VILLAGE OF HASTINGS-ON-HUDSON
Municipal Building
7 Maple Avenue
Hastings-on-Hudson, New York 10706
(914) 478-3400
Fax: (914) 478-4624
hastings@hastingsgov.org http://hastingsgov.org

March 3, 2006

George Heitzman, P.E.
Senior Environmental Engineer
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Re: Tappan Terminal PRAP

Dear Mr. Heitzman:

The Board of Trustees ("Board") of the Village of Hastings-on-Hudson ("Village") has carefully reviewed the Proposed Remedial Action Plan ("PRAP") for the Tappan Terminal site in the Village issued by the Department of Environmental Conservation (the "Department") in December 2005. The Board has retained Sive, Paget & Riesel, P.C. ("SPR") and Malcolm Pirnie, Inc. ("MPI") as special environmental counsel and environmental consultants, respectively, to review the PRAP and related documents and to advise it with regard to the proposed remediation. The Board submits these comments on the PRAP reflecting that review and consultation. We believe these comments will assist the Department in formulating the appropriate Record of Decision ("ROD") for the Site. The technical comments in this letter are based upon MPI's evaluation; the legal opinions were prepared with the assistance of SPR.[1]

Summary of Comments

The Tappan Terminal site (the "Tappan Terminal Site" or the "Site") consists of approximately 15 acres on the shoreline of the Hudson River. The Site is due south and adjacent to the Harbor at Hastings site (the former Anaconda property), which was the subject of a Record of Decision issued by the Department in March 2004.[2] Like the Anaconda site, the Tappan Terminal Site is zoned to allow residential and open space use. Also like the Anaconda site, it

[1] The Board wishes to acknowledge that civic organizations and members of the public have or will be submitting comments on the PRAP to the Department. In particular, the Board urges the Department to give very serious consideration to the comments submitted by Hastings Waterfront Watch, as the Board agrees with many of the comments submitted by that organization.

[2] A Proposed Remedial Action Plan was issued for those off-site portions of the Anaconda site (OU-2) to address contamination in the sediments and ecosystem of the Hudson River in October 2003.

was the subject of a conceptual plan prepared by the Regional Planning Association in conjunction with Village representatives and the public, which also provides for such uses Finally, and again like the Anaconda site, the Tappan Terminal Site is within the Village's draft Local Waterfront Revitalization Plan ("LWRP"). Simply put, the Tappan Terminal Site is of critical importance to the Village, and it is imperative that the remediation of the Site allows its redevelopment for residential and open space-recreation uses as soon as practicable, and certainly within a reasonable time frame.

The waterfront is the Village's gateway to the Hudson River. As Governor Pataki said when he visited the Hastings-on-Hudson waterfront in August 1998: "This absolutely gorgeous piece of land on the shores of the Hudson River will be useable again by the people of Westchester and the people of the State and will no longer pose a threat to the safety of the Hudson River."

As the Department is aware, the Record of Decision for the Anaconda site was consistent with the remedial plan negotiated with the Atlantic Richfield Company ("ARCO") (the then-owner of that site and successor to Anaconda Wire and Cable Company, the former operator of the site) by the Village and the Hudson Riverkeeper. Given the Site's proximity to the Anaconda property, the Board expected that the remediation proposed for the Tappan Terminal Site would constitute a comparably comprehensive program. Unfortunately, the PRAP, in our view, falls short of meeting the high standards set by the Department for the Anaconda site.

Although the Board supports the use of air sparging/soil vapor extraction ("AS/SVE") as a general approach with respect to the chlorobenzene contamination on the Tappan Terminal Site, we reluctantly conclude that the overall proposed remediation does not adequately take into account the anticipated uses of the Site, the need for a reasonably expeditious remediation, the applicable hierarchy of remedies articulated in governing regulations (6 NYCRR § 375-1.10(c)(5)), and the current conditions of the Site. In particular, the remedy articulated in the PRAP does not assure that the Site would be delisted and placed back into productive use by the public as soon as practicable and within a reasonable time. As discussed below, we believe that there are alternatives that have not been fully considered that would achieve the appropriate remedial goals and meaningfully accelerate the completion of remediation while also being cost-effective.

The principal inadequacies of the PRAP include the following:

- The PRAP does not clearly recognize and consider, in formulating the proposed remediation, that the reasonably anticipated use of the entire Site includes residential and open space-recreational uses. The Feasibility Study ("FS") for the Site assumed the continuation of the Uhlich Color Company operations. Although the PRAP notes that these operations were discontinued and that the buildings have been demolished, it is unclear whether the PRAP contemplates, as it must, residential and open space-recreational uses over the entire Site.

- The PRAP relies on sampling that was conducted prior to the demolition of the buildings on the Uhlich Color Company portion of the Site, and did not include borings in the locations of buildings. The sampling did not provide an appropriate delineation of the

principal contaminants, most particularly the extent of chlorobenzene contamination of both soil and groundwater. While the PRAP acknowledges the presence of underground bulkheading and other obstructions associated with historic expansion of the shoreline in to the Hudson River, which could significant affect the effectiveness of and the time to implement the proposed AS/SVE system for chlorobenzene remediation, there does not appear to have been any specific identification or delineation of such structures. In addition, there was no sampling for chlorobenzene at depth. Without such sampling, the efficacy of the proposed remedy cannot be determined. As discussed further below, these and other gaps in data should be addressed as part of the ROD, such as not to delay issuance of that document.

- The proposed remedy is a combination of Alternatives S6 and G2, which is the removal of approximately 100 cubic yards of soil that is grossly contaminated with dye-related compounds and weathered petroleum and the installation of an AS/SVE system to remediate chlorobenzene (and other volatile organic compounds) in soil and groundwater. The Board has the following concerns about the key elements of this proposal:

    - It is unclear whether the grossly contaminated soil is present only above the groundwater table and, if not, whether the proposed removal will also extend below the groundwater table. Excavation should not be limited to above the water table for such grossly contaminated soil absent compelling reasons. No such justification is contained in the FS or PRAP.

    - As did the ROD for the Anaconda site, the ROD for this Site should make clear that all excavated soils and others materials would be transported from the Site for disposal by rail or barge.

    - The PRAP does not establish criteria for determining when the AS/SVE remediation is complete. The Board assumes that the criteria are the applicable recommended soil cleanup objectives ("RSCOs") in Technical Administrative Guidance Memorandum ("TAGM") # 4046 and the applicable ambient groundwater standards; that should be confirmed in the ROD.

    - The Board has reservations about the complete reliance upon the AS/SVE remedy for chlorobenzene contamination of the soil and groundwater given the apparent failure to consider the implications of subsurface obstructions and structures that could significantly hinder the effectiveness of the SVE component of the remedy. Thus, as discussed below, the ROD should include provision for the excavation and removal from the Site of soil and subsurface structures that could impede the efficacy of the AS/SVE system or that, if not within the effective areas of this system, could contain chlorobenzene or other chemical residuals.

- The PRAP does not sufficiently address the potential for vapor intrusion in buildings constructed on the Site, and the potential for such intrusion after the completion of the AS/SVE remediation. This remedy, if possible, should avoid the need for further

remedial measures or engineering or institutional controls to prevent vapor intrusion into buildings. If that is not possible, other measures to address vapor intrusion through engineering and/or institutional controls should be identified.

- The PRAP does not consider the need for the overall remedy to be reasonably expeditious, and does not weigh the benefits of an expedited remediation versus any detriments thereof. In particular, the PRAP does not consider expediting the operation of the AS/SVE system through additional well points, which would significantly reduce the anticipated five-year time frame for this element of the proposed remediation. Nor does it consider the benefits of the removal of chlorobenzene-contaminated soil to minimize the need for SVE and expedite the overall remediation.

- As noted above, the remedy does not propose excavation and removal of any chlorobenzene-contaminated soil. However, Alternative S5 provides for the removal of about 7,000 cubic yards of chlorobenzene-contaminated soil to the groundwater table. The justifications advanced for not selecting this remedy are that the chlorobenzene would be remediated by the AS/SVE system and that this remedial approach would have a high degree of short-term impact. These justifications are unpersuasive. As discussed, there is concern over the effectiveness of the AS/SVE, given the presence of underground obstructions and structures. And there is no reason (and none is advanced) why the excavation and removal of 7,000 cubic yards of soil would present serious short-term impacts. On the other hand, removal of this contaminated soil would accelerate the time period in which the AS/SVE remediation would be completed. Certainly, there should be consideration of some removal of chlorobenzene-contaminated soil – especially in locations where AS/SVE may not be effective – to reduce the need for SVE and thus the overall time for completion of the remedial program.

- The same standards applied to Operable Unit 1 of the neighboring Anaconda site with regard to hot spot remediation of soil contaminated by other pollutants (e.g., metals and semi-volatile organic compounds) should be applicable to the Tappan Terminal Site.

- The Remedial Investigation/Feasibility Study ("RI/FS") does not appropriately address the Tentatively Identified Compounds ("TICs"). There was no consideration of such chemicals in the Health Risk Assessment ("HRA"), and thus no consideration of whether the presence of these chemicals in the soil requires remediation beyond the proposed two-foot soil cover to protect human health, or whether the proposed AS/SVE system would address these substances in groundwater.

- The cover system of two feet of clean fill should be modified to be consistent with the remedy to be implemented at the adjacent Anaconda site, particularly in light of the failure to consider the exposure risks of the TICs, and the need for the cover to accommodate appropriate plantings.

- The existing asphalt on the Site should not be used as a demarcation barrier, as it would prevent the planting of appropriate vegetation, present serious issues of stormwater management, and result in high concentrations of carcinogenic polycyclic aromatic

hydrocarbons ("cPAHs") as the asphalt deteriorates over time. If asphalt is allowed to remain, a sufficient quantity of additional fill to adequately protect human health and accommodate plantings for open space areas should be added.

- The PRAP and FS rely on the good condition of the existing rip-rap (and filter fabric) to retain contaminated soil. The ROD, the Site Management Plan ("SMP") and subsequent Environmental Easement should require the responsible parties to maintain such a system, and to provide financial assurance for repairs and maintenance.

- The PRAP notes a likely problem with securing an Environmental Easement, as the responsible parties have not cooperated to date. (PRAP at 23.) The ROD should provide that if these parties do not agree to the Environmental Easement required by the ROD, the remedy would shift to increased reliance on excavation and removal of contaminated soils and the installation of a slurry wall to lessen the need for reliance on the Easement and accompanying provisions of the SMP for engineering and institutional controls.

