs, tires, pressure treated lumber, cross ties, etc.) were removed and disposed of at Carter's Valley

Landfill (see Figure 1). A six-inch grinder pump was used to remove smaller debris such as Asiatic clams and shells, plastic drink bottles, shoes, etc. This debris was discharged into the nearby dredge holding pond. Plant personnel did not observe any change in turbidity in the intake forebay area, nor in the plant's discharge during this operation (Stephens, 2005). The debris field in the dredge holding pond area (approximately 10 cubic yards) consisted of approximately 70 percent Asiatic clams and shells, 20 percent rock, and 10 percent 'shredded' plastics (i.e., drink bottles, kitchen dish detergent bottles, and toys). No considerable silt layer or sediment was observed in this debris field by plant personnel. TVA anticipates the debris from the proposed removal of materials for this project to be consistent with the materials removed in 1992.

Figure 1 Debris Pile from 1992 Debris Removal

Other Environmental Reviews and Documentation

Saltville Waste Disposal Ponds Superfund Site

Since the previous debris removal operation occurred, TVA has become aware of an Environmental Protection Agency (EPA) Region 3 Remedial Investigation/Feasibility Study (RI/FS) concerning historical releases of mercury into the North Fork Holston and Holston River (HR) that have migrated to the vicinity of JSF. The investigation includes a stretch of river both upstream and downstream of the JSF detention dam located at HRM 106.3 which would presumably involve the area of influence of the plant intake. The Saltville

Waste Disposal Ponds Site, located on the border of Smyth and Washington Counties, Virginia, was part of Olin Corporation's Saltville facility ("Saltville Waste Disposal Ponds," Region 3: Mid-Atlantic Region Hazardous Site Cleanup Division, EPA, August 3, 2002). The primary contaminant of concern, mercury, was released as waste product from the early 1950s to 1972, contaminating surface water and sediments of the adjacent North Fork of the Holston River (NFHR). The site was added to the National Priorities List on September 8, 1983. Beginning in the 1970s, TVA has measured elevated levels of mercury as far downstream as Cherokee Reservoir, about 170 miles away from this site. In 1982, Olin was required to remove mercury from a 1000-foot section of the NFHR adjacent to the former plant site at approximate river mile 81. In 1988, Olin began to implement interim actions and to perform a RI/FS which was completed in 1994. At that time, EPA decided that additional study on the former plant site and the North Fork would be required. A water treatment plant capable of removing mercury began operation in 1994. In late 2001, the remaining mercury leachate from the site was routed to the treatment plant, thus minimizing additional releases of mercury into the river. EPA's investigation of the NFHR and HR and the associated ecological risk assessment began in August 2001 and continued through 2002. Preliminary results reported by EPA indicate elevated mercury levels in sediment cores collected in front of the JSF detention dam, both upstream and downstream from the entrance to the JSF plant intake channel off the mainstem HR.

TVA 2003 Sediment Sampling Report

Due to the possibility that debris removal could mobilize and re-suspend sediments containing mercury into the water column and be transported downstream of JSF via the plant's discharge channel, TVA began a phased approach to investigate possible heavy metal contamination in sediment deposits immediately adjacent to the plant intake (trash racks). TVA conducted sediment sampling in 2003. Divers did a reconnaissance directly in front of the intake structure. Divers measured depths of sediment and types of debris in a 50- by 100-foot sampling grid. Sediment depths ranged from 0 to 15 inches and very little sediment was found in several locations (See Figure 2). During the sediment sample collections, divers had considerable difficulty in collecting adequate sample amounts due to lack of sediment in several locations. The sampling results revealed the presence of contaminants at concentrations above laboratory method detection levels but below the screening levels for industrial preliminary remediation guidelines for soils established by Region IX EPA.

Based on depth measurements taken during this sampling event, the total volume of sediment, small debris and organic material such as leaves, was calculated to be between 30 to 40 cubic yards. Normal operating water velocities (4 feet per second) in the intake channel exceed that which would typically allow deposition of sediments. In 1973 or 1974, the plant contracted for the intake channel to be dredged, anticipating depositions to have occurred since 1955 when John Sevier Fossil plant began operations. However, minimal sedimentation was found and no dredge material was removed from the intake channel. Subsequent soundings of the intake channel have verified that the channel contours approximately match those originally specified. Therefore, TVA anticipates relatively little sediment has accumulated in the intake channel near the trash racks in the area proposed for clean-out. The volume of the larger-sized debris was difficult to estimate because the larger mixed debris does not settle in the same manner as sediment, resulting in numerous large and small voids. It was estimated that the larger debris would be between 60 to 70 cubic yards when removed and compacted.

