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Report on:
Quanta Resources Superfund Site
Technical Summary of Areas of Community Concern with the Remedial Investigation, Feasibility Study and Proposed Plan
November 8, 2010

This document provides communities affected by the Quanta Resources Superfund site in Edgewater, New Jersey with a technical summary of potential issues of community concern related to the Remedial Investigation, Feasibility Study and Proposed Plan. These U.S. Environmental Protection Agency (EPA) documents explain site specific issues, outline cleanup priorities and contain a list of options (Alternatives 1-6b) to proceed with the cleanup.

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This summary is divided into the following sections:

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The summary highlights the following major points:

- The presence of numerous cultural features such as roads and buildings makes the cleanup more complicated and difficult.
- Separating the site into two operable units is standard practice at Superfund sites.
- The combination of remedies in the Proposed Plan will leave contaminants in place that have to be contained and monitored for years in the future.

- Any comprehensive cleanup effort is likely to disrupt local community traffic and other activities near the site.
- In situ stabilization (ISS) has been used for contaminants such as arsenic much more than for the non-aqueous phase liquid (NAPL) at Quanta. There are uncertainties about the performance and permanence of ISS at any site. EPA requires studies to demonstrate the effectiveness of ISS in order to overcome uncertainties.
- The reactive barriers are a fairly new technology that has had mixed results, with little experience in treating the combination of metals and organic chemicals found at Quanta.
- The reactive barrier will require continued maintenance and inspection, including replacement of the mats that make up the barrier.
- Remedial work on land is ideally performed prior to other stages because it can be a potential source of contamination to subsequent stages.
- More institutional controls, like restrictions on building and land use, will be required for all the cleanup methods except excavation.

1. Site Overview

The Quanta Resources Superfund Site, located on River Road at the intersection of Gorge Road, has a long history of industrial use and contamination. Site background information, such as the details about historical property operations, site geology, contamination histories and current site features are included in the Proposed Plan (EPA Quanta Resources Proposed Plan 2010, p 2-9). Specifics about site history, geology, ground water flow and current development complicate remedial efforts.

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- <u>Site history</u>: Widespread tidal marshland filling, using material contaminated with polycyclic aromatic hydrocarbons (PAHs) and metals in the 19th century, introduced widespread contamination on the site. Various industrial operations introduced additional contaminants in more concentrated amounts (EPA Quanta Resources Proposed Plan 2010, p 2-3).
- <u>Geology</u>: The site has bedrock well below the surface of the land with about 80 feet of unconsolidated fill, soil, and silty clay on top of the bedrock. The presence and thickness of geologic layers vary throughout the site, affecting the placement and mobility of contaminants (EPA Quanta Resources Proposed Plan 2010, p 6).
- <u>Ground water flow</u>: Ground water on site is shallow and unconfined. These factors make ground water restoration “technically infeasible” and the treatment of ground water flowing to surface water difficult (EPA Quanta Resources Proposed Plan 2010, p 12).
- <u>Current development</u>: River Road, the road accessing the hotel property to the north, the paved areas around the site and the buildings (115 River Road, CVS Pharmacy, etc.) are all on top of contaminants (EPA Quanta Resources Proposed Plan 2010, p 34). As a result of these “cultural features,” the cleanup has to address one or more of the following options:

    - Removing the structure or feature.
    - Containing the contaminants in place.
    - Removing contaminated media from beneath structures/features with engineering activities.

- Treating contaminants in place without removal with novel methods.

The unique site characteristics of the Quanta site present challenges to effective and long-term cleanup efforts. An understanding of the site features along with the specifics of site contamination must be considered when formulating an appropriate remediation plan.

The contaminants at the site include NAPL and metals. Coal tar NAPL is a mixture made up of various volatile organic compounds (VOCs, such as benzene) and semi-volatile organic compounds (SVOCs, including some oils) where most of the SVOCs are Polynuclear Aromatic Hydrocarbons (PAHs, also the major chemicals in creosote). High concentrations of NAPL are considered “free-phase” because they are concentrated enough to collect, but there are also soils “stained” with NAPL where the NAPL cannot be collected separately from the surrounding material. At the site, most of the NAPL is present in six zones where two zones are close to the surface (NZ-1, NZ-2) and the other four are deeper (NZ-3 through NZ-6). Solid tar can also be found at several places at the site ranging in thickness from 0.3 to 6 feet. Most of the solid tar has been observed in the fill material at the Quanta property and during warmer weather the tar can surface as “tar boils” (EPA Quanta Resources Proposed Plan 2010, p 7).

