Department of Energy
Washington, DC 20585
May 20, 1998

Ms. Elizabeth Cotsworth (5301W)
Director, Office of Solid Waste
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Dear Ms. Cotsworth:

Re: Interim Final Policy Directive 9200.4-17, "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites."

The Department of Energy (DOE) is pleased to provide comments on the Interim Final Directive. Given the increased interest in monitored natural attenuation (MNA) as an important component of remedies for contamination at CERCLA, RCRA Corrective Action, and UST sites, the directive is needed. The DOE is encouraged by EPA's pioneering efforts in researching how to demonstrate the efficacy of MNA and by EPA's action to develop a policy directive to promote consistency in how the use of MNA should be proposed, evaluated, and approved.

As indicated in the enclosed comment package, DOE supports the integration of pollution prevention, contingency measures, and institutional controls into MNA remedies as discussed in the interim final directive. While the DOE supports the overall form and content of the Interim Final Policy Directive, there are several areas where the guidance fails to address, or inadequately addresses issues of concern to the DOE. Therefore, the DOE seeks clarification on a number of points including:

integrating MNA into phased remedies;
the role of source control in MNA;
the use of non-EPA guidances;
radioactive decay as a natural attenuation process;
the effectiveness of MNA in remediating chlorinated solvents;
the required content of data used to demonstrate the effectiveness of MNA;
transformation products;
the reasonableness of remediation time frames;
performance monitoring requirements; and,
criteria which would trigger a contingency remedy.

In addition, DOE has a number of editorial comments and questions with regard to terminology.

If you have any questions pertaining to our comments, please contact Jerry Coalgate of my staff at (202) 586-6075 or email jerrycoalgate@hq.doe.gov.

Thomas T. Traceski
Director, RCRA/CERCLA Division
Office of Environmental Policy and Assistance

cc: Hal White, OUST (5401G)

United States Department of Energy
Comments on The Interim Final Policy Directive 9200.4-17,
Use of Monitored Natural Attenuation (MNA) at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

Specific Comments

Purpose and Overview

1) **pg. 1: Integrating Monitored Natural Attenuation (MNA) Into Phased Approaches**

EPA states that it expects that monitored natural attenuation will be most appropriate when used in conjunction with active remediation measures (e.g., source control), or as a follow-up to active remediation measures that have already been implemented (see page 13, paragraph 3). It also discusses the remediation of contamination sources or other highly contaminated areas as a precursor to monitored natural attenuation (see pages 14-15). The guidance, however, never explicitly discusses the use of monitored natural attenuation as a component of a phased approach. DOE suggests EPA consider incorporating into the final guidance some discussion integrating natural attenuation within a phased approach strategy.

2) **pg. 1, 2nd full paragraph, line 14: EPA Indicates "As with any other remedial alternative, monitored natural attenuation should be selected only where it meets all relevant remedy selection criteria, where it will be *fully* (emphasis added) protective of human health and the environment....**

EPA=s language suggests a remedy must always be Afully≅ protective. In is unclear as to the meaning of
there is no risk to humans or ecological resources? Or, does it mean that the risk is below a set value (i.e., 1 x 10-6)? The Department requests that
clearly.

If a more conservative meaning is given to
where it may not possible to achieve the required level given budgetary constraints and the need to mitigate risk at multiple environmental restoration sites located throughout the DOE complex.

3) **pg. 1, 2nd full paragraph: EPA states that "...the availability of monitored natural attenuation as a potential remediation tool does not imply any lessening of EPA's longstanding commitment to pollution prevention."**

The DOE in no way concludes that the availability of monitored natural attenuation (MNA) as a potential remediation tool implies any lessening of EPA's commitment to pollution prevention. Rather, EPA's willingness to accept MNA as a component of the total remedy at Office of Solid Waste and Emergency Response (OSWER)-regulated sites will foster pollution prevention. Active remediation technologies typically produce treatment-related residuals such as wastewater treatment sludges, spent activated carbon, incinerator ash, etc. However, in most cases, the MNA component of a remedy should produce no waste residuals. The MNA component of a remedy prevents pollution and at the same time, result in the remediation of the site.

