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Protection Agency

Science Advisory Board
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September 1994

EPA

AN SAB REPORT: REVIEW OF EPA'S APPROACH TO SCREENING FOR RADIOACTIVE WASTE MATERIALS AT A SUPERFUND SITE IN UNIONTOWN, OHIO

PREPARED BY THE *ad hoc* INDUSTRIAL EXCESS LANDFILL PANEL OF THE SCIENCE ADVISORY BOARD

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

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

September 30, 1994

EPA-SAB-EC-94-010

Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Subject: Review of issues related to the Agency's approach to screening for radioactive waste materials at Superfund sites, focusing on the Industrial Excess (IEL) Landfill Site in Uniontown Ohio.

Dear Ms. Browner:

The *ad hoc* Industrial Excess Landfill Panel of the Science Advisory Board (SAB) has completed its review of issues related to the Agency's approach to screening for radioactive waste materials at the Industrial Excess Landfill (IEL) Superfund Site in Uniontown, Ohio. This review was conducted at the request of the Office of Solid Waste and Emergency Response (OSWER). The following summarizes our responses to the Panel's Charge.

1) For screening purposes, what types of temporal and spatial sampling and analyses are sufficient to test a hypothesis that radioactive contamination is present?

Screening for radioactivity can be accomplished by analyzing drilling cores and/or well clusters on or near a site. Ground water analysis is effective in detecting radioactivity leaving the site, allowing corrective actions to be taken. There is no clear evidence that ground water monitoring is more sensitive in detecting the presence of radioactive material in the landfill than would be a soil core sampling program. However, the ground water monitoring program serves the additional purpose of protecting public health through corrective action, should radioactivity later be found to leak into the ground water. We see no basis for substantial additional radiation testing at the IEL site; however, it would be prudent after remediation to test a sample of the pump and treat water flow for radiation at least each calendar quarter until the successive quarterly samples have produced a constant level of near-basal gross alpha and beta activity.

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2) What radiological parameters, e.g., gross alpha plus alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14, are sufficient to determine the possible existence/extent of potential sub-surface radiological contamination? Are the methods employed by EPA for analysis of radioactive contamination adequate and appropriate for analyses of samples from hazardous waste sites?

The set of radiological parameters identified by EPA (gross alpha, alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14) is appropriate and sufficient for screening surveys to determine the possible existence and/or extent of potential sub-surface radiological contamination. The analytical methods identified by EPA for radionuclide analyses at hazardous waste sites are time-tested and appropriate. Some of the documentation on procedures presented to the *ad hoc* Panel, however, was several years old and sometimes did not reflect recent advances. Therefore, we recommend that EPA review and update its procedures in order to remain current and state-of-the-art.

3) There are generic guidelines for sampling and analytic methods and chain of custody protocols to ensure that cross contamination or tampering with samples does not occur when dealing with radioactive contaminants. If appropriate, these guidelines may be modified on a site-specific basis depending on the characteristics of the site in question. What modifications are scientifically justified while still assuring accurate, precise and valid data?

Generic guidelines for chain of custody protocols are not likely to have to be modified based on site characteristics. The guidelines for sampling and analytic methods could under certain site conditions be adapted to local conditions. Soil hydrology and geology could suggest that a standard protocol for sampling be modified. If radioactivity is a concern then well samples containing suspended solids should be appropriately separated and dissolved and suspended radioactivity assessed quantitatively. We also recommend the following: a) that surface monitoring for radioactivity be undertaken using a survey monitor very early in the characterization of a Superfund site; b) that during the remedial investigation of a Superfund site one round of gross alpha and gross beta activity in the monitoring wells be included in the protocol at the time the wells are investigated for other constituents. This would serve to establish whether special consideration should be given to radioactive deposits; c) that the cores collected at the time of the development of monitoring wells be subjected to a radiological survey by gamma analysis, and the results should be made a part of the remedial investigation record; and d) that if pump-and-treat is implemented at a site for non-radioactive clean-up and radioactive contamination is suspected, we recommend consideration of monitoring of the pump and treat flows for radioactivity for some period of time as a useful addition to any remedial plan.

4) What factors need to be considered in the development and application of data validation criteria for evaluation of radioactive contaminants at hazardous waste sites?

Verification should insure that: all contractual agreements, as outlined in the "Statement of Work" are in compliance for a given project; a pre-award audit of the laboratory is done by a team of experts before a contract is initiated; the lab is consistently performing well by submitting to the lab blind samples with known quantities of spikes disguised as real samples; the laboratory providing radiochemical analysis services must use agreed-upon and approved Standard Operating Procedures (SOPs), including software that is verified, validated and documented for approved instruments; and the equipment calibrations are performed using National Institute of Standards and Technology (NIST) traceable reference radionuclide standards.

Validation includes: reviewing the results and data from planning stages through sample collection, logging in, receiving, sample preparation, analysis, radiation measurements, calculation of results with associated propagated errors, and documentation; reviewing results of a given batch of samples along with quality control samples (Quality Control (QC) spiked samples, blanks, duplicates, blinds, etc.) for contractual requirements and technical correctness to validate the results; insuring that documentation is available if corrections are made and qualifiers added to the data (the same for rejected results); and reviewing all data to ensure that the data are of the level of accuracy and precision required, defensible, and complete.

5) What practices and organizational changes could lead to improved credibility for the U.S. EPA and constructive public participation at hazardous waste sites with potential radioactive contamination?

Good risk communication practices are vital to effective Superfund site management. Broadly construed, such practices entail: a) establishing an organizational structure that enables all stakeholders to inform, be informed and observe the total risk management process including risk identification; b) establishing some shared understanding of the goal of the risk assessment and management process; c) recognizing and respecting differences in language and searching for a common understanding of the site characterization; d) clearly specifying and agreeing on who has the authority and responsibility to make final decisions; and e) designating and agreeing on how differences will be arbitrated should that be necessary.

6) Presence of Radioactive Materials at the IEL Site

Historical evidence for the presence of radioactive materials is limited to anecdotal reports of "midnight dumping" at the site by vehicles alleged to have been marked with radiation symbols. Disposal records and a search of the records of the identified landfill users have not indicated the probability of disposal of radioactive materials. In addition, the available analytical data do not indicate that radioactive contamination is present at the IEL site as a result of disposal at the site. While there are a small number of analytical values that are unexpectedly high relative to the associated uncertainty estimates, the occurrence of such high values follows a pattern that is more characteristic of analytical errors or accidental contamination in the laboratory than of a positive identification of the occurrence of radioactivity at a field site.

Based on all the evidence presented to the *ad hoc* Panel, we judge it to be highly unlikely that radioactive contamination is, or was, present. Of course it is not (and never will be) possible to unequivocally establish the absence of contamination. Nonetheless, as noted in the response to the Panel Charge, the tests performed were appropriate and adequate to detect the occurrence of radionuclides that might be expected based on experience at sites that are contaminated with the most common radionuclides. Thus, the current weight of evidence argues that the issue of radioactive contamination should not be pursued further and the confirmed issue of chemical hazards and remediation thereof should proceed expeditiously.

Although the Board does not normally undertake site-specific reviews, we felt that there was merit in looking at this site and applying our responses to the questions raised in the charge broadly to include the generic methodology the Agency applies to evaluating the presence of radioactive waste at hazardous waste sites. We wish to express the Panel's appreciation for the excellent cooperation and assistance we received from all parties involved at IEL. While we felt the review exercise was valuable, it does require a large commitment of time and resources. In general, we will consider site-specific reviews on a case-by-case basis. We are pleased to have participated in this process and look forward to your response to our report.

Sincerely,

Genevieve M. Matanoski

Dr. Genevieve Matanoski, Chair
Executive Committee
Science Advisory Board

Dr. Jan A.J. Stolwijk, Chair
ad hoc Industrial Excess
Landfill Panel
Science Advisory Board

Enclosure

NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide balanced expert assessment of scientific matters related to problems faced by the Agency. This report has not been reviewed for approval by the Agency; and hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency or other agencies in the Federal government. Mention of trade names or commercial products does not constitute a recommendation for use.

ABSTRACT

The *ad hoc* Industrial Excess Landfill Panel of the Science Advisory Board reviewed issues related to the USEPA's screening criteria and procedures for radioactive waste materials, using the Industrial Excess Landfill Superfund site in Uniontown, Ohio as a test case. The Panel was asked: a) For screening purposes, what types of temporal and spatial sampling and analyses are sufficient to test a hypothesis that radioactive contamination is present? b) What radiological parameters are sufficient to determine the possible existence/extent of potential sub-surface radiological contamination? Are the methods employed by EPA for analysis of radioactive contamination adequate and appropriate for analyses of samples from hazardous waste sites? c) What modifications to generic guidelines for sampling and analytic methods and chain of custody protocols are scientifically justified while still assuring accurate, precise and valid data? d) What factors need to be considered in the development and application of data validation criteria for evaluation of radioactive contaminants at hazardous waste sites? e) What practices and organizational changes could lead to improved credibility for the U.S. EPA and constructive public participation at hazardous waste sites with potential radioactive contamination? The Panel responded to these and other questions in their report. Many of the Panel's conclusions and recommendations concerning issues such as sampling protocols, laboratory selection, data validation and verification, chain of custody, and risk communication should be taken broadly to apply to EPA's actions concerning Superfund sites in general, and not just the Industrial Excess Landfill which is featured in this report.

KEY WORDS: Industrial Excess Landfill; Superfund; Ohio; Radioactive Contamination

U.S. Environmental Protection Agency
Office of the Administrator
Science Advisory Board
ad hoc IEL Advisory Panel

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*NOTE: Dr. Robert J. Huggett, Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, Gloucester Point, VA, initially served as the Chair of this *ad hoc* Panel. At the time the report was being finalized he was selected by President Clinton as Assistant Administrator Designee for EPA's Office of Research and Development. Consequently, Dr. Huggett resigned from his position on the Science Advisory Board and this Panel.

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1. EXECUTIVE SUMMARY

The *ad hoc* Industrial Excess Landfill (IEL) Panel of the Science Advisory Board (SAB) has reviewed issues[1] related to the Agency's approach to screening for radioactive waste materials, using the IEL Superfund site in Uniontown, Ohio as a test case. Even though a specific site was investigated, the *ad hoc* Panel was asked to respond to a number of questions which addressed concerns that were applicable to Superfund sites in general. The Panel held three public meetings on July 20-21, 1993 (in Akron, Ohio), September 21-22, 1993 (in Washington, DC) and December 14, 1993 (in Uniontown, Ohio).

The Charge to the Panel asked: a) For screening purposes, what types of temporal and spatial sampling and analyses are sufficient to test a hypothesis that radioactive contamination is present? b) What radiological parameters, e.g., gross alpha plus alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14, are sufficient to determine the possible existence/extent of potential sub-surface radiological contamination? Are the methods employed by EPA for analysis of radioactive contamination adequate and appropriate for analyses of samples from hazardous waste sites? c) There are generic guidelines for sampling and analytic methods and chain of custody protocols to ensure that cross contamination or tampering with samples does not occur when dealing with radioactive contaminants. If appropriate, these guidelines may be modified on a site-specific basis depending on the characteristics of the site in question. What modifications are scientifically justified while still assuring accurate, precise and valid data? d) What factors need to be considered in the development and application of data validation criteria for evaluation of radioactive contaminants at hazardous waste sites? e) What practices and organizational changes could lead to improved credibility for the U.S. EPA and constructive public participation at hazardous waste sites with potential radioactive contamination?

The Panel has responded to its Charge as well as addressed other issues it felt warranted further attention. It should be noted that many of the Panel's conclusions and recommendations concerning issues such as sampling protocols, laboratory selection, data validation and verification, chain of custody, and risk communication should be taken broadly to apply to EPA's actions concerning Superfund sites in

[1] For a partial listing of the review materials available for the *ad hoc* Panel's review, please refer to Appendix A. This includes materials provided by the US EPA as part of the formal review process, as well as relevant listings from the Ohio EPA, which supplement the US EPA materials. Information on materials and comments from other sources, including other government agencies and interested parties is contained in the archives of the SAB.

general, and not just the Industrial Excess Landfill Superfund site in Uniontown, Ohio which is featured in this report.

1.1 Temporal and Spatial Sampling and Analyses

Principal methods for determining the presence of radioactive contamination at a site include ground surveys, ground water monitoring and soil coring studies. Ground surveys should be routinely conducted as an initial screening method, though they are only able to detect radiation near the immediate surface of a landfill. Furthermore, it is difficult or often infeasible to implement a ground survey at a site once it has become significantly overgrown with vegetation, as is the case at the IEL site. A groundwater monitoring program is effective at identifying the presence of soluble radioactive materials, since the goundwater provides as integrated measure of the materials in the landfill, but only if the resulting concentrations are high enough to be detected and are distinguishable from background concentrations in the area. Core sampling is more effective at identifying small quantities of immobile wastes, but only if the core borings encounter the wastes. If radioactive materials have been spread broadly over a wide horizontal area, then such an encounter is likely to occur with a limited and feasible number of core borings. However, if the waste is confined, then the probability of encounter is very low, unless an extraordinary (often infeasible) number of borings is made.

