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OPERABLE UNIT 3 TREATABILITY STUDY WORK PLAN COMMENT RESPONSE PACKAGE

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DOE-FN/EPA
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RESPONSES
OU3

OPERABLE UNIT 3
TREATABILITY STUDY WORK PLAN

COMMENT RESPONSE PACKAGE

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02

This document has bee prepared in response to USEPA and Ohio EPA (OEPA) comment provided for the December 22, 1993 submittal of the Draft Operable Unit 3 Treatability Study Work Plan (TSWP). The submittal includes the following specific sections:

Section 1	USEPA OU3 TSWP Comments and DOE Comment Responses
Section 2	OEPA OU3 TSWP Comments and DOE Comment Responses
Section 3	Summary of the Significant Changes to the OU3 Treatability Studies
Section 4	FERMCO Material Release Policy and Supporting Procedures

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Section 1

USEPA OU3 TSWP Comments and DOE Comment Responses

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Responses to General USEPA Comments on the OU3 Treatability Study Work Plan

Comment #1

The body of the work plan discusses treatability studies only in general and references other documents to the point of not containing worthwhile information itself. The U. S. Department of Energy (U. S. DOE) should revise the work plan to present important and applicable information in a summary format.

Response #1

Additional text has been added to Section 1 to clarify the format of the *Operable Unit 3 Treatability Study Work Plan* (TSWP), introduce the proposed treatability studies, and direct the reader to the appendices where study-specific information is located. The OU3 TSWP has been developed to contain general treatability study information in the main body of the document (Sections 1-16) with specific test information for each treatability study located in the appendices. The OU3 TSWP contains information suggested by the *EPA Guide for Conducting Treatability Studies Under CERCLA* (Final 1992). The study-specific appendices contain information such as data quality objectives (DQOs), test designs, applicable procedures, equipment and materials, a study-specific sampling and analysis plan, a study-specific health and safety plan, and summary information on applicable or relevant and appropriate requirements (ARARs) and permits.

Most of the documents referenced, such as the *Fernald Environmental Management Project Sitewide CERCLA Quality Assurance Project Plan* (SCQ) and the *Operable Unit 3 Remedial Investigation/Feasibility Study Work Plan Addendum* (OU3 RI/FS WPA), were reviewed and approved by both OEPA and USEPA and are currently part of the Administrative Record. Excessive repetition in reproducing portions of reviewed and approved documents would not, in most cases, provide technical benefits to this work plan. In situations where documents are not part of the Administrative Record, summaries of the information found in the referenced document has been provided. For example, brief summaries of what is found in referenced documents have been added to the study-specific appendices and several sections including, but not limited to, Sections 1, 3, 7, 11, and 13.

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Comment #1

Section A, Page A-2 & A-13. Information presented on the dry heat volumetric decontamination technology seems to contradict information presented on the dry heat surface decontamination technology. The surface technology text states that dry heat has been successful in removing polychlorinated biphenyls (PCB), but the volumetric technology text states that dry heat is untried for removing PCBs. U.S. DOE should resolve this apparent discrepancy.

Response #1

Research and review of information concerning process options is on-going to support the continuing development of the OU3 Treatability Study Program and the OU3 Feasibility Study Report. The Appendix A tables have been modified in response to OEPA General Comment #9 and OEPA Specific Comments #30 and #31. Also, in response to this comment, the summary text describing the dry heat process option in the Appendix A tables has been modified to provide more information.

Dry heat, also referred to as dry heat roasting, is an accepted industrial process for removing surface contaminants, particularly volatiles. It is listed as a "demonstrated" process in Table A.1 because of its limited experience in removing contaminants other than volatiles from metal and concrete surfaces.

It has been suggested that contaminants could be removed from certain volumetrically contaminated media such as transite and asbestos-containing insulation using dry heat. The Oak Ridge K-25 Site has been considering testing the removal of volatiles, oils, and PCBs from these media, and feel there is a moderate probability of success. The dry heat information contained in Table A.3 has been changed to reflect this.

Comment #2

Section B.2.2, Page B-6. Figure B.2.1 depicts the mixing system for the ABCOV method. The figure shows what seems to be a closed-loop, four-tank system, but the figure does not show input and output locations or materials. U. S. DOE should revise the figure to show these items.

Response #2

The mixing system for the ABCOV Method recirculates the conversion chemical formulation, ABCOV-C, through the filters and into the regeneration tank. Once regenerated, the ABCOV-C is transferred to the holding tank until the conversion tank is emptied and ready for recharge. In this regard, the liquid is contained within a closed loop configuration. However, after a large number of batches, which will be determined as part of the lab-scale treatability study, the spent ABCOV-C will be purged from the system and sampled to determine/verify acceptable levels of contaminants to be sent to the wastewater treatment system. Chemicals (ABCOV-R and ABCOV-R1) are manually added to the regeneration tank as needed. Figure B.2.1 does not show the manual addition of regeneration chemicals but process lines have been added to schematically represent removal of the waste streams from the tank system.

Comment #3

Section C.2, Page C-7, Line 27. The text states that the test variables will be considered effective if the concentration of uranium or thorium is reduced by 80 percent. Although 80 percent reduction would be substantial, the test material would still be considered a low-level waste. U. S. DOE should justify the 80 percent reduction criterion.

Response #3

The text in Section C.2 has been revised to state that "the chemical leaching process will be considered a feasible technology warranting further testing (e.g., pilot-scale testing) if the target compound(s) concentration is reduced by 80 percent in the test media and the technology is considered cost-effective."

Comment #4

Section C.4.5, Page C-33, Line 1-2. The text states that the optimal operating conditions will be selected for each medium based on performance and cost benefit. U. S. DOE should explain how performance and cost will be weighed against each other to determine the optimal conditions.

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Response #4

The following discussion has been added to Section C.2. "Optimal conditions or the most promising variables are defined by the combination of variable(s) and constants which yield the greatest reduction in contaminant concentration after chemical leaching is performed on the test media. Costs will be weighed if two variables produce similar results. The more cost-effective variable would be selected for further testing, while the second variable is set aside and may be re-considered at a later time." For example, during Step 1, "Select Optimal Leaching Solution(s) and Concentration(s) of Media," the combination of leaching solution and concentration of leaching solution which produces the greatest reduction in the concentration of contaminants in the test media will be selected as the optimal condition for Step 1.

Comment #5

Section E.1, Page E-5, Line 20. The text states that the number of waste blends will "not exceed the minimum number required to stabilize all OU3 wastes." This statement indicates that U.S. DOE will develop the fewest number of waste blends possible that can incorporate all Operable Unit (OU) 3 wastes. As such, U. S. DOE would not actually optimize the waste blends; it would only prepare waste blends until all OU3 wastes have been included in at least one waste blend. U. S. DOE should clarify this statement in the text.

Response #5

Clarification will be provided by the following text revision: "The tentative number of crucible melts is given in Table E.2.3. The actual number will be determined by the number of tests required to optimize waste blends for stabilization of all wastes listed in Table E.2.2."

Comment #6

Section 3.1, Page 3-2, Line 11. Please define "background" for surface contaminated media, how background is to be determined, the frequency of determining background, and what procedures and instrumentation are to be used to determine release of materials.

Response #6

The text in Section 3.1.1 which states "Materials which are judged to have surface contamination levels within the range of background may be released without restrictions..." has been changed to state "Materials which are determined to have surface contamination below the guidelines referenced in the *FERMCO Material Release Policy* may be released without restriction. However, the ALARA process will be applied to further minimize the potential risks to human health and the environment."

The methods for sampling and/or measurement of material depend on the physical characteristics of the material. Materials which are in non-porous, consolidated forms are usually measured for radioactive contamination by the use of direct reading instruments. The direct reading instruments can be used to assess both fixed contamination and, with the use of absorbent pads, removable contamination.

Materials which may have volumetric contamination (e.g., porous and/or unconsolidated materials) must be sampled and submitted to a laboratory for analysis prior to release. The FEMP has a variety of sampling procedures and protocols for sampling material with potential volumetric contamination. For example, for RCRA wastes, the DOE has granted conditional approval of the FEMP Criteria and Procedures for Certification of Non-Radioactive Hazardous Waste. These criteria are used to verify the absence of residual radioactive material in hazardous waste. For other media (e.g., soil, groundwater, concrete, etc.) sampling and analytical methods are contained in documents such as the Site Media Sampling Procedures Manual (media specific) and the FEMP Extraction Methodologies (sampling device specific).