The Reasonably Anticipated Uses of the Site:
Residential and Open Space-Recreational

It is well-established that evaluation of the most likely future use scenarios in the absence of remedial action is required in conducting a baseline risk assessment. The FS assumes that the Uhlich portion of the Site would continue as industrial use. (FS at 1-11.) Although it also indicates that future residential use is a hypothetical pathway of exposure (id.), it is unclear whether that assumption was carried forward in the PRAP because that document is vague about future uses. The PRAP only states, in identifying as one potential exposure pathway: "Inhalation of contaminated vapors in indoor air by future occupants of buildings...." (PRAP at 11.) The PRAP does appear to assume that part of the Site would be used for recreational purposes, and it identifies dermal contact with contaminated soil and/ River sediments by Pioneer Club members and recreation users. (Id.)

The ROD must assume that the Site would be used in the foreseeable future for residential and open space-recreational uses. The Waterfront Zoning, the State's coastal zone management policies and the Village's draft LWRP all contemplate residential and open space-recreational use of the Site. It is well established under the federal Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), the National Contingency Plan ("NCP") and prior Department precedent – including the Anaconda site – that such uses need to be considered in adopting a remedial program for the Site.

Federal guidance issued by the Environmental Protection Agency ("EPA") specifically directs the Department, acting as a "lead agency," to consider realistically anticipated future land uses in selecting remedies under CERCLA. See Elliott P. Laws, Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04 (1995) ("Land Use Directive") (attached as Exhibit "A"); Don R. Clay, "Role of the Baseline Risk Assessment in Superfund Selection Remedy Decisions," OSWER Directive No. 9355.0-30 (1991) ("Baseline Risk Assessment Directive") (attached as Exhibit "B"). This approach is echoed in the preamble to the NCP. See 55 Fed. Reg. 8710 (relevant portions of which are attached as Exhibit "C").

The anticipated future development of this Site for residential use has a significant impact on the Department's efforts both to determine the baseline risk for the Site and to develop a remedial action plan. Indeed, EPA's 1995 Land Use Directive states (at 3) that:

> [r]easonably anticipated future use of the land at . . . sites is an important consideration in determining the appropriate extent of remediation. Future use of the land will affect the types of exposures and the frequency of exposures that may occur to any residual contamination remaining on the site, which in turn affects the nature of the remedy chosen.

In determining which future uses should be taken into account, this Guidance specifically indicates that zoning laws and maps and community plans should be a source of information in determining what anticipated future land uses have been articulated. (Id. at 5.) EPA's 1991 directive on baseline risk assessment states that the clean-up level chosen should be based on the most sensitive of those future anticipated land uses: "[t]he potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the baseline risk assessment. Further, this land use and these exposure assumptions should be used in developing remediation goals." (Baseline Risk Assessment Directive at 5.)

The Village Board has enacted and incorporated, as part of its local zoning code, the Waterfront Zoning District. This Waterfront Zoning was crafted specifically to encourage principally residential use (other than single family residential), together with a mix of recreational, marine, commercial, and public uses as soon as the Site is suitable for redevelopment.

The Village Board was reasonable in anticipating that future development at the Site will be non-industrial. The Site lacks access to an interstate highway and is located in a residential suburb of New York City. The area, like many along the Hudson River in Westchester County, is characterized by high property taxes, high utility costs, and an expensive work force. The paucity of new industrial development in Westchester County makes it plain that future use of the Site is far more likely to be residential than industrial. Indeed, the closing of the Uhlich facility and the demolition of structures on that part of the Site essentially proves that point. Because residential uses are reasonably anticipated, and are the most sensitive in terms of exposure, the Department must consider these uses in selecting the remedial action plan that is most appropriate for the Site.

The Proposed Air Sparging/Soil Vapor Extraction System

The PRAP proposes to implement an AS/SVE system to address the extensive chlorobenzene plume on the Site, which appears to be centered on the Mobil/Uhlich Paint property boundary line. Initially, there is a need to more precisely delineate the plume, which requires additional groundwater and soil sampling. There should also be a concomitant geotechnical evaluation to more precisely identify important site features that can significantly impact the effectiveness of the proposed AS/SVE remedial system. Of major concern are buried bulkheads, rip-rap and other geological features noted in the RI and FS that do not appear to be considered in the AS/SVE treatment zones of influence. In addition, there should be sampling

for chlorobenzene at depth to ensure the efficacy of AS/SVE in addressing the contamination. This further investigation should be required as part of the ROD, so as not to further delay issuance of that document, the completion of remediation and the return of the Site to productive use. Only in the event the additional sampling yields dramatically different data from that utilized in the PRAP, such that a different remedial approach from that discussed herein may be indicated, should a modified PRAP be issued prior to issuance of the ROD.[3]

If this sampling discerns the presence of obstacles that could prevent or seriously hinder the effectiveness of this remedy and/or extend the time for its implementation and completion, and/or chlorobenzene contamination at levels suggestive that AS/SVE may not effectively remediate the contamination, the ROD should provide for a second remedy. That backup remedy should probably consist of excavation of contaminated soil, dewatering and the treatment of dewatered groundwater. As in the Anaconda site ROD (at 19), the ROD for the Site should make clear that all excavated soils and other materials would be transported from the Site for disposal by rail or barge.

In addition, the PRAP does not mention how AS/SVE will address underground transport/delivery systems associated with chlorobenzene in which chlorobenzene product likely remains. As AS/SVE would not reach such contamination, some removal action addressing these structures will likely be necessary to augment the proposed remedy.

The PRAP does not articulate the remedial objectives for the AS/SVE remediation, other than in the most general terms. The Board assumes that the objective is the achievement of the applicable standards, criteria and guidance ("SCGs") for chlorobenzene in soil and groundwater: i.e., 1.7 parts per million ("ppm") for soil pursuant to the RSCO in TAGM #4046 and 5.0 parts per billion ("ppb") in groundwater pursuant to the applicable ambient groundwater standards. These objectives should be sufficient to eliminate, to the maximum extent possible, the need for the imposition of engineering and/or institutional controls to address vapor intrusion into buildings that may be constructed on the Site – particularly residential dwellings. An appropriate vapor intrusion model (such as the Johnson-Ettlinger model) should be considered to assure achievement of this objective.[4]

The AS/SVE system would, according to the PRAP, take approximately five years to yield a completed remediation (although no basis for this estimate is provided). This remedy, as proposed, would take far too long. The development and implementation of the remedy has already been delayed, and to wait at least another five years before the property can begin to be placed back into productive use is unreasonable – particularly as there are several potential means to substantially reduce this time frame.

It is undisputed that the time in which this remedy can be completed can be significantly shortened by the addition of well points, which would provide increased effectiveness within the

[3] The Board is constrained to express its disappointment that additional sampling was not conducted at any time after November 1999, given the five and one-half year gap between issuance of the FS and issuance of the PRAP.

[4] There is no mention in the PRAP of the State Department of Health Vapor Intrusion Guidance, which is frequently cited in cleanups under the BCP.

applicable zones of influence. The FS specifically acknowledges this point. (FS at 5-20.) Other engineering approaches might also afford the ability to shorten the time-frame for this remedial approach. Nonetheless, neither the FS nor the PRAP contains an assessment of the benefits of accelerating remediation versus the additional costs of additional well points.

It is clear, however, that the additional costs would not be significant. The total cost (conservatively using net present worth) for Alternative G2, which includes both AS and SVE, is $2,060,000. The capital cost is slightly less than $1 million, with the remaining approximately $1 million attributable to annual Operation and Maintenance ("O&M"). The addition of well points would not be likely to significantly increase this cost – particularly as the time of O&M, and thus these costs, should be shortened with a more effective remedy. The greater number of well points would also allow for a more timely means of addressing any recurrence of elevated levels of cholorobenzene and, in such event, the greater number of well points would abbreviate such an occurrence.

Use of Chemical Oxidation to Accelerate AS/SVE Remedial Approach

The Department should consider the use of chemical oxidation to provide an immediate reduction in contaminants, followed by AS/SVE to expedite treatment. Although chemical oxidation was somewhat experimental when the FS was issued in July 2000, it is over five and a half years later, and this technology is now an accepted remedial technology. A pilot test could be implemented for chemical oxidation during the time other Site remediation commenced. If demonstrated to be successful, chemical oxidation could be implemented after targeted removal of the most highly chlorobenzene-contaminated soils, as discussed below, with SVE then utilized to remediate any remaining contamination. This combination would produce the most comprehensive and expedited soil remediation.

Removal of Chlorobenzene-Contaminated Soil is Warranted

As noted above, the AS/SVE remedy would take approximately five years to complete. Alternative S5, which was not recommended, would provide for the removal of approximately 7,000 cubic yards of chlorobenzene-contaminated soil to the groundwater table.[5] The justifications advanced for not selecting this remedy are that the chlorobenzene would be remediated by the AS/SVE system and that the excavation and removal of approximately 7,000 cubic yards of such material (together with the additional 100 cubic yards of grossly contaminated soil) would have "a high degree of short-term impact because a large volume of soil, containing volatile organic contaminates, would be excavated over a 2-year time frame." (PRAP at 21.) Neither of these rationales withstands scrutiny.

The first proffered justification is that SVE would remediate the chlorobenzene-contaminated soil. However, as explained earlier, there is significant concern that the numerous

[5] Alternative S6 would excavate approximately 100 cubic yards of contaminated soil, exclusive of chlorobenzene-contaminated soil, and Alternative S5 would remove approximately 7,100 cubic yards of soil, including chlorobenzene-contaminated soil, resulting in a 7,000 cubic yard differential representing the quantity of chlorobenzene-contaminated soil that would be removed under Alternative S5.

subsurface obstructions present on Site would materially reduce the effectiveness of this approach and/or would extend the time the remedy would take to effectuate. Thus, the success of the SVE to remediate soil is not a foregone conclusion. Excavation and removal of chlorobenzene-contaminated soil, however, would indisputably accelerate the time period in which the AS/SVE remediation would be complete.[6] The removal of the 7,000 cubic yards of chlorobenzene-contaminated soil would significantly reduce the need for SVE, and allow it to be focused on areas beneath the remaining slabs, near underground utilities and other areas in which excavation is difficult to achieve. At a minimum, the aereal extent of SVE coverage would be substantially reduced.

Should removal of soil to the groundwater table present a question as to the efficacy of the AS/SVE system related to the necessary pressure for its successful implementation, that could be addressed through a combination of predesign testing and placement of a liner over the area being remediated to ensure the requisite vacuum effect and vapor capture zone. Indeed, both of these measures are identified as being necessary for the AS/SVE approach in the FS in any event. (See FS at 4-11, 4-20.) In the event it was determined that complete excavation of chlorobenzene-contaminated soil would render the AS/SVE system less effectual, some quantity of soil short of complete excavation to the groundwater table could be removed.

