Document	EPA Response to Comments from Seaway Environmental Technologies, Inc. on **Engineering Performance Standards – Public Review Copy** **Hudson River PCBs Superfund Site**
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Reviewer	#	Comment	Topic	Response
Seaway	1	**Residuals Performance Standard** The attached represents the comments of Seaway Environmental Technologies, Inc. (Seaway) relative to the Residuals Performance Standard. Seaway is a marine engineering and contracting firm. Additional information on Seaway can be found on Seaway's website (www.seawaytech.com). A. General Comments Seaway recognizes the difficulty faced by EPA in defining the residuals performance requirements of the project: *EPA must define a sampling program that includes a statistically reliable spatial and temporal distribution of data that can be used to determine whether actual cleanup goals are being achieved and must do this with little relevant statistical history and proven sampling protocols upon which to define appropriate statistical parameters (e.g., variance and confidence limits) that will be used to gauge the validity of the success or failure of the cleanup.* Failure in defining appropriate parameters that can adequately characterize the level of cleanup that is	**Residuals** Achieving clean up goals and defining the appropriate statistical parameters	The Residuals Standards has been developed with a framework that includes action levels for a practical cleanup that can be described in terms of statistics – mean and maximum values. USEPA notes that the triangular grid required by the post-dredging sediment sampling program has the same spacing (and is offset from) the grid used by General Electric Company in the ongoing sediment sampling program that will help identify the target areas to be dredged.

		actually achieved will produce a *"statistical cleanup"* that bears little relevance to actual field conditions *"practical cleanup."*		
Seaway	2	Seaway does not believe that there exists sufficient data to project with a high degree of confidence the expected statistical distribution of post-dredging PCB data at previously remediated subaqueous cleanup sites. The reason such data does not provide a high degree of statistical reliability is due to the inherent unreliability of existing technology to produce uniform and high efficiency cleanups that can reduce contaminant (PCB) levels to the target goals proposed by EPA, and the absence of reliable sampling procedures to characterize the actual field conditions in such a subaqueous environment.	**Residuals** Lack of data for statistical distribution of post-dredging PCB	USEPA believes that the case study data are reasonable and appropriate to use in estimating the future post-dredging conditions in the Upper Hudson. The technology to be selected for dredging the Upper Hudson will likely be similar to or produce better results than the methods used previously at the case study projects. The "weight of evidence" approach taken to derive the thresholds found consistency in the results from the different case studies. USEPA recognizes the unavoidable uncertainty in deriving relationships based on data from other dredging projects and applying those relationships to Upper Hudson River sediment data. Therefore, at the end of the Phase 1 dredging in the Upper Hudson, USEPA will evaluate the Residual Performance Standard. At that time, USEPA expects to have sufficient data to refine the statistically-based criteria using post-dredging sediment data collected in Upper Hudson.
Seaway	3	Almost everything in a subaqueous remediation project is determined by operational controls (cleanup and monitoring) applied in the field. Existing environmental cleanup technology (which is essentially navigational dredging technology) has shown itself to be effective in removing sediment, but totally insensitive to the	**Residuals** Concerns about achieving cleanup goals	In issuing its 2002 Record of Decision, USEPA determined that targeted environmental dredging is the most appropriate alternative for cleaning up the Hudson River PCBs Superfund Site. USEPA developed the Residuals Standard based on

		requirements of environmental cleanups, such as the Hudson River. As a result, both the debate and discussion will continue to rage between the two sides: 1) practical cleanup cannot be effected with existing technology; 2) practical cleanup can; with neither side being able to definitively make its case The result of all this is that the current cleanup strategy proposed by EPA contains an undefined, but high degree of risk. This is particularly true when levels of cleanup must achieve 1 ppm Tri+ PCBs (rounded off to the nearest integer). To deny that such risk exists is unwise and shortsighted. The risk of practical failure can only be reduced by employing technology that isolates and controls segments of the river that are being remediated and ensures that these segments can be properly cleaned and that the cleanup can be validated by simplified monitoring approaches that do not rely on marginal statistics.	Dredging technology	post-dredging data from other sites reemediated using existing environmental dredging technologies. Based on site-specific information and a review of the case studies, USEPA believes that the Residual Standard is achievable at the site. The Residual Standard does not require that the anticipated residual of approximately 1 mg/kg Tri+ PCBs (prior to backfilling) specified in the Record of Decision be achieved at every post-dredging sediment sample location. Rather, USEPA developed a statistical approach to apply the residual concentration over a 5-acre certification unit. The dredging technologies selected during the remedial design and the means by which the dredging is implemented will greatly affect compliance with the Residuals Standard. This approach is effective because the case studies have shown that environmental dredging is capable of achieving the goals set for the projects in all but the most difficult conditions. The Residuals Standard does not specify the dredging, containment or other technologies to be used in order to allow flexibility during design
Seaway	4	Up until this time, such technology did not exist and so the decision to proceed or not with such cleanup activities were based on the aforementioned debate (weighing the risks of moving forward verses the no-action alternative). With the advent of "Control Zone	**Residuals** Achieving cleanup goals Dredging	The Draft Engineering Performance Standards intentionally do not require or prohibit containment of areas to be dredged by sheeting, silt barriers or other facilities. USEPA expects that the use of containment