The ground water at the site is classified as a source of potable water but is not currently used as a drinking water source. Coal tar components are found in the ground water confined to the shallow soil and include benzene, naphthalene and benzo(a)pyrene. Benzene is the most wide-spread of these. Dissolved lead and chlorinated VOCs are also found at the site (EPA Quanta Resources Proposed Plan 2010, p 8).

2. Areas of Community Concern Overview

The Quanta Community Advisory Group of Edgewater (QCAGE) requested TASC assistance to better understand the Remedial Investigation, Feasibility Study and Proposed Plan for the Quanta Site as well as speak to members’ concerns about the site cleanup. QCAGE members communicated their concerns to the TASC Technical Advisor as follows:

1. The reason for the site’s division into two operable units is unclear.
2. Interactions between arsenic and NAPL are a concern
3. The vertical cross-sections of the sub-surface in the Feasibility Study are difficult to understand.
4. Contamination is left on site.
5. Regarding Alternatives 1-3 of the Proposed Plan:
    - Is capping an adequate approach?
    - Institutional controls do not eliminate waste from the site.
6. Regarding Alternative 4a of the Proposed Plan (EPA’s preferred alternative)
    - Does in situ solidification work?
    - Is the subaqueous reactive barrier adequate?
7. Regarding Alternatives 5a-5b of the Proposed Plan:
    - Is in situ chemical oxidation an adequate approach?
8. Regarding Alternative 6a-6b of the Proposed Plan:
    - What are the pros and cons associated with excavation?

3. Area of Community Concern: Operable Units

QCAGE requested an explanation of why the Proposed Plan separates the site into two operable units. Additionally, QCAGE asked why the Proposed Plan treats the two units at different times.

EPA and state agencies often separate contaminated sites into operable units based on some natural and logical features that distinguish the contamination areas. A simple example is where a discrete ground water plume is contaminated with one chemical and there is an area of soil contamination at another location. The Quanta site is subdivided into two Operable Units, OU1 on land and OU2 at the shore and nearby river bottom. The land segment, OU1, is addressed under the current Remedial Investigation, Feasibility Study and Proposed Plan. The water segment, OU2, will be addressed in separate studies. In the case of the Quanta site, EPA decided some years ago to distinguish the land contaminated areas from the river and intertidal areas of contamination.

The upland contamination is the source of contamination in the river and at the shoreline because the ground water and surface water carry contaminants toward the river. The standard practice in cleaning up contamination is to start with the most upriver or higher elevation locations and sources so that later work will not re-contaminate areas that are already cleaned up. If this site were only on land, the plan would largely start at sources in higher elevations. For sites that are only submerged, cleanup begins upriver. When the source of river contamination is in the adjacent land or watershed, the cleanup of land and in-water contamination has to be closely coordinated and timed to avoid re-contaminating clean areas with later work.

The order of cleanup from the sources at higher elevation at Quanta makes sense and is in keeping with practices used at other contaminated sites. The challenge presented at the Quanta Site, related to operable units, is that during the OU2 river cleanup, there will be contamination remaining upland in OU1 after OU1 cleanup is complete.

4. Area of Community Concern: Arsenic and NAPL Interactions

Community members expressed concern over the interactions between arsenic and NAPL present on site. The concern was raised because of present conditions where contamination from both arsenic and NAPL overlap, and because of potential problems created if both contaminants remain on site after cleanup.

No known direct chemical reactions could be found between arsenic and NAPL, and this finding makes sense because NAPL consists of quite different chemicals than arsenic (and other metals). However, the presence of NAPL in ground water and soil does influence what happens to arsenic and how arsenic affects ground water. First, if NAPL coats the soil, then any part of the soil will be affected. Second, the presence of NAPL in ground water can cause more arsenic in ground water than normal. This condition exists on the Quanta Site now in places where very high levels of arsenic were measured in locations with NAPL. Removing the NAPL should improve conditions so arsenic is not found in ground water at such elevated levels.