The scientific studies used by the Agency to support the selection of a ground water monitoring program, and not a soil core sampling program, are summarized in correspondence from EPA Region 5 Administrator Valdas Adamkus to Senator John Glenn (EPA, 1990[2]; EPA, 1991[3]). Each letter includes a technical report; the first demonstrating the infeasibility of the core monitoring program, the second supporting the adequacy of ground water monitoring. Both of these reports include technical flaws and provide no clear evidence that ground water monitoring is more sensitive in detecting the presence of radioactive material in the landfill than would be a soil core sampling program. However, the ground water monitoring program serves the additional purpose of protecting public health by allowing for corrective action, should radioactivity later be found to leak into the ground water. A groundwater monitoring program is thus an effective and appropriate method for determining both the

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[2] EPA, 1990. Letter from EPA Region 5 Administrator Valdus Adamkus to Senator John Glenn, transmitting EPA's justification for not characterizing the waste material by soil core sampling with analysis for radionuclides. December 18, 1990.

[3] EPA, 1991. Letter from EPA Region 5 Administrator Valdus Adamkus to Senator John Glenn, transmitting EPA's ground water modeling report which was used to estimate the concentration of three potential radioactive sources downgradient from the IEL landfill at selected periods. March 25, 1991.

presence and potential health implications of radioactive contamination at a site such as IEL.

An effective groundwater sampling program requires the use of a sufficient number of monitoring wells to detect multiple possible pathways from the landfill, and a adequate number of properly located background wells to describe the distribution of naturally occurring radiation at the site. The background wells must be located at sufficient distances upgradient from the site to ensure that they have not been influenced by leakage from the site. Given the radial pattern of groundwater flow at the site identified by USGS, and the uncertainty this creates in identifying upgradient vs. downgradient wells, the two current background well clusters at the IEL site are not adequate to reliably characterize the background condition. More background wells are needed at moderate and further distances from the landfill. In addition, the Agency should consider a special monitoring program during or following storm events at seepage faces near the landfill. This type of sampling program involves a proactive search for evidence of contamination where it is most likely to be found, and has been effective at locating wastes which are periodically mobilized at other sites.

Despite these problems, we believe that EPA has looked hard for signs of radioactive contamination and has not found clear evidence to support a claim of past radioactive dumping. That does not imply that such dumping did not occur, only that presently there is little or no evidence for it. We see no basis for substantial additional radiation testing at the IEL site; however, it would be prudent after remediation to test a sample of the pump and treat water flow for radiation at least each calendar quarter until the successive quarterly samples have produced a constant level of near-basal gross alpha and beta activity.

With the recommendations presented above and additional recommendations discussed later concerning sampling methodology to provide a full accounting of both particulate and dissolved radiation, the current groundwater monitoring program is deemed adequate to indicate the presence of radioactive contamination at IEL and provide future protection for public health. However, should the Agency decide to consider a soil coring program, it should be recognized that it will likely be effective only for determining the presence of contamination which is widely spread over a significant horizontal area. Such a program should thus be limited to this particular objective, and be very limited in scope.

1.2 Radiological Parameters and Analytical Methods

The set of radiological parameters identified by EPA (gross alpha, alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14) is appropriate and sufficient for screening surveys to determine the possible existence and/or extent of potential sub-surface radiological contamination. If there is concern about possible radiological contamination at a particular site, then all available information should be reviewed (e.g., site characterization) to determine whether specific radionuclides might reasonably be expected at the site. Obviously, if it were known (or there were adequate reason to suspect) that specific radionuclides have been disposed of at the site, analyses for those contaminants should be conducted.

The analytical methods identified by EPA for radionuclide analyses at hazardous waste sites are time-tested and appropriate. Some of the documentation on procedures presented to the *ad hoc* Panel, however, is several years old and sometimes does not reflect recent advances. Therefore, we recommend that EPA remain cognizant of, and responsive to, advances in radiochemical procedures and analytical technology as they may apply to the characterization of hazardous waste sites for radiochemical materials.

1.3 Guidelines for Sampling

Guidelines for sampling and analytic methods and chain of custody protocols may be modified on a site-specific basis depending on the characteristics of the site in question. Very early in the characterization of a Superfund site we recommend that surface monitoring be undertaken using a survey monitor. Even though a surface survey likely will not detect any radioactive material at depths greater than several inches (depending on the amount of radionuclide present and the characteristics of radiation emitted), it will provide a helpful record of the pre-remediation state. During the remedial investigation one round of gross alpha and gross beta activity in the monitoring wells at the time the wells are investigated for other constituents would serve to establish whether special consideration should be given to radioactive deposits. The drinking water protocol as used at IEL, without separate determination of the activity in suspended solids, should suffice for this first determination. The cores collected at the time of the development of monitoring wells should be subjected to a simple radiological survey (with a Geiger-Mueller counter), and the results should be made a part of the remedial investigation record. If pump-and-treat is implemented at a site for non-radioactive clean-up and radioactive contamination is suspected, monitoring of the pump and treat flows for radioactivity for some period of time would be a necessary addition to any remedial plan. Such monitoring could reasonably be restricted to gross alpha and beta analysis.

1.4 Data Validation Criteria

The goal of any quality-oriented measurement program is to establish credibility and to maintain the quality of results within established limits of acceptance. A good laboratory that provides analytical services of high integrity will gain customer and public confidence. Meaningful and reliable results generated by the laboratory will also be legally defensible in a court of law. In order to achieve the goal of obtaining quality data, verification and validation must be carried out for the sample collection, analysis, and measurement processes.

Verification exercises should insure that: a) all contractual agreements, as outlined in the "Statement of Work" are in compliance for a given project; b) a pre-award audit of the laboratory is done by a team of experts before a contract is initiated; c) the lab is consistently performing well by submitting to the lab blind samples with known quantities of spikes disguised as real samples; d) the laboratory providing radiochemical analysis services must use agreed-upon and approved Standard Operating Procedures (SOPs), including software that is verified, validated and documented for approved instruments; and e) the equipment calibrations are performed using National Institute of Standards and Technology (NIST) traceable reference radionuclide standards.

Validation exercises include: a) reviewing the results and data from planning stages through sample collection, logging in, receiving, sample preparation, analysis, radiation measurements, calculation of results with associated propagated errors, and documentation; b) reviewing results of a given batch of samples along with quality control samples (Quality Control (QC) spiked samples, blanks, duplicates, blinds, etc.) for contractual requirements and technical correctness to validate the results; c) insuring that documentation is available if corrections are made and qualifiers added to the data (the same for rejected results); and d) reviewing all data to ensure that the data are of the level of accuracy and precision required, defensible, and complete.

1.5 Risk Communication

Good risk communication practices are vital to effective Superfund site management. Broadly construed, such practices entail: a) establishing an organizational structure that enables all stakeholders to inform, be informed and observe the risk assessment and management process; b) establishing some shared understanding of the goal of the risk assessment and management process; c) recognizing and respecting differences in language and searching for a common understanding of the site characterization; d) clearly specifying and agreeing on who has the authority and responsibility to make final decisions; and e) designating and agreeing on how differences will be arbitrated should that be necessary.

At the IEL site, both disagreements about prior knowledge and expectations about the site and disagreements about how to interpret new information have contributed to conflicting judgments about risk, and consequent differences in opinions between various stakeholders and EPA about appropriate management of the site. Conflicts are likely to continue until the public and the U.S. EPA find some common ground.

Invalidation and non-release of data from the first round of IEL sampling and the subsequent growth of suspicion and distrust provides an important object lesson. Data, once collected, should not be withheld. Even when results must be weighted with qualifying statements or even totally discounted, it is ultimately wise to release them. Obviously, appropriate qualifiers should accompany the data, just as the uncertainty terms should accompany data from radionuclide analyses. However, even with qualifiers, misuse or misinterpretation of the results should be anticipated. Nonetheless, the use of unreliable data is a less serious problem than the overall loss of credibility that results from apparent data suppression. This conclusion for the IEL experience is borne out by the much larger experience relating to radioactive discharges at sites operated by or for the Department of Energy (DOE).

1.6 Radioactive Materials at the IEL Site

Although not part of the stated charge to the Panel, it is clear that one of the important issues which the *ad hoc* Panel needed to address is the possibility of radioactive contaminants at the Industrial Excess Landfill. Historical evidence for such presence is limited to anecdotal reports of "midnight dumping" at the site by vehicles alleged to have been marked with radiation symbols. Disposal records and a search of the records of the identified landfill users have not indicated the probability of disposal of radioactive materials. In addition, the available analytical data do not indicate that radioactive contamination is present at the IEL site as a result of disposal at the site. While there are a small number of analytical values that are unexpectedly high relative to the associated uncertainty estimates, the occurrence of such high values follows a pattern that appears more characteristic of analytical errors or accidental contamination in the laboratory than of a positive identification of the occurrence of radioactivity at a field site.

While significant evidence of contamination is not found in the current data, neither is it possible from these data to preclude the possibility that some radioactive contamination is present. Indeed, it is not now (and never will be) possible to unequivocally establish the absence of contamination. The current groundwater monitoring, with the recommended modifications of including more background wells, full accounting of dissolved and particulate phase radioactivity, and a proactive wet-weather survey, is adequate for the intended radioactive screening and protection of public health. Should this program conclude that there is no evidence of contamination, ongoing radiological screening of area drinking water and groundwaters pumped as part of the site remediation plan would then be adequate over the longer term. If the Agency elects to supplement the program with additional soil core sampling, it should be of limited scope, aimed only at detecting the presence of a widely dispersed waste. While some screening effort to detect radioactive contamination should continue, the current lack of evidence of contamination is such that no further delay in planned remediation is warranted. This additional monitoring should thus be conducted in concert with planned efforts to remediate the confirmed chemical hazards present at the site.

2. INTRODUCTION

2.1 Charge to the Panel

The Agency's Office of Solid Waste and Emergency Response (OSWER) requested that the Science Advisory Board (SAB) conduct a review of issues related to screening criteria and procedures for radioactive waste materials at Superfund sites, using the Industrial Excess Landfill Superfund Site in Uniontown Ohio as a test case. The SAB established an *ad hoc* panel to conduct this review. In general, at hazardous waste sites where radioactive contamination is suspected, EPA first performs a screening round of sampling. If the screening round data indicate that there is a problem, the Agency performs more extensive investigations. If the screening round data indicate no radiological contamination, further radiological testing is eliminated. What kind of sampling and analytic protocol is adequate to determine the presence/extent of soil and groundwater contamination at a site which may incorporate radioactive wastes? The specific items of the Charge were:

a) For screening purposes, what types of temporal and spatial sampling and analyses are sufficient to test a hypothesis that radioactive contamination is present?

b) What radiological parameters, e.g., gross alpha plus alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14, are sufficient to determine the possible existence/extent of potential sub-surface radiological contamination? Are the methods employed by EPA for analysis of radioactive contamination adequate and appropriate for analyses of samples from hazardous waste sites?

c) There are generic guidelines for sampling and analytic methods and chain of custody protocols to ensure that cross contamination or tampering with samples does not occur when dealing with radioactive contaminants. If appropriate, these guidelines may be modified on a site-specific basis depending on the characteristics of the site in question. What modifications are scientifically justified while still assuring accurate, precise and valid data?

d) What factors need to be considered in the development and application of data validation criteria for evaluation of radioactive contaminants at hazardous waste sites?

e) What practices and organizational changes could lead to improved credibility for the U.S. EPA and constructive public participation at hazardous waste sites with potential radioactive contamination?

To address this charge, the *ad hoc* Panel reviewed a specific site where sub-surface radioactive contamination could be present, the Industrial Excess Landfill (IEL) Superfund site in Uniontown, Ohio. Citizens residing near the IEL site were concerned that radioactive wastes had been illegally disposed at the site. Administrator Reilly tasked Mr. Thomas Grumbly, President of Clean Sites, Inc., to perform an independent evaluation of the Agency's management of the IEL site, with emphasis on the radiation sampling being conducted. His report (Grumbly, 1992)[4] to the Administrator contained several recommendations. With respect to radiation sampling, Grumbly recommended that the Agency request that the Science Advisory Board (SAB) perform specific tasks to resolve data analysis issues at the IEL site. Although these issues arose from this one site, they are of concern to other Superfund sites at which radioactive contamination is suspected and could be used to develop generic guidelines for dealing with such sites. Past, present, and anticipated activities and data collected at this location were used as source materials for the *ad hoc* Panel in its deliberations.

2.2 Panel Review Process

On July 27, 1992, the Science Advisory Board was asked by Richard Guimond, Deputy Assistant Administrator for the Agency's Office of Solid Waste and Emergency Response (OSWER) to consider a review of radiological sampling and data validation issues at Superfund sites where contamination by radiological wastes is suspected. To do this, Mr. Guimond asked that the Board conduct a site-specific review using the Industrial Excess Landfill (IEL) Superfund Site in Uniontown, Ohio. After discussion, the Board agreed to take on this site-specific review as a test case to determine if such reviews were a good use of the Board's resources and if such a review could provide useful input to the Agency's management of Superfund sites in general. The Board formed an *ad hoc* subcommittee to perform this review, using several SAB Members and Consultants with pertinent expertise.