		Technology (CZT)" however, Seaway believes that a new generation of environmental dredging technology has been introduced that can eliminate almost all of the inherent risks associated with current approaches and achieve the requirements necessary to remediate and monitor the effectiveness of the cleanup. Control Zone Technology is the "Best Available Technology" for remediating the Hudson River.	technology **Resuspension** Achieving cleanup goals Dredging technology	devices, which could include CZT, will be evaluated by General Electric Company as it prepares the engineering design documents to be submitted to USEPA pursuant to the Administrative Order on Consent for Remedial Design.
Seaway	5	B. Achieving Target Cleanup Goals. 1. It would appear from the data presented that no prior cleanup project using existing cleanup technology has achieved the desired target cleanup goal (Cm < 1 mg/kg) using the same technology as that proposed for the Hudson River (even after multiple dredging passes). Mean concentrations presented in the document for the case studies listed range from 2 to 80 mg/kg, even after as many as 18 dredging passes at a site.	**Residuals** Achieving target cleanup goals	For two of the case studies, a target concentration of 1 mg/kg Total PCBs was selected, and both came close to attaining this goal. At Reynolds Metals, the average post-dredging concentration was 2 mg/kg Total PCBs. At GM Massena, the average post-dredging concentration was 3 mg/kg Total PCBs. The goal for these sites was in terms of Total PCBs, not Tri+ PCBs. These sites may indeed have achieved the 1 mg/kg Tri+ PCB goal selected for the Hudson River, although this cannot be confirmed from the reported data. USEPA believes that it is feasible to achieve the 1 mg/kg Tri+ PCBs residual in the target areas of the Upper Hudson due to its the more favorable river conditions and typically lower pre-dredging concentrations than the Reynolds and GM Massena sites. Moreover, similar percent contamination reduction levels have been achieved.
Seaway	6	2. The assumption that target goals will be	**Residuals**	USEPA's residual goal of 1 ppm represents a

			achieved appears to be based on percent reductions found at other projects and the assumption that similar percent reductions are achievable. There does not appear to be any basis for this assumption. To assume a linear extrapolation of percent removal (i.e., a reduction of 500 mg/kg to 10 mg/kg will produce a similar reduction of 50 mg/kg to 1 mg/kg) is not logical in such systems.	Achieving target cleanup goals Basis for percent reductions	reduction of 95 percent of the mean concentration of Tri+ PCBs in the areas to be dredged. USEPA's review of the literature on dredging demonstrates that a number of sites were able to achieve a 95 percent reduction in the original concentrations. The process of sediment removal is a simple mechanical one wherein each dredge pass removes a portion of the contaminated sediment inventory while partially mixing the sediments left behind. Additionally, some portion of the sediments removed or disturbed are spilled from the dredge and fall back down to the surface. Thus, each pass serves to create a partially mixed underlying layer. Subsequent passes of the dredge remove more of the contamination, removing the previously existing mixed layer in the process and creating a new one. As the dredge approaches the desired depth of cut in the Upper Hudson, the mixed layer is expected to decline in its concentration from the mixing of pristine sediments (pre-1950) with residual contamination from the now removed overlying sediments. Assuming the depth of cut is correctly defined and attained by the dredging, the final concentration is a function of the efficiency of the dredge operation and the number of dredge passes made. Because the process is a mechanical reduction in contaminant inventory, the final concentration is simply a

				proportional combination of the remaining contaminated sediment and the underlying pristine material. In this manner, the percentage reduction in concentration is independent of the absolute concentration of the original material.
Seaway	7	3. Contaminated sediment remediation activities using conventional dredging practices tend to produce limiting concentrations regardless of whether 10 dredging passes or 20 passes are implemented. The ability to achieve low levels of contamination using existing technology is first order limiting. Only by modifying sampling procedures from those used at previous cleanup sites, by compositing cores or certification units can a "statistical cleanup" be achieved.	**Residuals** Achieving target cleanup goals Dredging technology	Compliance with the Residuals Standard does not rely on compositing; it is determined based on a calculated mean concentration in the surficial sediment at 40 sampling locations per 5 acre area. USEPA's review of case studies supports the concept of limiting the nunber of redredging attempts, as reflected in the Residuals Standard. The selection of an appropriate dredge in the first instance, based on site-specific conditions, is expected to increase the benefit of re-dredging attempts.
Seaway	8	C. Statistical Development and Extrapolation 1. The 99% PL, the 97.5% PL, the 99% UCL, and the 95% UCL all appear to be based on the equation presented in the document: $M_{CS} / M_{HR} = L_{CS} / L_{HR}$ where M_{CS} = case study mean M_{HR} = Hudson River mean L_{CS} = PL or UCL from the case	**Residuals** Statistical development and extrapolation	The action levels selected were derived from a "weight of evidence" approach and not a single equation. The equation identified in the comment is an engineering estimate that does not account for changes in the coefficient of variation with concentration. The other methods rely on substitution of the parameters associated with the project (e.g., n=40, mean=1 ppm) to account for the effects of the study specific parameters on the coefficient of variation.