Unfortunately, there is scientific uncertainty over the exact nature of what will happen as NAPL declines in areas where arsenic is elevated.

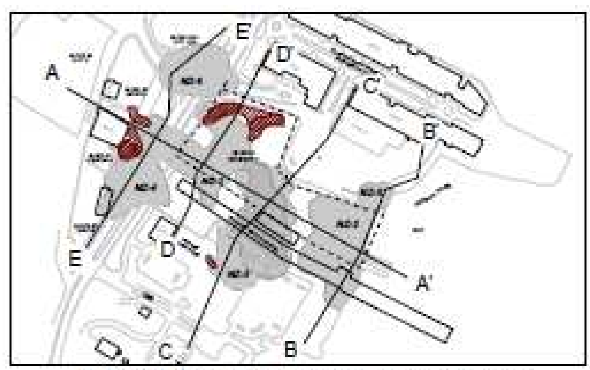
5. Area of Community Concern: Cross-Sections

QCAGE members were concerned that the figures in the Feasibility Study containing cross-sections were not easy to understand. They requested assistance in understanding them.

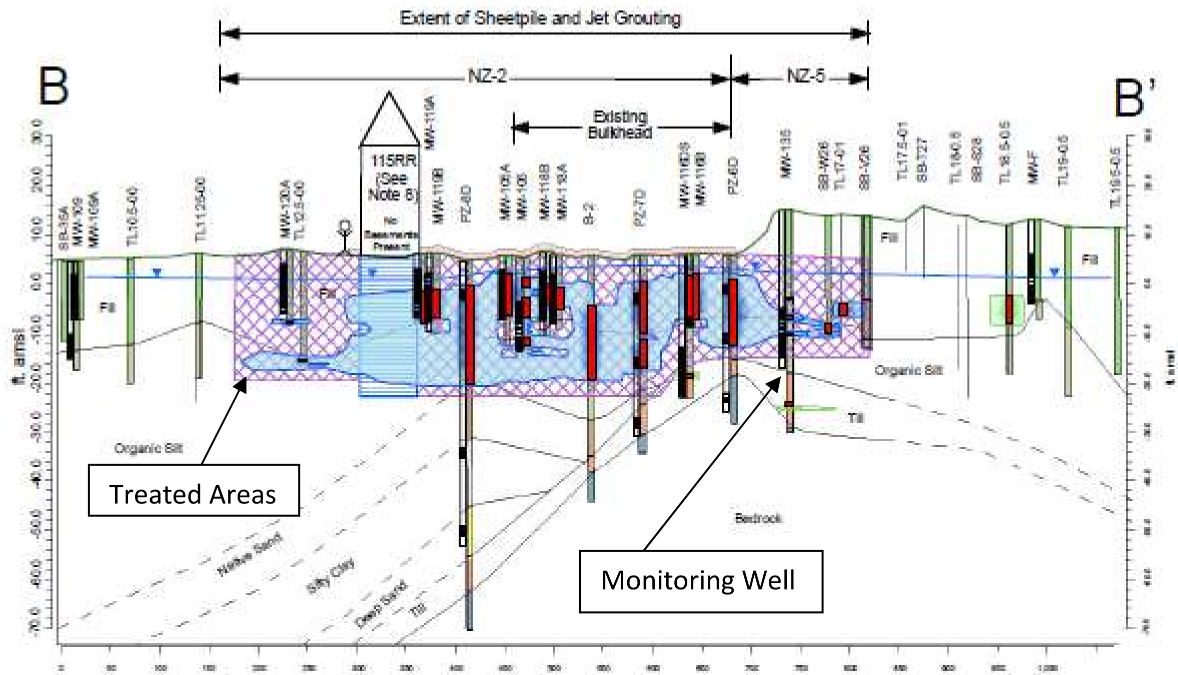
A series of cross-sections included in the Feasibility Study illustrate the nature and extent of contamination, the geology of the site and the extent of each remedial action alternative. An understanding of the site geology is necessary in the understanding of contaminant movement trends within the area.