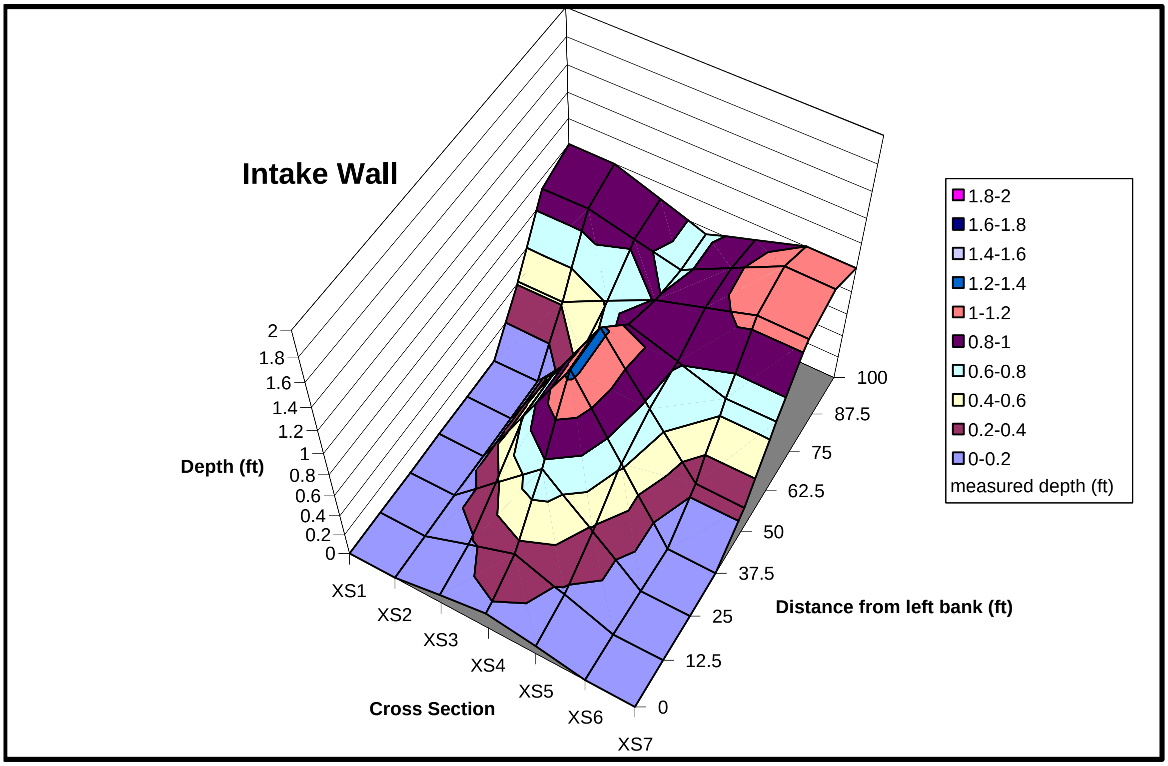


Figure 2 Three Dimensional View of Sediment Depths in 2003 Reconnaissance

Alternatives and Comparison

No Action

Under the No Action alternative, TVA would not remove any accumulated debris from the front of the plant intake structure and would continue with routine trash rack cleaning. Routine trash rack cleaning involves using a rake designed to pass over the debris impinged against the rack and then capture the debris (leaves, grass, etc) as the rake is pulled up. As the rake is lowered, the larger items (such as jugs or limbs) are pressed down to the bottom of the structure and compressed into a layer that accumulates more each time the racks are cleaned. This prevents the rake from going all the way to the bottom of the structure. Large logs that have broken loose from upstream impoundments also impede the rake from being lowered, and this allows even more debris to accumulate near the bottom. The area that the rake is able to clean has been reduced by approximately one-third, and water flow through the units is now restricted. Under the No Action Alternative, eventually the plant will not be able to effectively clean the trash racks. This will reduce the cooling water flow and unit efficiency, which could cause thermal discharge limit issues, unit deratings, and potentially damaging equipment as a result of operating at lower water supply volumes. The No Action alternative would not meet TVA’s need to maintain the JSF plant as an efficient, low cost supplier of electricity.

Action Alternative

TVA proposes to use divers to manually remove the large logs and larger sized debris (such as tires, large plastic jugs, etc.) which are typical of the accumulated debris in front of plant intakes. The debris blocking the trash racks creates an intertwined mass that ranges from solid compaction to loose shifting material areas with large and small voids. Divers would begin by assessing the current configuration of the materials. The debris pile in Figure 1 is expected to be similar to what the divers would encounter in the water. Based on the assessment, pumping smaller-sized debris and sediment may occur first, or initial work may involve removal of large items (logs, limbs and various trash items) located at the top of the accumulated materials and not embedded in the materials to be pumped. The large items would be rigged out of the water until enough have been removed to continue using the pump. Since divers would be needed to remove the larger debris, TVA also proposes to have them manually remove all other smaller debris including Asiatic clams and shells, organic debris, small amounts of sediment, and trash, with a hand held, six-inch suction grinder pump. This process would be repeated until the project is completed. When possible, and as a BMP to minimize the mobilization of sediment through the plant intakes, the divers would pump the smaller debris and sediment/shells first.

The large logs and larger-sized debris (such as tires, large plastic jugs, etc.) which are typical of accumulated debris in front of plant intakes would be removed and sorted. Non-treated wood products would be managed on-site, such as burned or chipped and used for mulch, in accordance with any required permits. All other material (tires, plastics, treated lumber products, etc.) would be placed in a roll off and disposed of at an approved landfill.

Because of the background mercury levels as a result of the Saltville Waste Disposal Ponds Superfund Site, TVA is voluntarily considering precautionary measures to handle the small amount of sediments that have mercury levels that are above laboratory method detection limits but below any current regulatory action limits. Therefore, alternative ways to handle the sediment, shells, and smaller material and the return water from the grinder pump were considered. This mix of this debris would be ground up and pumped at a rate of 600 gallons per minute (gpm). The amount of this smaller-sized debris is anticipated to be very minor compared to the total amount of material and the bulk of it is expected to be clam and mussel shells based on diver surveys and previous debris removal activity. The options evaluated for handling the sediment, shells, and smaller materials are presented below. Additionally, in permitting discussions with TDEC, they indicated that an option that treats the fines to a final pore size of 0.5 micron would be permitted. If the action alternative is chosen, TVA will select one of these precautionary methods for handling the smaller debris.

Option 1: Pump the estimated 30 to 40 cubic yards of the smaller debris and associated water into geotextile non-woven dirt bags contained in water-tight solid waste containers. These dirtbags™ (see Figure 3) can handle 5.5 cubic yards of solids and can handle flow rates up to 1,100 gpm. Dirt Bag™ initial filtration is approximately 80 microns to 100 microns, according to the manufacturer.

The discharge from the water-tight solid waste container would be filtered again in a series of sock filters to a final filtration of no more than 0.5 microns. Once dewatered, the material in the dirt bag would be tested (pending satisfactory results per state regulatory requirements) or sufficient data is available to make a process knowledge determination and disposed of at an approved landfill. Filters would also be tested and properly disposed of in a similar manner. A similar technology would include the use of a canister system with replaceable cartridge filters to a 0.5 micron nominal rating instead of the geotextile bags (see Figure 4). The filtered return water from this operation using either technology would be allowed to drain to the dredge holding area.