4) <u>pg. 1 footnote 2:</u> Remediation Objectives

Although DOE appreciates the need to distinguish between objectives and chemical-specific cleanup levels, DOE is not convinced that using the phrase "remediation objectives" reflects the best choice of terms. Specifically, DOE is concerned that the term remediation objectives too closely resembles the term "remedial action objectives" (RAOs)[1] which, under CERCLA [40 CFR § 300.430(e)(2)(i)], consist of medium-specific or operable unit-specific standards for protecting human and environmental receptors and must specify:

> the contaminants and media of concern,
> the potential exposure pathways and receptors, and
> the remediation goals (i.e., an acceptable contaminant level or range of levels for each exposure medium or operable unit).

In contrast, EPA has used the phrase "response objectives" to mean medium-specific, initial cleanup objectives that are established on the basis of the nature and extent of the contamination, the resources that are currently and potentially threatened, and the potential for human and environmental exposure. Relative to responding to ground water contamination, the Agency illustrates potential or generic (i.e., nonsite-specific) objectives that may be appropriate as including:

> Prevent exposure to ground water contaminants.
> Prevent further migration of contaminants to or within ground water.
> Remove contaminant from ground water (ground water restoration).[2]

Because of the previous confusion between remedial action objectives and remediation goals (see 55 <u>FR</u> 8712) and the regulatory specificity of remedial action objectives, DOE suggests EPA consider using the term "response objectives" or "cleanup objectives" to signify the overall objectives that remedial actions are intended to accomplish. Furthermore, the Department recommends EPA begin moving toward inter-program consistency by building a baseline of terms and terminology that can be used interchangeably as a glossary of terms whenever they are used within the context of an OSWER-driven cleanup program.

---

[1] On limited occasions, EPA has used the term "remediation objectives" interchangeably with remedial action objectives (see 55 <u>FR</u> 8712, col. 3).

[2] EPA, 1988. *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (OSWER Dir. 9283.1-2).

5) **<u>pg. 2, 1st full paragraph:</u> EPA states that "Where monitored natural attenuation's ability to meet these expectations is uncertain and based predominantly on predictive analyses, decision makers should incorporate contingency measures into the remedy."**

DOE fully supports EPA's position regarding contingency measures. In cases where MNA's ability to meet remedy expectations is uncertain, decision makers should incorporate contingency measures into the remedy.

6) **<u>pg. 2, 2nd full paragraph:</u> EPA states that: "Furthermore, largely due to the uncertainty associated with the potential effectiveness of monitored natural attenuation to meet remedial objectives that are protective of human health and the environment, source control and performance monitoring are fundamental components of any monitored natural attenuation remedy."**

DOE agrees with EPA regarding the need for performance monitoring as a fundamental component of any MNA remedy. However, DOE questions the need for source control as a component of a MNA remedy. In the Advance Notice of Proposed Rulemaking on the RCRA Corrective Action Program, EPA discussed natural attenuation and stated: "Remedies involving natural attenuation should include: a thorough site characterization; **source control or removal where appropriate**" (emphasis added Part III.C.5.i, 61 *FR* 19451). DOE agrees with the EPA's position as stated in the ANPR; that is, source control or removal should be components of a MNA remedy "where appropriate" and that source control does not necessarily have to be a component of a MNA remedy. DOE requests additional information from EPA regarding what appears to be a change in EPA's position which makes source control a defacto component of a MNA remedy.

