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**COMMENTS ON THE PROPOSED PLAN AND PREFERRED ALTERNATIVE
FOR THE PUCHACK WELL FIELD SUPERFUND SITE**

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and South Jersey Legal Services, Inc.**

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The following comments on the Proposed Remedy for Operable Unit 1 of the Puchack Well Field Superfund Site were written by Henry S. Cole, Ph.D. at the request of South Jersey Legal Services, Inc. (SJLS) and South Jersey Environmental Justice Alliance (SJEJA). In preparing these comments I reviewed the following documents:

- Proposed Plan, Puchack Well Field Superfund Site, July 2006.
- Final Operable Unit 1 Remedial Investigation Report Puchack Well Field Superfund Site Remedial Investigation/ Feasibility Study. Pennsauken Township, New Jersey, June 22, 2005.
- Final Human Health Risk Assessment, Puchack Well Field Site OU1, Remedial Investigation/ Focused Feasibility Study, Pennsauken, New Jersey, March 23, 2003.
- Final Human Health Risk Assessment Puchack Well Field Site OU1, Remedial Investigation/ Focused Feasibility Study Pennsauken, New Jersey, March 2003.
- Draft Groundwater Feasibility Study Report Puchack Well Field Site OU1

I am grateful to Jon Gorin, U.S. EPA (Region 2) Project Manager for the Puchack Well Field Site for providing these documents and further information on a short time frame.

1.0 Failure to address VOCs and Cancer Risks

The Proposed Plan (p. 4) includes the following remedial action objective:

- *Prevent or minimize potential current and future human exposures including groundwater ingestion and dermal contact with groundwater that presents a significant risk to public health and the environment.*
- *Minimize the potential for migration of chromium contaminated groundwater plume.*
- *Restore the chromium contaminated groundwater to drinking water standards within a reasonable timeframe.*

Clearly, these Remedial Action Objectives are critical to reduce the risks and potential drinking water supply problems associated with hexavalent chromium. However, the remedial action objectives fail to include protection against the risks associated with ingestion and inhalation of volatile organic compounds (VOCs) associated with contaminated groundwater in and near the Puchack Well Field. Failure to include VOC objectives represents a major deficiency in the Proposed Plan since the Remedial Investigation (RI), the Human Health Risk Assessment (HHRA) and the Feasibility Study (FS) for the site all acknowledge that **the total cancer estimated cancer risks are driven by VOCs rather than chromium.** Note the following quote from p. 6-2 of the HHRA describing the “Reasonable Maximum Exposure” cancer risk assessments:

“Total excess lifetime cancer risks from residential use of Middle Aquifer groundwater as drinking water were above the range of 10^{-6} to 10^{-4} due to the presence of VOCs. The total excess lifetime cancer risk for adult residents is 4.7×10^{-3} , primarily from inhalation of volatile chemicals from groundwater while showering (4.5×10^{-3}) and from water ingestion (1.7×10^{-4}). As shown in Table 9.1a, four VOCs accounted for 99% of the total inhalation cancer risks for adult residents: TCE (4.3×10^{-3}), benzene (1.0×10^{-4}), PCE (5.7×10^{-5}), and 1,1-DCE (5.6×10^{-5}). The same four VOCs accounted for over 99% of the total ingestion cancer risks for adult residents: PCE (5.7×10^{-5}), benzene (4.3×10^{-5}), 1,1-DCE (3.8×10^{-5}), and TCE (2.9×10^{-5}).

Child resident cancer risks are higher than the adult cancer risks. For child residents, risks from inhalation exposures are about 160 times higher than risks from groundwater ingestion and 1600 times higher than risks from dermal contact. The total excess lifetime cancer risk for child residents is 1.6×10^{-2} , primarily from inhalation of TCE from groundwater while bathing (1.5×10^{-2}). As shown in Table 9.2a, other chemicals that contribute to the inhalation risks for child residents include benzene (3.7×10^{-4}), PCE (2.1×10^{-4}), and 1,1-DCE (2.0×10^{-4}). Four VOCs accounted for over 99% of the total ingestion cancer risks: PCE (3.3×10^{-5}), benzene (2.5×10^{-5}), 1,1-DCE (2.2×10^{-5}), and TCE (1.7×10^{-5}).”

Even the less conservative “Central Tendency” cancer risk estimates are significantly higher than EPA’s acceptable risk range.