		study L_{HR} = PL or UCL for the Hudson River 2. The extrapolation described above is highly questionable. Since the coefficient of variation in almost all natural systems will increase with lower concentrations, it should be expected (if a Cm < 1 mg/kg is achieved) that the values of PL and UCL will differ significantly from the values given.		More importantly, the assertion that the coefficient of variation will increase at lower concentrations applies to a system with a single measurement basis, with variance increasing as the detection limit of the data is approached. USEPA does not feel this assertion is valid for two reasons. First, the target concentration for the Residuals Standard (1 mg/kg) is not "far" from the mean values observed in many of the other studies used in this analysis (3-10 mg/kg). Second and more importantly, the threshold concentration of 1 mg/kg is ten times greater than the detection limit of the PCB measurement techniques expected to be deployed during the remedial operations (0.1 mg/kg).
Seaway	9	3. The use of data collected and lumped together from several sites using poorly defined sampling, analytical, and quality control procedures does not lend itself to a high degree of confidence that the data is relevant. It does not appear that any comparative analysis of variance of the data sets from the individual case studies (ANOVAs) were undertaken to see whether these data sets are in fact comparable, and can be combined as was done in the analysis presented.	**Residuals** Statistical development and extrapolation Statistical analysis on case studies	The case study data were not pooled in this analysis. An observed correlation between the mean and standard deviation of the individual case studies was used in one case, and the average of the site-specific standard deviations in another case. In each instance, data to determine each mean and variance were examined on a site-specific basis. Only the resulting coefficients of variance were then pooled to estimate the coefficient for use in the Residuals Standard.
Seaway	10	4. It would seem that a running assessment of the number of samples required as well as	**Residuals** Statistical	The standard provides threshold values for the typical case where n=40. This is the only

		values of Cm and F would be appropriate during the course of the demonstration to continually adjust PL and UCL values, if statistical accuracy is desired. No such practice is inferred in the document.	development and extrapolation	variable that could be changed using the methods to estimate the action levels of the Residuals Standard. In the interest of productivity, it is unlikely that the size of the certification units will be routinely larger than 5 acres. The targeted average residual value is assumed to be the maximum value specified in the ROD, 1 ppm Tri+ PCBs. The variance is estimated from the case studies. With this means of determining the action levels, no adjustments will be needed. The specific values themselves, however, may be refined for Phase 2 using the data gathered during Phase 1.
Seaway	11	D. Engineering Contingencies 1. In the event that the target mean, UCL, or PL goals are not achieved (even after multiple passes) using conventional, mechanical, or hydraulic dredging techniques (existing technology), the default option appears to be in-situ (subaqueous) capping. While some alternative approaches (alternative dredges) are presented, there is no data presented to demonstrate that such approaches will be useful or how they will be employed. At best such practices will severely impact the proposed schedule and cost of the cleanup and at worst they will result in no measurable improvement. A suggestion in the document that these options be further investigated during the design phase of the project appears to underscore that their utility is unknown at this time. As a result, it can be	**Productivity Residuals** Engineering contingencies Dredging technology and capping	The Productivity Standard recognizes that re-dredging will probably be needed in some area to achieve the target goals, and accounts for the time needed to perform the re-dredging. The Residuals Standards, however, limits the required number of attempts to meet the target cleanup level through re-dredging to two additional passes over an area following removal of the original inventory of PCB contaminated sediment to the cutlines approved during remedial design. Further attempts at re-dredging are considered unlikely to achieve any significant gains. The example dredging schedule includes an allowance for re-dredging equal to 50 percent of the time included in the schedule for the initial dredging effort. There are many potential methods of

		anticipated that the default option will be capping.		completing this project and meeting the target cleanup goal. The selection of the approach to dredging and the equipment to be used is, and should be, left to the designers, not specified in the Performance Standards. The Standards do not require that any specific alternative approaches, dredging technologies, or contingent technologies or equipment be employed, but give a few examples of methods that might be considered and leave it up to the designers to determine which contingency methods will best complement the other components of the project, such as the dewatering and water treatment systems. The Engineering Performance Standards do not specifically address the costs of certain equipment or options. In developing the Engineering Performance Standards, however, USEPA sought to make the standards flexible enough to allow the designers latitude in selecting appropriate and cost-effective equipment and techniques. USEPA does not believe that the Residuals Standard will result in a default capping. The Residuals Standard requires inventory removal to the design cut-lines prior to consideration of a capping contingency. Indeed, most of the case studies examined achieved similar reductions in previous dredging programs without capping, and USEPA expects the same, or a better, level of success in the Upper Hudson.