7) **<u>pg.2, 3rd full paragraph:</u> The directive states that "Although non-EPA documents may provide regional and state-site managers, as well as the regulated community, with useful technical information, these non-EPA guidances are not officially endorsed by EPA, and all parties involved should clearly understand that such guidances do not in any way replace current EPA or OSWER guidances or policies addressing the remedy selection process in the Superfund, RCRA or UST programs."**

Technical resource documents, and guidance documents will continue to evolve as the scientific understanding of natural attenuation processes continues to evolve. Because of the evolutionary nature of the field, in some cases, EPA guidance on a technical issue may be lacking. In the absence of EPA guidances, the regulated community and regional and state site managers may need to utilize non-EPA policy and technical guidances when evaluating and/or demonstrating the efficacy of MNA as a component of a remedy. DOE recognizes that non-EPA guidances do not in any way replace current EPA or OSWER guidances or policies addressing the remedy selection process. However, in areas other than the remedy selection process such as: sampling/analyses protocols, quality assurance/quality control, predictive modeling, microcosm studies, etc. non-EPA sources may be critical when trying to demonstrate the efficacy of MNA. As a result, it is important for the EPA to emphasize in the final version of the directive that state and regional regulators can consider proposed MNA remedies which rely on non-EPA guidances for the technical foundation of a MNA remedy.

<u>Background</u>

8) **<u>pg. 3, 1st full paragraph:</u> As part of its background discussion, EPA clarifies that "natural attenuation processes" are those processes that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or ground water. EPA recognizes radioactive decay as an attenuation mechanism for certain inorganics (see page 6, para. 2)."**

In listing "in-situ processes" that it views as "natural attenuation processes," however, EPA inadvertently omits the radioactive decay process. Radioactive decay occurs without human intervention and can serve to reduce the activity level. After monitoring (i.e., surveying) the contaminated soil or ground water using an appropriate survey instrument and technique, an individual can demonstrate that the radiation emitted from the media is indistinguishable from representative background levels (i.e., below regulatory concern). Therefore, all subsequent exposures are as low as reasonably achievable (ALARA) below the appropriate dose limits. Accordingly, EPA should consider incorporating "radioactive decay" or "decay" into its list of physical, chemical, or biological processes that constitute in-situ processes.

<u>Transformation Products</u>

9) **<u>pg. 4, 2nd full paragraph:</u> Such cross-media transfer is not desirable, and generally not acceptable except under certain site-specific circumstances, and would likely require an evaluation of the potential risk posed by the contaminant(s) once transferred to that medium.**

It is not readily apparent why cross-media transfer is not acceptable at candidate MNA sites. It would seem that cross-media transfer occurs at the majority of all OSWER-regulated sites and that cross-media transfer is relied upon for at least some of the remedies implemented at those sites.

For example, the release of hazardous constituents from a disposal site into groundwater (a cross-media transfer) may be treated by a groundwater pump and treat system. The release of hazardous constituents into the vadose zone (a cross-media transfer) may be treated by a soil vapor extraction system. Even if cross-media transfers occur, risks posed by contaminants transferred to other medium are already being evaluated as part of the characterization step (Remedial Investigation under CERCLA and RFI under RCRA Corrective Action) in each of the pertinent remediation programs. EPA should consider re-wording portions of the paragraph to indicate that cross-media transfer of transformation products may be inevitable and that such cross-media transfers would have to be fully considered as part of the risk evaluation. The Department seeks clarification on under what circumstances cross-media transfer is acceptable.

<u>Petroleum-Related Contaminants</u>

10) **<u>pg. 5, line 16:</u> Where non-degradable contaminants are present, all processes (listed on page 4).**

This sentence indicates natural attenuation processes are listed on page 4; however, processes actually appear in the first paragraph on page 3. Delete "4" and insert "3".

Chlorinated Solvents

11) <u>pg. 5, 1st full paragraph:</u> However, the hydrologic and geochemical conditions favoring significant biodegradation of chlorinated solvents may not often occur.