Figure 3. Dirt Bag™

Figure 4. Canister System

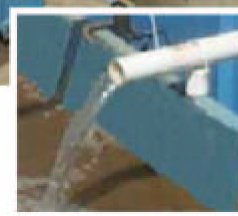
Option 2: Use an un-watering filter system to remove the debris and sediment. Flocculent would be used to coagulate sediments enough for the materials to combine and fall to the bottom of the water column in a frac tank. The solid material would be tested (pending satisfactory results per state regulatory requirements) or sufficient data is available to make a process knowledge determination (to be documented by the appropriate staff of FPG Environmental Affairs) and disposed of at an approved landfill. The return water from this approach would be allowed to drain to the dredge holding area. These type systems require a steady-state operation in order to be most effective

Option 3: Pump directly into a sand filter, then through a tube settler (see Figure 5). The sand filter would filter particles down to a size of approximately 20 microns. Additional sock filters and/or cartridge filters would be added in line to reduce the pore size to 5 microns. The solid material would be tested (pending satisfactory results per state regulatory requirements) or sufficient data is available to make a process knowledge determination and disposed of at an approved landfill. Return water would be allowed to drain to the dredge holding area.

RAIN FOR RENT

Tube Settler

Rain for Rent's **Tube Settlers** utilize individual, isolated tubular channels, each sloped at 60°, to expand the settling capacity of water and wastewater clarifiers. Engineered with the individual tubes rising in the same direction to eliminate mixing currents and unstable flow patterns. Constructed of flame-resistant, self-extinguishing PVC that is also inert to naturally occurring constituents in water and wastewater.



Improve Efficiency

The shape and configuration of the modules inside the Tube Settler are engineered to minimize the Reynolds Number and to create laminar flow for rapid settling of solids. This enhanced settling reduces chemical coagulant use and downstream filter backwash requirements. For plant design and upgrading, less settling area is needed.

Structural Integrity

The Tube Settler has a 5,000 gallon maximum capacity with a swing-out door for easy cleaning. The modules inside the Tube Settler are self-supporting and constructed of prime, rigid, UV-protected PVC. Integrated structural ribs provide substantial loading strength (maximum 250 lbs/ft^2). The unique design assures a solid interface during installation.

Rain for Rent

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RAIN FOR RENT

Figure 5

Under these three options, TVA would dispose of all non-hazardous filtered material in an approved landfill after verification that it is non-hazardous. Because the small amount of sediments collected in 2003 have mercury levels that are above laboratory method detection limits but below any current regulatory action limits, TVA has determined that it is unlikely that a hazardous waste would be generated. However, should verification sampling determine any hazardous waste was generated, a qualified hazardous waste disposal facility that is on TVA's Environmental Restricted Awards List (ERAL) at the time of the project would be used for the ultimate disposal.

Option 4: Cover unfiltered smaller-sized debris. With state approval, TVA would pump the ground up debris, sediment, and shells to the dredge holding pond without filtration, let the water perc, and then cap and cover the area using an appropriate cover design to minimize the mobilization of sediments to ground water (called Dump & Cover). The cover cap would be designed by engineering per specifications from the state or other sound engineering practice if no specifications are provided by the state. Sediment sampling of the intake area or sufficient data to make a process determination would be required before this option would be implemented.

Future Debris Removal Operations

One purpose of this EA is to establish acceptable methods for routine debris removal operations at JSF. These operations would be conducted on a greater frequency than previously. Based on the 2003 sediment survey, an estimated 30 to 40 cubic yards of sediment/shell material consistency is expected for the currently proposed project. Longer time between debris removal operations provides an opportunity for velocities behind the larger debris in the vicinity of the trash racks to slow sufficiently to allow particles to settle out and accumulate. It is likely that, if cleaned on a more frequent basis, substantially less materials and sediment would have to be handled than even for the present situation. If more cost effective, equally protective, feasible alternatives are identified that reached equivalent results, they would be evaluated prior to implementation.

Evaluation of Impacts

Due to the presence of some heavy metals in the previous sediment sampling results, TVA identified three areas of concern that could potentially impact the aquatic environment: 1.) During the removal of the debris from the intake area, sediment containing heavy metals could be mobilized and ultimately be transported downstream through the plant's discharge. 2.) Debris containing sediment could result in waste requiring special handling. 3.) Use of a hand held grinder pump to remove the smaller debris could result in return water that could potentially contain suspended heavy metals.

TVA evaluated the potential impacts and determined there would be no impacts to terrestrial threatened and endangered species or wetlands because none are known or expected to occur within the area of work (JSF NO_x DEA). No impacts are anticipated on air quality, recreation, and navigation. TVA also has determined there would be no effect to historic properties. Under Executive Order 11988, the project would be considered a repetitive action in the floodplain that should not result in adverse impacts. The project would also comply with the TVA Flood Control Storage Loss Guideline because the material would be disposed of at an approved landfill.

Water Quality

Current Conditions

The section of the Holston River in the vicinity of JSF (HRM 106) and downstream to the Cherokee Dam (HRM 53) is not listed as limited in the Tennessee Department of Environment and Conservation (TDEC) Final Version Year 2004 303(d) List. The Holston River use designations are for domestic and industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation (TDEC, Use Classifications for Surface Waters).

Due to historical releases of mercury into the North Fork of the Holston River and the subsequent detection of elevated mercury concentrations in the sediments located in the vicinity of JSF, mercury is a contaminant of concern for the JSF intake debris removal project. The maximum sediment mercury concentration detected in the JSF intake channel was 0.23 mg/kg in 2003. In 2004 the TVA Vital Signs Monitoring Program sampled the top 3 centimeters of sediment at HRM 76.0 and HRM 55.0 (well downstream of JSF) and detected mercury concentrations of 0.40 mg/kg and 0.10 mg/kg, respectively. Higher sediment mercury concentrations were detected at HRM 76.0 and HRM 55.0 in previous years by the TVA Vital Signs Monitoring Program Table 1 summarizes the sediment mercury data from these two locations.

Table 1 - Sediment Mercury Concentrations 1990-2004 (mg/kg)

Location	Maximum	Average	Year 2004
HRM 55.0	0.29	0.21	0.10
HRM 76.0	0.70	0.43	0.40

According to the Sediment Sampling and Analysis Results John Sevier Fossil Plant Intake, August 4, 2003, Report, the maximum sediment mercury concentration at the JSF intake channel was 0.23 mg/kg, and the average concentration was 0.16 mg/kg. In the same report, grain size distribution data for three locations were presented. The majority of the sediment accumulated in the JSF intake channel was silts, clays, and sands. The average grain size distribution data for the three locations are summarized in Table 2.