The cross-sections show the different geologic layers and their thicknesses throughout the site. A thick clay layer acts as a physical boundary to the NAPL moving farther into the ground or sideways toward the river (EPA Feasibility Study 2010, Table 1-4). Natural depressions within the layer are also cited as making NAPL lateral movement difficult (EPA Feasibility Study 2010, Table 1-4).

Data were gathered from several sources to create the cross-sections. Observations from soil borings, monitoring well data, soil screening tests, laboratory test results and TarGOST® technology (www.dakotatechnologies.com) were compiled and used to create the geologic site model, as well as the contaminant nature and extent model.



Plan view of the Quanta Resources Superfund Site



CROSS-SECTION B-B'

The cross-sectional figure above (EPA Feasibility Study 2010, Figure ES-9) shows what the ground beneath the surface looks like when looking at the site from the river, with the down river end on the left (labeled B) and upriver on the right (labeled B'). The sampling and monitoring wells extend top-to-bottom into the ground. The earth that will be cleaned up is shown as shaded areas beneath the surface. Further discussion on cross-section interpretation will be given during the oral presentation on November 4, 2010.

6. Area of Community Concern: Alternatives 1-3

QCAGE requested that Alternatives 1-3 of the Proposed Plan be explained in more detail. In addition, QCAGE members were concerned that institutional controls do not eliminate waste from the site and about whether capping is an adequate approach.

Alternative 1 requires "no action" and would therefore not provide adequate protection of human health and the environment (EPA Quanta Resources Proposed Plan 2010, p 24).

Alternative 2 relies on capping to protect human health by eliminating direct human contact with principal contamination sources. However, a cap's effectiveness is largely dependent on the materials used and its indefinite maintenance and upkeep. Long-term monitoring and upkeep may be technically difficult over a large site. Capping also does not directly address "principal threat" contaminants that present the greatest health risk (EPA Quanta Resources Proposed Plan 2010, p. 24).

The effectiveness of NAPL recovery wells, used along with capping in Alternative 3, may not be adequate because these collection systems may meet their capacity and stop extracting the NAPL even when more NAPL still exists (EPA Quanta Resources Proposed Plan 2010, p 16). Additionally, Alternatives 2 and 3 do little to satisfy the principal threat remedial action objectives (RAOs) which may be better met by treating or removing the contaminants.

7. Area of Community Concern: Alternative 4a

Alternative 4a action steps are detailed in Feasibility Study, Section 4.2.4:

- Principal threat NAPL and arsenic would be treated with in situ solidification/stabilization.
- Portions of low-level threat NAPL would be passively addressed through the use of existing deep wells.
- Low-level threat free-phase NAPL would be recovered where "practicable," through the use of 10 recovery wells placed in areas where NAPL has been located.
- The High Concentration Arsenic Area (HCAA) treatment depends on treatability testing results, but would consist of hydraulic containment or in situ solidification/stabilization (ISS).
- ISS treated soils and any contaminated soil remaining would be contained through the placement of a cap or cover.
- 115 River Road basements would be enhanced and equipped with systems to prevent vapor intrusion.
- Alternative 4a depends on Institutional Controls (IC) to reduce direct human exposure to contaminated soils.
- Indefinite long-term operation and maintenance would be needed to assure the long-term effectiveness of the chosen alternative.
- Ground water alternative G3, passive treatment with a subaqueous reactive barrier (SRB), would address contaminated ground water moving into the Hudson River (OU2).
- Regarding shoreline treatment, a temporary sheet pile barrier wall would be installed vertically, 10 feet below the sediment. This barrier is intended to help control turbidity during ISS treatment and is not intended to supply structural support to the bulkhead (EPA Feasibility Study 2010 Appendix C, p 5).
- Also regarding shoreline treatment, the temporary sheet pile barrier will be removed after the ISS along the shoreline has been completed. ISS at the shoreline will extend all the way to the confining geologic layer, acting as a barrier to contaminated ground water moving from the site to the river (EPA Feasibility Study 2010 Appendix C, p 6).