DOE recognizes that chlorinated solvents represent a special case in the natural attenuation evaluation process. However, the background discussion on chlorinated solvents in the interim final directive appears to create the impression that MNA may not be an effective remedial option for chlorinated solvents. DOE is concerned that the background discussion may bias regional and state regulators against MNA as a remedial option for chlorinated solvents. It is DOE's experience that there are many sites where MNA is an effective component of a total remedy for chlorinated solvents and that there is literature available (summarized after this comment) documenting the natural attenuation of this class of common contaminants. Furthermore, the fact that a solvent spill contains multiple contaminants does not necessarily preclude MNA from being a viable remediation option. Different contaminants may still attenuate, but at different attenuation rates, and thus natural attenuation may still result in protective contaminant concentrations at exposure points. DOE considers it important for EPA to emphasize in future versions of the directive that regulators should maintain an open mind and weigh the efficacy of MNA as a component of remedy for chlorinated solvents on a case-by-case basis.

- Acton, D.W. 1990 Enhanced in situ biodegradtion of aromatic and chlorinated aliphatic hydrocarbons in anaerobic, leachate-impacted groundwaters; M.Sc Thesis, University of Waterloo, Waterloo, Ontario.

- Bradley, P.M., and Chapelle, F.H. 1996 Anaerobic mineralization of vinyl chloride in Fe(III)-reducing aquifer sediments; Environmental Science and Technology, V. 40, p. 2084-2086.

- Butler, B.J., and Barker, J.F., 1996, Chemical and microbiological transformation and degradation of chlorinated solvent compounds, In Pankow, J.F. and Cherry, J.A. eds. Dense Chlorinated Solvents and Other DNAP:s in Groundwater; History, Behavior, and Remediation; Waterloo Press, Waterloo, Ontario, p. 267-312.

- Chapelle, F.H. 1996, Identifying redox conditions that favor the natural attenuation of chlorinated ethenes in contaminated ground-water systems, In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas TX; EPA/540/R-96/509, September 1996.

- Cox E., Edwards, E. Lehmicke, L. and Major, D. 1995 Intrinsic biodegradation of trichloroethylene and trichloroethane in a sequential anaerobic-aerobic aquifer, In Hinchee, R.E., Wilson, J.T. and Downey, D.C. eds., Intrinsic Bioremediation; Batelle Press, Columbus, OH, P. 223-231.

- Freedman, D.L. and Gossett, J.M. 1989, Biological reductive dehalogenation of tetrachloroethylene and trichloroethylene to ethylene under methanogenic conditions; Applied and Environmental Microbiology., V. 55, no. 4, p. 1009-1014.

- Vogel, T.M., and McCarty, P.L., 1987 Biotransformation of Tetrachloroethylene to

Trichloroethylene, dichloroethylene, Vinyl Chloride, and Carbon Dioxide Under Methanogenic Conditions. Appl. Environ. Microbiology. 49: 1080-1083.

Inorganics

12) pg. 6, 1st full paragraph: Monitored natural attenuation may, under certain conditions (e.g., through sorption or oxidation-reduction reactions), effectively reduce the dissolved concentrations and/or toxic forms of inorganic contaminants in groundwater and soil.

EPA may wish to consider including the following types of factors that must be demonstrated on a site-specific basis and may help to distinguish those sites at which natural attenuation may be a viable option:

1. There may be natural reductants present within the aquifer;
2. The amount of inorganic species (e.g., hexavalent chromium) and other reactive constituents do not exceed the capacity of the aquifer to reduce them;
3. The time period required to achieve reduction of the inorganics to the target concentration is less than the time period for the transport of the aqueous inorganic constituents from the source to the point of compliance;
4. Once reduced, the inorganic will remain immobile; and
5. There is no net oxidation of the inorganic constituents.

Advantages and Disadvantages of Monitored Natural Attenuation

13) pg. 7, 1st full paragraph: As with any *in situ* process, generation of lesser volume of remediation wastes (bullet #1) ....and**... Less intrusion as few surface structures are required (bullet # 2);**

In the first bullet, EPA is describing advantages of an *in situ* process. EPA should consider augmenting this bullet with the following: "reduced risk of unexploded ordnance hazards to site workers and when radionuclides are present, adheres to ALARA requirements, provided site circumstances offer conditions that lead to better management and control of exposures."

In the second bullet EPA indicates the following: "Less intrusion as few surface structures are required;" EPA should consider augmenting this bullet with "Less intrusion resulting in reduced disturbance of important ecological resources."