The definition of "background" will be subdivided into material background and instrument background (response to other radiation).

Material background is defined as the amount of radioactive material from a source other than U.S. Department of Energy (DOE) activities (DOE uses the term "residual radioactive material" in Order 5400.5 to describe material background) which is contained in or on the medium in question. For non-porous, consolidated material (e.g., steel), process knowledge would be

sufficient to determine if DOE activities at the FEMP accounted for volumetric contamination (no activation sources are present). The only concern for release of non-porous material would be potential surface contamination. Background for non-porous material is that level of activity which is exhibited by an uncontaminated surface (i.e., it is indistinguishable from instrument background).

Instrument response to other radiation is specific to the type of detector used to assess radioactive material. Gross alpha contamination is assessed using zinc-sulfide scintillation detectors. These alpha detectors have essentially zero response to other forms of radiation. This combined with the limited range in air of alpha particles results in an alpha detector background of zero with no special actions needed to determine instrument background. Gross beta contamination is assessed using mica window geiger-mueller detectors. These detectors have at least a limited response to alpha, beta, and gamma radiation. The limited range in air of the alpha particles prevents instrument background to alpha radiation. The poor sensitivity of the detector to gamma radiation (< 1%) combined with the low percent abundance of gamma emitters at the FEMP, except for areas of thorium and radium storage which are well defined, result in a manageable instrument background to gamma radiation. For beta radiation, the particles are capable of entering the mica window but not the back side of the detector, making the detector highly directional. Instrument background is determined by turning the detector 180 degrees from the source or using a beta shield. The technique of turning the detector away from the source is of limited use in areas of high beta background due to the high energy of emission for the predominant beta emitter (^{234} Protactinium > 2 MeV beta maximum), the long range in air (approximately 12 feet/MeV), and the tendency of beta particles to scatter. In addition, areas with high beta background probably have significant gamma background.

The frequency of determining background depends on the which type of background is being determined. Background for porous-unconsolidated material is based on the scope of the sampling event and is addressed in the *Sitewide Quality Control Program Plan*. Instrument background is generally changed as the physical location of the material, and corresponding instrument readings, varies.

FERMCO SP-P-35-010 is the procedure currently used to establish the requirements necessary for the unrestricted release of materials from the FEMP. FERMCO SP-P-25-023 is the procedure currently used to assign responsibilities and establishes the procedure for performing radiological contamination surveys. FERMCO SP-P-25-023 is being revised. The new procedure number (final draft) is RC-RDA-010. The revision is based on the draft final Technical Basis for Detection Limits of Portable Instrumentation. The new procedure will be forwarded upon approval. FERMCO SP-P-35-025 is currently the procedure which identified FEMP administrative and DOE requirements for posting of radiologically controlled areas. All three procedures and the current *FERMCO Material Release Policy* are included with these comment responses.

Comment #7

Section 3.1, Page 3-2, Line 11. Please define "release without restrictions" in the context of surface contaminated and volumetrically contaminated media. Please explain the basis of "release without restriction" of formerly contaminated materials as opposed to release that restricts use to DOE facilities or NRC-licensed facilities.

Response #7

The definition of "release without restrictions" would refer to those materials which are not contaminated or have surface contamination below the guidelines in DOE Order 5400.5 and which can be released from DOE control with no further surveillance. The guidelines in DOE Order 5400.5 are consistent with the guidelines in Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*.

Currently, materials which have volumetric contamination, as a result of DOE activities, will not be released for unrestricted use. Site-specific techniques used to determine volumetric contamination require DOE approval.

"Release that restricts use to DOE facilities or NRC-licensed facilities" applies to any materials not acceptable for "release without restrictions." For example, metals which are volumetrically contaminated could be fabricated into disposal containers exclusively for use at DOE disposal facilities. The containers must, however, meet the criteria in U.S. Department of Transportation (DOT) regulations.

Responses to General USEPA Comments on the OU3 Treatability Study Work Plan

Comment #8

Section 3.1, Page 3-2 Line 11. Please provide a copy of the FERMCO Material Release Policy to the following address: Gene Jablonowski, U. S. EPA (AT-181), 77 West Jackson Blvd, Chicago, IL 60604-3590.

Response #8

The current *FERMCO Material Release Policy* is included with these comment responses along with copies of supporting procedures; FERMCO SP-P-35-023, FERMCO SP-P-35-025, and FERMCO SP-P-35-010.

Comment #9

Section 3.1, Page 3-2, Line 15. Please explain the role of the commercial recycler in their handling of residual surface contaminated materials. Is the commercial recycler expected to decontaminate materials further prior to recycling and/or restrict use of the formerly contaminated recycled product? Does the process of recycling contaminated materials provide separation of radiological contaminants from the material media, or can waste from the recycling of contaminated material be considered radioactive?

Response #9

The role of the commercial recycler will be to provide for decontamination, recycle, and/or beneficial reuse of the OU3 materials as most appropriate for each type of material, considering the nature and extent of any contamination and the selected disposition. FERMCO/DOE must approve any disposition options proposed by the subcontractor prior to their implementation.

Based on the disposition option selected, the commercial vendor(s) may decontaminate materials prior to recycling in order to reduce, as much as practical, the amounts of material which must continue to be controlled. Non-porous contaminated materials which have been decontaminated and are proven to contain no added radioactivity may be released for use without restrictions if they are below the DOE guidelines. The vendor will be responsible for all record keeping requirements associated with such unrestricted release. For materials which exhibit surface contamination higher than background but less than the limits in DOE 5400.5,

ALARA must be applied in addition to specific numeric limits for surface activity. The numeric values are used as the "upper limit" and the ALARA process is applied to bring the concentrations as far below these limits as is practical.

The processing of contaminated materials for the purpose of recycling/beneficial re-use may also provide separation of radiological contaminants from the material media, resulting in the generation of a relatively small quantity of radioactive waste. All secondary wastes generated by the recycler, as a result of processing the OU3 materials, will be adequately characterized to determine if they should be handled as radioactive or non-radioactive wastes.

Comment #10

Section 11.3, Page 11-3, Line 22. Please explain the basis for using Figure III-1 of DOE Order 5400.5, "Derived Concentration Guides (DCGs) for Members of the Public from Ingested Water and Inhalation Resulting in 100 mrem/yr," in establishing free release criteria of laboratory samples. Also, since Figure III-1 of DOE Order 5400.5 only applies to ingested fluid and inhaled air, explain what will be the basis for free release of solid samples, or whether all solid samples be returned to FEMP.

Response #10

Sections 11.2 and 11.3 have been revised to summarize information from the *Radioanalytical Laboratory Services Task Order Subcontract for the Fernald Environmental Management Project* and the *FEMP Waste Acceptance Criteria* (WAC) document. The reference to Figure III-1 of DOE Order 5400.5 has been deleted from the text.

Section 2

OEPA OU3 TSWP Comments and DOE Comment Responses

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Responses to General OEPA Comments on the OU3 Treatability Study Work Plan

Comment #1

Please enclose a map showing the location of the buildings under consideration for the treatability study.

Response #1

The following text has been added to Section 1. "Based on the results of the bench-scale studies proposed in this submittal of the TSWP, pilot-scale studies (remedy selection tier) may be conducted. All pilot-scale test designs, along with data quality objectives, test objectives, applicable procedures, equipment and materials, a study-specific sampling and analysis and health and safety plan, summary information on ARARs, permit information summary, and a map showing the pilot-scale study location will be submitted for review prior to implementing the study."

Currently, four bench-scale treatability studies are proposed. Both bench-scale vitrification studies will be conducted off-site at a vendor's facility. The chemical leaching and chemical conversion bench-scale studies will be conducted in the on-site Laboratory (Building 15). Although plans have not been finalized, it is anticipated that the pilot-scale phase of the chemical conversion treatability study will be performed in Plant 9 (Building 9A). Plant 9 was suggested because it already houses the Operable Unit 4 (OU4) Minimum Additive Waste Stabilization (MAWS) project and can be used as a study/ demonstration center for the Fernald Environmental Management Project (FEMP).