Moreover, removal of the contaminated soil would achieve assurance of a permanent long-term remedy, as compared to the AS/SVE approach. As acknowledged in the PRAP, Alternative S5 would remove "the highly contaminated soil above the water table that is impacting groundwater." (PRAP at 22.) In contrast, Alternative S6, the proposed remedy, would "provide a high degree of long-term effectiveness by stripping volatile organic contaminants from soils and excavating the highest levels of non-volatile contaminants." (Id.) Removal would guarantee a permanent solution, and thus be somewhat more consistent with the Department's hierarchy of remedies. See 6 NYCRR § 375-1.10(c)(5).

The second justification advanced to justify rejection of removing chlorobenzene-contaminated soil is the supposed "high degree" of short-term impact. There is no explanation for this asserted impact. Moreover, this reason is not advanced in the FS. (See FS at 5-6 to 5-7.) The fact that excavation might cause odors can be addressed by appropriate odor control measures; the Department has recent extensive experience with the success of proper odor controls in the Queens West Development project in Region 2 and Manufactured Gas Plant sites in New York City and other locations. A properly implemented odor control program should avoid significant odor problems. The volume of incremental soil that would require removal – 7,000 cubic yards – is not that large an amount. Excavation and removal actions at sites throughout the State frequently exceed this volume. And it is quite puzzling why the removal of 7,100 cubic yards of soil under Alternative 6 would require two years while the removal of

[6] Such excavation and removal would, according to the FS (at 4-5), presumably also include the slabs and tank pads that are on the surface in the areas of chlorobenzene contamination. It should also include the removal of all underground transport/delivery systems associated with chlorobenzene or other chemicals.

121,000 cubic yards of soil under Alternative 7 could be completed in three years. (PRAP at 18, 21.)[7]

The estimated net present value cost of Alternative S6, including removal of petroleum and dye-contaminated soil and SVE, is $3,746,000. The cost of removing the chlorobenzene, petroleum and dye-contaminated soil is $4,125,000. Thus, the incremental cost of removing of chlorobenzene-contaminated soil is approximately $379,000, together with the cost of replacement fill. At a conservative cost of $20 per cubic yard for (as opposed to the $13 per cubic yard used in the FS), that additional cost is approximately $513,000. That incremental cost would be further reduced by the savings from the reduction in the time of operations and O&M for the contemplated AS/SVE operations resulting from removal of the chlorobenzene-contaminated soil. In any event, the Board believes that these incremental costs certainly should not preclude consideration of this alternative approach, particularly given the benefits of an accelerated remediation and greater consistency with the Department's hierarchy of remediation.

Finally, and most importantly, neither the FS nor the PRAP considers an intermediate approach consisting of the excavation and removal of some quantity of chlorobenzene-contaminated soil, which would accelerate the completion of remediation and enhance the likelihood of the success of the AS/SVE approach. For example, the excavation could be focused on areas that are easier to access, leaving areas near harder-to-reach areas such as subsurface utilities, etc., for the SVE system. The excavation could instead focus on the soil areas with the highest concentrations of chlorobenzene. Or, alternatively, the top several feet of chlorobenzene-contaminated soil could be excavated and removed, which would accelerate the AS/SVE remediation without the need to excavate the entire 7,000 cubic yards as assumed in Alternative S5. At a minimum, the Department should consider middle-ground approaches that would yield at least an equally effective but more expeditious cleanup, and which would remain cost-effective.

Removal of Grossly Contaminated Soil
Below the Water Table is Warranted

Alternative S6, part of the proposed remedy, entails the removal of about 100 cubic yards of soil that is grossly contaminated with dye-related compounds and weathered petroleum. It is unclear whether such soil is present only above the groundwater table and, if not, whether the removal will also extend below the groundwater table. Excavation should not be limited to above the water table for such grossly contaminated soil; rather, if there is grossly contaminated soil below the water table it should be excavated and removed absent a compelling showing as to why this cannot or should not be done. It is typical to require removal of grossly contaminated soil below the water table in the State Brownfield Cleanup and Superfund Programs. Absent such a showing (not made in the FS or PRAP), this Site should be held to the same standard to which the Anaconda site and other sites throughout the State have been held -- i.e., dewater, excavate and remove grossly contaminated soils below the groundwater table.

[7] The FS indicates that this Alternative (S5 in the FS) could be achieved within 12-18 months. (FS at 5-7.) It is unclear why the PRAP increased the time for this remedy by up to 100%.

The ROD should also include excavation and removal of underground transport/delivery systems associated with Site contaminants (in addition to those relating to chlorobenzene). Although the RI (at 3-1) discusses buried chemical piping, it does not specify what chemicals were transported in this piping. Absent a showing that the piping in fact did not carry chemicals or was not otherwise involved with chemical use, it should be excavated and removed from the Site.

Insufficient Attention to Vapor Intrusion

The only mention in the PRAP of vapor intrusion is in the context of the Environmental Easement that would accompany a number of the alternatives. Alternative S4, in addressing this issue, speaks of requiring a proper barrier and a ventilation system to address vapor intrusion. However, the PRAP's discussion of the proposed remedy is more ambiguous on this subject, and appears to provide for the adoption at some point in the future of criteria to determine the need for such protection. (See PRAP at 25.) Yet the PRAP articulates no criteria by which to determine whether any buildings on the site would require such protection.[8]

As noted above, the AS/SVE system should be designed and implemented under criteria that avoid the need for engineering or institutional controls in or under buildings in order to address vapor intrusion. If that is not possible, the ROD should articulate the criteria to determine the need for a vapor barrier and/or ventilation system (such as a subslab depressurization system). This should be spelled out in some detail, and not left to future documents.[9]

These requirements should also be made part of the SMP and be specified, pursuant to the Environmental Easement, as a cost to be borne by the responsible parties. If these requirements are not made an explicit component of the SMP and Environmental Easement, the costs would need to be born by prospective developers of the Site, which would serve as a deterrent to Site redevelopment.

The ROD Should Require Maintenance of Shoreline Rip-Rap

The PRAP and FS appear to rely on the good condition of the existing rip-rap and associated filter fabric to retain contaminated soil. The requirement should be imposed on the responsible parties to maintain such a system in perpetuity, and to provide financial assurance for repairs thereto, as part of the ROD, the SMP and the subsequent Environmental Easement.

[8] It seems clear that these remedial measures have not been considered, as the costs for the Alternatives in both the FS and PRAP do not include the costs of vapor intrusion controls.

[9] It is difficult to understand why soil gas sampling was not conducted. Samples could have been taken under the paved portion and/or building slabs on the Ulrich site and the former tank pads on the Mobil site, where the chlorobenzene plume is present.

Hot Spot Removal of Contaminated Fill

The Site contains historic fill with elevated levels of metals and polycyclic aromatic hydrocarbons ("PAHs") (although some of such contaminants may result from historical industrial uses). The remedial standards that were applied to the neighboring Anaconda site should also apply at the Tappan Terminal Site.

The PRAP, however, does not apply comparable standards. The only remedy relating to metal and PAH "hot spots" is covering with two feet of soil. There is no alternative that discusses removal of hot spots. The assumption that these contaminants were derived from historic fill does not vitiate the potential need for remediation beyond soil cover. It is commonplace in the State's remedial programs to require excavation and removal of hot spots regardless of the source (i.e., whether the contamination resulted from historic industrial operations or represents anomalies in the context of historic fill at the Site).

In contrast to the lenient approach in the PRAP, the ROD for the Anaconda site required the excavation and removal of hot spots. For example, that ROD required that lead hot spots >1,000 ppm be excavated and removed from surface soil (defined as the top two feet in the Anaconda ROD, which is more stringent that the definition of near-surface soil as 3-11 inches in this PRAP). At the Site, lead was found in surface soils (top 3 inches) at concentrations up to 1,320 ppm, and 8 of the 18 samples exceeded the cleanup objective of 400 ppm. Lead was found in subsurface soils (>11 inches depth) at levels up to 3,090 ppm. The removal of lead at the Site is of particular consequence, as lead significantly exceeds the water quality standard (261 ppb versus 25 ppb) in a filtered sample.

In addition, arsenic is found at levels up to 90 ppm in surface soil (the TAGM RSCO is 7.5) and chromium is found at concentrations up to 97 ppm in surface soil (with a TAGM RSCO of 10 ppm). Similarly, there are exceedances of the RSCOs for cPAHs in the surface soils. Six cPAHS exceed the applicable RSCO of background levels in surface and near surface soils; indeed, the majority of the samples for these contaminants are exceedances. No removal of these hot spots is even considered, although some of the highest levels are found in the surface soil, where removal is the easiest and thus most cost-effective to implement. Importantly, the ROD for the Harbor-at-Hastings site, makes clear that the highest levels of other contaminants in shallow soils, such as copper, would be removed along with the lead hot spot removal required for that Site. (See Harbor-at-Hastings ROD at 37.) Similarly, surface soils contaminated with dioxin would be removed because of their co-location with the PCBs to be excavated. (Id.)[10]

The ROD should establish some appropriate standard for the excavation and removal of hot spots, particularly for surface and near-surface soils. This can be based on an appropriate statistical analysis of the sample results and the toxicity of the pertinent chemicals. The PRAP is devoid of any justification for undertaking absolutely no removal of metal or PAH hot spots, which is inconsistent with remedial programs in other sites throughout the State under both the Superfund and Brownfield Cleanup programs.

[10] The criteria for the remediation of PCB hot spots in surface and near surface soil employed in the Anaconda ROD should also govern the Tappan Terminal ROD.

Inadequate Attention to Tentatively Identified Compounds (TICs)

The Tappan Terminal PRAP is deficient in not assessing the risk associated with the TICs and assessing the need for soil and/or groundwater remediation. Strikingly, the HRA does not assess the risk associated with the different TICs found on the Site, which is surprising and unusual for a chemical manufacturing site. It is also striking when some of these chemicals, such as ethyl ether, is noted in the RI as a key contaminant but is not addressed in either the HRA or remedial program in the PRAP (other than in the context of the two-foot soil cover).

According to the PRAP, there are several locations on the Mobil property that contain TICs that were generally identified at hydrocarbon semi-volatile organic compounds and dye-related TICs. (PRAP at 9.) It does not appear that the limited soil removal proposed as part of Alternative S6 would include this area. And the PRAP acknowledges that the AS/SVE system would not be effective in remediating these contaminants. Thus, the PRAP recommendation has been met without any assessment of the risk of leaving these constituents in situ.

