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Summary Paper for the Centredale Manor Superfund Site Contaminated Sediments Technical Advisory Group (CSTAG) Meeting

PREPARED ON BEHALF OF:

Brook Village Associates, LP
Centredale Manor Associates, LP
Emhart Industries, Inc.
New England Container, Inc.

PREPARED BY:

AMEC Earth & Environmental
Loureiro Engineering Associates.

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CENTREDALE MANOR SUPERFUND SITE

In response to the invitation to do so, this summary paper is being submitted to the U.S. EPA Contaminated Sediments Technical Advisory Group (CSTAG) on behalf of the following private parties associated with the Centerdale Manor Superfund Site: Brook Village Associates, LP; Centredale Manor Associates, LP; Emhart Industries, Inc.; and New England Container, Inc. The paper was prepared jointly by AMEC Earth & Environmental and Loureiro Engineering Associates.

Contaminated sediments present an atypical challenge to risk managers. Setting and physical characteristics of different sediment contamination sites can and do have substantial impacts on the types of uses, and consequently exposures, that may occur as a result of the contamination. In some cases, there may be little to no human contact with contaminated sediments, due to either a lack of activity or a lack of accessibility, and little to no ecological impact due to low bioavailability and sediment burial. However, the risks of remediating contaminated sediments can be substantial, depending upon the methods employed. Critical habitats may be removed, buried sediments may be re-suspended and transported to downstream areas, thereby increasing their impact on the system, and increases in noise, dust, and traffic may present a nuisance in populated areas. It is, therefore, critical that contaminated sediment sites be fully characterized and well understood before risk management decisions are made.

There are three major steps that are critical for making risk management decisions at contaminated sediment sites. The first is the complete characterization of the site, including the extent of contamination, identification of all chemicals of potential concern, identification of potential sources of contamination, and consideration of current and potential fate and transport of sediments. The second is the site-specific risk assessment that fully identifies and evaluates all human and ecological receptors of concern, realistically characterizes potential routes and points of exposure, and estimates risks to both using reasonable and representative exposure assumptions and parameters. The third step is the consideration of potential remedial alternatives, should such action be necessary, to ensure that all of the critical factors associated with different remedial options are fully considered.

EPA'S *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (EPA, 2002) outlines a framework for making risk management decisions concerning hazardous waste sites that have contaminated sediments. It presents an iterative approach to site evaluation to ensure that the site is fully understood before remedial decisions are made. This guidance outlines eleven principles to consider when evaluating contaminated sediment sites. The first eight of these principles, and means of maximizing them for the Centredale Manor Site, are discussed below. The remaining three principles are more relevant to later stages of the project and, thus, are not discussed in this summary paper.

Principle 1 – Control Sources Early

The first principle relates to controlling sources of contamination. It indicates that site managers should "identify all direct and indirect continuing sources of significant contamination to the sediments under investigation." These sources may include industrial or wastewater discharges, spills, erosion of soil or sediment, contaminated groundwater, sewer outfalls, and aerial deposition, to name a few. While site investigations often spend substantial effort characterizing known sources of contamination, they often do not spend adequate time characterizing additional sources that may be contributing to site-related problems. It is critical however that <u>all</u> potential sources be identified early in the process and controlled to the extent

possible. Lack of understanding of all sources of contamination could result in recontamination of an area after it has already been remediated.

A number of source control measures have already been taken at the Centredale Manor site (the Site). These include capping of soils, reconstruction of Allendale Dam, capping of the former tailrace and draining channel, and investigation and removal of certain residential soil. These source control actions have resulted in an immediate reduction of exposure potential and reduced the potential for soils and sediments to be re-suspended and transported to downstream areas. It is important that the human health and ecological risk assessments take these source control activities into consideration in selecting potential receptors and exposure routes of concern. This will ensure that the risk assessments reflect current conditions at the Site.

Principles 2 and 3 – Involvement with the Community and Coordination with States, Local Governments, Tribes and Natural Resource Trustees

EPA (2002) recognizes that sediment sites can present a number of technical and social issues that need to be resolved. Thus it recommends that decision-makers involve the community early and regularly to ensure that the direction taken is one that is acceptable to the community. Such community involvement will ensure that the decision-makers have an accurate characterization of the impacts posed by both the contaminated sediment and the potential remedial actions. Similarly, it is critical that the decision-makers coordinate with other interested parties, such as state and local governments, to ensure that all decisions made at the site receive input from those parties to the extent possible. To that end, we encourage EPA to redouble their efforts to make available to all stakeholders and potentially responsible parties, in a timely fashion, all data and the interpretation thereof, that are generated as part of the ongoing assessment of the Centredale Manor site.