Comment #2

Will all of the individual components of the asbestos containing material consist of the same amount of asbestos fibers? In other words, will all of the pipe insulation site-wide contain the same amount of asbestos; will all of the floor tiles site-wide contain the same amount of asbestos, etc? Varying amounts of asbestos fibers in each location could alter study results.

Response #2

The transite panelling used across the site does not vary significantly in the concentration or type of asbestos fibers. Analyses show transite to contain approximately 30% chrysotile.

However, sampling of the many miles of pipe insulation show three different types of asbestos fibers (amosite, chrysotile, and crocidolite) and a wide range of fiber concentrations (5 to 80 percent).

The lab-scale phase of the chemical conversion treatability study will use glovebags of thermal system insulation (TSI) that have already been removed from various locations around the FEMP under Removal Action 26. The glovebags of TSI will be selected from waste inventory based on the level of radiological contamination. The contents of these glovebags will be combined and homogeneously mixed before the TSI is sampled for type and concentration of asbestos fibers. The primary intent of the lab-scale testing is to qualitatively prove that the ABCOV Method works before significant time and money is spent on the design and use of a pilot-scale facility.

The pilot-scale phase of the Chemical Conversion of Asbestos-Containing Materials Treatability Study will test a wide variety of asbestos concentrations. Since the lab-scale testing only looks at one mixture of asbestos in transite and one mixture in TSI, the pilot-scale testing may involve some fine-tuning of the process parameters. However, the chemists who developed the ABCOV Method believe that varying the asbestos fiber concentration will not greatly affect the retention time of the process.

For the vitrification studies, the explanation in the first paragraph is also applicable. Also, though the concentration and the type of asbestos fibers will vary, the impact on the final result (i.e., vitrified material) is not expected to be of great concern because none of the types of asbestos contain any constituents that may hinder the glass forming process. If the samples form glass at the crucible and mini-melt stages, then the impact of the varying types of ACM can be easily eliminated by fine tuning the large vitrification systems.

Comment #3

Sections 1-15 seem to contain numerous references to other documents and procedural outlines, but do not contain much information directly mentioning the OU3 plan. The sections in the front of the document do not present enough data to make the review worthwhile. The study would be easier to understand if the sections were condensed and irrelevant data deleted. The "meat and potatoes" of the study lies in the appendices.

Response #3

Additional text has been added to Section 1 to clarify the format of the *Operable Unit 3 Treatability Study Work Plan* (TSWP), introduce the proposed treatability studies, and direct the reader to the appendices where study-specific information is located. The OU3 TSWP has been developed to contain general treatability study information in the main body of the document (Sections 1-16) with specific test information for each treatability study located in the appendices. The OU3 TSWP contains information suggested by the *Guide for Conducting Treatability Studies Under CERCLA* (Final 1992). The study-specific appendices contain information such as data quality objectives (DQOs), test designs, applicable procedures, equipment and materials, a study-specific sampling and analysis plan, a study-specific health and safety plan, and summary information on applicable or relevant and appropriate requirements (ARARs) and permits.

Most of the documents referenced, such as the *Fernald Environmental Management Project Sitewide CERCLA Quality Assurance Project Plan* (SCQ) and the *Operable Unit 3 Remedial Investigation/Feasibility Study Work Plan Addendum* (OU3 RI/FS WPA), were reviewed and approved by both OEPA and USEPA and are currently part of the Administrative Record. Excessive repetition in reproducing portions of reviewed and approved documents would not, in most cases, provide technical benefits to this work plan. In situations where documents are not part of the Administrative Record, summaries of the information found in the referenced document has been provided. For example, brief summaries of what is found in referenced documents have been added to the study-specific appendices and several sections including, but not limited to, Sections 1, 3, 7, 11, and 13.

Comment #4

DOE should build on the information available at other DOE complexes. Vitrification is ongoing at DOE's Rocky Flats plant. Bench and pilot test data should be available. FEMP should not reinvent the wheel if possible.

Response #4

Text has been added to Section 1.4.1 and the Introduction to Appendices D and E of the OU3 TSWP to discuss integration efforts with other DOE vitrification projects. Telephone contact with Rocky Flats personnel reveals that there is, in fact, no ongoing vitrification program at Rocky Flats. Surrogate testing of vitrification for stabilization of radiological constituents only was conducted in the late 1980s but completion of the tests has not been funded. Also, no vitrification has been attempted on mixed waste at Rocky Flats. Testing at Savannah River, Idaho National Engineering Laboratory, West Valley, and Hanford has been concerned primarily with stabilization of high-level radioactive waste. Currently, Hanford is planning the vitrification of low-level wastes (sludges) from underground storage tanks and Savannah River has begun treatability testing for vitrification of low-level mixed waste. A liaison has been established between other DOE sites utilizing vitrification and the FEMP vitrification testing efforts to ensure complete coordination and integration between DOE vitrification projects.

Comment #5

DOE should evaluate the need for treating ACM. If this material could be used as feed in the vitrification process, then there is no need to spend money abating contamination when it would not be necessary.

Response #5

The intent of the OU3 TSWP is not to decide on a preferred approach, but to first perform an initial screening of process options and, second, to outline the plans for testing the process options that could potentially work. Although vitrification and the ABCOV Method are both process options for the treatment of asbestos-containing material, there is insufficient information to evaluate them in the detailed evaluation of alternative performed during the FS. The necessary information for complete risk and cost analyses will be obtained during these studies and the evaluation/comparison of these process options will be included in the OU3 Feasibility Study report.

Comment #6

DOE will need to state the criteria waste/material will need to meet before being "free released" or recycled. It is Ohio EPA's understanding that no criteria exist for volumetrically contaminated materials. DOE should incorporate the criteria which will be used to make disposal decisions within the treatability study work plan.

Response #6

The definition of "release without restrictions" would refer to those materials which are not contaminated or have surface contamination below the guidelines in DOE Order 5400.5 and which can be released from DOE control with no further surveillance. The guidelines in DOE Order 5400.5 are consistent with the guidelines in Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors.*

Currently, materials which have volumetric contamination, as a result of DOE activities, will not be released for unrestricted use. Site-specific techniques used to determine volumetric contamination require DOE approval.

"Release that restricts use to DOE facilities or NRC-licensed facilities" applies to any materials not acceptable for "release without restrictions." For example, metals which are volumetrically contaminated could be fabricated into disposal containers exclusively for use at DOE disposal facilities. The containers must, however, meet the criteria in U.S. Department of Transportation (DOT) regulations.

Comment #7

There is no indication in the TSWP of the extent of the RI activities completed to date. The treatability study is normally initiated following, at least, the completion of the first phase of the RI. A section of the document should summarize the level of data gathered to date and its adequacy to warrant the initiation of this TSWP.

Response #7

The following text has been added to Section 1.2.1. "OU3 RI Field Characterization activities are in progress; currently field characterization sampling activities are approximately 50% complete with nearly 20% of the analytical data validated and returned to CRU3. The OU3 RI Field Characterization Program will generate data which will improve existing knowledge regarding the nature of contamination in OU3 media. This characterization data may validate or negate assumptions made in the OU3 TSWP and may result in potential improvements to test designs which may be presented at a later date."

Comment #8

The treatability test goals, experimental design, equipment, materials, and budget should be included as integral parts of the TSWP in each treatability test.

Response #8

Test goals, experimental design, and equipment/materials are presented for each treatability study and are located in the study-specific appendices (Appendix B - Appendix E). The Fiscal Year 1994 (FY94) Treatability Study Program costs were prepared to support the FERMCO annual budgeting process. Detailed preliminary cost estimates for each study are also currently being prepared to support procurement for vendor services, equipment, analytical services, etc. Individual studies will be planned and performed to maximize data collection activities within the FY94 funds available for the program.

Comment #9

Distinction should be made between technology types and process options. Table 2-1 specifies process options for several technology types, while Table A-1 list those same process options as remedial technologies.

Response #9

Changes have been made throughout the OU3 TSWP, particularly in Section 2 and Appendix A to distinguish the terms "technology types" from "process options". For example, a column

has been added to Table 2.1 to break the listing of general response actions apart from technology types and thus more clearly identify that the technology types considered for OU3 include: surface decontamination; surface removal; volumetric (bulk) decontamination; and dismantlement/bulk removal. Also, the titles to Section 2 and Appendix A have been changed to reflect the distinction.