Similarly, the PRAP notes that in the northern part of the Site, separate and distinct from the chlorobenzene plume (at least as delineated to date), there is an area of ethyl ether and diisoproply ether contamination. The PRAP also notes that there is no ambient groundwater standard or guidance for these chemicals. (PRAP at 10.) Although the proposed AS/SVE system would include this area, it is unclear whether that remedy would address the TICs, or the ethyl ether and diisoproply.

Insufficient Remedy for Soil Contamination

The PRAP offers no remediation other than two feet of soil cover for the residual contamination at the Site that would remain after implementation of AS/SVE and the limited removal of grossly contaminated soil. This remedy is insufficient, particularly in the absence of any hot spot removal, the limited sampling and lack of a health risk assessment for TICs and/or, as discussed below, if asphalt is retained as a demarcation barrier. Two feet of fill would not allow for planting necessary for appropriate vegetation. It would also guarantee that any utilities installed in the future would disturb highly contaminated fill, causing unnecessary risk to construction workers. Accordingly, particularly (i) if hot spots are not proposed to be excavated, (ii) in the absence of any further delineation or assessment of the health risks associated with leaving TICs in place, or (iii) if asphalt is to be utilized as a demarcation layer, significantly more soil cover, consistent with that required at the Anaconda site, should be required at the Site.

Inappropriate Demarcation Barrier

Alternative S4, which is incorporated into the proposed remedy (Alternative S6), provides for the existing asphalt on the Site to be used as a demarcation barrier, to be covered with eighteen inches of clean soil and then a 6-inch layer of topsoil. Using asphalt in this manner would cause increased levels of cPAHs in the soil as the asphalt breaks down over time, as is acknowledged in the FS. (See FS at 1-6.) Thus, the result of this portion of the remedy would be to increase, rather than decrease, the levels and extent of cPAHs in the underlying soil. The proposal would also present serious stormwater management issues, as the PRAP

acknowledges. It would further prevent the planting of appropriate vegetation. Thus, if the ROD allows the asphalt to remain, it should require sufficient additional soil cover to serve as a protective layer against future exposure and to support appropriate plantings for open space use.

On a related issue, the potential use of remaining slabs from former buildings on the Site as an impervious surface barrier would be problematic. The RI (at 3-3) notes the existing differential settling of Building 55, which suggests that any use of an impermeable subsurface barrier for this Site would not be successful.

Alternate Remedy if No Environmental Easement

The PRAP notes a problem with securing an appropriate Environmental Easement, as the responsible parties have not cooperated with the Department to date. (PRAP at 23.) To prevent this problem from delaying effectuation of the remedial program, the ROD should contain a condition that if the responsible parties refuse to record an Environmental Easement consistent with the ROD within a specified time frame, the remedy would shift to a greater deployment of excavation and removal (and other permanent remedies) to lessen the need for reliance on the Easement and the accompanying provisions of the SMP. For example, this alternative remediation could incorporate the following remedial measures:

- Remove all soil with concentrations over the applicable RSCOs, to eliminate the need for controls on the soil cover (in addition to removing all grossly contaminated soil).
- Maximize the number and coverage of well points for AS/SVE, or alternatively employ repeated injections of chemical oxidants, to lessen the reliance on future O&M related to the use of AS/SVE.
- Require the installation of a slurry wall or sheeting parallel to the shoreline to protect against the failure to maintain the rip-rap and fabric filter and consequential release of contaminated soil or groundwater to the Hudson River.

Questionable Remedial Investigation

The Board has a number of questions relating to the investigation conducted at the Site, in addition to those noted earlier. These are summarized below:

- There does not appear to be one sampling event that represents a snapshot in time of the entire Site.

- There is no information regarding sampling of soil and debris piles on-site as shown in figures from the RI and the FS. There is no information about whether the soil and debris piles were removed and, if so, whether they were sampled and characterized before removal, and the result of such work.

- The investigation was conducted at a time when Uhlich Color Company was still operating and, as a result, does not appear to have conducted sampling under former buildings.

- Samples taken from the Boat Club were chosen to represent background conditions on the basis that it is unlikely that Mobil petroleum products could influence that area. However, boats use many lubricants, oil, gas, and cleaning fluids like TCE. Accordingly, this does not seem like a likely source for a background sample.

- The RI (at 3-23) indicates that there are no surface water bodies on the Site. However, the RI goes on to state that there is standing water consistently within one foot of the surface. The FS (on 3-4) mentions the growth of cattails. Thus, the document raises the potential for the presence of wetlands on the Site, an environmental issue not addressed by the FS or PRAP. (The fact that such wetlands may be manmade as a result of site industrial activities is irrelevant to the presence and value of such an area.)

- There is no figure that shows the location of the chlorobenzene storage tank or its supply and delivery structures. The only reference to the location of this tank is in the FS (at 1-8), which refers to boring SS-2. Yet there does not appear to be a boring SS-2.

- The FS (at 1-6) notes high salinity in sampling sue to tidal fluctuations. The RI references the use of meters to measure tidal flow at the Site, but does not discuss how the high salinity may have influenced chemical testing or analysis.

- The RI (at 2-9) mentions sampling for a suspect dense non-aqueous phase liquid ("DNAPL") plume. There are, however, no results or any further discussion of DNAPL at the Site.

- There is no discussion of historic Site use of underground chemical transport or disposal facilities. The RI mentions soil and drilling fluids stores for disposal in the Uhlich Color Company wastewater treatment system, but does not indicate whether this was on- or off-Site. If on-Site, there should be a discussion of the chemical testing of that material, and transport and disposal records.

Questionable Aspects of the Health Risk Assessment

There are a series of concerns about the propriety of the HRA, which of course is a material consideration in the development of the appropriate remedy:

- The 95% upper confidence limit ("UCL") concentrations used as the exposure point concentrations ("EPCs") in the HRA exposure assessment do not appear to have been calculated appropriately. It was assumed that all data were normally distributed and the t-statistic (for normally distributed data) was used to calculate the 95% UCL concentrations. However, the correct procedure is to determine the underlying statistical distribution of the data, if possible, and to use an appropriate parametric equation to calculate the 95% UCL concentration. If the distribution cannot be determined, it is more widely accepted practice, particularly with soil data, to assume the data are log-normally distributed and use an appropriate nonparametric equation to calculate the 95% UCL concentration. Consequently, the EPCs that were used may incorrectly estimate exposure.

- 95% UCL concentrations were also calculated in the HRA and used as the EPCs even for environmental media with very small data sets (e.g., subsurface soil with 2-3 or 8 samples). These statistics would not generally be run with sample sizes less than 10. Since average or 95% UCL concentrations are questionable with such small sample sizes, the maximum detected concentrations should have been used as the EPCs. Therefore, the risks for these media may be understated.

- There may be some discrepancies in the data summaries in the HRA. For example, the text indicates that exposure to groundwater on the Uhlich property is based on data from that property only and that exposure to groundwater on the Mobil property is based on data from both properties. However, the data summary tables for both properties indicate a sample size of 37. It is also not clear why "NA" is listed in the tables for the summary statistics for some chemicals.

- Although recreational exposure to sediment is identified as a potential exposure pathway in the HRA, it is not discussed in the exposure profiles.

- A few future receptors/scenarios in the HRA showed risk estimates above acceptable levels: i.e., consumption of home-grown produce by residents, ingestion of surface soil by resident children, and dermal contact with groundwater by construction workers. The cPAHs, arsenic, iron, cadmium, mercury, and vanadium were the constituents of interest largely responsible for these risk estimates. This should be further explained.

Conclusion

The Board of Trustees appreciates the Department's consideration of these comments, and urges the agency to move forward as soon as practicable with the issuance of the ROD in accordance with the recommendations made herein.

Very truly yours,

Wm. Lee Kinnally, Jr.
Mayor

On behalf of the Board of Trustees of
the Village of Hastings-on-Hudson

cc: Village of Hastings-on-Hudson Conservation Commission
Hastings Waterfront Watch

EXHIBIT A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 25 1995

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

OSWER Directive No. 9355.7-04

MEMORANDUM

SUBJECT: Land Use in the CERCLA Remedy Selection Process

FROM: Elliott P. Laws
Assistant Administrator

TO: Director, Waste Management Division
Regions I, IV, V, VII
Director, Emergency and Remedial Response Division
Region II
Director, Hazardous Waste Management Division
Regions III, VI, VIII, IX
Director, Hazardous Waste Division,
Region X
Director, Environmental Services Division
Regions I, VI, VII

Purpose:

This directive presents additional information for considering land use in making remedy selection decisions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at National Priorities List (NPL) sites. The U.S. Environmental Protection Agency (EPA) believes that early community involvement, with a particular focus on the community's desired future uses of property associated with the CERCLA site, should result in a more democratic decisionmaking process; greater community support for remedies selected as a result of this process; and more expedited, cost-effective cleanups.

The major points of this directive are:

- Discussions with local land use planning authorities, appropriate officials, and the public, as appropriate, should be conducted as early as possible in the scoping phase of the Remedial Investigation/Feasibility Study (RI/FS). This will assist EPA in understanding the

reasonably anticipated future uses of the land on which the Superfund site is located;

- If the site is located in a community that is likely to have environmental justice concerns, extra efforts should be made to reach out to and consult with segments of the community that are not necessarily reached by conventional communication vehicles or through local officials and planning commissions;

- Remedial action objectives developed during the RI/FS should reflect the reasonably anticipated future land use or uses;

- Future land use assumptions allow the baseline risk assessment and the feasibility study to be focused on developing practicable and cost effective remedial alternatives. These alternatives should lead to site activities which are consistent with the reasonably anticipated future land use. However, there may be reasons to analyze implications associated with additional land uses;

- Land uses that will be available following completion of remedial action are determined as part of the remedy selection process. During this process, the goal of realizing reasonably anticipated future land uses is considered along with other factors. Any combination of unrestricted uses, restricted uses, or use for long-term waste management may result.

Discussions with local land use authorities and other locally affected parties to make assumptions about future land use are also appropriate in the RCRA context. EPA recognizes that RCRA facilities typically are industrial properties that are actively managed, rather than the abandoned sites that are often addressed under CERCLA. Therefore, consideration of non-residential uses is especially likely to be appropriate for RCRA facility cleanups. Decisions regarding future land use that are made as part of RCRA corrective actions raise particular issues for RCRA (e.g., timing, property transfers, and the viability of long-term permit or other controls) in ensuring protection of human health and the environment. EPA intends to address the issue of future land use as it relates specifically to RCRA facility cleanups in subsequent guidance and/or rulemakings.