Seaway	12	2. If this is the case and target goals cannot be achieved (a reasonable outcome), then it is possible that a substantial portion of the river may require remediation capping, resulting in a significant increase in project costs. Such costs have not been considered in the Standard.	**Residuals** Engineering contingencies Capping and project cost	In the revised text, USEPA clarifies the preference for dredging over capping. Sub-aqueous cap construction is only expected for areas with elevated, recalcitrant residuals concentrations. USEPA does not expect such conditions in a substantial portion of the river bottom. As described in Section 4.0 of the Residuals Standard, USEPA will evaluate the application of the standard during Phase 1 and determine the need for necessary changes to the standard or to the dredging operations in Phase 2.
Seaway	13	3. In the remediation of subaqueous contaminated sediment it is preferable to decide in advance whether an area will be capped or dredged because once dredged, the area will be disturbed and the application of a secure clean cap will be extremely difficult. This does not appear to be the case, given the proposed approach.	**Residuals** Engineering contingencies Capping option	In its 2002 Record of Decision, USEPA selected targeted dredging over a capping cleanup alternative. The Residual Standard recognizes that capping may be the only alternative to isolate unacceptable concentrations of PCBs in recalcitrant areas. Caps have been applied at other sites in areas that were recalcitrant to dredging (GM Massena). The design and application will have to account for the added difficulty of placing the cap over disturbed sediment.
Seaway	14	4. While redredging triggers subsequent sampling in the proposed logic tree, placement of a subaqueous cap does not trigger subsequent sampling. It is therefore assumed that a subaqueous cap will eliminate the problem. This assumption is questionable, particularly if the residue (or	**Residuals** Engineering contingencies Effectiveness of capping	The design of the cap may require sampling following the placement of the cap. This will be addressed during the Remedial Design. Text will be added to the standard to address this issue.

		residual fluff) is the reason for the problem. Capping will not fully contain the fluff. The document appears to acknowledge this in Section 2.1. The existing plan provides no way to assess what the cap has achieved relative to the contamination present in the certification unit.		
Seaway	15	5. There is little available data on which to gauge the effectiveness and long term longevity of a subaqueous remediation cap, particularly in a dynamic river environment. This problem is not addressed in the document.	**Residuals** Engineering contingencies Effectiveness of capping	The subaqueous caps will be placed only after the removal of sediment to the design cut lines. At this point, most of the contamination will be removed, leaving only a thin residual contaminated layer. This is a key difference between the intended use of the cap specified by the Residuals Standard and a capping alternative for containing inventory. The issue of cap longevity and maintenance is a design issue that will be addressed during the Remedial Design.
Seaway	16	6. No consideration appears to have been given to the ecological effects of widespread remediation capping on the river system.	**Residuals** Ecological effects due to capping	Capping is a contingency for dealing with a small percentage of the remedial area where dredging is not effective in reducing the residual concentrations. It is not expected to be "widespread." The need to maintain compatibility with habitat is addressed in the Standard; design of multi-layer caps may be required to both contain residuals and avoid significant loss of habitat. USEPA will evaluate the use of technologies such as capping in Phase 1 in determining the need for changes to the Engineering Performance Standards or to the dredging operations in

				Phase 2.
Seaway	17	E. Certification Units 1. The current plan appears to define a Certification Unit based on spatial considerations, but no consideration is given to temporal considerations.	**Residuals** Certification units Temporal considerations in the CU	The following temporal considerations pertain to the dredging certification unit: • Residual sampling must be completed after inventory removal is confirmed and within 7 days after dredging is completed in a particular targeted area (Residuals Standard, Section 3.2). • Portions of a certification unit can be backfilled as dredging proceeds downstream within the same certification unit (Residuals Standard, Section 3.5). This is meant to encourage the contractor to fully complete certification units/portions of units as soon as compliance with the standard can be assessed. • If barriers are used during dredging, backfill must be placed before removing barriers around a certification unit (Productivity Standard). • All dredged areas must be backfilled before demobilization at the close of a dredging season (Productivity Standard). These considerations will facilitate timely data acquisition regarding a certification unit's compliance with the standard and facilitate the placement of backfill over disturbed, post-dredging bottom areas prior to their exposure to river flows that could mobilize sediments.