Comment #10

The TSWP should discuss the budget for the completion of the remedy selection treatability study. The budget must include major cost elements associated with remedy selection.

Response #10

See the response to OEPA General Comment #8.

Comment #11

The headings "Remedy Design" and "Remedy Selection" (section 4.0) are actually "Remedy Design Goals" and "Remedy Screening Goals," respectively, and should be changed accordingly. The TSWP Remedy Design should be revised to include Remedy Screening Tier (such as particle size, solubility, miscibility, dispersibility, contaminants, selection of most prevalent contaminants, etc.), and the Remedy Selection Tier (such as availability of power supply, materials, equipments, precision, RREL search, rations, additives, test duration,variability in grain size, holding time, etc.).

Response #11

The headings in Section 4 have been edited to "Remedy Screening Testing Goals," "Remedy Selection Testing Goals," and "Remedial Design/Remedial Action Testing Goals." The Remedy Screening Tier is the usually first step in treatability testing and is performed to determine if the process option can be used to treat the media and contaminant(s) of concern. Remedy Screening studies are typically performed in a laboratory and are limited in size and scope to bench-scale tests with off-the-shelf equipment. Remedy Screening studies provide qualitative data for a single contaminant of concern to determine whether the process appears to meet or exceed the performance goal for that contaminant and whether the process is considered feasible for further testing. Based on the results of Remedy Screening testing, Remedy

Selection testing may be performed. The Remedy Selection Tier is designed to quantitatively verify that a process can meet site cleanup goals and the cost. Remedy Selection testing may be performed on a bench-scale, pilot-scale, or full-scale level. Treatment train considerations are also addressed at the Remedy Selection Tier. Based on results of previous testing (Remedy Screening and/or Remedy Selection testing) Remedial Design/Remedial Action (RD/RA) testing may be performed. This tier is the final step and is generally conducted after the final record of decision (ROD). RD/RA testing is conducted to generate detailed design, cost, and performance data to optimize and implement the remedy. RD/RA testing is conducted in the field with pilot- or full-scale equipment.

Comment #12

The test objectives (goals) for each treatability test should include specific "Remedy Screening Goals" and Remedy Selection treatability study goals. This applies to the TSWP for chemical conversion of ACM, chemical leaching, vitrification of ACMs, and vitrification of mixed waste.

Response #12

All currently proposed treatability studies are for bench-scale testing. Test objectives (goals) for each of these bench-scale (remedy screening/remedy selection tier) studies are provided in the study-specific appendices.

The following text has been added to Section 1. "Based on the results of the bench-scale studies proposed in this submittal of the TSWP, pilot-scale studies (remedy selection tier) may be conducted. All pilot-scale test designs, along with data quality objectives, test objectives, applicable procedures, equipment and materials, a study-specific sampling and analysis and health and safety plan, summary information on ARARs, permit information summary, and a map showing the pilot-scale study location will be submitted for review prior to implementing the study. The following information relates to the currently proposed treatability studies. Based on the results of the bench-scale tests, pilot-scale studies (remedy selection tier) may be conducted. Pilot-scale test designs, along with remedy selection treatability study goals, will be provided to OEPA prior to implementing the study."

Responses to Specific OEPA Comments on the OU3 Treatability Study Work Plan

Comment #1

Section 1.2.1.4, Page 1-7, Line 13. The text states that the metals involved in the study are contaminated mostly on the surface. Is it possible for the metals to be contaminated throughout? How will the extent of contamination be determined and effectiveness of the treatment technology?

Response #1

It is possible for metals, which have been involved in certain processes at the FEMP, to be contaminated below surface levels. However, the media category referenced in OEPA Specific Comment #1 addresses non-porous metals. Since the metals are non-porous, it is anticipated that contamination is mainly located on surfaces. It is also anticipated that non-porous metals will be sent to a vendor for beneficial reuse/recycle. The vendors will be licensed to accept the material, whether the metals are contaminated at or below the surface. Therefore, the extent of contamination in these metals does not effect implementing the recycling/reuse technology. Also, the technology (recycle/reuse) will be effective whether the metals are contaminated at or below the surface.

Comment #2

Section 1.2.1.5, Page 1-8, Line 12. Please provide a definition of inconel and monel.

Response #2

Both inconel and monel are high-nickel exotic alloys that are manufactured by the International Nickel Company for special applications. Inconel is a nickel-chromium alloy that is highly resistant to oxidizing and reducing environments and is used for severely corrosive environments at elevated temperatures. Inconel was used at the FEMP for various processes that involved hydrofluoric acid. Monel is a nickel-copper alloy that has high strength, good weldability, excellent corrosion resistance over a wide range of temperatures and conditions, and is also highly resistant to oxidizers and reducers. The FEMP has several monel chemical reactors.

Comment #3

Section 1.2.1.8, Page 1-9. The railroad ties are generally treated with creosote and therefore are suspected, along with the top 6 inches of underlying soils, to be contaminated with creosote. A clarification as to whether or not those timber ties and affected soils have been characterized during the RI efforts should be included.

Response #3

As discussed in Section D.9.8.26 of the OU3 RI/FS WPA, railroad ties will not be sampled as part of the OU3 RI Field Characterization Program. This material has been screened from sampling because the average of the radiological survey measurements were well below the established sampling criteria. However, comprehensive screening will be performed on the tracks prior to segregation and disposition. Creosote has been identified in Section D.9.8.26 of the WPA as an expected contaminant of concern. Decisions for selecting final treatment and disposition options for railroad ties will be based on the expected creosote contamination.

The soils surrounding railroad ties which may be affected by creosote will be remediated by Operable Unit 5 (OU5). At this time, OU5 is not characterizing the soils surrounding railroad ties for creosote. However, this characterization may be added at a later date. Also, the OU5 Soil Washing Treatability Study is currently performing bench-scale testing in support of the OU5 FS to determine the effectiveness of soil washing for treating contaminants of concern other than uranium. These contaminants of concern include compounds associated with creosote and the creosote degradation products.

Comment #4

Section 1.2.1.11, Page 1-10, Line 13. Part of the backlog is from past manufacturing activities. Where and how is this waste being stored?

Response #4

Low-level wastes are stored in various warehouses and former production buildings throughout the former process area and on some outside storage pads. Mixed wastes (i.e., RCRA hazardous waste with radionuclide contamination) are stored in compliance with

the Stipulated Amendment to the Consent Decree with the State of Ohio dated January 22, 1993, in warehouses identified in the FEMP RCRA Part B Application. Ohio EPA, Division of Solid and Hazardous Waste Management, Southwest District Office is thoroughly familiar with FEMP waste storage practices.

Comment #5

Section 1.2.2, Page 1-11, Line 19. Insert the work "nature" after "regarding the".

Response #5

The word "nature" has been added to the text in Section 1.2.2 as suggested.

Comment #6

Section 1.4, Page 1-12, Line 25. The last statement of this section should be revised to state that the treatability studies will be conducted to ensure that selected remedial technologies comply (rather than are in accordance) with ARARs.

Response #6

The text has been modified as suggested.

Comment #7

Section 1.4, Page 1-12, Line 22. Typographical error.

Response #7

The text has been corrected in Section 1.4.

Comment #8

Section 1.4.3, Page 1-15. The last paragraph should be refined to show how the treatability study would aid in the selection of the most applicable remedial alternatives (based on CERCLA evaluation criteria) during the FS.

Response #8

Section 1.4.3 has been modified as suggested.

Comment #9

Section 2.2, Page 2-3, Line 22. The "Secondary Waste Generation" is normally considered, during the remedy selection, as part of the "effectiveness" criterion and not as a fourth criterion (RI/FS guidance document). Also, Overall Protection of Human Health and the Environment as well as Compliance with ARARs should be included as part of the Effectiveness criterion during this phase of screening (refer to EPA 99, Sec 4.3.2).

Response #9

"Secondary Waste Generation" was integrated into the "Effectiveness" criterion and eliminated as a fourth criterion. Also, Overall Protection of Human Health and the Environment and Compliance with ARARs was added to the "Effectiveness" criterion.

Comment #10

Section 2.3, Page 2-5, Table 2.1. A column for "General Response Actions" should be added to the table. The no action, Treatment/Decontamination, Dismantlement/Removal, and Disposition/Recycling are all General Response Actions and should be part of this new column. Surface removal, volumetric decontamination, etc. should be retained under "Technology Types."