7.1 In Situ Solidification/Stabilization

ISS involves adding a mix of concrete and stabilizing compounds to contaminated soil to either solidify and/or convert it to a less soluble, less mobile or less toxic form, thereby stabilizing it (Renholds 1998, p 3). Additives may be included in the mixture to improve the ability to bind organics to the solid product (EPA 1990, p 7).

7.1.1 Advantages

- ISS treatment may reduce the handling of contaminants, as the contaminants are left in place during treatment. This reduced handling may decrease the potential for exposure and spills (Renholds 1998, p 4).

- The lack of transport needed to take the contaminated soil away from the site reduces the treatment cost when compared to extraction treatments (Renholds 1998, p 4).

7.1.2 Disadvantages

- In situ treatment is almost always characterized as being less effective than removal methods such as excavation (Renholds 1998, p 4).

- The expansion of treated source material and the treatment activities themselves may cause the contaminant to migrate. Also, different sediment types and geologic layer thicknesses may affect the uniformity of the treatment (Renholds 1998, p 4).

- The "first field demonstration of an in situ stabilization/solidification process" was conducted in the 1980s, reported 21 years ago, leaving uncertainty about how ISS will perform as permanent solution (EPA 1989, p 36).

- ISS treatment targets only principal threat contamination portions of the site, leaving low-level threat and residual contaminants in place and untreated (EPA Feasibility Study 2010, Table 5-3). Areas left untreated are detailed in Section 6.1.3.

- The National Remedy Review Board cited that ISS treatment of high organic content contaminants such as NAPL is limited and so uncertainty about long-term effectiveness remains (EPA NRRB 2010, p 3).

- Natural weathering of ISS masses may damage the internal structure of the cemented mass and possibly lead to contamination of ground water and soil (Stinson and Sawyer 1989).

- Soil expansion may occur after ISS treatment. The Feasibility Study estimated this expansion as 15 percent cement by weight of soil treated (for cost estimating purposes). With this same cement type, the soil volume may increase 25 percent in the most contaminated NAPL areas (EPA Feasibility Study 2010, p 4-22). The soil expansion may create other problems such as affecting ground water flow.

- The aesthetics and appearance of the site may be changed by the ISS treatment and the backfilling. The Proposed Plan estimated that fill material will raise the grade of OU1 two to 10 feet in order to facilitate redevelopment and to place the grade "above the flood hazard area design flood elevation" (EPA Feasibility Study 2010, p 4-2). In addition, the areas treated with ISS will be covered or capped.

- ISS will be accompanied by increased truck traffic in the area (EPA Feasibility Study 2010 Appendix C, p 8). This problem will likely exist for several of the proposed alternatives.

7.1.3 Untreated Areas

- In Alternative 4a, NAPL zones NZ-4, NZ-6, portions of NZ-3 and the portions of NZ-1 underlying River Road and the 115 River Road building would not be treated using ISS treatment.

- A large segment beneath and around River Road would remain untreated until remediation can be coordinated with Bergen County road construction. Remediation efforts would be coordinated with Bergen County and carried out by the Potentially Responsible Parties (EPA Feasibility Study 2010, p 4-5).

- As part of Alternative 4a, the Proposed Plan states that free-phase NAPL underneath the 115 River Road buildings would be left in place. A sheet of steel would be put in place beneath the building as a barrier wall to attempt to keep untreated NAPL from seeping into the Hudson River sediments (OU2) (EPA Quanta Resources Proposed Plan, p 18).

- Alternative 4a does not comply with ground water applicable or relevant and appropriate regulations (ARARs), meaning that NAPL outside the treatment zones would continue to leach into ground water and would persist indefinitely (EPA Feasibility Study 2010, Table 5-3). EPA sought and obtained a waiver of this ARAR because of technical impracticability in cleaning up ground water. In its review of the proposed remedial action plan, the National Remedy Review Board commented that, "Treatment or removal of these wastes [deep NAPL and NAPL located under 115 River Road] may result in a more permanent and reliable remedy over the long term" (EPA NRRB 2010, p 3).

- The Feasibility Study notes that to maintain the structural stability of 115 River Road and the associated utilities, an approximate 30 foot zone around the building must remain untreated, leaving a significant source of contamination in place near the surface contributing to the potential for direct contact exposure (EPA NRRB 2010, p 3). EPA has indicated that ISS will be used as close as possible to the buildings to leave as little contamination as possible.