EPA may also wish to consider adding the following:

> Minimizes potential for causing downward DNAPL (dense nonaqueous phase liquid) migration by avoiding inadvertent drilling through a barrier layer below DNAPL, which can create a vertical pathway for DNAPL migration;

Implementation

14) pg. 8, 1st full paragraph, line 10: Topics addressed include....

Insert the phase "the role of monitored natural attenuation;" after the word "include".

Role of Monitored Natural Attenuation in OSWER Remediation Programs

15) **pg. 9, 2nd bullet: Contaminated groundwaters should be returned to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site. When restoration of groundwater is not practicable, EPA "expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction (which may be appropriate).**

The Department believes it is important that EPA reiterate its policy that, although these expectations guide remedial alternative development, the fact that a proposed remedy is consistent with the expectations does not necessarily constitute sufficient grounds for the selection of that remedial alternative (55 FR 8702).

16 **pg. 9, Footnote 8: Contaminated groundwater is neither a principal nor a low-level threat waste**.

The footnote correctly indicates that contaminated groundwater is neither a principal nor a low-level threat waste. It may be difficult, however, to separate (from a remediation standpoint) groundwater from any associated pools of DNAPLs submerged beneath or light nonaqueous phase liquids (LNAPLs) floating on top. Moreover, DOE points out that EPA has clarified that free product (NAPLs) floating on or submerged beneath groundwater are examples of principal threat wastes (see OSWER Directive 9380.3-06FS). Therefore, the Department suggests EPA consider revising the last sentence to read "Contaminated groundwater itself is nether a principal nor a low-level threat waste; however, free product floating on or submerged beneath groundwater may constitute a principal threat waste."

17) **<u>pg. 10, 2nd full paragraph, lines 3 and 18:</u> It also should be emphasized that the selection of monitored natural attenuation as a remedy does not imply that active remediation measures are infeasible, or are "technically impracticable".....** and **.....from the recognition that the restoration of a portion of the plume is technically impracticable.....**

Insert the phrase "from an engineering perspective" after the word "impracticable".

<u>Demonstrating the Efficacy of Natural Attenuation through Site Characterization</u>

18) **<u>pg. 11, 2nd full paragraph:</u> Use of Data Quality Objectives**

DOE agrees with EPA's emphasis on the utility of the site conceptual model during site characterization. EPA may also wish to consider recommending the integration of the Data Quality Objectives (DQO) process in the site characterization step.

19) **<u>pg. 12, 2nd full paragraph:</u> Once the site characterization data have been collected and a conceptual model developed, the next step is to evaluate the efficacy of monitored natural attenuation as a remedial approach. Three types of site-specific information or "evidence" should be used in such an evaluation:**

DOE agrees that site-specific evidence is essential in performing an evaluation. However, the differences between the evidence in bullet "2" versus bullet "3" are not readily apparent. Since geochemical analyses may also result in the identication of microbially produced degradation products, it might be useful to clarify that bullet # 3 is addressing laboratory studies of microbial action, if indeed this is what is really inferred.

DOE recognizes that the directive is a policy directive and not a technical resource document, however, key technical points are touched on in the discussion on page 12 and additional technical points should be added in order to make the discussion complete.

The literature suggests, and DOE and its environmental restoration contractors have learned through experience, that demonstrating the efficacy of MNA in the case of contaminated groundwater almost always requires a sampling program that focuses on the collection of a number of field and "fixed-lab" analytical parameters. A more complete discussion of the elements of such a sampling program should be included in point 2 on page 12. For example, in order to demonstrate the efficacy of MNA for chlorinated solvents in groundwater, as a minimum, investigators need to determine field parameters gauging the oxidation/reduction status (oxidation reduction potential, dissolved oxygen concentrations, carbon dioxide, methane), relative concentrations of ion couplets (sulfide/sulfate, nitrate/nitrite, ferrous/ferric iron) and parameters to determine likely degradation pathways (ethane, ethene, volatile organics). DOE recognizes that the preceding discussion focused on groundwater, but the point is that, in all likelihood, demonstrating the efficacy of MNA for other contamination scenarios are probably equally complex.