Response #10

A column for "General Response Actions" has been added to Table 2.1, as suggested. Also, see the response to OEPA General Comment #9.

Comment #11

Section 3.1.1, Page 3-2, Line 10. The text states that "Materials which are judged to have surface contamination levels within the range of background may be released without restrictions..." Please describe how the materials are sampled and measured for radiation. Also describe the determination of background levels.

Response #11

The text in Section 3.1.1 which states "Materials which are judged to have surface contamination levels within the range of background may be released without restrictions..." has been changed to state "Materials which are determined to have surface contamination below the guidelines referenced in the *FERMCO Material Release Policy* may be released without restriction. However, the ALARA process will be applied to further minimize the potential risks to human health and the environment."

The methods for sampling and/or measurement of material depend on the physical characteristics of the material. Materials which are in non-porous, consolidated forms are usually measured for radioactive contamination by the use of direct reading instruments. The direct reading instruments can be used to assess both fixed contamination and, with the use of absorbent pads, removable contamination.

Materials which may have volumetric contamination (e.g., porous and/or unconsolidated materials) must be sampled and submitted to a laboratory for analysis prior to release. The FEMP has a variety of sampling procedures and protocols for sampling material with potential volumetric contamination. For example, for RCRA wastes, the DOE has granted conditional approval of the FEMP Criteria and Procedures for Certification of Non-Radioactive Hazardous Waste. These criteria are used to verify the absence of residual radioactive material in hazardous waste. For other media (e.g., soil, groundwater, concrete, etc.) sampling and analytical methods are contained in documents such as the Site Media Sampling Procedures Manual (media specific) and the FEMP Extraction Methodologies (sampling device specific).

The definition of "background" will be subdivided into material background and instrument background (response to other radiation).

Material background is defined as the amount of radioactive material from a source other than U.S. Department of Energy (DOE) activities (DOE uses the term "residual radioactive material" in Order 5400.5 to describe material background) which is contained in or on the medium in question. For non-porous, consolidated material (e.g., steel), process knowledge would be

sufficient to determine if DOE activities at the FEMP accounted for volumetric contamination (no activation sources are present). The only concern for release of non-porous material would be potential surface contamination. Background for non-porous material is that level of activity which is exhibited by an uncontaminated surface (i.e., it is indistinguishable from instrument background).

Instrument response to other radiation is specific to the type of detector used to assess radioactive material. Gross alpha contamination is assessed using zinc-sulfide scintillation detectors. These alpha detectors have essentially zero response to other forms of radiation. This combined with the limited range in air of alpha particles results in an alpha detector background of zero with no special actions needed to determine instrument background. Gross beta contamination is assessed using mica window geiger-mueller detectors. These detectors have at least a limited response to alpha, beta, and gamma radiation. The limited range in air of the alpha particles prevents instrument background to alpha radiation. The poor sensitivity of the detector to gamma radiation (< 1%) combined with the low percent abundance of gamma emitters at the FEMP, except for areas of thorium and radium storage which are well defined, result in a manageable instrument background to gamma radiation. For beta radiation, the particles are capable of entering the mica window but not the back side of the detector, making the detector highly directional. Instrument background is determined by turning the detector 180 degrees from the source or using a beta shield. The technique of turning the detector away from the source is of limited use in areas of high beta background due to the high energy of emission for the predominant beta emitter (^{234} Protactinium > 2 MeV beta maximum), the long range in air (approximately 12 feet/MeV), and the tendency of beta particles to scatter. In addition, areas with high beta background probably have significant gamma background.

The frequency of determining background depends on the which type of background is being determined. Background for porous-unconsolidated material is based on the scope of the sampling event and is addressed in the *Sitewide Quality Control Program Plan*. Instrument background is generally changed as the physical location of the material, and corresponding instrument readings, varies.

FERMCO SP-P-35-010 is the procedure currently used to establish the requirements necessary for the unrestricted release of materials from the FEMP. FERMCO SP-P-25-023 is the procedure currently used to assign responsibilities and establishes the procedure for performing radiological contamination surveys. FERMCO SP-P-25-023 is being revised. The new procedure number (final draft) is RC-RDA-010. The revision is based on the draft final Technical Basis for Detection Limits of Portable Instrumentation. The new procedure will be forwarded upon approval. FERMCO SP-P-35-025 is currently the procedure which identified FEMP administrative and DOE requirements for posting of radiologically controlled areas. All three procedures and the current *FERMCO Material Release Policy* are included with these comment responses.

Comment #12

Section 3.1, Page 3-2, Line 26. The intended meaning of the second sentence in the last paragraph is not clear. Please explain how the establishment of concentration for the media would define background levels that will be remediated under OU3.

Response #12

See the response to OEPA Specific Comment #11.

Comment #13

Section 3.2, Page 3-3, Line 14. Expand on the statement "Specific (radionuclides) may be stated as test goals; but not meeting these goals does not mean the technology is ineffective or that the test site has not met the stated objectives." This idea is not fully discussed. DOE will need to clarify its position on this idea.

Response #13

This sentence has been deleted from the text in Section 3.2.

Comment #14

Section 3.4, Page 3-4. The following additional objectives should be included:

- *Demonstrate that residual risks are controllable.*
- *Demonstrate that the technology would achieve permanent reduction of risk to human health and the environment.*

Response #14

The additional objectives suggested have been added to Section 3.4.

Comment #15

Section 4.2, Page 4-2, Line 12. The "S" in the term ARARS should not be capitalized.

Response #15

A general search was performed throughout the document to change "ARARS" to "ARARs".

Comment #16

Section 4.2, Page 4-2. The following goals should be distinguished as integral parts of the treatability study selection:

- *Measure of the percentage of contaminants that can be destroyed or removed from treated media.*
- *Produce the design information required for the next level testing, should the remedy selection evaluation indicate that remedy design studies are warranted.*
- *Ensure that the removal efficiency, achieved by the technology, will meet site cleanup goals, based on the risk assessment and ARARs.*

Response #16

The text in Section 4.2 has been amended to include the suggested goals.

Comment #17

Section 4-3, Page 4-3. Please explain why the Remedy Design was excluded from this TSWP. The remedy design tests are essential in designing the full-scale unit, optimizing the performance of technologies, refining cleanup time estimates, and refining cost estimates. This tier of testing is necessary for this project, due to the number of innovative (evolving) technologies considered.

Response #17

The quantity and level of data present on the currently proposed process options are not sufficient to support RD/RA testing. Preliminary testing (remedy screening and/or remedy

selection) is required to collect performance, design, and cost data to be utilized in RD/RA testing. Based on results of remedy screening and/or remedy selection treatability testing, if it is determined that RD/RA testing is warranted, test designs for RD/RA treatability studies will be submitted for review prior to initiating the study.

Comment #18

Section 6.2, Page 6-3, Line 22. The idea of "unconventional sampling techniques" needs to be expanded. Describe the techniques and justification for their use. Provide insight on DOE's definition of "unconventional sampling techniques."

Response #18

The term "unconventional sampling technique" was removed from the text. The sentence now states that "test media may be obtained by sampling techniques other than those techniques identified in Appendix K of the SCQ or Table D.6-1 of the OU3 RI/FS WPA Sampling and Analysis Plan." The "unconventional sampling technique" which was referred to in the text is the dismantlement of transite panels, double-wrapping the panels in plastic, and boxing the panels for delivery to the treatability study laboratory.

Comment #19

Sections 6.4.2.1 and 6.4.2.2, Pages 6-11 and 6-12. This whole document is filled with references to the location of certain information. Perhaps brief summaries of what will be found in the referenced documentation will give a little more depth to the document. An example of this excessive referencing is on the noted pages. These sections contain no content just referral information.

Response #19

Refer to the response to OEPA General Comment #3.

Comment #20

Section 7.1, Page 7-1. The discussion regarding entry into the laboratory logbook should include additional specific items such as the correction procedures, signing of the logbook at the beginning and end of the day, and the logbook transfer process. Conformance with the EPA recording procedures is required and need to be followed.

Response #20

Text has been added to Section 7.1 to provide additional detailed information regarding daily logs.