- Future land development and/or natural events could disturb the NAPL, especially in the deeper soils. These potential future activities or occurrences could contribute to mobilization of untreated NAPL (EPA Feasibility Study 2010, p 4-3). Alternative 4a remedial steps could cause increased mobility of NAPL contaminants.

7.1.4 Ground Water Flow

- A flow model indicates that the ground water will flow beneath or around ISS columns in areas of native sand or peat deposits. One resulting problem is that flooding could occur after local precipitation collects in fill areas that overlay capped soils (EPA Feasibility Study 2010 Appendix D, p 6-1).

- The National Remedy Review Board expressed concern about the possible continued flooding of the basement of 115 River Road. EPA responded that a "zone of separation between the water table and the vapor mitigation system" of the buildings and a ground water monitoring program must be established by the chosen alternative (EPA Quanta Resources Proposed Plan 2010, p 29). This problem will have to be resolved as the detailed work plan is developed.

7.2. Subaqueous Reactive Barrier

The subaqueous reactive barrier (SRB), or the ground water Alternative G3, is a ground water treatment technology. The barrier is a submersible mat consisting of two layers filled with chemicals to treat the contaminants. As contaminated ground water passes through the mat, contaminants are chemically treated before reaching the surface water (EPA Quanta Resources Proposed Plan 2010, p 14). The materials that make up the core of the mat are selected on the basis of what contaminants are being treated in the water (EPA Quanta Resources Proposed Plan 2010, p 14).

7.2.1 Process Overview

- The installation process would begin with either compaction or removal of sediment, over which the SRB mat would be placed. A sand and gravel layer would cover the mat, and an additional layer of rocks would be placed over the mat.
- Construction would require a temporary cofferdam during sediment removal or compaction (EPA Feasibility Study 2010 p 4-25). The mat has to be inspected and monitored over the long-term, and mat replacement will be necessary. The Plan assumes 30 percent of the mat will be replaced every 10 years (EPA Feasibility Study 2010, p 4-25).

7.2.2 Past Implementations

Permeable reactive barriers (PRBs) have been used to reduce concentrations of ground water contaminants at more than 50 sites in North America and Europe (Savoie et al. 2004). PRBs have been installed to remove a variety of ground water contaminants including VOCs, hexavalent chromium (Cr(VI)), nitrate, uranium and other inorganic contaminants (Savoie et al., 2004). However, there are a few studies that show inconsistencies in the ability to effectively filter contaminants such as arsenic and NAPLs:

- The Monkstown permeable reactive barrier, Europe's oldest commercially-installed PRB, had been treating trichloroethene (TCE) contaminated ground water for about 10 years (1996-2006) on the Nortel Network site in Northern Ireland when cementation, corrosion and mineral precipitation were found on the PRB. There was a large fluctuation in TCE concentrations down gradient of the PRB, showing that the barrier was not always effective (Philips et al., 2010).

- The Massachusetts Military Reservation in Cape Cod, Massachusetts installed a PRB to filter TCE out of the ground water, but there was an issue with the membrane becoming clogged. During the first two months after placement, it was concluded that the ground water was flowing around the wall. Even after the membrane was treated and became unclogged, down gradient TCE levels did not significantly decrease. In several samples arsenic increased down gradient (Savoie et al., 2004).

- It is unclear how reliable PRBs are in removing contaminants such as arsenic and NAPLs, and the combination. There needs to be a full understanding of the ground water flow as well as strategies to prevent problems with clogging. Li et al. (2005) evaluated five strategies to limit the impact of fouling of PRBs. None of the methods tested eliminated clogging or prevented reduced ground water flow during the 30-year service life of the PRB.

7.2.3 Disadvantages

- SRBs are a relatively new technology, as the National Remedy Review Board notes, “with limited data on long-term performance.” Because of the uncertainty about long-term effectiveness, comprehensive testing will be conducted, but testing alone will not be able to yield completely conclusive results on the technology as a long-term solution.