The Panel held three public meetings. The first was held in Akron, Ohio on July 20-21, 1993. This was a two-day meeting with an evening session on July 20th devoted to public comment. Although public comment at SAB meetings is normally

[4] *Report to the Administrator United Stated Environmental Protection Agency - Concerning the Industrial Excess Landfill Superfund Site, Uniontown, Ohio.* Thomas P. Grumbly, President, Clean Sites, Inc. March 4, 1992. 38 p.

arranged in advance of the meeting, this public comment period was designed (and advertised) to permit walk-in commentors. A total of four members of the public provided comments. The bulk of the meeting was devoted to presentations by representatives of the US Environmental Protection Agency (USEPA), Ohio Environmental Protection Agency (Ohio EPA) and the Agency for Toxic Substances and Disease Registry (ATSDR) concerning site background and procedures used.

The second meeting was held in Washington, DC on September 21-22, 1993. The primary purpose of this meeting was to lay out the volumes of material (data, procedural documents, correspondence, comments, etc) concerning the IEL site so that the Panel members could review them publicly and obtain guidance from USEPA and Ohio EPA Staff concerning the materials. The public was also invited to participate and did so actively. Following this meeting, Panelists were provided with copies of those documents they identified as requiring further study. The Chairman assigned questions from the Charge to each panelist for discussion at the next meeting.

The third meeting was held on December 14, 1993 in Uniontown, Ohio. This meeting was designed to obtain additional public comment and to discuss responses to the questions in the Charge.

In January 1994, a working paper describing the responses to the Charge was developed by the Chairman and SAB Staff based on comments provided by the Panelists. A brief discussion of the progress of the project was presented to the SAB Executive Committee at its public meeting on January 27, 1994. A telephone conference link at that meeting was provided for the USEPA Region V, Ohio EPA and the Concerned Citizens of Lake Township (CCLT), a local citizens group from the Uniontown, Ohio area. The Executive Committee reviewed the final draft report of the *ad hoc* Panel subsequently through its vetting process (that is, by appointing a subset of its members to review and approve, on behalf of the Executive Committee, any subsequent edits to the final Panel report).

3. RESPONSE TO THE CHARGE TO THE *ad hoc* PANEL

3.1 Temporal and Spatial Sampling and Analyses

Charge Question a): For screening purposes, what types of temporal and spatial sampling and analyses are sufficient to test a hypothesis that radioactive contamination is present?

3.1.1 General Findings

There are three principal types of studies that can be conducted to test for the presence of radioactive contamination at landfills: a) ground surveys; b) ground water monitoring; and c) soil coring studies.

a) Ground Surveys - Ground surveys involve a walkover of the site with simple monitoring equipment, such as a scintillation or a Geiger-Mueller counter, to check for gross radiation emissions. This type of survey is only effective for detecting significant radiation sources near the surface, typically in the top several inches (depending on the amount of radionuclide present and the characteristics of radiation emitted). It is likely to miss contamination which is buried at greater depths. Despite this high "false negative" characteristic of the ground survey, it should be conducted at all suspect sites since it is relatively quick and inexpensive, and can identify major, near surface contamination. Thus, while a negative ground survey (i.e., one that detects no radiation) does not preclude the presence of radioactive material at the site, it is a worthwhile first step in any investigation.

b) Ground Water Monitoring - Ground water monitoring involves sampling subsurface waters at or near the site to test for the presence of gross radiation and/or specific radionuclides. Therefore It can be used to assess the presence of radioactive contamination in a landfill, so long as this material is leaching into the ground water at the site and the resulting concentrations in monitoring wells are high enough to be distinguished from background levels. Ground water monitoring is particularly appropriate for testing whether there has been any off-site migration of radioactive material from a landfill that could lead to exposure of the surrounding population.

Two approaches can be taken to sampling ground water for the presence of radionuclides, involving different temporal and spatial strategies. The first is the standard approach for ground water monitoring at Superfund sites, whereby a number of fixed monitoring wells are placed at locations in the aquifer, upgradient and downgradient of the site. Wells are sampled on a periodic basis, typically once every three months. This type of routine ground water monitoring program is designed to test for long-term, major impacts on the aquifer. The second approach involves specific studies designed to search for possible radioactive contamination when and where it is more likely to occur. For instance, monitoring during, or immediately following, storm events could detect intermittent contamination as it is mobilized and transported. These studies can focus on particular locations near the site where surface or subsurface water is present that has recently traveled through the landfill such as springs or seepage points along slopes down-gradient from the landfill. These types of special study have not normally been conducted at Superfund sites, but have been proven effective in identifying sources of contamination at sites with known radioactive waste problems.

c) Soil Corings - The third general approach for identification of radioactive contamination at landfills involves soil corings. Borings are drilled into the landfill on a predetermined grid or using a directed search strategy. The soil corings and/or landfill gases in the borehole are tested for gross radiation and, if necessary, specific radionuclides. Soil coring studies are directed at determining whether radioactive materials are present in the landfill, rather than whether off-site migration has occurred. If radioactive materials are present in small, confined volumes, it is difficult to detect their presence unless a dense, often prohibitively expensive search grid is used. If however, radioactive materials are present in a more diffuse (e.g., horizontally spread) pattern, then relatively rapid and efficient detection can be expected. A negative result in a soil coring study can thus be used to preclude the presence of such a diffuse, wide spread waste, but not the presence of a small, confined waste.

3.1.2 Adequacy of Information to Characterize Background Concentrations at the IEL Site

Prior to considering the adequacy of the information used to establish background concentrations of radionuclides and indicators of radioactivity in ground water for comparison with measured values at IEL, it is important to recognize the two principal, but very different reasons for making such a comparison. The first is to determine whether the measured levels of radioactivity at IEL are significantly different from those found at other locations, and as a result of this difference, pose a public health concern. The second is to determine whether there is any evidence that leakage from the site has impacted the local ground water, resulting in concentrations that are measurably higher than would have been present had the site never existed.

The principal information presented by the Agency to establish ground water background concentrations include data from:[5]

a) The USGS Regional Aquifer System Analysis (RASA) database, which includes a number of samples from northern Ohio.

b) The US Geological Survey's (USGS) intensive studies of ground water in Lucas, Sandusky, and Wood counties, located in northwestern/ northcentral Ohio; and

c) The US EPA National Inorganics and Radionuclides Survey (NIRS), which addresses radionuclides in water supplies taken from ground water, including 27 samples from Ohio;

d) The US EPA Environmental Radiation Ambient Monitoring System (ERAMS), which represents data from finished drinking water systems, including five sampling stations in Ohio;

Since none of these datasets involve samples from the groundwater from near the IEL site, they can be used as part of a public health evaluation, but not for rigorously determining whether leakage from the IEL site has affected the local aquifer. To provide an indication of whether ground water monitoring wells at IEL are detecting levels of radioactivity significantly higher than would have been measured had the landfill not existed, background data are needed that can serve as an estimate of, or surrogate for, this "no-landfill" condition. This can only be accomplished using data sampled from the local ground water aquifer, close enough to ensure that the same geologic formation is captured, with similar soil and rock types contributing to the natural radioactivity, yet far enough away to ensure that the background wells are not themselves impacted by leakage from the site. This is not an easy task, and multiple wells are required to capture and determine the magnitude of the natural variability from one location to another, and to allow an assessment of whether levels in one or more of the background wells are too dissimilar to those in the rest of the assumed background set to safely ascribe this difference to natural variation. If so, consideration can then be given to the decision to remove the suspected wells from the background set, and initiate further studies to determine

[5] See items 18.b), 18.c), 18.d) and 18.e) of the USEPA listing in Appendix A.

whether leakage from the site may have in fact reached these locations. To provide this type of information and flexibility for sequential evaluation and reassessment, at least four or five (though preferably on the order of 5-10) background wells are needed at intermediate and varying distances from the site. To the extent that the regional ground water flow is adequately characterized, the large majority of the background wells should be located upgradient of the site (a few background wells may be located downgradient, though at significant distances from the site).

The ground water monitoring plan for the IEL site currently includes two well clusters designated as background monitoring wells (MW): MW20, immediately east of the Metzger Ditch boundary, screened at shallow, intermediate, and deep depths; and MW12, approximately 1000 feet north of the northeast corner of the landfill, screened at intermediate and deep depths. Even if the ground water flow patterns at the landfill were simple and predominantly from east to west, these two wells, alone, would not be adequate to characterize the mean and variability of background radionuclide concentrations for estimating the "no-landfill" condition, based on the criteria given above. Given the complex, partly radial nature of ground water flow at the IEL site, as described in the recent USGS report (USGS, 1993)[6], the two wells are clearly inadequate for characterizing background[7]. Data from MW20 are particularly suspect, given the site flow patterns and immediate proximity of the well to the site[8]. Data from MW12 may be appropriate for inclusion in the background dataset, but this could only be determined through collection of data at a number of other offsite wells which are located at different orientations and distances relative to the site. A reliable, scientifically credible characterization of the mean and variability of the background radionuclide conditions at the site, for comparison with data collected within and immediately adjacent to the site, will require such a larger dataset. It may be possible to gather such data from existing residential wells.

Currently lacking an adequate background dataset at the site for rigorous comparison with the monitoring well samples, the previously cited datasets can be used for a preliminary evaluation and exploration of public health concerns. ERAMS

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[6] United States Geological Survey (USGS), Water Resources Division, 975 West Third Street, Columbus, OH 43212-3192. Report to Ms. Linda Kern, Remedial Project Manager, Region 5, USEPA. *Review of water-level data and interpretations by PRC Environmental Management, Inc., in two reports: (1) Draft Ground Water Modeling Report, Industrial Excess Landfill Site, Uniontown, Ohio (U.S. EPA, 1992), and (2) Preliminary Remedial Design - Industrial Excess Landfill Site, Uniontown, Ohio, Draft Report, Volume I, Chapters 1-10 and Appendix A (U.S. EPA, 1993).* Document dated August 13, 1993.

[7] Due to site constraints which prevented installation of additional background monitoring wells, MW 12 and MW20 were supplemented with two irrigation wells east of the IEL landfill and several residential wells some distance from the site.

[8] The usability of the MW20 cluster and other off-site wells for both chemical and radiochemical background data will be discussed by the Technical Information Committee and decided based on the conclusions in USGS (1993).

provides an extensive data base on radioactivity in drinking water. While some are near nuclear facilities, others are not. Comparing the radioactivity levels in the residential wells around the IEL site to the levels observed in ERAMS, there is no evidence of unusual concentrations in the residential wells. There are occasional slightly elevated readings, in monitoring wells, most often in the gross beta counts at shallow depths. However, the average of all gross beta counts at shallow monitoring wells is 10 pCi/L, which is not out of range relative to the ERAMS data. In comparing ERAMS data to IEL data, it is important to note that the ERAMS figures are averages of data over four quarters. Therefore, they are less likely to show occasional high values than the measurements on single samples such as available at IEL. One well, #14S, does have somewhat elevated beta counts during all four rounds, although the observed levels are not at all alarming as the counts are not high relative to possible background levels.

The information provided by EPA does not address radioactivity in suspended sediment, so it is more difficult to address whether or not the levels observed in the filtrate are within background levels. There is one high reading at monitoring well #4S during the May 1992 round of measurements. The gross beta reading is 358 pCi/sample or a 157 pCi/gram, which in either case makes it the highest observed value. With the information at hand, one cannot say whether or not these values should be considered unusual. Certainly they are not evidence of substantial radioactive contamination (i.e., a consistent pattern, continuous in time and space, of concentrations that are well (>2 standard deviations) above the detection limit or regional background, whichever is higher).

There was one extremely high tritium reading of 1×10^6 pCi/L reported once at a residential well, which is 50 times the current Federal drinking water standard.[9] This reading, if correct, could not plausibly be due to background radiation. However, repeated retesting of the water from this well has failed to produce any high tritium levels, which suggests that this anomalous measurement was faulty.

While no other tritium measurements were above the drinking water standard, there were several other measurements that were somewhat elevated, and while not direct evidence for harmful levels of radiation, could be viewed as evidence of past radioactive contamination. When considering whether the occasional elevated measurements provide evidence of radioactive dumping, it is essential to consider how often such measurements would be obtained if there had been no radioactive dumping at the site. Many hundreds of radiation measurements have been made on IEL water,

[9] The current Federal Drinking Water Standard for tritium is 20,000 pCi/L.

and considering the difficulties in measuring radiation accurately, the observed levels do not support the contention of past dumping of radioactive waste.

We offer several suggestions in future Superfund site characterization activities. The Panel heard that there is no mechanism for lessons learned at one site to be widely disseminated to other sites. The obvious outcome will be a repetition of errors whether in approach or interpretation. With the current trend toward increased public participation in decision-making on environmental management issues, agencies such as EPA need to learn from errors and incorporate those lessons into future efforts.