Table 2 - Average Grain Size Distribution Data for Sediment Samples Collected at the JSF Intake Channel

Gravel	0.7%
Sand	20.3%
Silt	56.3%
Clay	22.8%

The sediment volume calculated for the intake area proposed for dredging was approximately 30 to 40 cubic yards; however, this estimate includes organic materials such as leaves, clam shells, and some trash.

No Action

Under the no action alternative TVA would not manually remove any debris in front of the plant intake structure, but would continue routine trash rack cleaning using a mechanical rake. Under this scenario, eventually the plant would not be able to effectively clean the trash racks which would reduce the plant cooling water inflow. Reduced cooling water flow would put the plant at risk for not meeting its NPDES permit thermal discharge limits, thus impacting the receiving stream. In addition, if the sediment is not removed from the intake channel, it could still be mobilized, re-entrained into the water column, and transported downstream during future storm events, or other high flow conditions. Unmitigated, the No action could in theory have a significant impact on the surface water. However, TVA would take actions to avoid exceeding regulatory limits for thermal discharges, by derating units or using cooling towers or other methods to lower the temperature of the discharge water. The No Action alternative does not meet TVA's stated need to maintain JSF as an efficient, low cost generator of electricity in the TVA power service area.

Action Alternative

The JSF intake channel water velocity is 4 feet per second during normal operations at the plant. Sedimentation typically would not occur in waters with velocities of 4 feet per second or greater unless obstacles, such as large debris, disrupt the water flow. Based on the previous historical debris removal activities and the 2003 diver survey, the amount of sediment available to be mobilized is relatively small. Estimates range from 30 to 70 cubic yards, but much of the estimated sediment may actually be sediments overlaying leaves, clams, shells or other small debris. According to the August 4, 2003, Sediment Report, approximately 30-40 cubic yards of small debris, including sediment, has accumulated in the vicinity of the plant intake. Therefore, during manual removal of the larger sized debris the accumulated sediment could be mobilized and re-entrained into the water column. Also, during removal of the smaller debris using a hand held, six-inch suction grinder pump, a portion of the sediment could be mobilized and re-entrained into the water. The average JSF plant intake flow is 669.442 million gallons per day (Flow schematic from JSF 2003 NPDES Permit Number TN0005436). Using the average grain size distribution data from Table 2 and the United States Department of Agriculture General Guide for Estimating Moist Bulk Density, the approximate weight of the estimated 40 cubic yards of actual sediment accumulated in the JSF intake channel is 47,500 kg. If all of the sediment accumulated in the JSF intake channel was re-suspended during one day (a conservative assumption), the total suspended solids (TSS) concentration in the intake water would be approximately 18.5 mg/L. Since the approximate overall duration of the intake debris removal project is 40 working days (8 hours per day, 5 days per week), any sediment re-suspension would occur over a much longer period than one day, thereby substantially reducing the TSS concentration at any given time. In addition, only a fraction of the sediment volume is likely to be re-suspended, not all 40 cubic yards. As a comparison, the current NPDES permit limits for TSS at the ash pond discharge is a monthly average concentration of 24.0 mg/L, and a daily maximum concentration of 72.0 mg/L (JSF 2003 NPDES Permit Number TN0005436). In addition, the Tennessee Multi-Sector General Permit cut-off concentration for TSS in storm water is 200 mg/L. The amount that could potentially be suspended is less than either of the values found in the permits. The prescribed BMPs to remove smaller materials first will also minimize the possibility of a visible plume in the work area or downstream.

The maximum sediment mercury concentration detected in the JSF intake channel was 0.23 mg/kg in 2003. In 2004 the TVA Vital Signs Monitoring Program sampled the top 3 centimeters of sediment at HRM 76.0 and HRM 55.0 (well downstream of JSF) and detected mercury concentrations of 0.40 mg/kg and 0.10 mg/kg, respectively. Higher sediment mercury concentrations were detected at HRM 76.0 and HRM 55.0 in previous years by the TVA Vital Signs Monitoring Program (Table 1).

TVA analyzed the potential for impacts to water quality and the aquatic environment which could potentially occur from mobilization and re-suspension of contaminated sediments into the water column where they may subsequently be transported downstream of JSF via the plant's discharge channel. As stated earlier, regardless of TVA's proposed action, without the accumulation of the larger materials in the intake channel these smaller materials, including debris and sediments, would have passed through or by the plant anyway. However, using the maximum sediment mercury concentration detected in the intake channel (0.23 mg/kg), assuming a worst case of all of the sediment being re-suspended during one day without mitigation, and assuming all the mercury becomes soluble (highly unlikely), the mercury concentration in the intake water would be approximately 0.0043 ug/L. The TDEC General Water Quality Criteria for mercury in waters designated for both recreation and water supply is 0.05 ug/L (the most stringent criteria for mercury), which by comparison, is an order of magnitude greater than this hypothetical worst case scenario. Again, since the duration of the project is greater than one day, not all of the 40 cubic yards of sediment could be re-suspended, and not all of the mercury would be made available, the mercury concentration in the water would be less than 0.0043 ug/L at any given time during the project. Therefore, even for this unmitigated worst case scenario, mercury re-suspension by this proposed action would be well below any currently required water quality criteria.

As a BMP to minimize the mobilization of sediment through the plant intakes, the divers would, when possible, pump the smaller debris, including sediment and shells, before removing the larger debris. Use of one of the filter system options (options 1, 2, or 3) as a precautionary measure would further reduce the amount of minor, insignificant sediment and mercury that would be in the return water. The return water could be discharged in the intake channel or in the dredge holding pond. However, disposing of the return water in the dredge holding pond would further reduce the minor risk of any significant impact to the surface water even further since there is no direct surface water discharge from the pond. Disposing of all of the material (sediment, debris, and water) in the dredge holding pond and covering the material (option 4) as a precautionary measure would also further reduce the minor risk of any significant impact to the surface water.