“The total excess lifetime CT cancer risk for adult residents was 4.1×10^{-4} , and for child residents was 2.2×10^{-3} , primarily from inhalation of volatile chemicals from groundwater while showering or bathing water and from water ingestion. The total cancer risks for residents when the adult and child risks are combined (i.e., ages 0-30 years) under the CT exposure scenario is 2.6×10^{-3} , above the EPA threshold range of 10^{-6} to 10^{-4} .” (HHRA, p. 6-6).

The Proposed Plan’s preferred remedy (Alternative 3c) is also fails to meet those ARARs (Applicable or Relevant and Appropriate Requirements) associated with the drinking water standards (MCLs) for volatile organic compounds including TCE, PCE, and benzene. Furthermore, with regard to its failure to address VOCs, the preferred fails to meet the community acceptance criteria. (E.g., See comments from South Jersey Environmental Justice Alliance and the New Jersey Environmental Federation regarding VOCs).

Finally, neither the Proposed Plan nor the Human Health Risk Assessment fail to evaluate an additional pathway of exposure – that associated with the potential inhalation of VOCs in indoor air resulting from vapor intrusion into buildings from soil and groundwater into buildings. Please note:

- Consideration of this exposure pathway and associated risks is an established part of risk assessment where there are VOCs in soil and/or groundwater. EPA documents contain abundant guidance on estimation of risks associated with vapor intrusion.
- Vapor intrusion may result in a completed pathway at present and does not depend on current or future use of contaminated drinking water.
- This pathway is most likely to present a problem where (a) Volatile carcinogens are elevated (b) where homes and buildings are located in and adjacent to the site and probable sites for future buildings (c) where the contamination is relatively shallow and/or (d) where soils are relatively permeable.
- In estimating the cumulative/additive risks associated with volatile carcinogens, EPA should add the inhalation risks associated with vapor intrusion to those associated with inhalation of VOCs originating from drinking water. Adding inhalation risks is likely to show even higher exceedances of EPA’s acceptable cancer risks and non-cancer hazard index.
- EPA should conduct an analysis to determine areas most vulnerable to vapor intrusion and develop an Addendum to the Proposed Plan that includes: (a) a soil vapor survey to better delineate the distribution of VOCs (b) an estimate cancer risk associated with vapor intrusion and an estimate of total cancer risk associated with all potential

pathways of exposure including vapor intrusion and drinking water (c) a evaluation of the remedial technologies / alternatives necessary to reduce risks associated with soil vapor and (d) selection of remedy.

- The soil vapor survey is necessary to ensure that significant hot spots are determined. Moreover, soil vapor surveys can be accomplished quickly and cost-effectively using real time analytical methods (e.g. Membrane Interface Probes [MIPs], Field GC and automated optimization methods [Triad Approach has been used in NJ]).

EPA gives several rationales for not addressing VOCs in groundwater as part of the Operable Unit 1 Groundwater Cleanup.

“There is a wide variety of VOCs found commingled with the Site’s chromium contaminated groundwater. The VOC contamination also extends well beyond the boundaries of the chromium plume. These (VOC) sources are being addressed individually under State authority and are not addressed as part of this Superfund action.” (Proposed Plan, p.3)

“The groundwater at the Puchack Site is also contaminated with VOCs. The RI results show that VOC contamination is scattered in and around the Puchack Site; VOC contamination is therefore a regional problem rather than specific to the Puchack Site. Municipal wells in the area have existing treatment facilities to remove VOCs from the extracted groundwater. In the PE report, remedial options for treatment of VOC contamination have also been evaluated, in addition to the treatment for chromium contamination. The evaluation results indicate that an additional large quantity of groundwater would need to be pumped in order to capture the VOC plumes. It therefore increases substantially the technical complexity and cost to the remedy. Given the above, this FS will only consider treatment of extracted VOCs together with the chromium. VOC contamination will not be targeted for in situ treatment nor specifically extracted for treatment.” (Draft Groundwater Feasibility Study, p. 2-2)

None of the reasons cited are individually or collectively sufficient to exclude the consideration of VOCs which account for nearly all of the estimated cancer risks associated with the site:

- The fact that the VOC plume appears to have more sources and extends beyond the chromium plume is not a valid excuse for excluding VOCs from the remedial process. The site is a well field with multiple sources, contaminants and risks.
- The Proposed Plan neglects to describe and evaluate in situ technologies that could be used to address groundwater that is contaminated both with chlorinated VOCs and hexavalent chromium. Consider for example, EPA’s case study entitled, An In Situ Permeable Reactive Barrier for the Treatment of

Hexavalent Chromium and Trichloroethylene in Ground Water (Environmental Protection Agency, EPA/600/R-99/095a September 1999). Either the Permeable Reactive Barrier approach or an in situ geochemical approach using a similar chemical mechanism could be considered.¹ Why not include in the Record of Decision (ROD) bench scale and/or pilot tests on in-situ technologies that attempt to simultaneously reduce hexavalent chromium and VOCs?