It is the Panel's feeling that site characterization guidance by EPA should be more process oriented and less prescriptive. A sense of reliance on procedures and prescriptions has pervaded the presentations to the IEL panel. Site characterization planning and conduct should be based on iterative examinations of the site dynamics. Hydrogeology at the IEL site does not appear to be especially complex.

Eastward flow from the site toward Metzger's Ditch should be expected at some elevation from even the simplest examination. A topographic map would suggest that any surface flow that occurred would be eastward. Interflow (lateral flow in the unsaturated zone during periods of high infiltration) could be presumed to follow the surface contour. An eastward slope to the water table shown by USGS (1993) implies some eastward flow even in the saturated zone. Characterization ought to address the lateral extent of such flow (e.g., does it terminate at Metzger's Ditch?) and the depth to which it occurs. Screening for the presence of radioactive contaminants should have included sampling of seeps along the west bank of Metzger's Ditch adjacent to the IEL site.

3.1.3 Adequacy of Methods used to Evaluate the Effectiveness of Possible Core Sampling and Ground Water Monitoring Programs

The methodology used by the Agency to assess the potential of a core sampling program to detect radioactive contamination was evaluated by reviewing documents which were attached to letters sent to Senator John Glenn by EPA Region 5 Administrator Valdas Adamkus (EPA, 1990; EPA, 1991).

One of these documents (EPA, 1990) examines the probability of detecting a 10-cubic yard waste source as a function of the number of corings. In this exercise, it is assumed that the probability that each core detects the radioactive waste is equal to this 10-cubic yards divided by the volume of the landfill. The detection probability for many corings is then computed from the binomial probability, assuming each coring is independent. The coring program is thus assumed to be random, and completely nonsequential. The resulting calculations indicated only a 0.22 probability of detection with 50,000 boreholes. The technical assumptions of this calculation are wholly inappropriate for a real core sampling program, and the estimate is thus flawed. The problem with this calculation is the assumption that the ratio of volume of contaminated waste to volume of landfill gives the probability of a single core containing radioactive waste. The problem with this assumption is that it attempts to calculate this probability without making any assumptions about the geometry of the waste. It is easy to see that such an approach is doomed to failure by comparing two possible configurations of a given volume of waste. In the first, suppose the waste is spread out over a thin horizontal layer. In this case, it would be relatively easy to detect it with vertical boreholes. On the other hand, if the same volume of waste is located within a narrow vertical shaft, then it is obviously much harder to detect. For example, suppose there is a single source that is literally a cube with volume 10-cubic yards and one face parallel to the ground. Then a triangular lattice of boreholes spaced 2.15 yards apart will necessarily intersect the source. To cover 30 acres in this manner requires about 36,000 boreholes. Suppose, however, that this same 10-cubic yards of waste is in the shape of a box with vertical dimension 0.1 yards and other dimensions of 10 yards. Then a triangular grid spaced 10 yards apart will necessarily intersect the waste. Such a grid requires about 1670 cores. When the source, if one exists, is assumed to be in a particular section of the landfill, then the number of holes required goes down proportionately.

On the other hand, the calculations reported on in the middle of page 2 of EPA (1990) are much more appropriate. However, even these seem somewhat pessimistic. Consider detecting a single unshielded source. If bores are put on a triangular lattice, which is the most efficient possible, then to ensure that every point in a 30-acre plot is within 4 feet of the center of a borehole requires about 31,000 holes. Since an unshielded source must have some physical extent and the borehole itself has a positive width, using the 4 foot distance is reasonable. Even so, the cost of 31,000 boreholes, in dollars, time and possible exposure to toxic chemicals of field workers and nearby residents, would be unacceptably high compared with the alternative strategy of ground water surveillance.

It is obvious that the ability to detect a radiation source by coring depends critically on the horizontal extent of the source. It is true that a single shielded source of little horizontal extent would be difficult to find even if one had a general idea as to where such a source might be. However, even a moderate amount of horizontal spreading of the source makes the detection problem much easier.

A second report on ground water monitoring (EPA, 1991) is more detailed and complex, using ground water models to evaluate the likelihood of plume detection. On the basis of the studies presented in this reference, EPA concluded that, "U.S. EPA is confident that the extensive groundwater and soil gas testing that is planned at IEL will identify any contamination that may exist at levels of concern." However, the studies show no such thing. What they show is that under some range of assumptions about the nature of the contamination and using a simple model for the hydrogeology of the site, that the exposure of any one individual will be very small. They also show that under these same assumptions, the chances of the network of wells detecting radiation from radioactive waste at the site may not be large. It certainly does not follow that the network of wells would detect the radiation with high probability if enough waste had been dumped to cause a threat to human health. This may in fact be true, but the analyses presented, even if correct, are only indirectly related to this question of interest.

The reports themselves have serious problems. In particular, Section 5 of the follow-up Final Report on the Probability of Detection of Hypothetical Radiochemical Contamination of Groundwater at the Industrial Excess Landfill (PRC, 1991)[10] is in error. Specifically, the assumption that the event of one well overlapping the plume being independent of the other wells overlapping the plume is incorrect. It is easy to visualize this by looking at Figure 2 of that document and noting that if the plume overlaps MW-18 it cannot overlap MW-6. Moreover, it is straightforward to do the correct calculation that takes into account this lack of independence by directly calculating the fraction of the time the plume overlaps at least one monitoring well. The effect of this error is to give a lower probability of the wells detecting the radiation than would the correct calculation.

Another problem with this study (PRC, 1991) is that the probabilities are based on what might happen at a single point in time, rather than what would happen over some schedule of monitoring times. The effect of using a more realistic monitoring schedule is unclear. If there are multiple releases or if the interval between monitoring times is small relative to the movement of the plume, the model used in EPA (1991) could underestimate the probability of detection. Again, it would have been straight-forward to do a simulation study that would have taken into account possible monitoring schedules.

10 PRC, 1991. *Final Report on the Probability of Detection of Hypothetical Radiochemical Contamination of Groundwater at the Industrial Excess Landfill - Uniontown, Ohio.* March 11, 1991. Prepared for the U.S. EPA by PRC. Submitted as an attachment to EPA (1991).

The part of this study (PRC, 1991) that attempts to model total exposure of an individual is hard to judge because of its critical dependence on assumptions about the nature and amount of radioactive waste. However, unless the estimates of possible levels of radioactive waste at the site are much too low, it is hard to see how the simulated exposures could be off by more than an order of magnitude or so. One possible problem is that for a highly mobile radionuclide, a slow and steady release could lead to a considerably higher lifetime exposure than an instantaneous large release. However, since the simulated exposures in excess of background are small in comparison to the background exposures, the threat to human health is likely to be negligible if levels of contamination are as low as presumed in this study. The Panel recognizes that both of these reports are based on a large number of assumptions that have not been validated for the IEL site.

In summary, the studies EPA (EPA, 1990; EPA, 1991) carried out to support ground water monitoring rather than coring are poorly done and should not be used as models for future studies. Nevertheless, for a coring program to have a substantial probability of detecting radioactive contamination not found by ground water monitoring, it is necessary that the radioactive waste has considerable horizontal extent, but does not contaminate the ground water during the times ground water monitoring is done.

3.2 Radiological Parameters

Charge Question b): What radiological parameters, e.g., gross alpha plus alpha spectrometry, gross beta, gamma spectrometry, tritium, and carbon-14, are sufficient to determine the possible existence/extent of potential sub-surface radiological contamination? Are the methods employed by EPA for analysis of radioactive contamination adequate and appropriate for analyses of samples from hazardous waste sites?

The set of radiological parameters identified in the charge is appropriate and sufficient for screening surveys. In addition, all available information should be reviewed to determine if specific radionuclides might reasonably be expected at a site. Obviously, if it is known (or there is adequate reason to suspect) that particular radionuclides have been disposed of at a site, analyses for those contaminants should be conducted. In cases such as IEL where there was no indication of the presence of specific radionuclides, the use of the set of screening analyses listed in the charge was appropriate.

3.2.1 Laboratory Analytical Methods

a) Gross alpha analyses are relatively rapid and low-cost. They are semi-quantitative methods that will detect unusual levels of high atomic weight radionuclides from both naturally occurring and anthropogenic sources. Principal naturally occurring nuclides are the isotopes of uranium and thorium, and radium-226. The most commonly encountered anthropogenic alpha emitters in the environment are isotopes of plutonium, Pu-239 and Pu-240 from atmospheric weapons tests and Pu-238 from reentry and atmospheric burnup of an isotopic power source. Americium-241 is also present in global fallout as a product of plutonium-241 decay. All of the alpha emitters identified above occur in the global environment so that there is a "background" level to be expected.

b) Alpha spectrometric analyses to determine which specific alpha emitters are present are both quantitative and labor-intensive, hence expensive. Such analyses are poor screening tools but form a very important adjunct to the gross alpha analyses. Where gross alpha results exceed a previously selected threshold, alpha spectrometry should be applied. Identification of specific alpha emitters is important a) to assist in the recognition of excess contamination and its sources; and b) for radiological risk assessment.

c) Gross beta analyses are also relatively rapid and low-cost, semi-quantitative methods that will assist in detecting the presence of a large number of radionuclides that are not found by gross alpha measurements. Common naturally occurring beta emitters include radium-228 and potassium-40. Anthropogenic beta-emitters in the environment are the fission products from atmospheric weapons tests and include cesium-137, strontium-90, and others. Where gross beta results exceed a previously selected threshold, an evaluation should be carried out to determine the principal contributors to the high value. Results of gamma-ray spectrometry may identify the contributors (e.g. cesium-137) or specific radionuclide analyses may be required for beta-emitters that do not reveal themselves by emitting gamma-rays (e.g. strontium-90).

d) Gamma-ray spectrometry is a relatively low-cost quantitative method suitable for screening for a large number of radionuclides and can be applied to large-volume samples. Naturally occurring environmental radionuclides typically identified by gamma-ray spectrometry are potassium-40, members of the uranium and thorium decay series, and beryllium-7 produced in the atmosphere by cosmic rays. Anthropogenic gamma-emitters that are widespread are cesium-137 and cobalt-60. More rarely gamma spectrometry will detect cesium-134, iodine-131, manganese-54, and antimony-125. Computer-based data reduction methods in general use for gamma spectrometry, when applied to environmental samples, can result in a large number of tentative radionuclide identifications (false positives). Naturally occurring gamma emitters produce gamma rays at energies that may lead to these tentative identifications but analysts familiar with environmental samples can identify the interferences. Therefore, it is exceedingly important that an experienced analyst participate in the data verification and validation to ensure that proper qualifiers are affixed.

e) Tritium and Carbon-14 analyses are appropriate as screening methods because tritium and carbon-14 are relatively common radionuclides and none of the preceding tests will indicate their presence. Each of them has a naturally occurring background level which has been significantly elevated by global fallout. Tritium and carbon-14 are also candidates for screening gas-phase samples since they may be present in gaseous components such as water vapor, tritium gas, or organic compounds. In fact, gas-phase monitoring can be an extremely sensitive test for the presence of these nuclides.

3.2.2 Analytical Methods and Procedures

The analytical methods identified by EPA for radionuclide analyses at hazardous waste sites are time-tested and appropriate. Some of the documentation on procedures presented to the *ad hoc* Panel, however, is several years old and sometimes does not reflect recent advances. Therefore, we recommend that EPA remain cognizant of, and responsive to, advances in radiochemical procedures and analytical technology as they may apply to the characterization of hazardous waste sites for radiochemical materials. An interagency approach involving EPA, DOE, and possibly the Department of Defense (DOD) might be appropriate.

Radiochemical analyses, although potentially highly reliable and accurate, require painstaking attention and effort from the analyst. For such analyses to be reliable it is necessary that the analyst be trained and experienced not only with the procedures and instruments being used but also with the matrix types (soil, water, tissue) being analyzed. Experienced analysts are familiar with specific interference problems and can either avoid them or at least recognize and make qualifying notations.

Data reporting for radioactive components should include the propagated counting error terms identified either as 1-sigma or 2-sigma level of confidence. Good practice reporting also includes the minimum detectable activity (MDA) value for the nuclide and sample. Consideration of these confidence parameters is essential to any responsible interpretation of results and either reporting or interpretation that does not take the confidence estimates into account should be discounted as not credible.

3.2.3 Field Sampling and Analytical Methods

Sampling protocols and media need to be defined after the purpose for screening is clear. It is essential that the goals of the screening be clearly established and agreed upon in the earliest stages of planning. Whether to filter water samples or not depends on the questions posed for the screening test. For example, filtered waters will provide the best estimate of transport of contaminants by water. If direct personnel exposure is of greater interest, unfiltered tap water is probably more appropriate to analyze. On the other hand, unfiltered water samples taken from unlined wells are likely to contain large volumes of suspended matter that does not represent either transport or personnel exposure. To detect the presence of contaminants that are very insoluble, such as thorium or plutonium isotopes, analyses of particulate phases are much more sensitive than analyses of filtered water.