Seaway	18	2. A 5 acre area with depths of 3 feet or greater could take weeks (or even months, depending on the details of the operation) to remediate. The result being that the effectiveness of the cleanup may not be known for a significant period of time. 3. Such a practice will result in the exposure of high levels of PCB contaminated sediments to the river for extended periods before subsequent remedial actions are implemented.	**Residuals** Certification units Effectiveness of clean up and exposure of high levels of PCBs	The standard includes a provision that portions of a certification unit can be sampled and closed out under certain conditions. This will limit the exposure from the residual sediment in these areas. Substantial areas of high concentrations are not expected to remain after dredging, even in areas where the residuals standard is not met, given that the PCB inventory already will have been removed to the design cutlines. Highly concentrated sediments will not necessarily be exposed to the water column, even if portions of the certification unit are not closed out. However, this detail will need to be worked out as a part of the Remedial Design.
Seaway	19	4. To reduce this possibility it is recommended that a temporal criteria (e.g., a maximum of one week of dredging) be applied to the definition of a Certification Unit.	**Residuals** Temporal criteria for certification units	USEPA believes that the requirements inherent in the Resuspension and Productivity Standards provide sufficient temporal restrictions on certification units.
Seaway	20	**Resuspension Performance Standard** Seaway recognizes the difficulty faced by EPA in trying to define the resuspension standards for this project. This difficulty is underscored by the EPA's objective, which is paraphrased below: *EPA must define, without the benefit of precedent, a temporal and spatial monitoring plan that can accurately depict the resuspension and release of particulate phase*	**Resuspension** Temporal and spatial monitoring plan	USEPA believes that the monitoring program is appropriate. USEPA has provided a comprehensive monitoring plan in both the near-field and the far-field to ensure that impacts from dredging are well constrained. The statistical basis for the dredging period monitoring design is presented in Attachment G for both routine and non-compliant conditions. As noted in Section 3 of the

		and soluble phase PCBs resulting from non-steady state dredging operations with nonuniform source discharges into a waterway with a nonuniform cross section with varying flows and horizontal and vertical velocity distributions, upon which may be superimposed temporary barriers (such as vessels, and engineered barriers) that might temporarily mask releases or sediment traps within the river where released contaminants will migrate and remain indefinitely. Seaway does not believe that EPA has defined a monitoring plan that can depict, with a high degree of confidence, the migration of contaminants from a dredging operation of this magnitude. At best the results will yield an approximation that has a wide error bar. The risks of misrepresenting the impact of the remediation are high. Residual undetected contamination will be in the upper river, and undetected contamination will migrate into the lower river, resulting in long term ecological impacts to the river system, water supply and irrigation systems along the river. The limitations of the proposed program and the confidence in the anticipated results (confidence limits) were not adequately represented by EPA in the document.		Resuspension Standard, without barriers, some form of sediment monitoring outside of the target areas may be required. Sediment monitoring for this purpose will be included as a part of the design, if necessary. Undetectable increases from baseline in the PCB load will not have a significant affect on the ecology, water supplies or irrigation systems along the river. Any increases in the PCB load that would significantly affect the lower river will be identified with the proposed monitoring. Furthermore, the tiered approach to the action levels will indicate problems with the dredging operations, which in turn will prompt efforts to resolve situations well before any significant effects on the river system are made. As stated in Attachment G of the Resuspension Standard, the frequency of sampling in the Lower Hudson will be increased in response to exceedences in the Upper Hudson. The proposed method of cross-sectional sampling in the Upper Hudson (EWI or EDI) will capture the river-wide PCB increases from dredging. Any increases in the PCB load that would significantly affect the lower river will be noticeable with the proposed monitoring. The combination of high frequency or continuous TSS measurements with discrete and integrative PCB sampling techniques as required by the standard provides a basis to examine short-term and long-term conditions related to PCB release and should readily identify conditions

				warranting further investigation. Undetectable increases from baseline in the PCB load will not have a significant affect on the ecology, water supplies or irrigation systems along the river. These sampling methods are designed to accurately capture the water-column concentrations and is more representative than simple grab samples. As noted in Attachment G: “The Lower Hudson stations are intended to characterize general water column conditions in response to elevated PCB concentrations and loads originating from dredging. These stations consist of a single center channel location that can be readily reoccupied. Cross sectional sampling is not required, since flow is not unidirectional and thus flux cannot easily be estimated. The frequency of sampling is increased in the Lower Hudson in response to greater loads and concentrations in the Upper Hudson, specifically, when Troy is expected to exceed 350 ng/L Total PCB. This is done to examine Lower Hudson conditions in response to these loads as part of the documentation of the recovery of the river.” Furthermore, the tiered approach to the action levels will indicate problems with the dredging operations that require solutions before having any significant effects on the river system.