- The Feasibility Study acknowledged that “barrier treatment may be reversible if adsorption sites are completely used up” (EPA Feasibility Study 2010, p 4-24). Only through indefinite monitoring and maintenance efforts could the SRB adequately perform. The National Remedy Review Board also comments that, “NAPL/organic contaminants or biological media” may clog the reactive barrier, reducing the technology’s effectiveness.

8. Area of Community Concern: Alternatives 5a and 5b

With regards to Alternatives 5a and 5b, QCAGE requested more information about in situ chemical oxidation (ISCO). Alternatives 5a and 5b utilize ISCO in the following ways:

- Principal threat NAPL would be treated by means of shallow excavation (zero to four feet deep) and by ISCO.
- Under Alternative 5a, the 115 River Road basements would have to have vapor intrusion mitigation systems installed.
- Under Alternative 5b, the 115 River Road building would be demolished and the area beneath treated through the ISCO process.
- ISCO and ISS treated and residual soils would be contained through the placement of a cap or cover.
- Institutional controls would be used to reduce direct human exposure to contamination.

<u>8.1 In Situ Chemical Oxidation (ISCO)</u>

ISCO is the use of chemicals to turn organic contaminants into carbon dioxide and water. The injection process would occur through wells or boreholes at the site (EPA Feasibility Study 2010, p 4-29).

Disadvantages

The Feasibility Study describes the following issues with ISCO injection that may require more monitoring during and after its use.

- Before ISCO occurs, debris and vegetation must be removed from the areas to a depth of four feet. Any debris present could interfere with the injection of chemical oxidants (EPA Feasibility Study 2010, p 4-29).

- Site specific tests were performed on two different chemical oxidants. The test results showed that some contaminants were effectively oxidized but others had much lower effectiveness. Due to these variations in lab test site applications, ISCO is unlikely to succeed with such large differences across the site (EPA Feasibility Study 2010, p 4-30).

- An increase in a chemical's ability to turn into a gas may cause an increased risk of vapor intrusion.

- Dissolved arsenic concentrations actually increased in some soil samples after ISCO treatment.

- There is a possibility of currently immobile, residual NAPLs becoming mobilized due to the injection. The management of this risk might be larger and require booms and barrier walls.

- Relocation of the occupants near the buildings where ISCO is used may not be necessary because of chemical vapor concerns. But these buildings may be at risk for structural destabilization due to the ISCO injection.

- Additionally, under Alternative 5a, portions of principal threat NAPL contaminated areas would be left untreated. The area under the 115 River Road would not be treated using ISCO (EPA Feasibility Study 2010, p 4-31).

9. Area of Community Concern: Alternatives 6a and 6b

Regarding Alternatives 6a and 6b, QCAGE requested information on the advantages and disadvantages of excavation.

Alternatives 6a and 6b include excavation and off-site disposal (EPA Feasibility Study 2010, p 4-33). Under Alternative 6b, the 115 River Road building would be demolished and the area below would be excavated. The excavated area would be "backfilled and compacted with certified clean fill material" (EPA Feasibility Study 2010, p 4-34). Following demolition, the

NAPL zones underneath the 115 River Road buildings would be accessible for excavation, disposal and backfilling similar to the rest of the site (EPA Feasibility Study 2010, p 4-35).

9.1 Advantages

- Based on the alternatives presented in the FS, the most reliable and permanent method for contamination remediation is excavation (Alternative 6b).

9.2 Disadvantages

- Alternative 6a requires capping of remaining soils not treated through excavation. This plan leaves untreated soil and requires institutional controls.

- Under the 6a alternative, the 115 River Road basements will have vapor intrusion monitors installed instead of having the buildings demolished. Institutional controls will have to be relied upon to reduce exposure to contamination.

- Ground water alternative G3, which requires a subaqueous reactive barrier, will be relied upon to address contaminated ground water moving into the Hudson River (OU2) (EPA Feasibility Study 2010, p 4-35). As stated earlier, SRBs require institutional controls.

- A concern during excavation is air quality. The Feasibility Study notes that air monitoring would be important during excavation. Dust and odor suppressants and minimizing the open working area of the excavation will have to be used to prevent adverse effects on workers and the community.

- Alternative 6b would include the relocation of the 115 River Road tenants prior to the start of construction activities.

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