If possible, DOE urges EPA to establish, in subsequent versions of the directive, the nature of the "Hydrogeologic and geochemical data referenced only generally in bullet # 2 that can be used to demonstrate natural attenuation for contaminated media.

Sites Where Monitored Natural Attenuation May Be Appropriate

20) pg. 14, second bullet: The directive states "Whether the resulting transformation products present a great risk than do the parent contaminants."

DOE seeks clarification on this bullet. DOE does not consider the scenario described in the bullet, as it is currently worded, to be appropriate as a criterion to determine whether or not MNA is an appropriate remedy at a site. The fact that, in some cases, natural attenuation transformation products represent a greater risk than parent contaminants should not exclude a site for consideration of MNA as a remedy component. In some cases, although more threatening daughter products are produced and exist in the environment transiently, over the long-term even the daughter products are degraded to harmless constituents. For example, the more highly chlorinated ethanes and ethenes may be attenuated biotically and abiotically in the anaerobic portions of an aquifer by such reactions as reductive dehalogenation. Reductive dehalogenation may produce vinyl chloride which then discharges to aerobic surface waters and continues to degrade aerobically to harmless constituents. In this case, although a more harmful transformation product was produced, over the long-term, natural attenuation continued to degrade the vinyl chloride to harmless constituents.

EPA may wish to consider re-wording the language of the bullet to account for (and to allow) the temporary generation of more harmful daughter products in some natural attenuation systems.

21) pg. 14, 1st full paragraph, line 2: The directive states that "...lower concentration portions of the plume could achieve cleanup standards within a few decades through monitored natural attenuation if this time frame is comparable to those of more aggressive methods evaluated for this site."

DOE seeks clarification of EPA's position. In some cases, MNA and source control acting together may be sufficient to prevent the further migration of a plume; however, in other situations the rate of the natural attenuation may be such that contaminant levels within the plume cannot be reduced sufficently over time to prevent the migration of the plume. It would be useful if the Agency would define under what conditions can the regulated community use MNA to assist in preventing the growth or migration of a plume rather than strictly the "cleanup" of a plume? In addition, it would be useful if the Agency would what a reasonable (or maximum) "number of decades" that would be appropriate for the purposes of implementing monitored natural attenuation remedies.

22) **<u>p.14, last bullet:</u> Whether reliable site-specific vehicles for implementing institutional controls (i.e., zoning ordinances) are available, and if an institution responsible for their monitoring and enforcement can be identified.**

DOE agrees with considering the reliability of institutional controls (IC) when evaluating whether MNA is an appropriate remedy. Source control (a necessary component of some MNA remedies), which amounts to long-term exposure control, will need to be maintained with physical and institutional controls. As a result, institutional controls and an institution responsible for monitoring IC and enforcement will be an important foundation of some MNA remedies.

23) **<u>pg. 15, 1st complete paragraph:</u> Of the above factors, the most important considerations regarding the suitability of monitored natural attenuation as a remedy include whether the groundwater contaminant plume is growing, stable, or shrinking, and any risks posed to human and environmental receptors by the contamination.**

EPA's conclusion appears incomplete. As discussed in the preceding sentences, two important considerations regarding the suitability of monitored natural attenuation include (1) aerial extent and movement of the contaminant plume and (2) **any risks posed to receptors** (emphasis added). EPA's conclusion, however, focuses on plume dynamics only. Insert the phrase "provided risks to potential receptors are negligible" following the word "remedies."