Removing the debris from the JSF intake as proposed in the action alternative would not have a significant impact on surface water. Any potential for impact however minor and insignificant, resulting from the suction dredge pump operation would be due to the metals found in the sediments; metals do not typically adsorb onto large partition fractions. Using any of the precautionary measures outlined above or their equivalent to handle the small size debris and return water from the grinder pump would additionally minimize the minor amount of sediment returned to the environment. The return water would be discharged into the dredge holding pond area. This approach would also result in an insignificant impact to surface water since there would be no discharge from the dredge holding area.

Groundwater

TVA evaluated the potential for impact of the proposed intake debris removal on groundwater. A potential pathway begins when the sediment is removed from the JSF plant intake canal and either the "whole" sediment (solids and liquid), or a filtrate from the filtering of the whole sediment, or the effluent from the settled sediment is disposed of in the existing dredge pond area. The potential impact on the groundwater depends on: 1.) the quantity of the excavated sediments, 2.) the nature of the sediments, 3.) the mercury content of the whole or partial sediment to be deposited in the dredge pond area, 4.) the nature of the soils below the dredge pond area, and 5.) the difference in elevation between the bottom of the dredge pond area and the water surface of the adjacent or nearby water intake canal or the Holston River.

Ultimately, the potential for impacts would be related to the leachability and fate of the minor amount of mercury disposed of in the dredge pond area. One major factor affecting the degree to which impacts to groundwater could accrue is the distribution of the mercury and other trace metals between the aqueous and the solid phases (see Appendix 1).

For any sediment, whole or in part, deposited in the dredge pond area the movement of any mercury would depend in large part on the movement of the liquid phase vertically down through the soil to the groundwater table below, and then the movement of the mounded groundwater in accordance with the resultant hydraulic gradient. It is assumed that as the sediment leachate moves through the soil there may be some loss of mercury to the subsurface soil, in accordance with the appropriate soil/water distribution coefficient.

The location of the dredge pond area at the junction of the Holston River and the JSF intake canal, and the local topography, indicate that the groundwater flow should be towards the river and the intake canal. Based on TVA Geographic Information & Engineering information from the mapping of the dredge pond area in February 1993, the lowest elevation in the area is about 1083 feet msl. The depressed dredge pond area is about six acres with a shallow 550 foot face of 1 to 2.3 percent slope facing north, and shorter (6 to 12 feet) walls of 17 to 35 percent slopes facing east, west, and south. The normal pool level for the Holston River is elevation 1081 feet msl. The dredge pond area is located in the recent alluvial deposits associated with the Holston River. This alluvium typically occupies the present floodplain corresponding to areas where the predevelopment surface topography was below approximately elevation 1100 feet msl. The alluvium is primarily composed of clay and silt with lesser but variable amounts and gravel (Kelberg and Benziger, 1952). Subsurface investigations have not been performed in the dredge pond area itself, but groundwater well TW-28, which is located on the plant site just downstream of the plant discharge channel, is considered to be a reasonable surrogate for the dredge pond area. The boring log from groundwater well TW-28 shows a top-down sequence of topsoil, followed by weathered shale fill, then silty clay with weathered shale, and then sandy clay, followed by a sandy clay with shale, and then limestone (Boggs and Reeves, 1998). Borehole flow meter tests performed at groundwater well TW-28 provided horizontal hydraulic conductivities averaging 1.2 E-04 cm/s. A rough estimate of the vertical hydraulic conductivity, K_v, is 10 percent of K_h, i.e., ~1.2 E-05 cm/s.

The dredge pump rate for the removal of sediment from the JSF intake canal is given as 600 gpm, the same as for the earlier debris removal done in 1992. With the estimated elevation for the lowest point in the dredge pond area at elevation 1083 feet msl, given the conformation of the dredge pond area, the slurry from pumping for 8 hours would accumulate to just above the elevation 1084 feet msl contour, if there were no infiltration. This would then represent a 3-foot head relative to the normal pool elevation for the Holston River and the intake canal. For the worst case idealized representation of saturated flow using a hydraulic conductivity of 1.2 E-05 cm/s, a 3-foot head and a distance of 36 feet to the intake canal, the flow to the intake canal would be a few gallons per day for a flow area corresponding to dredge pond conformation at the 1084 foot elevation contour and a depth of six feet. Such a flux would be insignificant in comparison with the regular flow in the intake canal of more than 600 mgd. In a similar manner, flow to the river would be also only several gallons per day with a distance of 200 feet from the pond to the river's edge. This flow would be insignificant in comparison with the river flow. Whether the flow would be to the canal or the river, the dilution of any mercury in the issuing groundwater would be overwhelming, and no significant impacts to surface water resources or uses would result.

If the whole sediment were deposited in the dredge pond area, given that the overwhelming majority of the sediment mercury would be retained on the solids, only a low concentration and a small quantity of the mercury would be retained in the leachate. Even the small quantity of mercury in the leachate would be subject to further depletion when the mercury would be partitioned between the liquid and solid phases as the leachate percolated through the soil column between the soil surface at the bottom of the dredge pond area and the existing groundwater table.

No Action Alternative

The No Action Option would have no impact on the groundwater adjacent to the plant intake canal. The status quo would be maintained and no sediment either in whole or in part would be disposed of in the dredge pond area.

Action Alternative

The potential effects of the various options of the action alternative precautionary measures on the groundwater are related to the quantity and mobility of the mercury disposed of in the dredge pond area. The earlier discussion indicates that with the 0.5 micron filter, mercury and other trace metals are retained effectively by the solids. Among these solids the mercury and other trace metals are retained primarily by the finer clay-sized (<2 µm) particles because of their high specific surface area. The coarser silt and sand particles show only limited retention of mercury and other trace metals. Therefore, the use of a 0.5 micro filter size should be employed.

As the groundwater percolates through the soil column, the mercury and other trace metals are retained to varying extents by the soil solids, and as a result these metals do not move through the soil as fast as the water. The velocity of a given trace metal relative to the groundwater is a function of the retardation factor (see Appendix 1). This indicates that, on average, the mercury will move 380 times slower than the leaching front of the groundwater, i.e., the mercury is very immobile.