This guidance is also relevant for Federal Facility sites. Land use assumptions at sites that are undergoing base closure may be different than at sites where a Federal agency will be maintaining control of the facility. Most land management agency sites will remain in Federal ownership after remedial actions. In these cases, Forest Land Management Plans and other resource

management guidelines may help develop reasonable assumptions about future uses of the land. At all such sites, however, this document can focus the land use consideration toward appropriate options.[1]

Background:

Reasonably anticipated future use of the land at NPL sites is an important consideration in determining the appropriate extent of remediation. Future use of the land will affect the types of exposures and the frequency of exposures that may occur to any residual contamination remaining on the site, which in turn affects the nature of the remedy chosen. On the other hand, the alternatives selected through the National Oil and Hazardous Substance Contingency Plan (NCP) [55 Fed. Reg. 8666, March 8, 1990] process for CERCLA remedy selection determine the extent to which hazardous constituents remain at the site, and therefore affect subsequent available land and ground water uses.

The NCP preamble specifically discusses land use assumptions regarding the baseline risk assessment. The baseline risk assessment provides the basis for taking a remedial action at a Superfund site and supports the development of remedial action objectives. Land use assumptions affect the exposure pathways that are evaluated in the baseline risk assessment. Current land use is critical in determining whether there is a current risk associated with a Superfund site, and future land use is important in estimating potential future threats. The results of the risk assessment aid in determining the degree of remediation necessary to ensure long-term protection at NPL sites.

EPA has been criticized for too often assuming that future use will be residential. In many cases, residential use is the least restricted land use and where human activities are associated with the greatest potential for exposures. This directive is intended to facilitate future remedial decisions at NPL sites by outlining a public process and sources of information which should be considered in developing reasonable assumptions regarding future land use.

This directive expands on discussions provided in the preamble to the National Oil and Hazardous Substance Contingency Plan (NCP); "Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual" (Part A) (EPA/540/1-89/002, Dec. 1989); "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (OSWER Directive 9355.3-01, Oct. 1988); and

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[1] Federal agency responsibility under CERCLA 120(h)(3), which relates to additional clean up which may be required to allow for unrestricted use of the property, is not addressed in this guidance.

"Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions" (OSWER Directive 9355.0-30, April 22, 1991).

This land use directive may have the most relevance in situations where surface soil is the primary exposure pathway. Generally, where soil contamination is impacting ground water, protection of the ground water may drive soil cleanup levels. Consideration of future ground water use for CERCLA sites is not addressed in this document. There are separate expectations established for ground water in the NCP rule section 300.430 (a)(1)(iii)(F) that "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site."

Objective

This directive has two primary objectives. First, this directive promotes early discussions with local land use planning authorities, local officials, and the public regarding reasonably anticipated future uses of the property on which an NPL site is located. Second, this directive promotes the use of that information to formulate realistic assumptions regarding future land use and clarifies how these assumptions fit in and influence the baseline risk assessment, the development of alternatives, and the CERCLA remedy selection process.

Implementation

The approach in this guidance is meant to be considered at current and future sites in the RI/FS pipeline, to the extent possible. This directive is not intended to suggest that previous remedy selection decisions should be re-opened.

Developing Assumptions About Future Land Use

In order to ensure use of realistic assumptions regarding future land uses at a site, EPA should discuss reasonably anticipated future uses of the site with local land use planning authorities, local officials, and the public, as appropriate, as early as possible during the scoping phase of the RI/FS. EPA should gain an understanding of the reasonably anticipated future land uses at a particular Superfund site to perform the risk assessment and select the appropriate remedy.

A visual inspection of the site and its surrounding area is a good starting point in developing assumptions regarding future land use. Discussions with the local land use authorities and appropriate officials should follow. Discussions with the public can be accomplished through a public meeting and/or other means. By developing realistic assumptions based on information gathered from these sources early in the RI/FS process, EPA may develop

remedial alternatives that are consistent with the anticipated future use.

The development of assumptions regarding the reasonably anticipated future land use should not become an extensive, independent research project. Site managers should use existing information to the extent possible, much of which will be available from local land use planning authorities. Sources and types of information that may aid EPA in determining the reasonably anticipated future land use include, but are not limited to:

- Current land use
- Zoning laws
- Zoning maps
- Comprehensive community master plans
- Population growth patterns and projections (e.g., Bureau of Census projections)
- Accessibility of site to existing infrastructure (e.g., transportation and public utilities)
- Institutional controls currently in place
- Site location in relation to urban, residential, commercial, industrial, agricultural and recreational areas
- Federal/State land use designation (Federal/State control over designated lands range from established uses for the general public, such as national parks or State recreational areas, to governmental facilities providing extensive site access restrictions, such as Department of Defense facilities
- Historical or recent development patterns
- Cultural factors (e.g., historical sites, Native American religious sites)
- Natural resources information
- Potential vulnerability of ground water to contaminants that might migrate from soil
- Environmental justice issues
- Location of on-site or nearby wetlands
- Proximity of site to a floodplain
- Proximity of site to critical habitats of endangered or threatened species
- Geographic and geologic information
- Location of Wellhead Protection areas, recharge areas, and other areas identified in a State's Comprehensive Ground-water Protection Program

These types of information should be considered when developing the assumptions about future land use. Interaction with the public, which includes all stakeholders affected by the site, should serve to increase the certainty in the assumptions made regarding future land use at an NPL site and increase the

confidence expectations about anticipated future land use are, in fact, reasonable.

For example, future industrial land use is likely to be a reasonable assumption where a site is currently used for industrial purposes, is located in an area where the surroundings are zoned for industrial use, and the comprehensive plan predicts the site will continue to be used for industrial purposes.

Community Involvement

NPL sites are located in diverse areas of the country, with great variability in land use planning practices. For some NPL sites, the future land use of a site may have been carefully considered through local, public, participatory, planning processes, such as zoning hearings, master plan approvals or other vehicles. When this is the case, local residents around the Superfund site are likely to demonstrate substantial agreement with the local land use planning authority on the future use of the property. Where there is substantial agreement among local residents and land use planning agencies, owners and developers, EPA can rely with a great deal of certainty on the future land use already anticipated for the site. For other NPL sites, however, the absence or nature of a local planning process may yield considerably less certainty about what assumptions regarding future use are reasonable. In some instances the local residents near the Superfund site may feel disenfranchised from the local land use planning and development process. This may be an especially important issue where there are concerns regarding environmental justice in the neighborhood around the NPL site. Consistent with the principle of fairness, EPA should make an extra effort to reach out to the local community to establish appropriate future land use assumptions at such sites.

Land Use Assumptions in the Baseline Risk Assessment

Future land use assumptions allow the baseline risk assessment and the feasibility study to focus on the development of practicable and cost-effective remedial alternatives, leading to site activities which are consistent with the reasonably anticipated future land use.

The baseline risk assessment generally needs only to consider the reasonably anticipated future land use; however, it may be valuable to evaluate risks associated with other land uses. The NCP preamble (55 Fed. Reg. 8710) states that in the baseline risk assessment, more than one future land use assumption may be considered when decision makers wish to understand the implications of unexpected exposures. Especially where there is some uncertainty regarding the anticipated future land use, it may be useful to compare the potential risks associated with several land use scenarios to estimate the impact

on human health and the environment should the land use unexpectedly change. The magnitude of such potential impacts may be an important consideration in determining whether and how institutional controls should be used to restrict future uses. If the baseline risk assessment evaluates a future use under which exposure is limited, it will not serve the traditional role, evaluating a "no action" scenario. A remedy, i.e. institutional controls to limit future exposure, will be required to protect human health and the environment. In addition to analyzing human health exposure scenarios associated with certain land uses, ecological exposures may also need to be considered.

Developing Remedial Action Objectives

Remedial action objectives provide the foundation upon which remedial cleanup alternatives are developed. In general, remedial action objectives should be developed in order to develop alternatives that would achieve cleanup levels associated with the reasonably anticipated future land use over as much of the site as possible. EPA recognizes, however, that achieving either the reasonably anticipated land use, or the land use preferred by the community, may not be practicable across the entire site, or in some cases, at all. For example, as RI/FS data become available, they may indicate that the remedial alternatives under consideration for achieving a level of cleanup consistent with the reasonably anticipated future land use are not cost-effective nor practicable. If this is the case, the remedial action objective may be revised which may result in different, more reasonable land use(s).

EPA's remedy selection expectations described in section 300.430(a)(1)(iii) of the NCP should also be considered when developing remedial action objectives. Where practicable, EPA expects to treat principal threats, to use engineering controls such as containment for low-level threats, to use institutional controls to supplement engineering controls, to consider the use of innovative technology, and to return usable ground waters to beneficial uses to protect human health and the environment. (Some types of applicable or relevant and appropriate requirements (ARARs) define protective cleanup levels which may, in turn, influence post-remediation land use potential.)

In cases where the future land use is relatively certain, the remedial action objective generally should reflect this land use. Generally, it need not include alternative land use scenarios unless, as discussed above, it is impracticable to provide a protective remedy that allows for that use. A landfill site is an example where it is highly likely that the future land use will remain unchanged (i.e., long-term waste management area), given the NCP's expectation that treatment of high volumes of waste generally will be impracticable and the fact that EPA's presumptive remedy for landfills is containment. In such a case,

a remedial action objective could be established with a very high degree of certainty to reflect the reasonably anticipated future land use.

In cases where the reasonably anticipated future land use is highly uncertain, a range of the reasonably likely future land uses should be considered in developing remedial action objectives. These likely future land uses can be reflected by developing a range of remedial alternatives that will achieve different land use potentials. The remedy selection process will determine which alternative is most appropriate for the site and, consequently, the land use(s) available following remediation.

As discussed in "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions" (OSWER Directive 9355.0-30, April 22, 1991), EPA has established a risk range for carcinogens within which EPA strives to manage site risks. EPA recognizes that a specific cleanup level within the acceptable risk range may be associated with more than one land use (e.g., an industrial cleanup to 10^{-6} may also allow for residential use at a 10^{-4} risk level.) It is not EPA's intent that the risk range be partitioned into risk standards based solely on categories of land use (e.g., with residential cleanups at the 10^{-6} level and industrial cleanups at the 10^{-4} risk level.) Rather, the risk range provides the necessary flexibility to address the technical and cost limitations, and the performance and risk uncertainties inherent in all waste remediation efforts.

Land Use Considerations in Remedy Selection

As a result of the comparative analysis of alternatives with respect to EPA's nine evaluation criteria, EPA selects a site-specific remedy. The remedy determines the cleanup levels, the volume of contaminated material to be treated, and the volume of contaminated material to be contained. Consequently, the remedy selection decision determines the size of the area that can be returned to productive use and the particular types of uses that will be possible following remediation.