24) **<u>pgs.15-16:</u> Reasonableness of Remediation Time Frame**

The Department suggests EPA consider the suitability of including the following bullets as additional factors to be considered when evaluating the length of time appropriate for remediation (i.e., a reasonable time frame"):

> Potential and time period for groundwater to discharge to a surface water and significance of impact to surface water or associated ecological resources;
> Proportional decreases in risks to human health and the environment from exposure to carcinogens (e.g., radionuclides)/non-carcinogens relative to time period transpired;
> Projected amount of radioactive decay, and decay by-products expected to be present;
> Availability or expected availability of innovative technologies designed to address (in-situ or ex-situ) the particular contaminant(s) of concern (e.g., high-level waste);
> Expected affect of previously conducted, ongoing, or proposed remedial actions at the site and time frame associated with evidence of those affects; and
> Performance (i.e., success or lack thereof) of any previously conducted or ongoing remedial action(s).

Also, in discussing sources of information and guidance relevant to the enumerated factors, EPA mentions its policy for deferring to state determinations when they are reflected in an EPA-endorsed Comprehensive State Ground Water Protection Program (CSGWPP). To facilitate uniformity, the Agency should consider presenting its policy when the state does not have an EPA-endorsed CSGWPP (see *The Role of CSGWPPs in EPA Remediation Programs* (OSWER Directive 9283.1-09).

Performance Monitoring

25) pgs. 17-18: Performance monitoring to evaluate remedy effectiveness and to ensure protection of human health and the environment is a critical element of all response actions.

Although DOE recognizes the importance of monitoring (especially relative to this remedial alternative), the suitability and performance of ongoing natural attenuation requires both a monitoring program and an evaluation strategy (i.e., how the data collected during monitoring will be presented for interpretation and decision making purposes). The Department suggests that EPA consider revising the heading to read "Performance Monitoring and Evaluation" and expand the discussion under this heading to include performance evaluation considerations. One potential source of information is an EPA guidance document titled *General Methods for Remedial Operations Performance Evaluations* (EPA/600/R-92/002). This guidance also furnishes general considerations and principles for formulating performance monitoring strategies.

26) pgs. 17-18: Performance monitoring to evaluate remedy effectiveness and to ensure protection of human health and the environment is a critical element of all response actions.

DOE suggests that this section address the potential for decreasing monitoring requirements as the remedy matures. This is especially important to DOE because of the costs associated with long-term monitoring. Formal policy acknowledgment of the potential to evaluate and reduce monitoring could help DOE optimize limited environmental restoration dollars.

27) pg. 18-19: A contingency remedy is a cleanup technology or approach specified in the site remedy decision document that functions as a "backup" remedy in the event that the "selected" remedy fails to perform as anticipated.

The Department agrees with EPA that although sufficient information, available at the time of site remedy decision document (e.g., Record of Decision, RCRA permit) signature, may indicate that employing monitored natural attenuation will achieve the response objectives at a site, environmental restoration program managers should consider including one or more contingency measures in that document.

From another perspective, EPA does not present its views on incorporating the use of monitored natural attenuation as the future contingency into a decision document. DOE suggests EPA consider: (1) discussing when the Agency believes it may be appropriate to include monitored natural attenuation as a contingent measure in a site remedy decision document; and (2) furnish criteria that can be used to indicate when its appropriate to implement monitored natural attenuation as a contingency remedy.

Also, in its recent technical impracticability (TI) guidance document (*Guidance for Evaluating the Technical Impracticability of Groundwater Restoration*,OSWER Directive 9234.1-25), EPA suggests that when an existing ROD already includes a contingency for invoking a TI waiver, EPA suggests performing the following activities before concluding that a TI waiver is appropriate for the situation:

Implement/augment the remedy to improve its ability to attain cleanup levels; and,

Enhance the remediation technology for a sufficient period of time to ensure that the remedy's ability to restore contaminated ground water is thoroughly evaluated.

Recognizing that these activities were related to triggering a TI decision, DOE requests that EPA consider clarifying whether these types of activities also would be required before concluding that monitored natural attenuation, as a contingency, should be implemented

Summary

28) pg. 20, last paragraph, line 3: However, EPA believes that there will be many other sites where uncertainties too great or a need for a more rapid....

In the last paragraph, the phrase " uncertainties too great" is awkwardly phrased. The Department suggests inserting "are" after "uncertainties."