If samples are to be filtered and analyses of the material that is filtered out are to be made, it is important to record the volume of water passed through the filter and to determine the dry weight of the collected solids. It should be assumed that investigators examining the data will want to be able to compute particle bound radionuclide concentrations both per unit volume of water filtered and per unit mass collected on the filter. Investigators must exercise caution to ensure that comparisons among samples are made on like samples, that is filtered water to filtered water, etc. The failure to record the volume of water passed through the filter and the dry weight of collected solids for filtered samples at the IEL site was such that a full accounting of the dissolved and particulate concentrations of radioactive constituents could not be made. This should be corrected in the future.

3.3 Guidelines for Sampling and Analytic Methods

Charge Question c): There are generic guidelines for sampling and analytic methods and chain of custody protocols to ensure that cross contamination or tampering with samples does not occur when dealing with radioactive contaminants. If appropriate, these guidelines may be modified on a site-specific basis depending on the characteristics of the site in question. What modifications are scientifically justified while still assuring accurate, precise and valid data?

3.3.1 Considerations for other Superfund Sites in the Future

The experience at the IEL site is an indication that the standard procedures used for Superfund sites in terms of site characterization are inadequate in the face of concerns of the surrounding community. With the hindsight of the IEL experience it is possible to suggest measures that could have dealt with situations where there is concern about possible radioactivity on site.

Very early in the characterization of a Superfund site it is recommended that a surface monitoring be undertaken using a survey monitor. At other sites (Love Canal) measurements were made at 10 meter or 20 meter centers, recorded in microrads/hour. For example, at Love Canal values between 6 and 40 microrads/hour were recorded, and a few soil samples exceeded background levels of cesium-137 levels of 30 pCi/gram. Even though a surface survey will not detect radioactive material at depths greater than a foot or so, it will provide a helpful record of the pre-remediation state.

During the remedial investigation one round of gross alpha and gross beta activity in the monitoring wells at the time the wells are investigated for other constituents would serve to establish whether special radioactive deposits exist. For this first determination, the drinking water protocol as used at IEL for the residential wells, without separate determination of the activity in suspended solids should suffice. The cores collected at the time of the development of monitoring wells should be subjected to a simple radiological survey, and the results should be made a part of the remedial investigation record. Such survey monitors are used whenever radioactive materials are used in a laboratory.

In the case of the Industrial Excess Landfill, much of the concern of the surrounding community has been focused on the possibility that unknown amounts of radioactive materials may have been deposited at some time during the active operation of the landfill. This concern has resulted in considerable efforts to characterize the landfill in terms of the levels of radioactivity on-site and in the immediate surroundings. Routine measurements were made of the levels of radioactivity in the boring cores of the monitoring wells to assure the radiological protection of the field personnel, and a number of rounds of samples of water at different depths in the monitoring wells were analyzed. Analyses were made for gross alpha and beta activity, as well as tritium and carbon-14 activity. Where higher activities were encountered the contributions by a number of specific isotopes were determined with alpha and gamma spectroscopy. The initial rounds of sampling and analysis suffered from imperfections in the chain of custody of the samples and questions about counting methodologies, and these imperfections led to the invalidation of the results from these initial rounds.

In retrospect it would have been desirable if the processes of contracting and validation had been better coordinated. The appropriate use of protocols designed specifically for drinking water characterization for the characterization of a hazardous waste site also has led to confusion. Once a breakdown in the chain of custody occurs it is often difficult to ascertain precisely where the breakdown occurred, and it becomes difficult to rely on the results of such a study. From the records of the early rounds of IEL testing it is not always possible to determine from which well and at what depth a sample was drawn. Based on our observations, it is extremely unlikely that samples from another site found their way into the analysis of the first rounds. Nevertheless, any unusual findings could not be interpreted with confidence, nor could they be compared with values in another round of sampling. It is also not possible to determine whether any unusual values were lost in the early rounds. The invalidation decision thus becomes necessary and inevitable when breakdowns in the chain of custody occur, and USEPA was correct in invalidating such rounds. It should be noted that although the first rounds could not be validated, the round that was available for review did not contain any readings that were so high as to give reasons for serious concern.[11]

3.4 Criteria for Data Validation

Charge Question d): What factors need to be considered in the development and application of data validation criteria for evaluation of radioactive contaminants at hazardous waste sites?

The goal of any quality-oriented measurement program is to establish credibility and to maintain the quality of results within established limits of acceptance. A good laboratory that provides services of high integrity will gain customer and public confidence. Meaningful and reliable results generated by the laboratory will also be legally defensible in a court of law. In order to achieve the goal of obtaining quality data, verification and validation must be carried out for the sample collection, analysis, and measurement processes.

[11] Only one complete round of invalid results were available for review (December 1990 data from Controls for Environmental Pollution). The only results that were available for review from the August 1990 round of invalidated data were the carbon-14 results. The other results of the August 1990 round were returned to the laboratory after the data was declared invalid by EPA.

3.4.1 Recommendations for Verification

a) The Agency shall verify that ALL contractual agreements, as outlined in the "Statement of Work" are in compliance for a given project. It is essential to verify that the Performance Evaluation (PE) samples for the radionuclides-of-interest for the desired matrices are performed by the vendor laboratory and that the reported results on the PE samples are well within the agreed upon limits of accuracy and precision.

b) A pre-award audit of the laboratory shall be done by a team of auditors (including a radiochemist and a Quality Control (QC) specialist) before a contract is initiated.

c) The Agency shall verify that the lab is consistently performing well by submitting to the lab blind samples with known quantities of spikes disguised as real samples unknown to the lab, and by reviewing the results on a periodic basis.

d) The laboratory providing radiochemical analysis services must use agreed-upon and approved Standard Operating Procedures (SOPs) . The lab must also use software that is verified and validated and documented for approved instruments. Calibrations of equipment are performed using National Institute of Standards and Technology (NIST) traceable reference radionuclide standards. The laboratory shall also meet the prescribed Minimum Detectable Activity (MDA) for each radionuclide.

3.4.2 Recommendations for Validation

a) Radiochemical analysis data are validated by reviewing the results from planning stages through sample collection, logging in, receiving, sample preparation, analysis, radiation measurements, calculation of results with associated propagated errors, and documentation.

b) Results of a given batch of samples should be reviewed along with quality control samples (QC spiked samples, blanks, duplicates, blinds, etc.) for contractual requirements and technical correctness to validate the results.

c) If corrections are made, add qualifiers to the data and document. If results are rejected, a statement of explanation must be included in the document as to why the results are rejected.

d) Finally, ALL data must be reviewed to ensure that the data are of the level of accuracy and precision required, defensible, and complete.

3.5 Communicating Risk

Charge Question e): What practices and organizational changes could lead to improved credibility for the U.S. EPA and constructive public participation at hazardous waste sites with potential radioactive contamination?

Good risk communication practices are vital to effective Superfund site management. Broadly construed, such practices entail: a) establishing an organizational structure that enables all stakeholders to inform, be informed and be knowledgeable of the risk assessment and management process; b) establishing some shared understanding of the goal of the risk assessment and management process; c) recognizing and respecting differences in language and searching for a common understanding of the site characterization; d) clearly specifying and agreeing on who has the authority and responsibility to make final decisions; and e) designating and agreeing on how differences will be arbitrated should that be necessary. In Mr. Grumbly's words, USEPA needs a credible process, without which little can be accomplished.

A detailed evaluation of how the communication of risks did or did not occur in the IEL situation serves to point out the weaknesses of the Agency's risk communication process and how it may be improved. At IEL, both differences in prior knowledge and expectations about the site, as well as disagreements about how to interpret new information have contributed to conflicting judgments about risk, and consequent differences in opinions among various stakeholders about appropriate management of the site. Conflicts are likely to continue until the public and the Agency find some common ground.

3.5.1 Information

In 1990 the EPA established the IEL Technical Information Committee (TIC) as part of the Record of Decision (ROD) for the IEL site to ensure the continued active participation of the community in the characterization and remediation of the site. Members of the TIC include local clergy, local elected officials, representatives from the Concerned Citizens of Lake Township (CCLT) and their technical experts, members from the community at large, representatives for the potentially responsible parties, and members of the various agencies involved at the site. Although, the TIC has met at least 13 times, the Panel cannot judge the breadth of participation by the public or various groups of the TIC. The Agency has also provided two Technical Assistance Grants (TAG) totalling $100,000 to CCLT to fund the hiring of technical experts, become educated on the issues, provide the financial resources to inform and solicit opinions and support from of the community at large, and impact the decision-making process at the site. In spite of these efforts the citizens do not consider that their concerns have been adequately considered and dealt with.

In 1989 the Agency for Toxic Substances and Disease Registry (ATSDR) recommended that a computerized system for storage, retrieval, and spatial analysis of all pertinent environmental and demographic information gathered at IEL be made available for use by all interested parties (ATSDR, 1989). In communicating with the interested parties, it is important to present the raw data in an aggregated manner that is clear and understandable so as to provide comprehensive insights into site implications. Even in the case of the Panel, it was only during the latter portion of it's review that the IEL sample data was available in a format that was relatively easy to use.[12] Graphic information and clearly labelled tables including the relevant standards and background (comparison) information are very useful. This kind of system should be provided at all sites, if feasible, from the time that data are first collected. Use of such a system (on a personal computer) could be facilitated at advisory committee meetings, or by appointment with the EPA site manager. Such a system would also enable EPA to more easily prepare and produce graphic and tabular data presentations for the community.

USEPA needs to address what people know and what they need and want to know. Grumbly (1992) states clearly in his report[13] that EPA has been slow to respond to legitimate concerns from the community around IEL. He attributes this to a desire in the beginning to treat IEL as a standard site with a standard solution. Subsequently, EPA has been more responsive to the Uniontown community.

According to Grumbly (1992) "Almost all of the technical experts employed by the state and the EPA believe that there are no significant hot spots, based upon inferences from data. Accordingly, while it may be highly probable that no hot spots

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12 The scope of the IEL radiochemical characterization project has been large. Data presentation in a timely fashion in a format preferred by the Panel may not have been a failure on the part of any agency but rather a consequence dictated by the timing of the inquiry and the shorter timetable on which the SAB Panel members were conducting their inquiry. Nevertheless, the Panel still felt that data must be presented in a format that is clear and understandable to all readers, particularly those with the least technical expertise.

13 Grumbly, 1992. Op Cit. Pg. 9.

exist, it is not a fact."[14] Expert perceptions of risk differ significantly between scientists from different fields of risk. Independent of field research, risk perceptions are significantly associated with the type of institution in which a scientist is employed (Barke and Jenkins-Smith, 1993).[15] Maharik and Fischoff (1993)[16] predict that individuals within any group with strong prior commitments will be less responsive to evidence. Hence, it is very unlikely that concerns of the community will be adequately addressed or resolved after testing or sampling has already taken place. The information seeking and sharing process has to be one that the community finds legitimate and agrees to in advance; the community needs to be in the process.

Testing - in this case, sampling - is information seeking. The community has a set of concerns that relate to the tasks of information seeking, which are not necessarily the concerns EPA has. It is better to deal with these concerns BEFORE one deals with testing, and to design protocols that respond to those concerns in as much as the involved agencies are willing to understand what those concerns are. A formal advisory board, such as the TIC that EPA eventually implemented at IEL, is probably more appropriate than a completely negotiated settlement, to enable EPA to deal with the range of concerns up front. Disputes based on uncertainty cannot be ignored, and are unlikely to be resolved by reaching consensus. EPA is likely to gain legitimacy and credibility if it deals with such disagreements up front and directly, to try to reduce the gaps between parties. Dialogue with and outreach to the larger community is essential. The effectiveness of an advisory committee might be improved by (1) taking steps to ensure the independence of the advisory committee from the sponsor (EPA), (2) trying explicitly to have the committee be representative of the community (which EPA appears to have done, to some extent, although they state that active participation of non-Agency representatives other than those from the CCLT ceased several years ago), and (3) considering the use of an independent facilitator or mediator (Lynn and Busenberg, 1994).[17]

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[14] Grumbly, 1992. Op Cit. Pg. 12.

[15] Barke, R.P. and H.C. Jenkins-Smith, 1993. *Politics and Scientific Expertise: Scientists, Risk Perception, and Nuclear Waste Policy.* Risk Analysis, vol. 13, No. 4., pp 425-439.

[16] Maharik, M. and B. Fischoff, 1993. *Risk Knowledge and Risk Attitudes Regarding Nuclear Energy Sources in Space.* Risk Analysis, Vol. 13, No., 3, pp 345-353.

[17] Lynn, F. and G. Busenberg, 1994. *Citizen Advisory Committees and Environmental Policy: What we know, what's left to discover.* Dept. of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill. June 1994.

Even those unfamiliar with risk communication are likely to agree that much new, often complex and technical information is created and disseminated in the risk management process. This fundamental aspect of risk communication can create serious gaps in trust and credibility if it is mishandled. At IEL, this has happened. Lack of trust in EPA was fueled by the invalidation of two consecutive rounds of sampling for radioactive contamination and the non-release of the data gathered, followed by the slow release of subsequent data in a format that discouraged comparisons and contextual interpretations. It is also unfortunate that reanalyses in the earlier data focused on false positives, with much less discussion of possible false negatives.