Seaway	21	There is no precedent for such a program. Models utilized by EPA in the assessment to estimate the magnitude of source discharges, sampling locations and the temporal distribution of sampling events are weakly calibrated and unverified.	**Resuspension** Modeling source discharges	The modeling approach and assumptions are appropriate and mostly conservative (see model discussions in Attachment D). As noted in the sensitivity analysis of the near-field model in Attachment D, the PCB releases will be dependent on various parameters. The resuspension criteria, therefore, were structured on PCB loads and concentrations that will be protective of downstream water supplies and fish body burdens, and not dredging-related parameters and conditions. The transport mechanisms will be examined as part of the data collected during Phase 1. The sampling methods outlined in the Resuspension Standard are structured to provide reasonable assurance that significant releases will be detected. The far-field sampling methods will cover the width of the river and the near-field sampling will be taken within the plume. Many approaches have been used to control water quality impacts associated with dredging contaminated sediments. This program focuses on protecting human health and the river ecosystem, rather than simply restricting the dredging operation. It will encourage innovative strategies to maximize sediment removal rates while protecting human health and the environment. USEPA recognizes that uncertainty is

				inherent in the modeling process. However, the most appropriate model assumptions have been used to minimize the risks associated with the error. USEPA recognized the uncertainties in the model assumptions and structured the resuspension criteria on PCB load and concentrations at the far-field stations. These criteria are formulated to minimize the effects of PCB resuspension on human health and fish body burdens. The transport mechanisms will be examined as part of the evaluation of the data collected during Phase 1.

Seaway	22	Once implemented, EPA will have no way to verify the efficacy of the sampling program. The sampling plan is reactive. If a release is observed, an action (as of yet undefined) is triggered. But the release has already occurred and there is no way to mitigate it. Seaway does not believe that the success of Superfund cleanups should be based on reactive monitoring plans that inherently have a low probability of detecting the actual release of contaminants from a dredging operation.	**Resuspension** Sampling plan	Sampling during dredging is necessary to ensure that the dredging is being performed in a way that is protective of human health and the environment. Monitoring the PCB concentrations provides a basis for evaluating the success of the dredging operations. The Remedial Design will describe what engineering contingencies are necessary to comply with the action levels and standard. The Remedial Design will also describe the contingencies that would be set in place if exceedances occur. However, based on the modeling results, USEPA believes that proper dredging operations should not cause exceedences of the Resuspension Standard. The tiered level monitoring approach is preventive in two ways. The standard is proactive in that it leads to detection of elevated rates of release and requires actions in the form of engineering studies and engineering contingencies prior to the point where the level of release results in harm to human health or the environment. The action levels also provide a basis for development of the design so that exceedences can be avoided. The Resuspension Standard requires monitoring at frequencies that are capable of measuring compliance with the resuspension criteria with minimal decision error. This monitoring plan was developed using USEPA's data quality objectives process and

				is described in Attachment G. In particular, the monitoring is designed to capture events of sufficient magnitude and size to have the potential for meaningful impacts. Thus, the monitoring is focused sufficiently downstream of the operation to ensure detection of these events while avoiding unneeded contingency actions.
Seaway	23	If possible, it [the success of Superfund cleanups] should be based on active containment and cleanup of such contaminants at the point of release to minimize the need for complex monitoring programs with unknown accuracy. .	**Resuspension** Containment and cleanup vs. modeling	Containment is one option to be explored during the Remedial Design. In reviewing such options, the effects on productivity and residual concentrations will be considered in addition to resuspension. Monitoring of the water column levels is necessary to evaluate the success of the dredging, to ensure that the remedy is being

				performed in a way that is protective of human health and the environment, and to document whether the operations are in compliance with the Resuspension Standard. This is described in Attachment G of the text. An assessment of the Phase 1 data has the potential to reduce monitoring requirements during Phase 2, particularly for the sampling requirements that do not measure compliance with the resuspension criteria, but are needed in Phase 1 to answer questions critical to the remediation, such as understanding the mechanism of release. USEPA disagrees with the assertion that monitoring at the point of release will reduce the monitoring program. In fact, as demonstrated in several of the case studies, monitoring too close to the operation requires a much more extensive and expensive monitoring plan due to the inherent short-term spatial variations that occur near the point of release. USEPA's monitoring plan is designed specifically to avoid trying to assess the extremely variable near-field conditions and instead is a more focused and efficient program in which substantive losses due to dredging can be readily identified with a minimum number of samples.
Seaway	24	**B. Far-Field and Near-Field Monitoring Locations** 1. The path (vector), travel velocity and vertical distribution of contaminants (particulate and	**Resuspension** Dispersion of particulate and soluble	The USEPA agrees that the dredging operations represent a dynamic system. The modeling approach and assumptions are appropriate and mostly conservative. As