The immobility of mercury together with the low groundwater flux from the dredge pond area relative to the flows in the intake canal or Holston River, as presented above, suggest that even without a low permeability soil cap, contributions of the mercury associated with the dredged sediment, either whole or filtered, to the intake canal and the river would be insignificant over time.

Under all four of the precautionary options, the detailed discussions presented above show that disposal of the dredged sediment and or return water in the proposed dredge pond area, without prior filtration, would not produce significant groundwater mercury contributions to the plant intake channel or the Holston River. There are no drinking water supplies, water use, or water use classifications that would be affected by the return of this water to the intake canal or the river or groundwater.

Solid Waste Handling and Disposal

TVA sampling and analysis of the sediment in the intake area conducted in 2003 indicated that the material was not hazardous. Clams/shells were tested in August 2005 and were determined to be non-hazardous. However, due to possible mercury contamination in the surrounding area from historic Olin operations, if sediments and debris are present and would be removed, they would be tested in accordance with state regulatory requirements, prior to disposal unless sufficient sediment data can be obtained that would indicate no increase in mercury concentrations. Because the small amount of sediments collected in 2003 have mercury levels that are above laboratory method detection limits but below any current regulatory action limits, TVA has determined that it is unlikely that a hazardous waste would be generated. However, should verification sampling determine any hazardous waste would be generated, it would be containerized and managed as hazardous waste. The site PA(E) would be involved in the management and disposal of this material. The site PA(E) would ensure that regulatory requirements are implemented, if applicable. For any hazardous waste generated, a qualified hazardous waste disposal facility that is on TVA's Environmental Restricted Awards List (ERAL) at the time of the project would be used for the ultimate disposal.

Under the precautionary measures options 1, 2, or 3 of the proposed action alternative, all material collected would be segregated and disposed of properly. The large logs and larger-sized debris (such as tires, large plastic jugs, etc.) which are typical of accumulated debris in front of plant intakes would be removed and sorted. Non-treated wood products would be managed on-site, such as burned or chipped and used for mulch. All other material (tires, plastics, treated lumber products, etc.) would be disposed of at an approved landfill.

If Option 3 is selected, a significantly higher volume of filter units would be consumed if the discharge water is required to pass a less than 1 micron filter. This could result in a larger volume of hazardous waste if the results of the waste determination were unsatisfactory.

Aquatic Ecology

According to a review of the TVA Regional Natural Heritage Project database, the Tangerine darter (*Percina aurantiaca*) which is listed by the state of Tennessee as "In Need of Management" is known to occur nine miles upstream of John Sevier Fossil Plant and the state and federally threatened Spotfin chub (*Cyprinella monacha*) is known to occur twelve miles upstream of the plant. The federally endangered Pink mucket (*Lampsilis abrupta*) is also known to occur downstream of Cherokee Dam. With the nominal amounts of sediments anticipated to be mobilized by TVA's actions, coupled with the precautions being planned, cleaning the trash racks would have no impacts to these sensitive species. Therefore, no impacts to species either state-listed or federally listed as threatened or endangered would occur.

Olin Remedial Investigation/Feasibility Study

As directed by EPA for remedial investigation efforts, Olin is conducting a variety of in-stream studies on the North Fork Holston River and Holston River. Most of the planned studies have been completed. Of those that remain, or those that are being considered, it is unlikely that study results would be affected by TVA's actions even if the studies were conducted concurrent with TVA's planned debris removal. As outlined above, the intake channel has sufficiently high velocities to prevent sedimentation of fine particles. This is evidenced by studies demonstrating the lack of sediment accumulation over a period of several decades as well as the small volume (approximately 30 to 40 cubic yards) to be removed. Added precautions (use of suction dredge to remove the smaller materials first where possible) prior to removal of the large debris would further limit effects.

Olin has agreed with EPA to conduct sediment fate and transport studies in the Holston River, and EPA has provided a scoping document describing the data collections necessary for these studies. However, as of the date this EA was prepared, follow-up discussions between EPA and Olin had not concluded. Of all the studies associated with the RI/FS, this type of study would have greatest potential for results to be affected by debris removal. Again, the nominal amounts of sediments to be mobilized by TVA's actions, coupled with the precautions being planned, would prevent measurable influence on study results should actual sample collection efforts occur at the time of TVA's debris removal. However, in the unlikely event that the two efforts were concurrent, and to remove any possible concern, TVA will notify Olin of the dates for debris removal so Olin's crews could avoid collecting samples on those dates. TVA would also provide Olin an estimate of the time in which they should avoid sampling/resumption of sampling to be sure that water that had passed through the JSF intake during debris removal had completely passed their collection points downstream of JSF. Flow modeling using 2004 flows and Cherokee elevations shows the range of delay periods for worst case (i.e., longest transport) to be about 10 days and best case (i.e., shortest delay) to be about 2 days for water to be transported about 15 miles downstream of JSF, well into Cherokee Reservoir even at low Cherokee elevations (see Figures 6 - 8). Longest transport time would occur under conditions of high elevations of Cherokee and low river flows and shortest times would occur at low pool elevations on Cherokee. Hence, any sampling delay Olin would experience should be relatively short. However, as indicated in Figures 6 - 8, sampling or the resumption of sampling for any stations on Cherokee Reservoir that are located greater than 15 miles downstream of JSF can be longer (up to 30 days) depending on the distance of the sampling location from JSF and river flow conditions as the sediment travel time is progressive.

Summary of Impacts

The nominal amounts of sediments to be mobilized by TVA's actions would be insignificant, even unmitigated, and coupled with the precautions identified, would have no measurable influence on water quality, aquatic ecology, threatened or endangered species, or other water resources. The proposed action would have no effect on RI/FS water sampling results, as long as the actual sample collection efforts do not occur at the time of TVA's debris removal.