Comment #21

Section 8.1.3, Page 8-4. Additional data that should be part of the presentation may include:

- *Effectiveness on wet versus dry condition of tested materials.*
- *Effects of the process design variables on the treatment.*
- *Reduction of contaminants concentration as a function of time.*

Response #21

The text in Section 8.1.3 has been amended to include the suggested information.

Comment #22

Section 8.2, Page 8-5. The data interpretation should also include:

- *Determination of removal efficiency as a function of treatment duration*
- *Variability in tests and impact on the full-scale treatment*
- *Reasons for deviation from anticipated results.*

Response #22

Determination of removal efficiency as a function of treatment duration is already considered in the primary balancing criteria (implementability and cost). A sentence has been added to the last paragraph of Section 8.2 incorporating the suggested content relating to "the variability in testing and impact on full-scale treatment and the reasons for deviation from anticipated results."

Comment #23

Section 10.1.3, Page 10-3, Line 1. There is a discrepancy in the exact title of the "Federal Facilities Agreement for Control and Abatement of Radon-222 Emissions." "Control" appears in the first reference to the agreement, while "care" appears in the next reference.

Response #23

The word "care" has been changed to "control" in Section 10.1.3.

Comment #24

Section 12, Page 12-1. Please provide more detailed information concerning the CRP.

Response #24

Section 12 has been revised to include more detailed and updated information concerning the CRP.

Comment #25

Section 13, Page 13-1. This section should include a statement to satisfy the OERR requirement that a copy of the treatability study reports be submitted to the Agency's Superfund Treatability Data Base repository.

Response #25

A statement that a copy of the treatability report(s) will be submitted to the RREL Treatability Data Base has been added to Section 13.

Comment #26

Section 13, Page 13-2, Table 13.1. The suggested treatability study report should include sections on staffing, cost, and schedule.

Response #26

Table 13.1, Suggested Organization of Treatability Study Reports, has been modified to be consistent with reports section in the *Guide for Conducting Treatability Studies Under CERCLA* (Final 1992).

Comment #27

Section 14.1, Page 14-2. The treatability Study Milestone Chart is difficult to understand. The calendar does not match the text. Please correct this timetable.

Response #27

The text in Section 14 has been modified to include more detail and discussion concerning the anticipated treatability study schedule, as shown in Figure 14.1. Because Figure 14.1 considers only the treatability studies currently discussed in the TSWP appendices, anticipated scheduling of the potential pilot-scale phases of the chemical leaching and the vitrification studies has been removed from the figure. If pilot-scale studies are determined to be warranted based on the results of the chemical leaching and vitrification bench-scale studies, test designs will be written. As studies of new process options or additional phases of current studies are added to the TSWP, the schedule will be modified and updated accordingly and will be submitted to USEPA and OEPA as change pages along with new appendices. Another change to Figure 14.1 is the addition of activity groupings (i.e., procurement, lab-study duration, report preparation, etc.) under headings (i.e., chemical conversion, chemical leaching, vitrification, etc.).

Comment #28

Section 14, Page 14-2, Figure 14.1. The Treatability Study Milestone Chart is missing legends.

Response #28

Along with the modifications discussed in the response to OEPA Specific Comment #27, a legend has been added to Figure 14.1, as suggested.

Comment #29

Section 15, Page 15-2, Figure 15.1. Missing from the Treatability Study Management and Staffing is a box for the EPA Remedial Project Manager. Also, this work plan needs to identify the personnel responsible for executing the treatability study by name (if available) and qualifications. Specific expertise should be identified, such as: work assignment manager, chemist, engineer, geologist, and lab technician. The responsibility for various aspects of the project should be shown in the organization chart.

Response #29

A box has been added to Figure 15.1 for the EPA Remedial Project Manager. Most of the studies proposed in this submittal are currently in the procurement stages. Proposals have not been received and/or award of contracts have not been completed. Therefore, specific names and resumes of individuals performing the studies are not available at this time. However, selection of qualified individuals to support the treatability effort is also a priority for DOE.

Comment #30

Appendix A, Page A-6, Table A.1. The vapor extraction process is considered a demonstrated technology and should not be classified as an evolving technology.

Response #30

The text in Table A.1 has been modified as suggested.

Comment #31

Appendix A, Page A-12, Table A.2, A.3. The name of the remedial technology types is missing for several media identified in the table. Also, several of the identified technologies are actually process options and need to be listed.

Response #31

As stated in the response to OEPA General Comment #9, changes have been made throughout the TSWP, particularly in Section 2 and Appendix A to distinguish technology types from process options. The names of the missing process options have been inserted into the tables located in Appendix A. The tables in Appendix A represent a summary of the screening of process options for the following technology types: surface decontamination (Table A.1); surface removal (Table A.2); volumetric decontamination (Table A.3); and dismantlement/bulk removal (Table A.4).

Comment #32

Section B.2. The treatability work plan does not sufficiently address the radioactive aspects of the asbestos. Will radioactivity somehow alter the ABCOV method, or will the radionuclides have no effect on the process?

Response #32

The following text has been added to Section B.4.5. "Radionuclides are not expected to alter the rate or effectiveness of asbestos decomposition because they will not interfere with the chemical reactions involved with the ABCOV Method. However, the effects of the chemical reactions (primarily the slowly rising pH) on the solubility of the radionuclides are more difficult to predict. Characterization of the final solid residuals and the wastewater streams will be performed to determine the concentrations of radionuclides that are retained in the solid matrix and the concentration of radionuclides that have been solubilized into the liquid."

Comment #33

Appendix B, Page B-2. Removal techniques for the ACM will be the same regardless of the final disposition. All ACM will have to have surfactant applied and sufficiently wetted during and after removal. The ABCOV method only replaces the conventional disposal method costs.

Response #33

The following description of ABCOV-T has been added to Table B.3.1. "ABCOV-T starts the destruction of the asbestos fiber through a chemical reaction by breaking the molecular structure of the asbestos fibers." Because ABCOV-T is a surfactant, it is applied like any surfactant used during asbestos abatement and will fully comply with requirements set forth in 40 CFR 61.150.

Comment #34

Appendix B, Page B-6. The location-specific ARARs and TBCs are not considered in Table D-6. Although no location-specific ARARs may be applicable to the TS, potential ARARs and TBCs should be identified, considered, and then rejected. This comment is also applicable to Appendices C, D, and E.

Response #34

During the formulation of the ARAR tables found in Sections B.6, C.6, D.6, and E.6, no appropriate location-specific ARARs or TBCs were identified as potentially applying to these treatability studies. Therefore, none were listed in the text.

Comment #35

Section B.2.3, Page B-9, Line 10. How were these steps formulated? Are these recommended steps by the manufacturer or were they developed by FEMP?

Response #35

The steps of the Chemical Conversion of Asbestos-Containing Materials treatability study were developed by FERMCO. The study was designed to fill data gaps that were determined through the development of the DQO. Prior to the December 1993 submittal of the TSWP to OEPA and USEPA, DSI Industries Consolidated (the vendor) had reviewed and concurred with the basic design of the test.

Comment #36

Section B.4.1.8, Page B-19. The summaries included in each of the treatability options need simplification and clarification. They are difficult to understand in their current form.

Response #36

Because Section B.4.1.8 and corresponding sections in other appendices are summaries of the results of the DQO process, not the summary of the test design or the summary of the appendix, the title of these sections will be changed in each appendix to reflect this. The information that is contained within these sections is required by the SCQ and is intended to briefly state the highlights of the DQO.

Comment #37

Table B.4.2, Page B-24. The chart lists analytical instrumentation for an air matrix as tennelec. Please describe Tennelec instrumentation.

Response #37

Sampling for airborne radionuclides involves continuously pulling air through a filter using a device referred to as a Continuous Air Monitor (CAM). The filter is periodically removed, sent to the laboratory, and analyzed for total alpha and beta activity using a Tennelec. A Tennelec is a trade name for an automatic, low background activity counter. The term "Tennelec" has been replaced in Table B.4.2 with "low background counter."

Comment #38

Appendix B, Page B-28, Line 7-12. DOE does not indicate if any listed waste products will be produced by the ABCOV method. There is the potential to produce mixed waste from this process if the spent ABCOV solutions are listed or characteristic and are used to treat rad contaminated material.

Response #38

DSI Industries Consolidated claims that the solid residuals and the spent ABCOV solutions will not be a hazardous waste, providing the ACM did not contain hazardous constituents. DSI has provided results from TAL inorganics, TCL volatiles and semi-volatiles, and TCLP extraction analyses of spent ABCOV solution from a prior study to support this claim.