		soluble) released to the water column during dredging operations are unpredictable. Dispersed particulates at a dredge site will segregate based on specific gravity and will disperse based on localized currents. Higher specific gravity particles can be expected to hug the bottom and be carried offsite, if bottom currents exist, in directions dictated by localized currents. Lighter particles will initially rise and travel in the directions of localized currents at various and unpredictable vertical water column elevations. Particulate contaminants may settle and resuspend multiple times as it travels through the river (subject to storm and high flow events). Soluble contaminants will be released and travel with the currents. The assumed steady state release of contaminants (g/day) is in effect a slug release and contaminants are just as likely to flow in slugs or batches then to mix with the water column, making discrete time (every three hours) or discrete depth (mid-depth) or cross section (mid-cross section) sampling a low probability event. The introduction of temporary engineering controls (silt curtains) or the presence of vessels and structures in the river further complicates the ability to model or predict the outcome of contaminant transport in the river. The aforementioned factors are borne out by the lack of any consistent pattern observed in the data from prior remediation efforts.	contaminants	noted in the sensitivity analysis of the near-field model in Attachment D, the PCB releases will be dependent on various parameters. Therefore, the resuspension criteria were structured on PCB loads and concentrations that will be protective of downstream water supplies and fish body burdens and not on conditions specific to a given dredge type or remedial operation. The transport mechanisms will be examined as part of the data collected during Phase 1. The inherently transient and discontinuous nature of dredging operations result in non-uniform releases to the water column. Once released, ambient and induced currents will transport constituents according to many of the processes indicated in the comment. The steady-state modeling approach used effectively assumes constant and continual releases that represent a substantially more severe condition than actually present during a dredging operation.

Seaway	25	2. While EPA has developed models to predict transport rates, such models are weakly calibrated, unverified, assume steady state and CSTR source conditions, all of which can be called into question when simulating a dredging operation. Steady state water and air quality models are typically used to project downstream concentrations of source discharges in their respective ambient environments. Such models typically assume continuous and uniform source loadings and ambient conditions (e.g., velocities, temperature, dispersion coefficients, cross sections, etc.). It appears that EPA has employed similar models to project loadings, transport and the selected locations for sampling locations. It is unclear how dredging operations could be assumed to generate steady state, continuous source loadings. Mechanical dredging operations are inherently batch operations and hydraulic dredging operations are subject to starts and stops throughout the dredging process. The use of such models will unquestionably introduce an error into the analysis. The magnitude of which is unknown.	**Resuspension** Modeling assumptions when predicting transport rates	USEPA acknowledges that error is inherent in the modeling process. However, the most appropriate model assumptions have been used to minimize the risks associated with the error. USEPA recognized the uncertainties in the model assumptions and structured the resuspension criteria on PCB load and concentrations at the far-field stations. These criteria are formulated to minimize the effects of PCB resuspension on human health and fish body burdens. The transport mechanisms will be examined as part of the data collected during Phase 1. The steady-state modeling approach used assumes constant and continual releases that represent a substantially more severe condition than actually present during a dredging operation. Intermittent or cyclic operations (such as associated with many mechanical dredges) result in periods with no releases to the water column.
Seaway	26	3. While the document appears to make the assumption that near-field monitoring locations will produce heterogeneous water column conditions (page 10), it also appears to assume that far-field stations will experience homogeneous conditions in the form of a consistent plume. There does not	**Resuspension** Homogeneous vs. heterogeneous conditions at far-field stations	As noted, the water column in the near-field samples is not expected to be homogeneous. The locations for these samples are specifically required to be within the plume. The far-field conditions are expected to be much more homogenous than the near-field due to dispersion of the plume. However, it is

		appear to be any basis for this assumption other than the application of the aforementioned models, which by their very nature must conclude this homogeneous condition. How will EPA ensure that contaminants are not bypassing the station as they flow in stratified density currents? The actual monitoring scheme in terms of cross sectional and vertical sampling profiles is not very clear.		recognized that a plume or localized PCB flow may exist. Therefore, more than one far-field station will be sampled. Furthermore, the samples required are cross sectional composites. The sampling methods provided are equal-width-increment (EWI) and equal discharge-increment (EDI). Section 3.3.2 of the Resuspension Standard contains information on the sampling techniques. For further clarification please refer to: USGS, 2002. National Field Manual for the Collection of Water-Quality Data, Techniques of Water-Resources Investigations, Book 9, Handbooks for Water-Resources Investigations, Section 4.1.1. Available at http://water.usgs.gov/owq/FieldManual. Additional information on these sampling methods will be provided as part of the sampling plans. Also it should be noted that the TSS-Chem model does not assume the plume must be homogeneous at one mile. This is a function of the lateral dispersion.
Seaway	27	**C. Far-Field and Near-Field Temporal Monitoring Criteria** 1. What is the basis for three-hour sampling intervals for near-field stations and 24-hour intervals for far-field stations? These intervals introduce a high probability that releases could be missed.	**Resuspension** Sampling intervals at near- and far-field stations	It is not practical to require more frequent sampling during operations at the Evaluation Level. Real-time turbidity monitoring will be required even if there is no reliable semi-quantitative relationship between TSS and turbidity. These data will provide rapid feedback to the dredge operator regarding the dredge operations and resuspension. In