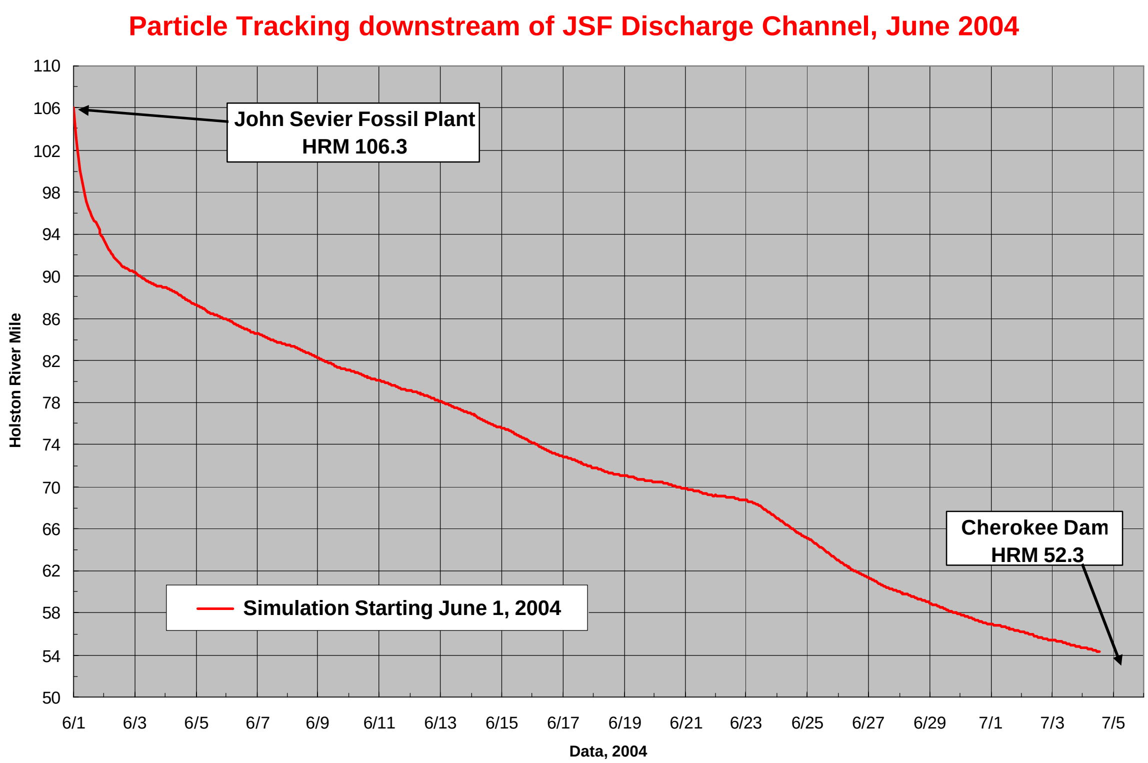

Figure 6

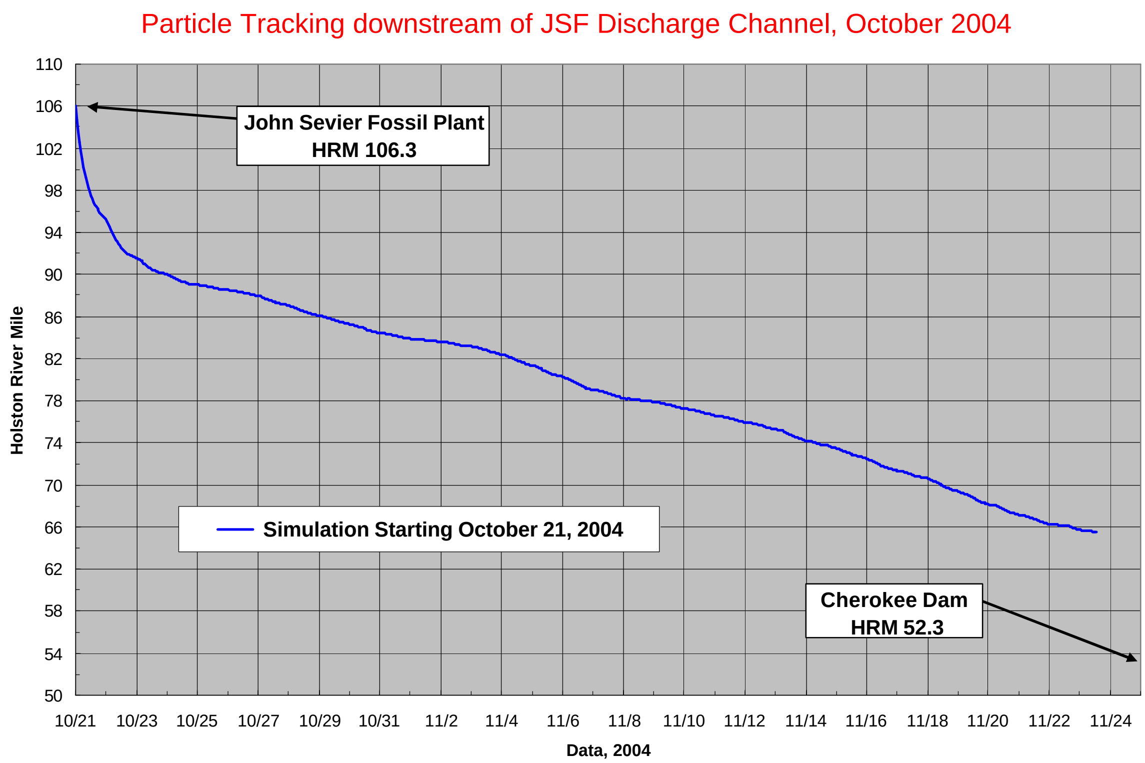

Figure 7

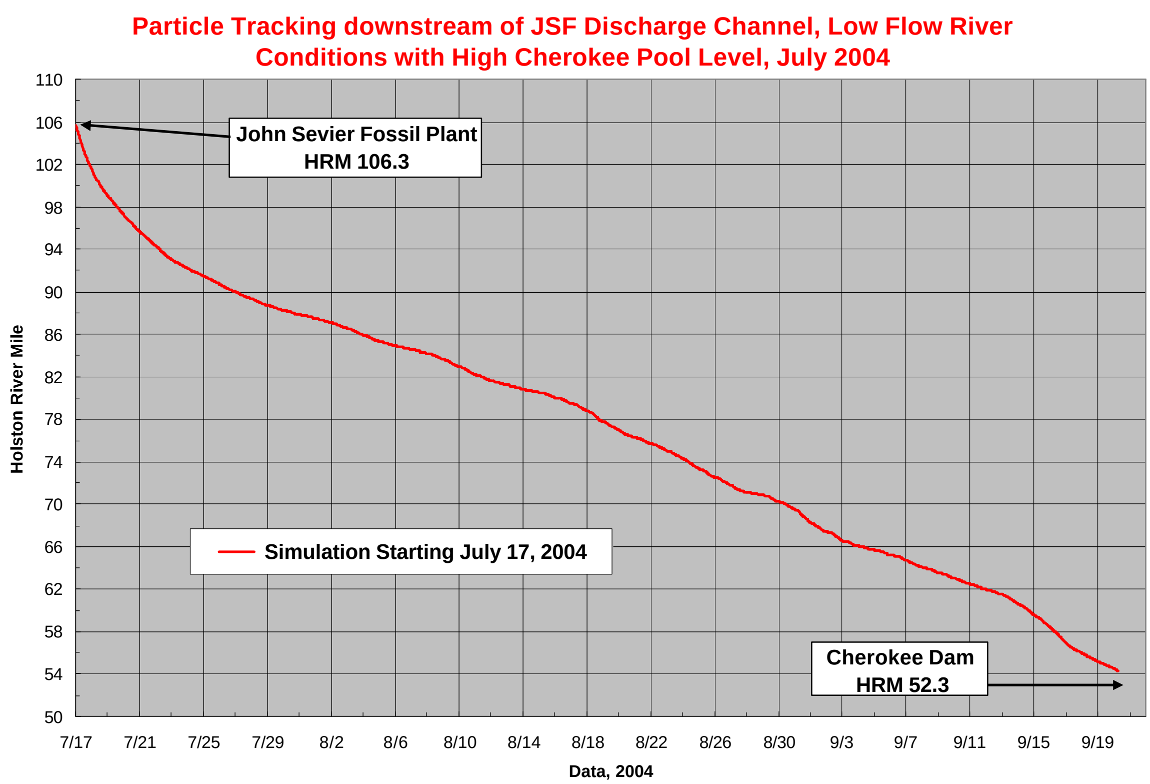

Figure 8

Summary of Commitments and Mitigation Measures For the Action Alternative

Routine and Compliance Commitment

TVA will obtain necessary permits and will comply with permit terms and conditions.

If sediments and debris are removed, they will be tested per state regulatory requirements, prior to disposal unless sufficient sediment data can be obtained to make a process knowledge determination (to be documented by the appropriate staff of FPG Environmental Affairs) that would indicate no increase in mercury concentrations and then disposed of at an approved landfill. Should any of this material be hazardous, it will be containerized and managed as hazardous waste per TVA's established procedures.

Special Commitments

The divers, when possible, will pump the smaller debris first to minimize mobilization of loose material through the plant intake.

TVA will notify Olin of the dates for debris removal and appropriate delay periods so Olin's crews could avoid sample collection during those times.

TVA will select one of the precautionary measures identified in this EA under the Action Alternative for handling of smaller debris.

If the precautionary measure option 4 is selected, the dredge holding pond cap required for cover will be designed by engineering per specifications from the state or other sound engineering practice if no specifications provided by the state unless sufficient sediment data can be obtained to make a process knowledge determination (to be documented by the appropriate staff of FPG Environmental Affairs) that this would not be necessary.

Preferred Alternative

TVA's preferred alternative is the action alternative.

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Agencies and Others Consulted

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TDEC, Division of Water Pollution Control

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APPENDIX 1

Groundwater - Technical Input