- The Proposed Plan doesn't identify or evaluate technologies that would be effective in preventing vapor intrusion. There are many approaches that can be considered especially for treating hot spots. These include soil vapor extraction (for VOCs in zone of aeration) and two-phase vacuum extraction (removes VOC in vapor, aqueous and product phases).
- Statements that local public water treatment can remove VOCs with well-head technologies (e.g. using air strippers, etc.) are problematic. The Preferred Alternative as currently written (a) provides no assurance that local jurisdictions will actually install the technology and (b) places an unfair burden on the local jurisdictions that operate the well fields and (c) doesn't address the vapor intrusion / indoor air issue. In essence the Proposed Plan represents a de facto "No-Action" alternative for VOCs. The proposed remedy is flawed in that the costs and risks to the public associated with this alternative have not been evaluated or included in the decision-making.
- That (VOC) sources are being addressed individually under State authority and are not addressed as part of this Superfund action provides neither specificity nor assurance to the public. If the NJ DEP has specific measures that would address the VOC problem they should be described in the Preferred Alternative and Record of Decision as a formal part of the remedial plan. What is needed is a holistic, well-integrated cleanup plan that effectively marshals state and federal resources to protect public health and critical groundwater resources.

2.0 Chromium-related Issues. As stated in Section 3.0, EPA should attempt to limit both total chromium and hexavalent chromium. This is necessary to prevent the migration of chromium to operating well fields, which may increase their pumping rates in the future to satisfy growing demand. However, as EPA acknowledges there are a number of hydrological and geochemical uncertainties associated with in-situ technologies. For example:

- It is not certain that such technologies will actually be capable of delivering chemical reducing agents to all areas of contamination.

¹ The reactive medium was composed entirely of granular iron, with an average grain size of 0.4 mm. The reactive medium was selected from various mixtures on the basis of reaction rates with Cr(VI), TCE and degradation products.

http://www.epa.gov/ada/download/reports/prbdesign_v1.pdf#search=%22in%20situ%20treatment%20of%20chromium%20VOCs%22

- Despite a cleanup standard of 70 ug/L for total chromium, the in-situ chemical reduction approach is not specifically designed to remove total chromium. There is no assurance that some portion of chromium (VI) converted to chromium (III) will not revert to chromium (VI). Similarly, not all chromium (III) is necessarily immobilized (e.g. adsorbed and removed from solution); this process is also reversible under certain conditions.

Moreover, There is considerable uncertainty regarding the protectiveness of the 70 ug/L cleanup standard. Reconsideration of all standards and decisions regarding chromium is necessary given recent evidence that industry consultants manipulated evidence and in doing so may have weakened a number of chromium-related regulatory decisions, i.e.:

- A Washington Post article (February 24, 2006) describes a George Washington University / Public Citizen journal article documenting that scientists working for the chromium industry failed to report inhalation studies showing fivefold increase in lung cancer deaths from moderate exposures to chromium. The Post article states that, "Company-sponsored scientists later reworked the data in a way that made the risk disappear." The apparent twisting of the science occurred at the same time that the chromium industry lobbied to block strict new OSHA limits for hexavalent chromium in workplace air.
- The *Journal of Occupational and Environmental Medicine* recently took the highly unusual step of retracting a 1997 article stating that the "financial and intellectual input to the paper by outside parties was not disclosed." The outside parties refer to consultants for PG&E who, according to investigative reports by the Wall Street Journal and the Environmental Working Group, manipulated data in the article in order to obscure a link between exposure to contaminated well water and cancer death rate found by a Chinese scientist.