Principle 4 – Development of Conceptual Site Model (CSM) that Considers Sediment Stability

The conceptual site model (CSM) is a critical step in site evaluation in that it guides site investigations, risk assessments, and risk management decision-making. Thus it is critical that the CSM be carefully constructed to ensure that it identifies all contaminants, affected media, exposure pathways, and known human and ecological receptors. It is a particularly important step in site evaluation for sediment sites due to the interrelationship of sediment, soil, water, biota, and receptor groups and the fact that the system is not static but is instead always changing due to natural and manmade disturbances and activities. In addition, it is important that the CSM be constantly updated as necessary to reflect site-specific conditions as new knowledge about the site is gained. For example, the effects of remedial actions on the CSM need to be considered, such as the reconstruction of the Allendale Dam at preventing downstream transport of contaminated sediment and serving as a physical barrier to exposure of downstream aquatic receptors.

It is particularly critical for a river, like that associated with the Centredale Manor Site, that adequate data be collected to accurately characterize the stability of the sediments and the hydrology of the river. It is important to understand how, when, and where sediments are likely to move before attempting to make risk management decisions. It is critical to have knowledge of how daily river-based activities, natural process, and storm events may affect and move the impacted media because the movement and deposition of sediments may greatly affect exposure potential for both humans and ecological receptors. Sound risk management

decisions cannot be made without a clear understanding of the dynamics of the river. As more information is gathered about the dynamics of the system, the CSM should be updated and refined, additional data gaps identified, and sampling efforts focused to address those gaps.

In addition, site investigations should not only focus on site-related contaminants in a system, but also, adequately investigate all contaminants in the system. This is an important issue because estimated risks based on site-related contaminants alone may result in remedial actions that do not actually reduce risks if risks posed by other non-site-related contaminants are high. It is important to understand all contaminants and factors impacting a system as well as understanding background conditions in the area.

Finally, CSMs are often developed early in the site investigation process and should be updated as new information is obtained and, eventually, field-tested. For example, a screening-level fate and transport model may predict contaminant movement and concentrations and this information may be used as inputs to the risk assessment. It is critical, however, that this type of modeled output be field-verified to determine whether contaminants are being moved and deposited in the way in which the model is predicting, and to determine whether the predicted concentrations in media and receptors of concern are actually occurring. Transport and bioaccumulation are highly dependent on the dynamics of a system, disturbances that may occur, temporal changes, and the specific biochemical conditions present (e.g., organic carbon content, pH, temperature, etc.). For example, a food web model may predict uptake in an ecological receptor that is not occurring due to differing bioavailability, patterns of sediment deposition and availability of food that are assumed in the model. Specifically, largemouth bass and sucker data from Lyman Mill (Figure 61) were collected prior to reconstruction of the Allendale Dam and, thus, may overestimate current exposures because these fish could have been foraging in Allendale Pond. Thus, before risk management decisions can be made, risk managers must receive verification that the predicted values are representative of the actual conditions in the system.

Principle 5: Use of an Iterative Approach in a Risk-Based Framework

Consistent with the continual refinement of the CSM discussed above, EPA (2002) recommends that an iterative approach be used, especially for complex sediment contamination sites. Such an approach allows screening level analyses to be conducted to focus the investigation and identify data needs. Risks estimated using screening conservative assumptions (e.g., Figure 71 for otter at each pond) may overestimate actual risks substantially. Once data gaps have been filled, fate and transport and exposure models can be modified and refined to more accurately define actual processes at the Site.

An iterative approach can also be used to help identify the effectiveness of various remedial options that are being considered. It may also be important, at some sites, to make early risk management decisions to reduce an immediate threat of harm or control sources. Using an iterative approach to take early action will allow the risk manager to consider the impact of that action on the system and potentially refocus additional future risk management decisions. In some cases, first actions taken may substantially reduce potential for exposure and transport, thereby relieving the need for additional remedial action. Thus it is critical that site assessors continually gather data and refine the CSM and other assumptions based on those findings to ensure that risk assessments are as accurate as possible and that remedial decisions are appropriate and ultimately effective.

Principle 6: Evaluate Assumptions and Uncertainties Associated with Site Characterization and Data Needs

EPA (2002) recommends that the uncertainties and limitations of site characterization data, and any of the qualitative or quantitative models used to extrapolate site data to future conditions should be carefully evaluated and described. To the extent possible, the uncertainty in chemical determinations of exposure media should be minimized and realistic assumptions and exposure data should be used. For example, in an ecological risk assessment, the use of empirical measurements of prey items is preferable over the use of conservative food-chain models to estimate exposures and risks to upper trophic level receptors. For both human health and ecological risk assessments, the use of site- or region-specific data should be used to minimize the uncertainty in the predicted risk estimates.