The volume and concentration of contaminants left on-site, and thus the degree of residual risk at a site, will affect future land use. For example, a remedial alternative may include leaving in place contaminants in soil at concentrations protective for industrial exposures, but not protective for residential exposures. In this case, institutional controls should be used to ensure that industrial use of the land is maintained and to prevent risks from residential exposures. Conversely, a remedial alternative may result in no waste left in place and allow for unrestricted use (e.g., residential use).

Results of Remedy Selection Process

Several potential land use situations could result from EPA's remedy selection decision. They are:

- The remedy achieves cleanup levels that allow the entire site to be available for the reasonably anticipated future land use in the baseline risk assessment (or, where future land use is uncertain, all uses that could reasonably be anticipated).

- The remedy achieves cleanup levels that allow most, but not all, of the site to be available for the reasonably anticipated future land use. For example, in order to be cost effective and practicable, the remedy may require creation of a long-term waste management area for containment of treatment residuals or low-level waste on a small portion of the site. The cleanup levels in this portion of the site might allow for a more restricted land use.

- The remedy achieves cleanup levels that require a more restricted land use than the reasonably anticipated future land use for the entire site. This situation occurs when no remedial alternative that is cost-effective or practicable will achieve the cleanup levels consistent with the reasonably anticipated future land use. The site may still be used for productive purposes, but the use would be more restricted than the reasonably anticipated future land use. Furthermore, the more restricted use could be a long-term waste management area over all or a portion of the site.

Institutional Controls

If any remedial alternative developed during the FS will require a restricted land use in order to be protective, it is essential that the alternative include components that will ensure that it remain protective. In particular, institutional controls will generally have to be included in the alternative to prevent an unanticipated change in land use that could result in unacceptable exposures to residual contamination, or, at a minimum, alert future users to the residual risks and monitor for any changes in use. In such cases, institutional controls will play a key role in ensuring long-term protectiveness and should be evaluated and implemented with the same degree of care as is given to other elements of the remedy. In developing remedial alternatives that include institutional controls, EPA should determine: the type of institutional control to be used, the existence of the authority to implement the institutional control, and the appropriate entity's resolve and ability to

implement the institutional control. An alternative may anticipate two or more options for establishing institutional controls, but should fully evaluate all such options. A variety of institutional controls may be used such as deed restrictions and deed notices, and adoption of land use controls by a local government. These controls either prohibit certain kinds of site uses or, at a minimum, notify potential owners or land users of the presence of hazardous substances remaining on site at levels that are not protective for all uses. Where exposure must be limited to assure protectiveness, a deed notice alone generally will not provide a sufficiently protective remedy. While the ROD need not always specify the precise type of control to be imposed, sufficient analysis should be shown in the FS and ROD to support a conclusion that effective implementation of institutional controls can reasonably be expected.

Suppose, for example, that a selected remedy will be protective for industrial land use and low levels of hazardous substances will remain on site. An industry may still be able to operate its business with the selected remedy in place. Institutional controls, however, generally will need to be established to ensure the land is not used for other, less restricted purposes, such as residential use, or to alert potential buyers of any remaining contamination.

Future Changes in Land Use

Where waste is left on-site at levels that would require limited use and restricted exposure, EPA will conduct reviews at least every five years to monitor the site for any changes. Such reviews should analyze the implementation and effectiveness of institutional controls with the same degree of care as other parts of the remedy. Should land use change, it will be necessary to evaluate the implications of that change for the selected remedy, and whether the remedy remains protective. EPA's role in any subsequent additional cleanup will be determined on a site-specific basis. If landowners or others decide at a future date to change the land use in such a way that makes further cleanup necessary to ensure protectiveness, CERCLA does not prevent them from conducting such a cleanup as long as protectiveness of the remedy is not compromised. (EPA may invoke CERCLA section 122(e)(6), if necessary, to prevent actions that are inconsistent with the original remedy.) In general, EPA would not expect to become involved actively in the conduct or oversight of such cleanups. EPA, however, retains its authority to take further response action where necessary to ensure protectiveness.

Further Information

If you have any questions concerning this directive, please call Sherri Clark at 703-603-9043.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

EXHIBIT B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

APR 2 2 1991

OSWER DIRECTIVE 9355.0-30

MEMORANDUM

SUBJECT: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions

FROM: Don R. Clay
Assistant Administrator

TO: Directors, Waste Management Division
Regions I, IV, V, VII, VIII
Director, Emergency and Remedial Response Division
Region II
Directors, Hazardous Waste Management Division
Regions III, VI, IX
Director, Hazardous Waste Division,
Region X

Purpose

The purpose of this memorandum is to clarify the role of the baseline risk assessment in developing Superfund remedial alternatives and supporting risk management decisions.

Specifically, the following points are made in the memorandum:

- Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10(-4) and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts. However, if MCLs or non-zero MCLGs are exceeded, action generally is warranted.

- Other chemical-specific ARARs may also be used to determine whether a site warrants remediation.

- A risk manager may also decide that a baseline risk level less than 10(-4)is unacceptable due to site specific reasons and that remedial action is warranted.

- Compliance with a chemical-specific ARAR generally will be considered protective even if it is outside the risk range (unless) there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure).

- The upper boundary of the risk range is not a discrete line at 1 X 10(-4), although EPA generally uses 1 x 10(-4) in making risk management decisions. A specific risk estimate around 10(-4) may be considered acceptable if justified based on site-specific conditions.

- The ROD should clearly justify the use of any non-standard exposure factors and the need for remedial action if baseline risks are within the generally acceptable risk range. The ROD should also include a table listing the final remediation goals and the corresponding risk level for each chemical of concern.

Background

The 1990 National Contingency Plan (NCP) (55 Fed. Reg. 8665-8865(Mar. 8, 1990)) calls for a site-specific baseline risk assessment to be conducted, as appropriate, as part of the remedial investigation(Section 300.430(d)(1)). Specifically, the NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)). The primary purpose of the baseline risk assessment is to provide risk managers with an understanding of the actual and potential risks to human health and the environment posed by the site and any uncertainties associated with the assessment. This information may be useful in determining whether a current or potential threat to human health or the environment exists that warrants remedial action.

The "Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual - Part A" (HHEM)(EPA/540/1-89/002) provides guidance on how to conduct the human health portion of the baseline risk assessment. Volume II of the "Risk Assessment Guidance for Superfund" the "Environmental Evaluation Manual" (EPA/540/1-89/001) and the companion manual, "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (EPA/600/3-89/013) provide guidance on conducting the environmental portion of the baseline risk assessment. Other

pertinent guidance includes the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (RI/FS guidance, EPA/540/G-89/004), which describes how the baseline risk assessment fits into the overall RI/FS process. "Guidance on Preparing Superfund Decision Documents" (ROD guidance) (EPA/624/1-87/001) provides information on how to document the results of the baseline risk assessment in the ROD.

Objective

The objective of this memorandum is to provide further guidance on how to use the baseline risk assessment to make risk management decisions such as determining whether remedial action under CERCLA Sections 104 or 106 is necessary. This memorandum also clarifies the use of the baseline risk assessment in selecting appropriate remedies under CERCLA Section 121, promotes consistency in preparing site-specific risk assessments, and helps ensure that appropriate documentation from the baseline risk assessment is included in Superfund remedy selection documents.

Implementation

RISKS WARRANTING REMEDIAL ACTION

Whenever there is a release or substantial threat of release of a hazardous substance into the environment (or a release or threat of release into the environment of a pollutant or contaminant "which may present an imminent and substantial danger to public health or welfare"), Section 104(a)(1) of CERCLA provides EPA with the authority to take any response action consistent with the National Contingency Plan it deems necessary to protect public health or welfare or the environment. Section 106 of CERCLA grants EPA the authority to require potentially responsible parties (or others) to perform removal or remedial actions "when the President determines that there may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance form a facility."

As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority. EPA may use the results of the baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. The risk assessment methodology for all sites should be the same regardless of whether the RI/FS or remedial

design and remedial action is performed by EPA or potentially responsible parties.

Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10(-4) lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10(-4), action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risks within the 10(-4) to 10(-6) risk range must explain why remedial why remedial action is warranted.

The cumulative site baseline risk should include all media that the reasonable maximum exposure scenario indicates are appropriate to combine and should not assume that institutional controls or fences will account for risk reduction. For noncarcinogenic effects of toxicants, unacceptable risk occurs when exposures exceed levels which represent concentrations to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, as appropriate to address teratogenic and developmental effects.

Chemical specific standards that define acceptable risk levels (e.g., non-zero MCLGs, MCLs) also may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action under Section 104 or 106 is warranted. For ground water actions, MCLs and non-zero MCLGs will generally be used to gauge whether remedial action is warranted.

EPA uses the general 10(-4) to 10(-6) risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to make an action, the Agency has expressed a reference for cleanups achieving the more protective end of the range (i.e., 10(-6)), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1 x 10(-4), although EPA generally uses 1 x 10(-4) in making risk management decisions. A

specific risk estimate around 10(-4) may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1 x 10(-4) to be protective.

When an ARAR for a specific chemical (or in some cases a group of chemicals) defines an acceptable level of exposure, compliance with the ARAR will generally be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure). Conversely, in certain situations EPA may determine that risks less than 1 x 10(-4) are not sufficiently protective and warrant remedial action.

Where current conditions have not resulted in a release posing risks that warrant action but there is a significant possibility that a release will occur that is likely to result in an unacceptable risk, remedial action may also be taken. The significance of the potential future release may be evaluated in part based on the quantities of material at the site and the environmental setting.

RISKS CONSIDERED IN RISK MANAGEMENT DECISION

As noted above, both current and reasonably likely future risks need to be considered in order to demonstrate that a site does not present an unacceptable risk to human health and the environment. An adequate consideration of future risk may necessitate the assessment of risks assuming a land use different from that which currently exists at the site. The potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the baseline risk assessment. Further, this land use and these exposure assumptions should be used in developing remediation goals.

The preamble to the NCP states that EPA will consider future land use as residential in many cases. In general, residential areas should be assumed to remain residential; and undeveloped areas can be assumed to be residential in the future unless sites are in areas where residential land use is unreasonable. Often the exposure scenarios based on potential future residential land use provide the greatest risk estimates (e.g., reasonable maximum exposure scenario) and are important considerations in deciding whether to take action (55 Fed. Reg. at 8710).