The distribution of the mercury and other trace metals between the aqueous and the solid phases is commonly represented by the metal partition coefficient also known as the sorption distribution coefficient, K_d. This parameter is very important as it is an indicator of the relative affinity a metal has for the solid phase as opposed to the liquid one. The greater the magnitude of K_d, the greater the affinity of the metal for the solid over the liquid phase. Depending on the circumstance, the solid phase of interest may be soil, sediment, or suspended particulate material. A comprehensive compilation of metal partition coefficients (Allison and Allison, 2005) provides median values for the mercury K_d, expressed as log K_d. These median log K_d values are 3.8, 5.3, and 4.9 for soil / water, suspended matter / water, and sediment / water systems, respectively. Taking into account the logarithmic representation, these K_d values indicate a very strong affinity for the solids over water. Thus, for log K_d = 5.3, K_d ~= 200,000 L/kg, and for a one percent (weight/weight) suspension in water, there is about 2,000 times as much mercury associated with the solid phase as with the water itself. More conservatively, for the lower end of the range for sediment / water systems, log K_d = 3.8, and K_d = 6,310 L/kg. The most recent references cited by Allison and Allison (2005) are from 1998. Since then, with the development of "finer" filtration techniques, the current data suggest that the earlier data which used the 0.45 µm filter as the separation between dissolved and particulate, overestimated the concentrations in the "dissolved" phase and thus underestimated the solid / liquid partition sorbent coefficients. The K_d values should be even larger, therefore indicating an even stronger affinity of mercury for the solids over water.

A filter that passes particles as large as 80 µm, which is in the size range of fine sand, allows through the majority of the mercury-holding sediment fraction. Moreover, if the filtrate from an 80 µm filter is disposed of in the dredge pond area without the benefit of a protective low permeability soil cap, the mercury containing residues so deposited would be subject to long term leaching due to the local precipitation. However, the movement to the mercury and other trace metals with groundwater is affected by the magnitude of the appropriate partition coefficient (K_d) value.

$$\text{Retardation Factor} = (1 + (?_b/n)\, K_d),$$

where $?_b$ is the soil bulk density, n is the soil porosity, and K_d is partition coefficient (Freeze and Cherry, 1979). For a soil bulk density of 1.2 g/cm^3, and a porosity of 0.5, both reasonable values for the dredge pond area soil, and a low value mercury-soil K_d = 158 L/kg, the retardation factor is ~380.