Principle 7: Selection of Site-, Project- and Sediment-Specific Risk Management Approaches to Achieve Risk-Based Goals

EPA (2002) states that there is "no presumptive remedy for any contaminated sediment site, regardless of the contaminant or level of risk". Multiple factors need to be weighed to identify the appropriate remedy, or combination of remedies, that best achieves the risk-based goals. Because the Centredale Manor site encompasses areas having different characteristics or uses, it is likely that a combination of remedies may be needed to attain the risk-based goals.

Moreover, in weighing the factors to identify the appropriate combination of remedies, the features of the site, not only as it currently exists, but as it may exist in the future must be considered. In other words, more than one future-use scenario should be contemplated. For instance, the risk-based goals for the Centredale Manor site may best be attained in the Allendale reach of the site by removing the pond condition, thus returning the aquatic system to something resembling its original and natural state. Such an approach, in addition to restoring a natural riverine wetland, would improve flood storage and migratory fish passage. This approach would also be consistent with the on-going efforts of the Urban Rivers Initiative and the Greenway Project.

Other remedies, such as those that include large scale dredge and haul operations may not be consistent with the risk-based goals and future use of the site. Dredging operations increase the potential for sediment suspension and downstream transport. Even if contaminated sediments are successfully removed, the local environs may preclude the use of dewatering and staging areas because the immediate vicinity of the Site is a densely settled urban neighborhood. Transportation may also be difficult due to the narrow local roads and the increase in truck traffic in the area.

Principle 7 and Principle 8 (*Ensure that Sediment Cleanup Levels are Clearly Tied to Risk Management Goals*)

Principles 7 and 8 taken together address the integration of risk management approaches to the decision making process. Although risk management often takes place after the completion of the risk assessment, the EPA Ecological Risk Assessment Guidance encourages the integration of risk management principles into the development and conduct of the risk assessment. This is a preferable approach that will encourage the development of coordinated, risk-based remedial

actions. In fact, deferring this integration to later phases of the project could be problematic for developing informed risk-based decisions and remedies most appropriate for the Centredale Manor Site.

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Loureiro Engineering Associates, Inc.

Centredale Manor Superfund Site Contaminated Sediments Technical Advisory Group Meeting

Russell E. Keenan, Ph.D.

Jeffrey J. Loureiro, P.E., L.E.P.

on behalf of the

Centredale Participating Respondents Group

July 15, 2004

The Participating Respondents Group

- **Four private parties have performed cleanup work at the Site:**
  - **Brook Village Associates LP**
  - **Centredale Manor Associates LP**
  - **Emhart Industries, Inc.**
  - **New England Container Company, Inc.**
- **The Group has been working with EPA and other stakeholders to identify and control potential sources of contamination since 2000.**

Principle #1 - Control Sources Early

- Identification of direct and indirect continuing sources of contamination
- Historical land-use along the Woonasquatucket River
  - Manufacturers of machine tools, files, woolens, worsted cloth, chemical products and processing
  - Mills that produced printed cloth, looms and textile machinery, rubber goods, jewelry, steam engines and locomotives
  - American Heritage River designation
- Other potential on-going sources of contamination
  - Storm water and surface runoff
  - Direct pipeline discharges from industrial facilities
  - Wastewater treatment plants
  - Power plant air emissions and incinerators
  - Pesticide applications

Principle #1 - Control Sources Early

- **Early Control of Sources**
  - **Capping soils on the Site proper**
  - **Restoration of Allendale Dam**
  - **Excavation of residential and recreational-use soils and floodplain sediments around Allendale and Lyman Mill Ponds and the transportation of soils and sediments for off-site disposal**
  - **Capping of sediments in the former tailrace and drainage channel**

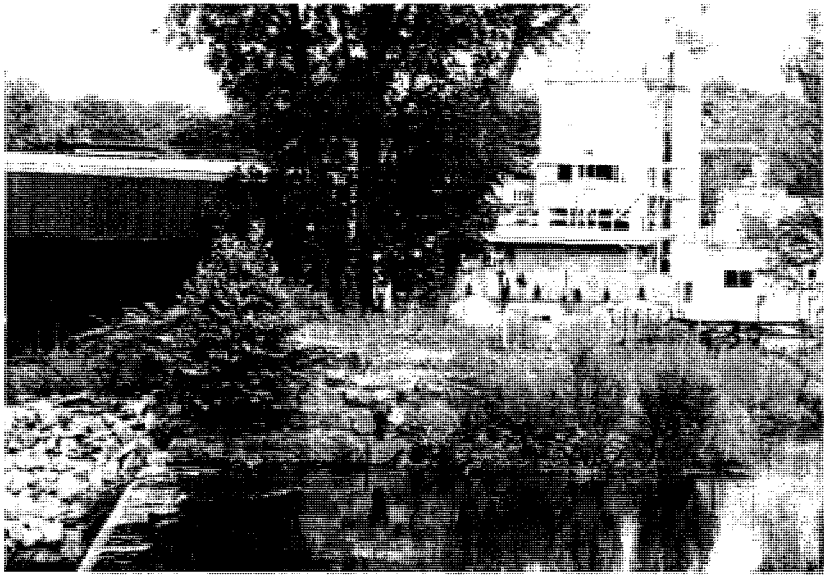
Principle #1 - Control Sources Early.