However, the NCP also states that "the assumption of future residential land use may not be justifiable if the probability

that the site will support residential use in the future is small. "Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial area unless there is an indication that this is not appropriate. Other land uses, such as recreational or agricultural, may be used, if appropriate. When exposures based on reasonable future land use are used to estimate risk, the NCP preamble states that the ROD "should include a qualitative assessment of the likelihood that the assumed future land use will occur" (55 Fed. Reg. at 8710).

Unacceptable environmental risks also may prompt remedial action and may occur where there is no significant risk to human health. Threats or potential threats to sensitive habitats, such as wetlands, and critical habitats of species protected under the Endangered Species Acts are especially important to consider when determining whether to take an action under CERCLA Section 104 or 106. Ambient Water Quality Criteria for aquatic organisms are chemical-specific standards that will generally be considered when determining whether to take an action based on the environmental risk of releases to surface waters.

NO-ACTION DECISIONS

If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet applicable or relevant and appropriate requirements (ARARs), are not triggered. CERCLA section 121 (a) requires only that those remedial actions that are "determined to be necessary ... Under section 104 or ... 106 ... be selected in accordance with section 121." If EPA determines that an action is necessary, the remedial action must attain ARARs, unless a waiver is invoked. Of course, sites that do not warrant action under CERCLA sections 104 or 106 may warrant action under another State or Federal statute, such as RCRA subtitle D requirements for the appropriate closure of a solid waste landfill.

The decision not to take action at an NPL site under section 104 and 106 should also be documented in a ROD. The decision documentation process should include the preparation of a proposed plan for public comment, ROD and eventually a closeout report and Federal Register deletion notice.

POINT OF DEPARTURE WHEN ACTION WARRANTED

Once remedial action has been determined to be warranted,

the results of the baseline risk assessment may be used to modify preliminary remediation goals. These preliminary goals are developed at scoping based on ARARs and the 10(-6) cancer risk point of departure pursuant to NCP section 300.430(e)(2)(I).

USE OF BASELINE RISK ASSESSMENT TO MODIFY PRELIMINARY REMEDIATION GOALS

Remediation goals developed under CERCLA section 121 are generally medium-specific chemical concentrations that will pose no unacceptable threat to human health and the environment. preliminary remediation goals are developed early in the RI/FS process based on ARARs and other readily available information, such as concentrations associated with 10(-6) cancer risk or a hazard quotient equal to one for noncarcinogens calculated from EPA toxicity information. These preliminary goals may be modified based on results of the baseline risk assessment, which clarifies exposure pathways and may identify situations where cumulative risk of multiple contaminants or multiple exposure pathways at the site indicate the need for more or less stringent cleanup levels than those initially developed as preliminary remediation goals. In addition to being modified based on the baseline risk assessment, preliminary remediation goals and the corresponding cleanup levels may also be modified based on the given waste management strategy selected at the time of remedy selection that is based on the balancing of the nine criteria used for remedy selection (55 Fed. Reg. at 8717 and 8718).

EARLY AND INTERIM ACTIONS

Early operable unit actions (e.g., hot spot removal and treatment) and interim actions (e.g., temporary storage or ground water plume containment) may be taken to respond to an immediate site threat or to take advantage of an opportunity to significantly reduce risk quickly (55 Fed. Reg. at 8705). For example, an interim containment action may be particularly useful early in the process for complicated ground water remedial actions, where concentrations greater than MCLS provide a good indication that remediation of a potential drinking water source is necessary; such quick remedial action is important to prevent further spread of the contaminant plume while a final ground water remedy is being developed.

Early and interim action RODs do not require a completed baseline risk assessment, although enough information must be available to demonstrate the potential for risk and the need to take action. Data sufficient to support the interim action decision can be extracted from the ongoing RI/FS for the site and set out in a focused feasibility study or other appropriate document that includes a short analysis of a limited number of

alternatives (55 Fed. Reg. at 8704). These data should include a summary of contaminants of concern, concentrations and relevant exposure information. A discussion should accompany these data explaining the need for immediate remedial action based on the presence of contamination that, if left unaddressed in the short-term, either contributes immediate risk or is likely to contribute to increased site risk or degradation of the environment/ natural resources. The early and interim action RODs should note that some exposure pathways at the site may not be addressed by the action.

An interim action ROD eventually must be followed by a subsequent ROD for that operable unit based on the complete RI/FS, that includes the baseline risk assessment, in order to document long-term protection of human health and the environment at that portion of the site. The interim action ROD, however, should demonstrate qualitatively (and quantitatively if possible) that there is a risk or potential for risk and explain how the temporary measures selected will address a portion of this risk.

DOCUMENTATION OF BASELINE RISK ASSESSMENT RESULTS IN THE ROD

The Summary of Site Risks section of the ROD should include a discussion of the risks associated with current and future land use and a table presenting these risk levels for each exposure medium (e.g., direct contact with soil by potential future residents exposed via incidental soil ingestion and dermal contact). In some situations, risks from exposure via more than one medium (e.g, soil and drinking water) will affect the same potentially exposed individual at the same time. It is appropriate in these situations to combine the risk that an individual may be exposed to from a site.

In addition to summarizing the baseline risk assessment information, the ROD (except no-action RODs) should include how remedial alternatives will reduce risks by achieving cleanup levels through treatment or by eliminating exposures through engineering controls for each contaminant of concern in each appropriate medium.

The Comparative Analysis should include a discussion of each of the nine criteria; consideration of risk is part of the discussion of several of the criteria. The discussion of overall protection of human health and the environment should include a discussion of how the remedy will eliminate, reduce, or control risks identified in the baseline risk assessment posed through each pathway and whether exposure levels will be reduced to acceptable levels. For example, if direct human contact with contaminated soil is identified as a significant risk at a site, the ROD (except no-action RODs) should indicate how the selected

remedy will eliminate or control exposures to ensure protection of human health. The discussion of long-term effectiveness and permanence should include, where appropriate, an assessment of the residual risk from untreated residual waste remaining at the site. The short-term effectiveness discussion should address risks during remedial action to those on-site and nearby.

Finally, that part of the Decision Summary in the ROD that focuses on the selected remedy should show:

- the chemical-specific remediation level and corresponding chemical-specific risk level(s) to be attained at the conclusion of the response action and the points (or area) of compliance for the media being addressed; and

- The lead agency's basis for the remediation levels (e.g., risk calculation, ARARs).

The attached table, "Remediation levels and Corresponding Risks," provides a direct means of displaying this information for health risks and, where appropriate, environment protection (Table 1). The table should be completed for all media for which the ROD selects final cleanup levels. The table should serve as a summary of text in the selected remedy section of the ROD Decision Summary. For interim action RODs, only qualitative statements may be possible.

Additional guidance on the baseline risk assessment and its role in remedy selection is available from several sources. For guidance on the baseline risk assessment contact:

David Bennett, Chief
Toxics Integration Branch (OS-230)
Hazardous Site Evaluation Division
Office of Emergency and Remedial Response
phone: (FTS) or (202) 475-9486.

For additional guidance on the interaction of the baseline risk assessment and Superfund remedy selection, contact:

David Cooper
Remedial Operations and Guidance Branch (OS-220W)
Hazardous Site Control Division
Office of Emergency and Remedial Response
phone: (FTS) 398-8361
commercial phone: (703) 308-8361.

For guidance on enforcement-lead sites contact:

Stephen Ells
Guidance and Evaluation Branch (OS-510)
CERCLA Enforcement Division
Office of Waste Programs Enforcement
phone: (FTS) or (202) 475-9803.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

TABLE 1
Remediation Goals and Corresponding Risks[a]

Final Remediation Levels[b]					Corresponding Risk Levels[c]	
					Chemical-Specific RME Risk[d]	
Medium	Chemical	Remediation Level[e]	Point of Compliance[f]	Basis of Goal	Cancer	Non-Cancer
SOIL	A	2.0 ppm	All facility	HI	N/A	0.5
	B	17.0 ppm	grounds	Risk	1.0×10^{-5}	N/A
	C	5.0 ppm		GW Risk	N/A	N/A
GROUND WATER	B	0.1 ppm	Waste	Risk	1.0×10^{-5}	N/A
	C	4.0 ppm	Management	MCL	1.0×10^{-5}	N/A
	F	7.0 ppm	Unit	MCLG	N/A	0.2
	G	15.0 ppm	Boundary	MCL	6.0×10^{-6}	0.09
SEDIMENT	Q	100.0 ppm	Downstream from point A	Ecological Effects	N/A	N/A

a. Prepare summary sheets for selected remedy.

b. Final Remediation Levels are based on preliminary remediation goals developed in the Feasibility Study (FS) (RI/FS Guidance 4.2.1) as modified through the nine criteria evaluation and engineering design. In the process of achieving remediation levels for each chemical, some chemicals will be reduced to concentrations below their remediation levels.

c. Chemical-specific risks correspond to associated remediation levels. Risks do not consider effects of exposures to other chemicals or media. If appropriate, risks may be summed to calculate media-specific risks. Short-term effectiveness is not considered.

d. Cancer risks are measured as individual incremental lifetime; non-cancer as Hazard Quotients.

e. Bases for values should be explained in the earlier Record Of Decision (ROD) table.

f. Bases for location and method for determining attainment (e.g., maximum value detected over area XYZ) should be explained in the description of the selected remedy.

N/A - Not applicable

EXHIBIT C

Westlaw

55 FR 8666-01
55 FR 8666-01, 1990 WL 331169 (F.R.)
(Cite as: 55 FR 8666)

RULES and REGULATIONS
ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 300
[FRL-3644-1]
RIN 2050-AA75
National Oil and Hazardous Substances Pollution Contingency Plan
Thursday, March 8, 1990

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

*** The requested pages begin below ***

EPA recognizes the logical advantages of establishing consistent preliminary remediation goals at sites where contamination and exposure considerations are similar. To the degree possible, EPA makes use of chemical-specific ARARs in determining remediation goals for Superfund sites. However, because these standards are established on a national or statewide basis, they may not adequately consider the site-specific contamination or the cumulative effect of the presence of multiple chemicals or multiple exposure pathways and, therefore, are not the sole determinant of protectiveness.

EPA does agree that a uniform process should be used to develop risk assessments and cleanup levels. To improve program efficiency and consistency, EPA is providing extensive guidance for characterizing site-specific risks and identifying preliminary remediation goals to protect human health and the environment in two ***8710** guidance documents: "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A" No. 9285.701A, July 1989 (Interim Final) and the "Risk Assessment Guidance for Superfund Volume II: Environmental Evaluation Manual," EPA/540/1-89/001, March 1989 (Interim Final) hereafter referred to as risk assessment guidance. The "Human Health Evaluation Manual" is a revision of the "Superfund Public Health Evaluation Manual" (October 1986) and also replaces the "Endangerment Assessment Handbook."