EPA has in several circumstances at IEL used hypothetical models. Poor communication practices can contribute to the impression that such models are being used inappropriately as "evidence" by the Agency. For example:

> *A very conservative, hypothetical analysis performed by the National Air and Radiation Environmental Laboratory, dated January 29, 1991, concluded that even if 100 drums of uranium sludge, like that found at the Department of Energy facility in Fernald, Ohio, were buried at IEL, the maximally exposed individual would receive an amount of radiation equal to that received by an average individual in about one hour from natural background. This would correspond to a little less than a lifetime risk of* 10^{-7}.[18]

The hypothetical model referred to here makes many assumptions (e.g., location of sludge) that could be challenged. In this context it would be appropriate to present some form of uncertainty analysis that acknowledges the effects of those assumptions. Also, risk comparisons are among the most alluring and potentially damaging mechanisms used to try to explain risks. Comparison on a single dimension (such as severity of harm) may invoke comparisons on other dimensions of risk (such as voluntariness or controllability).

Technicalities are best explained promptly by acknowledged experts with a firm grasp of the facts, the uncertainties about the facts, any preconceptions the recipients of the information hold, and an understanding of good communication practices. However, only the best experts are likely to understand the uncertainties well, and of them only a handful are likely to have learned what kinds of beliefs may prevail among non-experts. Rarer yet is such an expert who also understands the basics of good

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[18] Statement to the SAB *ad hoc* Panel on September 21, 1993 by Norman R. Neidergang, Associate Division Director for the Waste Management Division, Region 5, USEPA.

communication. Communication efforts are likely to fail if they are not informed by a thorough empirical characterization of the beliefs and knowledge held by those living near the site. Close collaboration between managers, communicators, technical specialists, and the public at an early stage can help overcome these likely deficits: in the case of conflicts, facilitation may help.

APPENDIX A

PARTIAL LISTING OF REVIEW MATERIALS MADE AVAILABLE TO THE SCIENCE ADVISORY BOARD FROM THE US EPA AND OHIO EPA

Contents:

1. Aug 10, 1993 - USEPA Catalogue of Materials for Review by the Science Advisory Board (13 pages)

2. Aug 11, 1993 - OhioEPA documentation regarding radiochemical issues and sampling results (3 pages)

3. Sep 7, 1993 - USEPA Radiological Ground Water Sampling Results Dec 92 and Mar 93 (2 pages)

4. Oct 5, 1993 - OhioEPA radiochemical data from ground water sampling (submission on disk) (2 pages)

5. Oct 15, 1993 - USEPA Transmittal of Radiochemical Data on Disk (1 page)

6. Nov 16, 1993 - USEPA Transmittal of Radiochemical Data on Disk (2 pages)

7. Dec 1, 1994 - USEPA Transmittal of Mapping Program for Radiological Data (1 page)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

MEMORANDUM

DATE: August 10, 1993

SUBJECT: Industrial Excess Landfill
Catalogue of Materials for Review by the
Science Advisory Board

FROM: Linda A. Kern
Remedial Project Manager

TO: A. Robert Flaak
Assistant Staff Director
Science Advisory Board

At the request of the ad hoc subcommittee of the Science Advisory Board (SAB), attached please find a Catalogue of Materials regarding the Industrial Excess Landfill (IEL) Superfund site in Uniontown, Ohio. I have included in the catalogue of materials, a narrative description of each document to assist in dissemination of the materials to the subcommittee members. Also included is a documentation listing which may be used as an abbreviated form of the catalogue. A copy of each document is also being transmitted.

This transmittal of material includes in information that was requested by the SAB ad hoc subcommittee during the course of the public hearings on July 20-21, 1993 with the following exceptions:

1) The Final U.S. Geological Survey (USGS) Report. The USGS estimates that their report of their review of the recent ground water investigations will be transmitted to Region 5 by the end of August. I will forward a copy of this report to your office as soon as it becomes available.

2) The spread sheets and the associated computer disk which presents the analytical results from U.S. EPA's National Air and Radiation Environmental Laboratory (NAREL) for the May 1992 and August 1992 round of comprehensive ground water sampling & analyses will be provided to your office by the week of August 16, 1993. In the interim, a hard copy of the radiological data results is included in this transmittal.

Printed on Recycled Paper

3) As was indicated by USEPA during the SAB meetings last month, the results of the December 1992 and March 1993 rounds of ground water sampling and analyses will be transmitted to your office as soon as they are available. A hard copy, spread sheets, and computer disk will be transmitted to your office.

If you have any questions, or if you should need any additional documentation regarding the IEL site, please feel free to contact me at (312) 886-7341.

Attachments

cc: Robert Huggett (w/attachments, w/out documents)
Dorothy Canter (w/attachments, w/out documents)

INDUSTRIAL EXCESS LANDFILL
DOCUMENTATION LISTING

1. Report on the Initial Sampling Performed at IEL (April, 1988)

2. Remedial Investigation (July, 1988)

3. Feasibility Study (December, 1988)

4. ATSDR's Health Assessment (July, 1989) Note: Included as an appendix to this document is the U.S. Geological Survey's 1988 Report regarding ground water flow within and around the IEL site.

5. Record of Decision (July, 1989)

6. Record of Decision - Alternate Water Supply (September, 1987)

7. Final Work Plan for Design Studies and Remedial Design (April, 1990)

8. Quality Assurance Project Plan (July, 1991)

9. Field Sampling Plan (July, 1991)

10. Draft 30% Remedial Design Document (February, 1993)

11. Draft Ground Water Modeling Report (February, 1993)

12. May 1992 Ground Water Monitoring and Residential Well Sampling Results Technical Memorandum (February, 1993)

13. Table of Monitoring Well Water Levels (March, 1993)

14. Radiological Analytical Results from the National Air and Environmental Laboratory (NAREL) - Samples Collected During the RD Fieldwork Activities

    a) Report of Radon Measurements at IEL (August 21, 1992)

    b) Report of Particulate Filter Measurements from IEL (August 28, 1992)

    c) Radiochemical Analytical Results for Samples from IEL (August 28, 1992)

15. Radiological Analytical Results from NAREL - Samples Collected During the Quarterly Ground Water Sampling Program

    a) Comprehensive Ground Water Sampling Round 1 Radiochemical Analytical Results - May, 1992[1]

    b) Comprehensive Ground Water Sampling Round 2 Radiochemical Analytical Results - August 1992[1]

c) Comprehensive Ground Water Sampling Round 3 Radiochemical Analytical Results - December 1992[1,2]

d) Comprehensive Ground Water Sampling Round 4 Radiochemical Analytical Results - March 1993[1,2]

16. Contract Laboratory Program Invalidated Radiological Results

a) August 1990 Invalidated Radiological Results

b) December 1990 Invalidated Radiological Results

17. IEL Technical Information Committee Position Papers

a) TIC Positions With Respect to the Radiological Sampling at IEL

b) TIC Positions with Respect to the Request to Perform Additional Soil Borings at the Landfill

18. Information Collected to Date on Background Radionuclide Concentrations (August 1993)

a) Information Sheets

b) U.S. Geological Survey's Regional Aquifer Study Analysis Data Base summarizes tritium concentrations found in northeast Ohio

c) U.S. Geological Survey's Water-Resources Investigation Report Abstract on Geohydrology and quality of water in Lucas, Sandusky, and Wood Counties in northwestern Ohio

d) Occurrence of Radon, Radium, and Uranium in Groundwater, Journal AWWA, 1988: A paper based on the National Inorganics and Radionuclides Survey (NIRS).

e) Environmental Radiation Ambient Monitoring System (ERAMS): An overview of the ERAMS and radionuclide concentrations are provided for tritium, gross alpha and beta, strontium-90, radium-226, and gamma.

19. Correspondence to Senators John Glenn and Howard Metzenbaum from Regional Administrator Valdas V. Adamkus

a) December 18, 1990 correspondence

b) March 25, 1991 correspondence

20. Questions & Answers About the Industrial Excess Landfill Superfund Site Fact Sheet (December, 1992)

[1]Data will be made available on computer disk as well as a hard copy
[2]Data will be transmitted as soon as they are available

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INDUSTRIAL EXCESS LANDFILL
CATALOGUE OF MATERIALS
FOR THE
SCIENCE ADVISORY BOARD

1. Report on the Initial Sampling Performed at IEL (April, 1988)

USEPA's Environmental Response Team (ERT) collected gas samples from the Methane Venting System at the IEL site in January of 1988. The results of these analyses were used to develop a target list for a soil gas and indoor air sampling program.

The gas was tested on-site utilizing a portable radiation survey meter, as well as detectors for hydrogen sulfide and phosgene. One soil gas Summa canister and the background Summa canister were sent to the EPA eastern Environmental Radiation Facility in Montgomery, Alabama for analyses for the presence of radioactive parameters including Radon.

The analytical results of this sampling is summarized in this report.

This document consists of 6 pages.

2. Remedial Investigation (July, 1988)

The Remedial Investigation (RI) summarizes the data collected to characterize the site in order to assess the immediate or potential threats to human health and the environment posed by the IEL site. This document was finalized in 1988, therefore the following information is compiled only through 1988 (current information is provided in the Draft 30% Remedial Design Document, dated February 1993):

Section 1 provides site background information including a site description, site history, chronology of events, and a summary of previously obtained data and information on the site. This section also provides a summary of the nature and extent of the contamination problem and a summary of the remedial investigation process, as well as an overview of the remedial investigation report.

Section 2 of the report describes site features including demography, land use, natural resources, and climatology. These descriptions are based on published data for the site area as cited in the text.

Section 3 summarizes the wastes and their respective characteristics and behavior. This section addresses waste quantities, locations and containment and their component characteristics.

Section 4 provides a summary of the geology and hydrogeology of the site area. Included in this section is a description of the geologic features, the hydrogeologic framework and the ground water flow patterns. In addition, the section identifies contaminant levels determined in the soil and ground water contamination investigations.

Section 5 addresses the hydrologic investigation conducted at and around the site. Included in this section are discussion of drainage patterns and the investigation and results of the surface water and sediment sampling programs.

Section 6 presents the results of the air investigations conducted at and around the site, and in the Uniontown community.

Section 7 describes the geophysical investigation that was carried out at the site. This section discusses the techniques used and the results of each of the types of surveys performed.

Section 8 is the public health evaluation. This section discusses and evaluation of the public health and environmental concerns posed by the conditions at the site.

The document consists of 2 volumes.

3. Feasibility Study (December, 1988)

The Feasibility Study (FS) provides a detailed evaluation of the remedial alternatives and screening of the remedial process options applying environmental, engineering, and economic factors in accordance with the NCP and CERCLA.

This document, coupled with the RI, provides the basis for EPA's selection of the final remedy for the IEL site.

The document consists of 1 volume.

4. ATSDR's Health Assessment (July, 1989)

The Agency for Toxic Substances and Disease Registry (ATSDR) is mandated by Congress to perform a Health Assessment for each hazardous waste site on the National Priorities List (NPL). A Health Assessment is the evaluation of data and information on the release of hazardous substances into the environment in order to (1) assess any current or future impacts on public health, (2) develop health advisories or other health recommendations, and (3) identify studies or actions needed to evaluate and mitigate or prevent human health effects.

Included as an appendix to this document is the 1988 U.S. Geological Survey (USGS) Report which evaluated geologic and hydrogeologic data available from the RI/FS, and from U.S. Geological Survey data bases, with emphasis on how well the available data describe ground water flow within and around the IEL site.

This document consists of 1 volume.

5. Record of Decision (ROD) (July, 1989)

This document contains the Record of Decision and the Responsiveness Summary the USEPA prepared for the IEL site. The ROD describes USEPA's overall approach for addressing the contamination problems associated with the site. The Responsiveness Summary, a requirement of Superfund Law, summarizes comments received from the public and other interested parties on USEPA's Proposed Plan, and presents USEPA's response to those comments.

The document consists of 1 volume.

6. Record of Decision (ROD) - Alternate Water Supply (September, 1987)

This documents describes USEPA's approach for providing an Alternate Water Supply to an area comprised of approximately 100 homes in Uniontown, Ohio. This action constituted an operable unit of the overall remedy for the site.

The document consists of 1 volume.

7. Final Work Plan for Design Studies and Remedial Design (April, 1990)

The work plan defines the scope and rationale of activities for the Remedial Design (RD) for the IEL site. In addition, the work plan describes the activities necessary to complete the RD and provides a detailed explanation of the design activities.

Section 1 provides the overall scope of the Remedial Design.

Section 2 presents the site background information.

Section 3 presents the RD data needs and investigative approach to obtain this data.

Section 4 discusses the preliminary activities that needed to be conducted prior to the initiation of the RD.

Section 5 describes the design studies necessary to obtain the data needed to complete the RD. The major elements of the design studies are ground water and aquifer characterization; landfill gas characterization; surface water, sediment, and soil contaminant characterization; and landfill cap evaluation.

Section 6 describes the remedial design activities. This section includes a discussion on the preparation of a detailed remedial design work plan, the preliminary design, the intermediate design, the prefinal/final design, and necessary construction contract support.

Section 7 describes the TIC meeting support provided by EPA's contractor for design, PRC Environmental Management, Incorporated.