- Improvements due to source control:
  - Immediate reduction in potential exposure.
  - Long-term reduction for soil/sediment suspension and transport.
- Key questions:
  - Are exposures more limited due to the implementation of these controls?
  - Will the Human Health and Ecological Risk Assessments reflect these improvements?
    - Are the bioaccumulation estimates and biota tissue results based on sampling conducted prior to reconstruction of Allendale Dam and the capping projects?
    - If so, then exposures in Lyman Mill Pond may be overestimated.

Principle #4 - Develop and Refine a Conceptual Site Model that Considers Sediment Stability.

What factual data and assumptions are the basis for the CSM?

- **Upper section of Woonasquatucket River is fairly rural and nondegraded.**
- **South of Smithfield line, the river is developed with a long and varied history of industrial uses for well over a century.**



Principle #4 - Develop and Refine a Conceptual Site Model that Considers Sediment Stability.

- Are data available and have assessments been completed to characterize accurately:
  - Sediment stability?
  - River hydrology?
  - Soil/sediment erosion and deposition?
- Have extreme weather events been incorporated into the CSM?
- Are upstream sources adequately characterized?
  - Possible upstream sources of dioxin and other chemicals have been identified by EPA

Principle #4 - Develop and Refine a Conceptual Site Model that Considers Sediment Stability.

- Is EPA conducting a complete characterization of chemicals other than dioxin and hexachloroxanthene?
- Are CSM assumptions being tested or verified with modeling/empirical data?
  - Hydrology
  - Sediment stability & transport
  - Sediment deposition
- Does CSM address temporal changes as well as interim remedial measures already implemented?

Principle #4 - Develop and Refine a Conceptual Site Model that Considers Sediment Stability.

- CSM used for risk assessment should be consistent with existing uses
  - Ecological risk assessment should focus on locally present and ecologically relevant receptors.
  - Additional conservatism may unrealistically exaggerate risk assessment results for either humans or ecological receptors.
  - Does CSM address temporal changes in exposure analyses?
    - Sequestered sediments and reduced bioavailability
    - Changes in receptor patterns
      - Replaced Allendale Dam
    - Other effects of source control efforts

Principle #5 - Use an Iterative Approach in a Risk-Based Framework.

- **Each iteration is based on additional site data and should refine the CSM.**
- **Need to recognize limitations of empirical and modeled data to focus future data needs. Examples:**
  - **Comparison of biota tissue results to those predicted from food chain model**
  - **Site-specific fish consumption rates**
  - **Incorporation of site-specific bioavailability into the risk assessment**

Principle #5 - Use an Iterative Approach in a Risk-Based Framework.

- Link Principle 8 – *Ensure that Sediment Cleanup Levels are Clearly Tied to Risk Management Goals* – into the iterative risk-based framework
  - EPA Ecological Risk Assessment Guidance encourages the integration of risk management principles into the development and execution of ecological risk assessments.
- Result should be an accurate, quantitative risk assessment model.
  - Risk assessments should be based on data with a high degree of certainty.
    - Reduces unnecessary conservatism with use of accurate exposure data and realistic assumptions

Principle #7 – Select Site-specific, Project-specific, and Sediment-specific Risk Management Approaches that will Achieve Risk-based Goals.

- Given that sections of the site have different characteristics or uses, the remedy may require a variety of cleanup methods (institutional controls, capping, thin layer placement, monitored natural recovery, etc.) to achieve risk-based goals
- In evaluating remedies, more than one future-use scenario should be contemplated. For example, the risk-based goals may best be attained in the Allendale reach by removing the pond condition
  - Restores natural habitat
  - Improves flood storage
  - Allows for fish migratory passage
  - Consistent with Urban Rivers Initiative and Greenway Project

Principle #7 – Select Site-specific, Project-specific, and Sediment-specific Risk Management Approaches that will Achieve Risk-based Goals.

- Large scale dredge and haul options:
  - May not be in line with site risk management goals and future use
  - Potential for sediment suspension and downstream transport
  - Disturbance of aquatic habitat
  - Difficult to implement based on local environs
    - Densely settled urban neighborhoods
    - Narrow roads; transportation would result in significant increase in traffic
- Must consider potential for significant re-contamination from un-addressed upstream sources