For verification, the initial media, solid residuals, and spent ABCOV solution from the lab-scale phase of the treatability study will be sampled for TAL inorganics, TCL volatiles, and TCL semi-volatiles, as indicated in Tables B.4.1 and B.4.3.

The only listed chemical identified on the Material Safety Data Sheets (MSDSs) is formic acid, which is U-listed. Since the formic acid is an ingredient of an ABCOV solution used in the process, the U-listing does not apply. The sampling discussed above will be suitable to determine if the resulting solution is characteristic as defined in 40 CFR Subpart C. The unused ABCOV chemicals will not be classified as waste and will be returned to DSI for their use in other projects.

Comment #39

Appendix B, Page B-47, Line 10. A total volume of 750 gallons of residual materials is listed in the text. However, Table B.8.1 shows that estimated volume totals 1,400 gallons. Please verify the discrepancy.

Response #39

The text states that a total volume of 750 gallons of spent ABCOV solution will be generated during the lab-scale and pilot-scale phases of the treatability study. In addition to this volume of liquid, approximately eight drums of solid residuals, less than one drum of activated carbon, and 2.7 drums of contaminated personal protective equipment are expected to be generated.

Comment #40

Appendix B, Page B-49, Line 19. DOE is being very optimistic on the operational lifespan of a HEPA filter. Operational life can sometimes be a short as a few days depending on the load the filter is subjected to.

Response #40

It is agreed that the concentration of particulate in the air greatly affects the operational life of a HEPA cartridge. However, since the air within the pilot-scale containment is not expected to have a high particulate concentration due to the wet nature of the processing, the HEPA cartridges should not have to be replaced during the several month span of the testing. The text regarding the anticipated HEPA cartridge life has been reworded for clarification.

Comment #41

Appendix C, Page C-1, Line 18. Appendix C states that concrete will be treated by scabbling (surface removal) and then chemical leaching. Section 3.1.2 describes concrete as volumetrically contaminated media (spread throughout the depth of the media.) If concrete is volumetrically contaminated, scabbing and chemical leaching is not a viable alternative. Please describe clarify this discrepancy. Rebar in reinforced concrete provides liquid contaminates a transport mechanism. Contamination may exist in concrete where surface conditions do not. DOE will need to address this problem.

Response #41

The discrepancy in text located in Section 3.1.2 and Appendix C has been resolved. The text in Section 3.1.2 has been modified to state that "OU3 porous media may be volumetrically contaminated (contamination spread throughout the depth of the media). Considerable additional insight into the nature of the OU3 contaminated materials will be obtained during the remedial investigation (RI) activities and the implementation of removal actions and interim remedial action. For example, concrete corings will be taken during RI at selected locations to determine the depth of contaminant migration." Text in the introduction to Appendix C states that preliminary data from ongoing scabbling activities indicates that the concrete and acid brick contamination is limited to surfaces.

Comment #42

Appendix C. Page C-7. Line 28. a) DOE needs to explain why a reduction of rad concentration by 80% will be considered effective. The remaining material will still be low-level wastes and will [be] required to be handled as such. b) If the chemical leaching process creates a mixed waste (e.g., makes inorganic contaminants more mobile) stream then DOE is creating a bigger problem then what originally existed. c) DOE should also analyze for TCLP semi-volatiles. By only analyzing for leachable metals DOE is not verifying the true nature of the media.

Response #42

The text in Section C.2 has been revised to state that "the chemical leaching process will be considered a feasible process option warranting further testing (e.g., pilot-scale testing) if the target compound(s) concentration is reduced by 80 percent in the test media and the process is considered cost-effective." As stated in the introduction to Appendix C, the chemical leaching process has been used extensively at the FEMP in previous uranium processing work. Therefore, the preliminary goal (to reduce the target compound concentration by 80 percent) was formulated by FEMP personnel who have had previous experience with leaching processes.

It is not anticipated that mixed wastes will be created by the leaching process. However, the chemical leaching testing will initially be performed on a very small scale (one-liter beakers) to minimize the quantities of waste generated by the testing and analytical testing will be

performed throughout the process to ensure that mixed wastes are not being formed as a result of the process. Also, as stated in the Introduction and Section C.4.6 of Appendix C, a secondary treatment process (filtration and precipitation) will be utilized for removing any contaminants from the liquid leachate.

TCL Semi-Volatile Organics have been added to the Chemical Leaching Sampling and Analysis Plan Addendum tables in Section C.4 as suggested.

Comment #43

Section C.2.1, Page C-10, Line 15. Where did the original set of constants originate? The constants in following sections come from experimentation already performed. Where the original constants recommended by a manufacturer, vendor or formulated by FEMP?

Response #43

The following statement has been added to the second paragraph in Section C.2. "As stated in the Introduction, the chemical leaching process has been used extensively at the FEMP in previous uranium processing work. The original constants were formulated by FEMP personnel who have had previous experience with leaching processes." Also, as described in the test design, three of the five original constants (time, solids loading ratio, and particle size) become variables to be tested during the chemical leaching process.

Comment #44

Section C.3, Page C-20, Table C.3.1. The decontamination fluid (to clean beakers, plastic containers, spatula, regent storage/dispensing bottles, etc.) should be listed. Also sample holding times and storage temperature should be listed.

Response #44

The equipment decontamination fluids which may be used during the chemical leaching study have been added to Table C.3.1. The decontamination fluids listed in Table C.3.1 are based on those decontamination materials specified in the SCQ and the *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*. Sample holding time and

storage temperatures for all studies are addressed in Section 6.4.1.

Comment #45

Appendix C, Page C-22, Line 9. Add to end of sentence " and/or mixed waste."

Response #45

The term "and/or mixed waste" has been added to the end of the last sentence in Section C.4.1.2, as suggested.

Comment #46

Appendix C, Page C-30, Lines 21-23. DOE will need to verify, through analytical testing, the final matrix product's chemical nature after being subjected to the leaching solution.

Response #46

Text in Section C.4.5 relating to the final characterization for Lab-scale, Phase I versus final characterization for Lab-scale, Phase II has been clarified. The last three paragraphs of Section C.4.5 and Table C.4.4 address the comprehensive testing to determine chemical nature and concentration of the final product and spent liquids as a result of the Lab-scale, Phase II leaching process. The text referenced in the above comment relates to final characterization which is performed after testing each variable during the Lab-Scale, Phase I study. This characterization is performed to verify the effectiveness of the variable in removing the target contaminant from the test media and to aid in the selection of which variables continue into the Lab-Scale, Phase II study.

Comment #47

Appendix C, Page C-55, Line 17. Why is DOE over-packing the drums at this time?

Response #47

The term "over-packed" has been deleted from the text in Section C.8.

Comment #48

Appendix C, Page C-56. DOE's residual table does not reflect the 80% reduction of waste. DOE provides a table on page D-9 but the values are not comparable.

Response #48

An 80% reduction of waste was stated as a preliminary test goal for the Appendix C, Chemical Leaching Treatability Study. To further define this goal, the volume of media containing wastes (contaminants) after chemical leaching is performed should be reduced by approximately 80%.

Table D.2.2 identifies types and quantities of test media for the Vitrification of ACM and Glass Treatability Study. Table D.8.1 lists anticipated residuals from the vitrification of ACM and glass study. The volumes of residuals indicated in Table D.8.1 are consistent with text in Section D.2.1 in Appendix D.

Comment #49

Appendix D, Page D-9. DOE provides volumetric measurements to show the volume reduction of waste, however, the quantity is not representative of the material. How will the material be placed in the containers to achieve the listed volume (eg pulverized, crushed, or whole).

Response #49

Table D.2.2 has been modified to indicate weights of test media which will be sent to a vendor (volumes of media have been deleted). The media will be placed into appropriate shipping containers based on weight. The weight of media is determined by the requirements of the vitrification test process and supporting analytical requirements.

Comment #50

Section D.2.2.2, Page D-11, Line 3. Provide information concerning the disposal of the cold cap.

Response #50

Information in Section D.8 has been provided for disposal of any unformed glass. Unformed glass also includes cold-cap formations. The text in Section D.8 has been revised to clarify that unformed glass includes cold-cap formations and as such, cold-cap formations and unformed glass will be dispositioned in the same manner.