Section 8 describes the project management activities and level of quality control necessary for the RD activities.

Section 9 present s the schedule of activities and deliverables.

This document consists of 1 volume.

8. Quality Assurance Project Plan (QAPP) (July, 1991)

A Quality Assurance Project Plan (QAPP) is required for every monitoring and measurement project. This document describes the procedures, objectives, and specific quality assurance and quality control (QA/QC) activities that USEPA's contractors followed to achieve the data quality goals established for the design studies phase of the RD at IEL.

This document consists of 2 volumes.

9. Field Sampling Plan (FSP) (July, 1991)

The field sampling plan (FSP) describes the sampling procedures and collection methods that were followed by USEPA's contractors during the design studies phase of the RD.

The four principal ares of the field investigation consisted of the ground water and aquifer characterization, the landfill gas characterization, the surface water, sediment, and solid characterization, and the geotechnical evaluation. The FSP describes the sampling activities associated with each of these ares.

Other sections of the FSP provide information on the site-specific objectives, sample handling, waste disposal, and proposed project scheduling.

This document is Appendix A of the QAPP, as described above, and consists of 1 volume.

10. Draft 30% Remedial Design Document (February, 1993)

The objective of this preliminary design report is to present conceptual plans and specifications for implementing USEPA's selected Remedial Action (RA) at the site.

Prior to the initiation of the design of the RA components, USEPA completed design studies and field testing in 1991 and 1992 to supplement information obtained during the 1988 RI. The document is organized as follows:

Chapter 1 introduces the preliminary design report.

Chapter 2 provides site background information.

Chapter 3 describes the design studies and field testing completed in 1991 and 1992 to supplement data obtained during the Remedial Investigation.

Chapter 4 identifies the design strategies and the basis for the design.

Chapter 5 describes the landfill cap and the expanded landfill gas extraction and treatment system.

Chapter 6 describes the ground water extraction and treatment system.

Chapter 7 discusses institutional controls.

Chapter 8 discusses the elements of the Operation & Maintenance (O&M) plan for RD.

Chapter 9 discusses the Construction Quality Assurance Plan (CQAP) which will be followed during construction of the Remedial Action for the site.

Chapter 10 provides preliminary cost estimates for the landfill cap, the landfill gas extraction and treatment system, and the ground water extraction and treatment system.

The analytical results of the design studies and field testing are detailed in this report. These results summarize the following information:

- Landfill Gas Generation Rate and Chemical Composition
- Landfill Gas Migration
- Surface Soil Contamination
- Sediment and Surface Water Contamination
- Hydrogeologic Characterization and Monitoring Well Installation
- Ground Water Contamination
- Slug Testing and Ground Water Modeling
- Geotechnical Investigation
- Landfill Cap

The document consists of 6 volumes.

11. Draft Ground Water Modeling Report (February, 1993)

This report summarizes USEPA's approach to computerized capture zone modeling at IEL. The purpose of the modeling was to provide information to support the preliminary RD of the ground water extraction and treatment system.

The report provides information on site history, geology, and ground water hydrology. A summary of the results of the capture zone and Theis drawdown modeling, as well as a discussion of the model limitations is provided. The document also presents recommendations for a ground water extraction system.

USEPA's 1989 ROD established design criteria that required (1) extracting and treating contaminated ground water beneath and near the landfill until cleanup levels are achieved, and (2) pumping ground water to maintain the water table beneath the waste in order to protect ground water from additional contamination. This report addresses these criteria and presents information related to the ground water extraction system, including the number and location of extractions wells and pumping rates.

This document consists of 1 volume.

12. May 1992 Ground Water Monitoring and Residential Well Sampling Results Technical Memorandum (February, 1993)

This document presents the results of the analyses for volatile organic compounds; semivolatile organic compounds; pesticides and polychlorinated biphenyls; unfiltered and filtered metals; and other chemical parameters, including sulfate, chloride, nitrate/nitrite on ground water samples collected in May 1992.

A comparison of ground water analytical results for samples collected from monitoring wells in August 1990, December 1990, December 1991, and May 1992 is presented.

The results of the August 1992, December 1992, and March 1993 will be made available for distribution to the SAB, if requested, as they become available.

This document consists of 1 volume.

13. Table of Monitoring Well Water Levels (March, 1993)

This table presents monitoring well water level measurements taken at the IEL site during each ground water sampling event from August 1990 through March 1993.

This document is summarized in 3 pages.

14. Radiological Analytical Results from the National Air and Environmental Laboratory (NAREL) - Samples Collected During the RD Fieldwork Activities

a) Report of Radon Measurements at IEL (August 21, 1992)

This report presents the following information:

- o Radon Concentrations in IEL Soil Gas Extraction Wells;
- o Measurement of Radon-222 in MVS and Pilot Extraction Wells;
- o Pilot Landfill Gas Extraction Wells;
- o Landfill Gaseous Monitoring Well Radon Concentrations;
- o Radon in Water;
- o Radon Measurements in Exploratory Boreholes;
- o Pylon Radon Detectors; and
- o Radon Flux Measurements.

This document consists of 28 pages.

b) Report of Particulate Filter Measurements from IEL (August 28, 1992)

This report presents data for the particulate sampling of the Methane Venting System and the three pilot extraction wells for radioactive materials.

This report is summarized in 3 pages.

c) Radiochemical Analytical Results for Samples from IEL (August 28, 1992)

The first three in-situ ground water samples from each borehole drilled on site were collected and analyzed for radiochemical parameters at NAREL. The results of these analyses are provided in tabular form.

Re-analyses were conducted on several of these samples. The results of these analyses are summarized in a February 5, 1993 memorandum from Jon Broadway of NAREL to Linda Kern.

These results are presented in a total of 31 pages.

15. Radiological Analytical Results from the National Air and Environmental Laboratory (NAREL) - Samples Collected During the Quarterly Ground Water Sampling Program

a) Comprehensive Ground Water Sampling Round 1 Radiochemical Analytical Results (May, 1992)

Radiochemical results are presented for ground water and filter samples collected from monitoring wells, irrigation wells, and residential wells collected in May 1992.

Also included is a copy of USEPA's Fact Sheet which summarizes the results obtained during this sampling event.

Re-analyses were conducted on samples which exceeded EPA's screening criteria for gross alpha activity of 15 pCi/L in ground water or 3 pCi/sample on filters.

These results consist of 1 volume.

b) Comprehensive Ground Water Sampling Round 2 Radiochemical Analytical Results (August, 1992)

Radiochemical results are presented for ground water and filter samples collected from monitoring wells, irrigation wells, and residential wells collected in August 1992.

Also included is a copy of USEPA's Fact Sheet which summarizes the results obtained during this sampling event.

These results consist of 1 volume.

c) Comprehensive Ground Water Sampling Round 3 Radiochemical Analytical Results (December, 1992)

Results will be transmitted as soon as they are available.

d) Comprehensive Ground Water Sampling Round 4 Radiochemical Analytical Results (March, 1993)

Results will be transmitted as soon as they are available.

16. Contract Laboratory Program Invalidated Radiological Results

a) August 1990

The only analytical results which were acceptable for this round of ground water sampling were the Carbon-14 results.

These results are presented in 64 data sheets.

A November 21, 1990 Memorandum from Gregg Dempsey to Curtis Ross of the Central Regional Laboratory summarizes the August 1990 data review.

b) December 1990

The invalidated results of the December 1990 sampling event are contained in 2 boxes. These data are in the original form as received from the Contract Laboratory.

A September 17, 1991 Memorandum from Gregg Dempsey to Curtis Ross of the Central Regional Laboratory summarizes the December 1990 data review.

17. IEL Technical Information Committee Position Papers

a) TIC Positions With Respect to the Radiological Sampling at IEL (May, 1992)

In a April 28, 1992 correspondence to the IEL TIC, Linda Kern requested that the members of the TIC provide a written statement outlining their technical opinions with respect to the radiological sampling at IEL (i.e., frequency of sampling, parameters, etc.). Responses were received in May, 1992 from the Ohio EPA, ATSDR, and the Concerned Citizens of Lake Township (CCLT).

b) TIC Positions With Respect to the Request to Perform Additional Soil Borings at the Landfill (July, 1993)

During the May 19, 1993 meeting of the IEL TIC, the committee agreed to draft position papers regarding the issue of performing additional landfill coring during the RD phase at IEL. Position papers were received from the Ohio EPA, ATSDR, CCLT, and the Potentially Responsible Parties (PRPs).

18. Information Collected to Date on Background Radionuclide Concentrations (August 1993)

a) Information Sheets have been compiled summarizing properties, health risks, production and use, releases, fate in the environment, monitored levels in the environment, and analytical methods for the following isotopes: thorium, plutonium, uranium, radium, tritium, carbon-14, and cesium.

b) U.S. Geological Survey's Regional Aquifer Study Analysis Data Base summarizes tritium concentrations found in northeast Ohio.

c) U.S. Geological Survey's Water-Resources Investigation Report Abstract on Geohydrology and quality of water in Lucas, Sandusky, and Wood Counties in northwestern Ohio.

d) Occurrence of Radon, Radium, and Uranium in Groundwater, Journal AWWA, 1988: A paper based on the National Inorganics and Radionuclides Survey (NIRS). USEPA is in the process of attempting to obtain a copy of the actual data base, possibly on disk.

e) Environmental Radiation Ambient Monitoring System (ERAMS): An overview of the ERAMS and radionuclide concentrations are provided for tritium, gross alpha and beta, strontium-90, radium-226, and gamma.

19. Correspondence to Senators John Glenn and Howard Metzenbaum from Regional Administrator Valdas V. Adamkus

a) December 18, 1990 correspondence from Regional Administrator Valdas V. Adamkus to Senators John Glenn and Howard Metzenbaum transmitting U.S. EPA's justification of reasoning for not characterizing the waste material by soil core sampling with analysis for radionuclides. Attachments include a statistical analysis for the probability of locating radioactive wastes based on the number of boreholes and samples to be taken, potential radiological contaminants and estimated volumes, and a discussion of the 1988 ERT testing of the Methane Venting System for radon.

b) March 25, 1991 correspondence from Regional Administrator Valdas V. Adamkus to Senators John Glenn and Howard Metzenbaum transmitting U.S. EPA's ground water modeling report which was used to estimate the concentration of three potential radioactive sources (cesium-137, tritium, and uranium-234/238) downgradient from the landfill at selected time periods. The input parameters chosen for the model were based on available site data (prior to the installation of the new RD monitoring wells) and accepted modeling practices. Also included are the results of the expanded calculations using U.S. EPA's PRESTO waste burial computer model. PRESTO is used to model long term impact associated with low level radioactive waste sites. The calculations, based on hypothetical radionuclide inventory data, were made for a 1000 year period following closure of the landfill.

20. Questions & Answers About the Industrial Excess Landfill Superfund Site (December, 1992)

This document is a Fact Sheet which addresses questions concerning the IEL site. It was distributed to the community and members of the IEL TIC in December 1992.

OhioEPA
State of Ohio Environmental Protection Agency
Northeast District Office
2110 E. Aurora Road
Twinsburg, Ohio 44087-1969
(216) 425-9171
FAX (216) 487-0769

George V. Voinovich
Governor
Donald R. Schregardus
Director

August 11, 1993

RE: Industrial Excess Landfill
Stark County
OHD 000 377 911 (276-0416)
Submission to the U.S. EPA
Science Advisory Board

Mr. Robert A. Flaak
Assistant Staff Director
U.S. Environmental Protection Agency
Office of the Administrator
Science Advisory Board
401 M Street, SW (A-101F)
Washington, D.C. 20460

Dear Mr. Flaak:

In accordance with requests made by the Science Advisory Board ad hoc Industrial Excess Landfill Advisory Panel during the meetings held in Akron, Ohio, during July of 1993, Ohio EPA is submitting the enclosed documentation regarding radiochemical issues and sampling results for this site.

A catalog of the documents contained in the submission is provided as Attachment I to this letter. Copies of all radiochemical sampling results obtained by Ohio EPA are included; however, a disk copy of the Ohio EPA data, organized into the spreadsheet format being employed by U.S. EPA for their radiochemical data, will be provided by U.S. EPA during the week of August 16, 1993. Please note that Item D on Attachment I should accompany both paper copies of the radiochemical data (Items E through K) and disk copies of the data when distributed to Panel members.

If the members of the Panel have any questions about this submission, or if additional documents are required, please do not hesitate to contact me (216-963-1126).

Sincerely,

Julie L. Corkran

Julie L. Corkran
Project Coordinator
Division of Emergency and Remedial Response

JLC:lt

enclosures

cc: Rod Beals, NEDO/DERR
Fran Kovac, CO/Legal
Bob Princic, NEDO/DERR
Linda Kern, U.S. EPA/Region V

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Attachment I: Industrial Excess Landfill SAB Submission Document Catalog

The documents have been organized into a two-volume set with lettered dividers for reference purposes. This catalog provides the location of each document, document title, and a brief description of the document where appropriate.