				addition continuous samplers for PCBs are required at the far-field stations which will collect integrated samples over time periods ranging from 2 weeks to 1 day. These will be used to examine the adequacy of the discrete monitoring samples.
Seaway	28	2. The sampling program appears to be focused on the May to November dredging period only, since dredging is not expected to occur during the high flow season. While dredging may not be performed during the high flow season, deposits of contaminated sediments that may have been released during the prior season may be available for release during this season. Does EPA intend to assess PCB releases during the off-season?	**Resuspension** Off-season releases of PCBs	Water column sampling in the off-season will be conducted as part of the ongoing long-term monitoring program. Wherever appropriate, backfill will be placed to control residuals, lessening the potential impact on the water column from the disturbed sediment.
Seaway	29	3. It is unclear from the document what the micro and macro duration of sampling and monitoring activities will be. Are near and far field stations monitored during dredging activities only? How long after dredging at a particular location does monitoring at that location cease? How long after the entire project is completed will monitoring continue? Sediment transport from dredge locations is unpredictable and could take days, weeks, months and maybe even years to migrate from the source to downstream stations.	**Resuspension** Monitoring of near- and far-field stations	Near-field monitoring will continue until baseline conditions are confirmed by two consecutive samples after dredging activities have temporarily halted for the day. As per the Residual Performance Standard, in most areas the dredging will continue until the dredged area has a average surface concentration of 1 mg/kg Tri+ PCBs and backfill will be placed as appropriate or areas with elevated residual concentrations that are not reduced sufficiently by dredging will be capped. This will reduce the extent of further downstream migration of PCBs from surface sediments. The potential for resuspended sediments to be

				deposited in non-targeted areas will be addressed in the Remedial Design. However, the mass removed from dredging should far outweigh any contamination left from resuspension. Thereby the PCB loads should be considerably lower than the current baseline once the system stabilizes after dredging activities have ceased. The monitoring outlined in the Performance Standard is for the dredging season only. Water column sampling in the off-season will be conducted as part of the ongoing long-term monitoring program. Post-remediation monitoring will be required, but the details of the monitoring have not yet been established. The basic parameters for a long term monitoring plan are provided in the December 2000 Feasibility Study.
Seaway	30	**D. Indicator Tests (Turbidity and TSS) and Dissolved Phase Partitioning** 1. Relationships between turbidity readings (NTUs) and TSS have proved in prior studies to be marginally reliable; and little or no relationship has been documented between NTUs, TSS and PCBs. Since PCBs can be expected to associate with fine organic and perhaps clay-like particles, not all types of suspended matter that manifest as TSS or turbidity will necessarily correlate with PCBs. Any such relationships must be considered suspect at best. Yet the EPA program places a great deal of emphasis on	**Resuspension** Turbidity and TSS as indicators of PCB release	The performance standard requires both discrete and integrative PCB sampling at the far-field stations and will not rely solely on TSS or turbidity readings. A relationship correlating TSS and turbidity will only be applied if it is reasonably reliable. The data collected during Phase 1 will be a measure of the effectiveness of the semi-quantitative relationship in predicting TSS. The TSS/turbidity data collected as part of Phase 1 and the far-field PCB data will be examined to see what levels of TSS indicate high resuspension rates and elevated PCB levels in the far-field. It is not anticipated that these parameters will have a one-to-one

		TSS and turbidity readings. How can EPA ensure that these measurements are in fact indicators of PCB releases?		relationship, however it is anticipated that the TSS levels will provide some indication of elevated far-field PCB concentrations. These parameters can then be used to indicate more PCB sampling at the far-field stations is necessary.
Seaway	32	2. Estimates of dissolved phase releases of PCBs during dredging operations were undertaken using partition coefficients. Such tools are typically utilized when experimental options are not available. In most field applications when dissolved or leachable fractions (dissolved components) are being projected, samples of the subject material (sediments) are collected and subjected to standard leaching tests (typically batch tests such as SW 846, Method 1320 at a conservative liquids to solid ratio) to assist in projecting the expected release of contamination. Why did EPA not provide such data in this assessment?	**Resuspension** Release of dissolved phase PCBs	The partition coefficients selected are based on site data. The study proposed is not necessary because site-specific partition coefficients were developed using water column measurements of PCBs in the dissolved and suspended phase (see USEPA, 1997). Furthermore the technique suggested is not sensitive enough for the proposed purposes. USEPA, 1997. Phase 2 Report, Further Site Characterization and Analysis, Volume 2C – Data Evaluation and Interpretation Report (DEIR), Hudson River PCBs RI/FS. Prepared for USEPA Region2 and USACE by TAMS Consultants, Inc., the Cadmus Group, Inc., and Gradient Corporation.
Seaway	33	**E. Costs ($)** 1) No information is provided in the document relative to the potential costs of the proposed monitoring activity or the costs of mitigating strategies that may be required.	**Resuspension** Costs of monitoring activities or mitigation strategies	The Resuspension Standard does not include cost estimates for the mitigating strategies. Such costs will be developed as part of the Remedial Design. However, estimates of the analytical and labor costs are provided in an accompanying white paper.