EPA received many comments on the methodology EPA uses to conduct site-specific risk assessments. EPA conducts an exposure assessment to identify the magnitude of actual or potential human or environmental exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. This exposure assessment includes an evaluation of the likelihood of such exposures occurring and provides the basis for the development of acceptable exposure levels.

Some commenters wanted specific clarification of the meaning of the "reasonable maximum exposure scenario" and how it is to be used. Some said that the methodology results in overstated and unrealistic risks and that the procedures provide significantly biased estimates of risks that are several orders of magnitude greater than actual risks. Several commenters argued that not only did the risk assessment methodology that Superfund has used in the past overestimate risk, but that the proposal's use of a "reasonable maximum exposure scenario" would institutionalize this overestimation of risk. Some stated that this overestimation of risk was especially a problem because both exposures and the toxicity of chemicals are overestimated. The combination of the two in risk characterization leads to the overstatement of risk. Other commenters favored the use of the reasonable maximum exposure scenario and recommended its inclusion in the rule. EPA will continue to use the reasonable maximum exposure scenario in risk assessment, although EPA does not believe it necessary to include it as a requirement in the rule.

EPA responds to the requests for clarification of the reasonable maximum exposure scenario and the baseline risk assessment in the remainder of this section. In the Superfund program, the exposure assessment involves developing reasonable maximum estimates of exposure for both current land use conditions and potential future land use conditions at each site. The exposure analysis for current land use conditions is used to determine whether a human health or environmental threat may be posed by existing site conditions. The analysis for potential exposures under future land use conditions is used to provide decision-makers with an understanding of exposures that may potentially occur in the future. This analysis should include a qualitative assessment of the likelihood that the assumed future land use will occur. The reasonable maximum exposure estimates for future uses of the site will provide the basis for the development of protective exposure levels.

Several commenters stated that EPA's exposure assessment methodology overestimates risk, especially if worst-case assumptions are used. EPA is clarifying its policy of making exposure assumptions that result in an overall exposure estimate that is conservative but within a realistic range of exposure. Under this policy, EPA defines "reasonable maximum" such that only potential exposures that are likely to occur will be included in the assessment of exposures. The Superfund program has always designed its remedies to be protective of all individuals and environmental receptors that may be exposed at a site; consequently, EPA believes it is important to include all reasonably expected exposures in its risk assessments. However, EPA does agree with a commenter that recommended against the use of unrealistic exposure scenarios and assumptions. The reasonable maximum exposure scenario is "reasonable" because it is a product of factors, such as concentration and exposure frequency and duration, that are an appropriate mix of values that reflect averages and 95th percentile distributions (see the "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual").

EPA does agree with one commenter that the likelihood of the exposure actually occurring should be considered when deciding the appropriate level of remediation, to the degree that this likelihood can be determined. The risk assessment guidance referenced above is designed to focus the assessment on more realistic exposures. EPA has adopted these positions as policy and has not revised the regulation. In addition, EPA agrees that risk assessments conducted for the Superfund should take into consideration background concentrations and conditions and should identify these critical assumptions and uncertainties in its risk assessments.

One commenter asked EPA to clarify that both actual and potential risks will be investigated in the baseline risk assessment. When considering current land use, the baseline risk assessment should consider both actual risks due to current conditions and potential risks assuming no remedial action. For example, these potential risks could arise by the migration of contaminants through ground water to wells that are currently uncontaminated. Future land use, where it is different from current use, is an evaluation of only potential exposures since the future land use addresses a potential situation. EPA is clarifying the language in the rule to indicate that both actual and potential exposure routes and pathways should be considered.

In considering land use, Superfund exposure assessments most often classify land into one of three categories: (1) Residential, (2) commercial/industrial, and (3) recreational. EPA also considers the ecological use of the property and, as appropriate, agricultural use. In general, the baseline risk assessment will look at a future land use that is both reasonable, from land use development patterns, and may be associated with the highest (most significant) risk, in order to be protective. These considerations

will lead to the assumption of residential use as the future land use in many cases. Residential land use assumptions generally result in the most conservative exposure estimates. The assumption of residential land use is not a requirement of the program but rather is an assumption that may be made, based on conservative but realistic exposures, to ensure that remedies that are ultimately selected for the site will be protective. An assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small. Where the likely future land use is unclear, risks assuming residential land use can be compared to risks associated with other land uses, such as industrial, to estimate the risk consequences if the land is used for something other than the expected future use.

Some commenters recommended performing the baseline risk assessment assuming that institutional controls were in place and effective at preventing exposure. EPA disagrees that the baseline risk assessment is the proper place to take institutional controls into account. The role of the ***8711** baseline risk assessment is to address the risk associated with a site in the absence of any remedial action or control, including institutional controls. The baseline assessment is essentially an evaluation of the no-action alternative. Institutional controls, while not actively cleaning up the contamination at the site can control exposure and, therefore, are considered to be limited action alternatives. The effectiveness of the institutional controls in controlling risk may appropriately be considered in evaluating the effectiveness of a particular remedial alternative, but not as part of the baseline risk assessment.

Some commenters stated that use of EPA's toxicity values will lead to overestimation of risk because they incorporate uncertainty factors or "margins of safety" that will bias the estimate of risk. EPA responds that the toxicity assessment component of Superfund risk assessment considers the following: (1) The types of adverse health or environmental effects associated with chemical exposures; (2) the relationship between magnitude of exposures and adverse effects; and (3) related uncertainties such as the weight-of-evidence for a particular chemical's carcinogenicity in humans. EPA recognizes that toxicity values do incorporate "uncertainty factors." Because the toxicity information is usually derived from studies of industrial workers or test animals, the size of these uncertainty factors is generally determined by the confidence that effects seen in these studies will manifest themselves in humans exposed at Superfund sites. Larger uncertainty factors are generally used to ensure that protective levels are identified when considering data with greater uncertainty. It should be noted that weights-of-evidence (and uncertainty factors) are not directly related to toxicity. For example, a high weight-of-evidence indicates only a high confidence that a chemical will cause cancer in humans. A high confidence in a toxicity value reflects a consensus that the value is not likely to change.

One commenter argued that EPA, or other lead agency, must consider information on toxicity that PRPs or interested parties bring to their attention during the public comment period. In response, EPA will, of course, consider such public comments submitted on toxicity. However, it is important to note that the Superfund risk assessment process typically relies heavily on existing toxicity information or profiles that EPA has developed on specific chemicals. EPA believes that the use of a consistent data base of toxicological information is important in achieving comparability among its risk assessments. This information generally includes estimated carcinogen exposures that may be associated with specific lifetime cancer risk probabilities (risk-specific doses or RSDs), and exposures to noncarcinogens that are not likely to present appreciable risk of significant adverse effects to humans (including sensitive subgroups) over lifetime exposures (reference doses or RfDs). EPA has also developed toxicity information for some ecosystem receptors. Where no toxicological information is available in EPA's data base, then EPA routinely considers other available information, including information provided by PRPs or other interested parties. Depending on the evidence, however, EPA may feel it is not appropriate to assess the toxicity of specific chemicals quantitatively because of the questions of reliability and consistency in data development. EPA may decide to address these chemicals qualitatively.

The results of the baseline risk assessment are used to understand the types of exposures and risks that may result from Superfund sites. Key assumptions and uncertainties in both contaminant toxicity and human and environmental exposure estimates must be documented in the baseline risk assessment, as well as the sources and effects of uncertainties and assumptions on the risk assessment results. Exposure assumptions or other information, such as additional toxicity information, may be evaluated to determine whether the risks are likely to have been under- or overestimated. These key assumptions and uncertainties must also be considered in developing remediation goals.

Several commenters suggested that the baseline risk assessment should be used to determine whether

particular requirements were applicable or relevant and appropriate for a site. EPA believes that this determination must be made independently from the risk assessment, although EPA agrees that the assumptions used in the risk assessment should be consistent with those used to determine what requirements will be ARAR for a site. Risk assessment and ARARs serve different functions. The identification of ARARs is used to identify remediation goals and to indicate how remedial alternatives are to be implemented. In contrast, the risk assessment is a technical analysis of the risks posed by hazardous materials at a site. Consequently, it would be inappropriate for these two elements of the RI/FS to be done together.

Final rule: Proposed § 300.430(d)(4) of the rule has been clarified to indicate that both current and potential exposures and risks are to be considered in the baseline risk assessment. No other changes have been made to the rule on risk assessment. The reference to advisories, criteria or guidance in § 300.430(d)(3) has been modified (see preamble section below on TBCs).

Name: Section 300.430(e). Feasibility study.

Existing rule: The 1985 NCP states in § 300.68(d) that a remedial investigation/feasibility study (RI/FS) shall, as appropriate, be undertaken to determine the nature and extent of the threat presented by the release and to evaluate proposed remedies. Part of the RI/FS may also involve assessing whether the threat can be prevented or minimized using source control measures or whether additional actions will be necessary because the hazardous substances have migrated from the area of their original location.

The 1985 NCP discusses FS development of alternatives in § 300.68(f), stating that to the extent it is possible and appropriate, at least one alternative should be developed in each of the following categories:

(1) Treatment alternatives; (2) alternatives that attain ARARs; (3) alternatives that exceed ARARs; (4) alternatives that do not attain ARARs; and (5) a no-action alternative. The alternatives should, as appropriate, consider and integrate waste minimization, destruction, and recycling.

The alternatives developed under § 300.68(f) are subject to an initial screening to narrow the list of potential remedial actions for further detailed analysis. The alternatives that remain after the initial screening must undergo a detailed analysis to evaluate and analyze each alternative against a set of specific criteria. The results of this analysis provide the basis for identifying the preferred alternative.

As specified in § 300.68(i), the appropriate extent of remedy will be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to, and provides adequate protection of, public health and welfare and the environment. This determination will require that a remedy, except in certain specified situations, attain or exceed federal public health and environmental ARARs. In selecting the appropriate ***8712** remedy, the lead agency will consider cost, technology, reliability, administrative and other concerns, and their relevant effects on public health and welfare and the environment. If there are no ARARs, the lead agency will select the cost-effective alternative that effectively mitigates and minimizes threats, and provides adequate protection to public health and welfare and the environment.

Proposed rule: The requirements of SARA led to significant changes in the feasibility study section of the 1985 NCP, primarily in the range of alternatives that are developed for consideration in the FS and in the development of the nine criteria, based on mandates and factors to consider specified by the statute, for analysis of the alternatives. The proposed rule separates the discussion of the FS from the RI. In § 300.430(e), the proposed NCP states that the primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the waste management options can be presented