Location	Document
Volume I	
A	Correspondence from J. Corkran (OEPA) to L. Kern (USEPA). July 13, 1993. Subject: Position paper on core sampling for radiochemical "hot spots" during Remedial Design activities.
B	Correspondence from J. Corkran to L. Kern. May 28, 1992. Subject: Position paper regarding the scope and frequency of radiochemical sampling at IEL during pre-design studies.
C	Correspondence from J. Corkran to L. Kern. May 26, 1993. Subject: Ohio EPA comments on the Preliminary (30%) Remedial Design Document for IEL. This letter provides an overview of the current technical status of the site as the involved parties enter into the design phase of the proposed remedy, including narrative on the issue of defining background for radiochemical contaminants of concern.
D	Summary of Data Qualifiers for Ohio EPA IEL Radiochemical Data. This item includes a chronological summary of any data point corrections and invalidations, deviances from the Quality Assurance Project Plan sampling protocol, and relevant correspondence required for proper interpretation of the radiochemical data. **Please note that Item D should accompany both paper copies of the radiochemical data (Items E through K, below) and disk copies of the data when distributed to Panel members.**
E	OEPA Ground Water Split-Sampling Results: March 1991.
F	OEPA Ground Water Split-Sampling Results: June 1991.

Attachment I, continued.

Location	Document
Volume I	
G	OEPA Ground Water Split-Sampling Results: December 1991/January 1992.
H	OEPA Ground Water Split-Sampling Results: May 1992.
I	OEPA Ground Water Split-Sampling Results: August 1992.
J	OEPA Ground Water Split-Sampling Results: November/December 1992
Volume II	
K	OEPA Ground Water Split-Sampling Results: March, 1993 (Draft).
L	The Model State Information System (MSIS) is a database that organizes the results of radiochemical sampling and analysis performed by Public Water Supplies (PWS) that rely on ground water and surface water sources. Gross alpha and gross beta analyses are typically reported. The database, organized by county, is current through 1992 and dates back to 1980 for a limited number of public water systems. Ohio EPA will be providing the MSIS data to the IEL Technical Information Committee for consideration as a possible local database for use in defining radiochemical background levels for the IEL site. Due to the geographic location of IEL near the juncture of three counties, MSIS listings for Portage, Stark, and Summit Counties are provided in this submission. Only ground water source data are included. Model State Information System, Radiological Sample Listing, Ground Water Systems: Portage County, Ohio.
M	Model State Information System, Radiological Sample Listing, Ground Water Systems: Stark County, Ohio.
N	Model State Information System, Radiological Sample Listing, Ground Water Systems: Summit County, Ohio.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

MEMORANDUM

DATE: September 7, 1993

SUBJECT: Industrial Excess Landfill
Radiological Ground Water Sampling Results
December 1992 and March 1993

FROM: Linda A. Kern
Remedial Project Manager

TO: Addressees

Enclosed please find copies of the following materials for the Industrial Excess Landfill (IEL) Superfund site in Uniontown, Ohio:

1) A Fact Sheet (September, 1993) which summarizes the results of the radiological ground water sampling/analyses performed on samples collected during the December 1992 and March 1993 sampling events at the IEL site;

2) Radiochemical Analytical Results for samples collected in December 1992; and

3) Radiochemical Analytical Results for samples collected in March 1993.

Due to the volume of material which comprises the radiochemical analytical results, copies of the data for the December 1992 and March 1993 ground water sampling events are being sent to the representative Technical Information Committee (TIC) members listed below as addressees and to individuals who have made specific requests for copies of the data.

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In addition, copies of the data are being sent to the two IEL Information Repositories located at the Lake Township Clerk's Office and the Hartville Branch Library for availability to the public. If you did not receive a copy of the data, but would like to, please call me at (312) 886-7341 or toll-free at 1-800-621-8431.

The results of the December 1992 and March 1993 ground water results for the inorganic, organic, and metal analyses will be transmitted under a separate cover.

Enclosures

Addressees: Julie Corkran, Ohio EPA
Laura Barr, ATSDR
Larry Sweeney, Burlington Environmental
Christine Borello, CCLT
Henry Cole, CCLT
Marvin Resnikoff, CCLT
Steven James, Ohio Department of Health
Information Repositories (Hartville Branch Library & Lake Township Clerk's Office)
A. Robert Flaak, SAB
IEL Technical Information Distribution List (w/Fact Sheet, w/out data)
Norm Niedergang, USEPA (w/Fact Sheet, w/out data)
Tim Fields, USEPA (w/Fact Sheet, w/out data)

OhioEPA
State of Ohio Environmental Protection Agency
Northeast District Office
2110 E. Aurora Road
Twinsburg, Ohio 44087-1969
(216) 425-9171
FAX (216) 487-0769

received
10/1/93

George V. Voinovic
Governc

CERTIFIED MAIL

October 5, 1993

RE: Industrial Excess Landfill
Stark County
OHD 000 377 911 (276-0416)
Radiochemical Data Submission
to the U.S. EPA Science Advisory
Board

Mr. Robert Flaak
Assistant Staff Director
U.S. Environmental Protection Agency
Office of the Administrator
Science Advisory Board
401 M Street, SW (A-101F)
Washington, D.C. 20460

Dear Mr. Flaak:

In accordance with requests made by the Science Advisory Board ad hoc Industrial Excess Landfill Advisory Panel during the September 21-22, 1993, meetings in Washington, D.C., Ohio EPA is submitting in disk format the radiochemical data generated by this agency during ground water sampling at this Superfund site.

The following items are enclosed with this cover letter and have also been submitted directly to each Panel member:

i. Ohio EPA radiochemical data in Lotus 1-2-3 (Release 3.0) format,
ii. Spreadsheet printout,
iii. Memorandum: Summary of Data Qualifiers for Ohio EPA IEL Radiochemical Data (originally submitted to the SAB on 8/11/93 as Item D in the Ohio EPA document catalog),
iv. TMA/Eberline Laboratory Analytical Methods and Reference table.

The additional information required by the Panel regarding specific Ohio EPA radiochemical data values has been requested of TMA/Eberline and will be forwarded to the Science Advisory Board upon receipt by this office.

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If the members of the Panel have any questions about this submission, please contact me directly at (216) 963-1126.

Sincerely,

Julie L. Corkran

Julie L. Corkran
Project Coordinator
Division of Emergency and Remedial Response

JLC:lt

enclosures

cc: (with enclosures)
SAB ad hoc IEL Advisory Panel Members
Linda Kern, U.S. EPA/Region V
Laura Barr, ATSDR
Stephen James, ODH
Chris Borello, CCLT
Larry Sweeney, Burlington Environmental
Mary Clark, NAREL
Todd Fisher, NEDO/DDAGW

(without enclosures)
Bob Princic, NEDO/DERR
Rod Beals, NEDO/DERR
Fran Kovac, CO/Legal

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

MEMORANDUM

DATE: October 15, 1993

SUBJECT: Industrial Excess Landfill (IEL)
Transmittal of Radiochemical Data on Disk

FROM: Tinka G. Hyde, Chief
MN/OH Section #3

TO: Science Advisory Board (SAB) ad hoc IEL Panel

The purpose of this memo is to transmit information to the SAB ad hoc IEL Panel which was requested during the September 21 - 22, 1993 meeting in Washington, D.C. You may remember that the following information was requested from USEPA: 1) Radiochemical data on disk; 2) List of monitoring wells which were pumped/ bailed; and 3) Set of Maps depicting the radiochemical data.

Included in this package are the radiochemical data on disk. Unfortunately, the task of mapping all of the radiochemical data and a subset of the volatile organic data was larger than I had originally expected. Therefore, the maps are not yet complete. I anticipate having the complete set of maps and the list of monitoring wells which were bailed/pumped ready for distribution by the end of next week.

The data was entered into Lotus 123 spreadsheets and is arranged on the disk in the following format:

1. **MAY-W.WK1** = May 1992 WATER Rad data w/o QA/QC data
2. **AUG-W.WK1** = August 1992 WATER Rad data w/o QA/QC data
3. **DEC-W.WK1** = December 1992 WATER Rad data w/o QA/QC data
4. **MAR-W.WK1** = March 1993 WATER Rad data w/o QA/QC data
5. **MAY-F.WK1** = May 1992 FILTERS Rad data w/o QA/QC data
6. **AUG-F.WK1** = August 1992 FILTERS Rad data w/o QA/QC data
7. **DEC-F.WK1** = December 1992 FILTERS Rad data w/o QA/QC data
8. **MAR-F.WK1** = March 1993 FILTERS Rad data w/o QA/QC data
9. **VOA.WK1** = 4/5 Volatile Organic compounds from May 1992 round. These compounds were provided per SAB request to compare general volatile distribution in groundwater with radiochemical distribution in groundwater. A separate map will be provided of the VOA distribution.
10. **RE-AN.WK1** = Samples requiring reanalysis from May 1992 round ONLY. Presented separately due to mapping constraints.
11. **QA-QC-W.WK1** = All WATER QA/QC data (i.e., blanks & MS/MSD)
12. **QA-QC-F.WK1** = All FILTER QA/QC data (i.e., blanks & MS/MSD)

Finally, I am including well location maps and an explanation of the well numbering system to assist you in your review. If you have any questions, please call me at (312) 886-9296.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

MEMORANDUM

DATE: November 16, 1993

SUBJECT: Industrial Excess Landfill (IEL)
Transmittal of Radiochemical Data on Disk

FROM: Linda A. Kern
Remedial Project Manager

TO: Science Advisory Board
ad hoc Industrial Excess Landfill
Advisory Panel Members

The purpose of this memorandum is to transmit a set of maps depicting the radiochemical data at the Industrial Excess Landfill (IEL) Superfund site. These maps were prepared in accordance with requests made by the ad hoc IEL Advisory Panel of the Science Advisory Board (SAB) during the September 21-22, 1993, meetings in Washington, D.C.

Included in this transmittal are a set of maps depicting the radiochemical results for each well. Due to the large volume of data points and map reproduction limitations, 10 sets of maps were made to graphically present all of the information requested. A map set represents 2 maps: 1) one map of the landfill proper; and 2) one map which presents the off-site wells. This configuration results in 20 individual maps. The following is a brief description of how the map sets are organized:

> Tritium data: All 4 rounds of tritium data are presented on one set of maps. The data are presented in small tables located adjacent to the corresponding well location. A matrix which defines the data points within these small tables is located at the bottom of each map. The activity, error, and MDA are presented for each well location sampled. If a well is missing from a map, assume that it was not sampled.

Gross Alpha, Gross Beta, Uranium, Radium in Groundwater: There are 4 sets of maps which present this data. Each set represents an individual round (May 1992, August 1992, December 1992, and March 1993). The data are presented in small tables located adjacent to the corresponding well location. A matrix which defines the data points within these small tables is located at the bottom of each map. The activity, error, and MDA are presented for each well location sampled. If a well is missing from a map, assume that it was not sampled.

Gross Alpha, Gross Beta, Uranium, Radium in Filter Samples: There are 4 sets of maps which present this data. Each set represents an individual round (May 1992, August 1992, December 1992, and March 1993). The data are presented in the same manner as was described for the groundwater.

Volatile Organics: May 1992 round of volatile organic data is presented on one set of maps. The volatile organic data presented on the map is a subset of a larger data set. As requested, this data is expected to serve as a general indicator of the direction of chemical transport in groundwater. The six most prevalent volatile organic contaminants from the May 1992 round which were detected above the Maximum Contaminant Level (MCL) were used to create this map. If a well is missing from this map, assume that the six contaminants were not detected above the MCL during the May 1992 sampling round.

If you have any questions regarding this transmittal, please feel free to contact me at (312) 886-7341.

SAB ad hoc IEL Advisory Panel Members
Dr. Robert Huggett, Chairperson
Dr. Ann Bostrom
Dr. Norman H. Cutshall
Dr. Robert Morrison
Dr. Oddvar Nygaard
Dr. Mitchell Small
Dr. Michael Stein
Dr. Jan Stolwijk
Dr. Myint Thein

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

MEMORANDUM

DATE: December 1, 1993

SUBJECT: Industrial Excess Landfill (IEL)
Transmittal of Mapping Program for Radiological Data

FROM: Linda A. Kern Linda A. Kern
Remedial Project Manager

TO: Science Advisory Board
ad hoc Industrial Excess Landfill
Advisory Panel Members

The purpose of this memorandum is to transmit supplemental material to the ad hoc Industrial Excess Landfill (IEL) Science Advisory Board (SAB) panel members.

U.S. EPA's National Air and Radiation Environmental Laboratory (NAREL) has developed a computer mapping program which can be utilized to display the radioanalytical results obtained for the IEL site. I have enclosed a computer disk which contains the programs and data files necessary to run the mapping program, as well as a copy of the supporting documentation which will assist you in the operation of the program.

If you have any questions, please feel free to contact me at (312) 886-7341.

SAB ad hoc IEL Advisory Panel Members

Dr. Robert Huggett
Dr. Ann Bostrom
Dr. Norman H. Cutshall
Dr. Robert Morrison
Dr. Oddvar Nygaard
Dr. Mitchell Small
Dr. Michael Stein
Dr. Jan Stolwijk
Dr. Myint Thein

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