We are aware that state agencies such as New Jersey and California are now re-examining regulatory decisions based on data provided by various chromium interests. The public must be reassured that chromium cleanup standards are protective. Moreover, reevaluation of the chromium cleanup standard should include consideration of recent evidence that ingestion of chromium-contaminated drinking water may be associated with certain forms of cancer.²

For these reasons, I would strongly recommend a buffer (compliance) zone that uses significant exceedance of background chromium concentration (on the order of 10 ug/L)

² Costa M; Klein CB, "Toxicity and carcinogenicity of chromium compounds in humans" [Critical reviews in toxicology](#), 2006 Feb;36(2):155-63. **Abstract:** Chromium is a human carcinogen primarily by inhalation exposure in occupational settings. Although lung cancer has been established as a consequence of hexavalent chromium exposure in smokers and nonsmokers, some cancers of other tissues of the gastrointestinal and central nervous systems have also been noted. Except for a few reports from China, little is known about the health risks of environmental exposures to chromium. Likewise, there has been a lack of epidemiological studies of human exposure to hexavalent Cr by drinking water or ingestion, and it has been suggested that humans can perhaps tolerate hexavalent Cr at higher levels than the current drinking water standard of 50 ppb. This review highlights the most recent data on the induction of skin tumors in mice by chronic drinking-water exposure to hexavalent chromium in combination with solar ultraviolet light. This experimental system represents an important new animal model for chromate-induced cancers by ingestion of drinking water, and it suggests by extrapolation that chromate can likely be considered a human carcinogen by ingestion as well.

as a trigger to take further measures to protect active well fields in the area. (See recommendations for additional points).

3.0 Community Involvement. I would strongly support SJLS calls for an extension of the comment period. The extension should be of sufficient length to allow SJEJA to obtain its TAG advisor. This would provide an opportunity for a more detailed technical review and to facilitate communication between the community organizations, the TAG advisor and officials from EPA and NJ DEP prior to the issuance of the Record of Decision. In my judgment, based on several decades in working with the public on cleanup issues, I believe that there is a definite need to build a more trusting relationship with the community. Providing an extended comment period and creating a more in depth technical dialogue will help to increase the level of trust.

4.0 Conclusions and Recommendations:

In order to address the concerns and problems described above, I would recommend the following revisions in the Remedial Action Objectives:

- 1. Permanently close and decommission the Puchack Well Field in order to ensure that the public is not exposed to VOCs and chromium in their drinking water.** EPA should restrict future use of the site so as to not allow reuse of the well field as a drinking water source. According to the South Jersey Legal Services Inc., the community including the South Jersey Environmental Justice Alliance is strongly opposed to reopening the Puchack Wellfield as a public water source. Similarly, the NJ Environmental Federation has urged that the former Puchack supply wells be permanently closed and decommissioned. I agree with these positions given the past history of the site, the contamination found in the area, and the uncertainties and potential time associated with remediation.
- 2. Place Operable Unit 2 [control of sources] on a fast track. Take timely and effective measures to reduce the levels of both VOC and chromium contamination in source regions in order to prevent the continued release and migration of contaminants. potential exposures.**
- 3. Fully delineate the distribution of VOCs in the Puchack Field Site and its environs. Evaluate and select remedial options that address VOC contamination at the site as well as chromium. Identify areas with the potential for vapor intrusion of VOCs and take effective and timely measures to prevent exposure to indoor air resulting from vapor intrusion.** (See previous discussion).
- 4. To the maximum extent feasible, undertake remedial actions designed to reduce the concentrations of all contaminants in Puchack Well Field groundwater including chromium as well as VOCs.** (See previous discussion).
- 5. Reconsider the quantitative remedial goal for chromium-contaminated groundwater for the Puchak Site as follows: (a) numerical cleanup standards**

should be set for both total chromium and hexavalent chromium. The standards should be based on a scientifically valid review of scientific data. The total chromium standard should be reduced substantially below the current 70 ug/L in order to incorporate an adequate margin of safety. Please note that both California and the World Health Organization uses 50 ug/L total chromium as for drinking water standard.³

- 6. Establish a compliance zone around the Puchack Well field site. The compliance levels for groundwater should be set as background concentrations for chromium and risk levels of 10^{-6} and QI of 1 (for cancer and non-cancer risks respectively).**
- 7. Take necessary, timely and effective measures to protect (a) currently operating well fields in the area and (b) portions of aquifers that are clean and potentially usable for water supply in the future. Significant exceedances of compliance zone standards will trigger additional efforts to reduce the potential for migration (including source reduction measures, hydraulic barriers and additional treatment measures).**
- 8. The Record of Decision should include a coordinated plan for cooperation between NJ DEP and Region 2 EPA. This plan should detail efforts aimed to address all source areas and contaminants including VOCs.**
- 9. Extend the comment period and facilitate technical dialogue prior to the issuance of a Record of Decision.**

³ California Department of Health Services, Chromium 6 in Drinking Water, Background Information, Dec. 2004. <http://www.dhs.ca.gov/ps/ddwem/chemicals/chromium6/Cr+6backgroundinfo.htm>