Comment #51

Section D.2.2.2, Page D-11, Line 5. Describe what is meant by "foaming events" and if foaming will have a detrimental effect upon the vitrification of the waste.

Response #51

The text has been revised to identify foaming events as releases of decomposition gases (primarily CO_2 from carbonates) at high temperature. Although no detrimental effects from foaming events are known, records will be kept to determine if a correlation exists.

Comment #52

Table D.7.1, Page D-44. Will Permit to Install and Permits to Operate not be required for the crucibles? Since the crucibles have the potential to emit contaminants, they should be permitted unless exempted.

Response #52

The vitrification treatability tests will be conducted off-site at a vendor's facility. The treatability vendor will be responsible for obtaining any applicable local, state, and federal permits.

Comment #53

Appendix E, Page E-1, Line 23. Typographical error.

Response #53

The typographical error has been corrected.

Comment #54

Table E.2.1, Page E-8. The text describes vitrification as "the process of melting silica-containing material at a very high temperature to form a non-porous solid (glass) which can immobilize and contain the material contained in the glass. Have preliminary tests been run on the substances listed in the table to determine if the proper amount of silica exists and, if not, how much will need to be added. In addition, will all of the materials listed be able to withstand a high temperature without the risk of fire or explosion?

Response #54

The wastes identified as blend groups 1-5 (Table E.2.1) are anticipated to be relatively low in silica content, whereas those identified as blend groups 11-13 are anticipated to have higher silica content and will be used as an additive (diluent) to facilitate vitrification of the low-silica wastes. No preliminary tests have been run at the FEMP to determine silica content. However, one of the purposes of this treatability test is to determine if we have enough high silica-containing mixed waste streams to form glass during vitrification. The vendor will be required to analyze the test media for silica content as described in the revised Table E.4.3. Also, process knowledge and technical evaluation of these waste materials reveal that there is no risk of uncontrolled fire or explosion. Although a waste may have been generated from a process involving pyrophoric material, the waste identified as Dust Collector Residues, pyrophoric (MEF #50091), is actually not pyrophoric, but is hazardous for its arsenic and lead content.

Comment #55

Section F.1.1, Page F-2. It would be helpful if the sections regarding FEMP Site History and Operable Unit 3 History were moved to the beginning of the document to provide necessary background. Maps of the study area should also be included in this section.

Response #55

The *OU3 Treatability Studies Health and Safety Plan* is a project-specific, stand-alone health

and safety plan which has been developed by the FERMCO Industrial Hygiene (IH) Department in accordance with the lead health and safety plan for OU3, the *CERCLA/RCRA Unit #3 Health and Safety Plan* (June 1993). The format for the *OU3 Treatability Studies Health and Safety Plan* has been developed by IH personnel and is the standard format utilized for all health and safety plans at the FEMP. Also, refer to the response to OEPA General Comment #1 regarding maps of locations of treatability study areas.

Section 3

Summary of the Significant Changes to the OU3 Treatability Studies

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Summary of the Significant Changes to the OU3 Treatability Studies

In addition to the resolution of the agency comments, DOE and CRU3 have made additional improvements to the proposed treatability test designs which are presented in the appendices of the Operable Unit 3 Treatability Study Work Plan (TSWP). The improvements are based on CRU3's increased understanding of the technology, information gathered through field characterizations, and/or effects to the test design due to the procurement process. The information below summarizes the significant changes which have been made to the test designs in addition to the changes made as a result of resolving agency comments.

The size of the Chemical Conversion of Asbestos-Containing Materials (Appendix B) lab-scale tank system has been decreased from a five-gallon tank to a 3/4-gallon tank. The decision to decrease the tank size was based on a reduction in the required volumes of media to support chemical and/or radioanalytical testing.

No modifications were made to the Chemical Leaching Treatability Study, presented in Appendix C, other than the revisions described in the comment response package.

The following information in the Vitrification of Asbestos-Containing Material (ACM) and Glass Treatability Study, located in Appendix D, has been revised or added.

1. A footnote has been added in the Introduction to clarify that the term "mini-melter" may also be referred to as "joule-heated continuous melter" and/or "10 Kg melter".

2. Two objectives have been added to Section D.1. To determine if vitrification of ACM and glass media can be performed in a conventional joule-heated melter and to determine which glass forms may be synthesized (e.g., monoliths, gems, etc.).

3. Figure C.2.1, Sequential Steps for Glass Preparation, has been improved based on additional insight to the vitrification process.

4. Specific vendor names have been deleted from the text (e.g., Dohrman TOC-Analyzer and Dionex ion exchange chromatograph now reads TOC-Analyzer and ion exchange chromatograph).

5. The use of "clay" crucibles to perform the crucible melts are no longer specified in the test design. Crucible melts are still required, however, the use of "clay" crucibles are not.

6. A specific number of samples have been determined for all analytical characterizations.

7. Silica analysis was added to the initial characterization requirements discussed in Section D.4.3 and Table D.4.1. Silica analysis will determine the concentration of silica present in test media. This data will be used by the vendor to create melt matrix formulations.

8. Residual characterization has been modified to include off-gas monitoring.

The Vitrification of Mixed Waste Treatability Study, presented in Appendix E, has been also been improved. All of the items discussed in the Vitrification of ACM and Glass Study are also changes in Appendix E. In addition to the seven items listed above, the following improvements have been made to the treatability study.

1. Several of the mixed waste streams identified in Table E.2.2, Wastes and Quantities to be Shipped, have been deleted from the scope of this study because it is anticipated that these streams will be shipped off-site for disposition in the near future.

2. Table E.2.3, Number of Crucible and 10 Kg Melts, has been simplified and the number of crucible and mini-melts have been calculated in the table.

3. Due to the large number of crucible melts anticipated, a reduced list of analytical parameters (e.g., total uranium and thorium instead of isotopic radionuclides) will be requested to control costs. The characterization text (Sections E.4.3 and E.4.5) and tables (Tables E.4.1 and E.4.3) reflect this reduction in analytical requirements for crucible melts.

Section 4

FERMCO Material Release Policy and Supporting Procedures

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FERMCO MATERIAL RELEASE POLICY

1.0 OBJECTIVE

FERMCO will manage the release of FEMP materials to ensure protection of public health and the environment, to ensure safe use or disposal of the material, to promote recycling, and to facilitate rapid and efficient site remediation consistent with the FEMP Mission Statement.

DOE 5400.5, "Radiation Protection of the Public and the Environment," was the primary consideration in the formulation of this policy.

2.0 SCOPE

This Policy is applicable to all FERMCO departments that are involved with the disposition of material potentially contaminated with residual radioactive material. Disposition includes activities such as treatment, storage, disposal, recycling, or reuse.

3.0 DEFINITIONS

3.1 Low-Level Radioactive Waste - radioactive material that: (1) is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or by-product material as defined in Section IIe(2) of the Atomic Energy Act of 1954 [42 U.S.C. 2014(e)(2)]; and (2) the Nuclear Regulatory Commission, consistent with existing law, classifies as low-level radioactive waste. The requirements for the management of low-level wastes are presented in DOE 5400.1 and 5820.2A.

3.2 Material - as used in this Policy, includes personal property; waste, recycle, and reuse material; and equipment as described in DOE 5400.5, II. 5, "Release of Property Having Residual Radioactive Material."

3.3 Mixed Waste - contains a radioactive component as defined in the Atomic Energy Act of 1954 and a hazardous component as defined in the Resource Conservation and Recovery Act or the Toxic Substances Control Act.

3.4 Potential for Contamination - property shall be considered to be potentially contaminated if (1) it has been used or stored in areas that could contain unconfined radioactive material or (2) where the property could be exposed to beams or particles capable of causing activation.

3.5 Release - unless otherwise specified, means release for unrestricted use or material/waste left in place.

3.6 Residual Radioactive Material - any radioactive material which is in or on the soil, air, equipment, or structures as a consequence of past (DOE) operations or activities.

3.7 Disposition Evaluation - an assessment of potential risks related to the specific disposition of material which may include, but is not limited to, an environmental ALARA evaluation as defined in DOE 5400.5, II, 2. b.

4.0 ELEMENTS

The "Material Release Policy Flowchart" (Figure 1) identifies the process by which materials are evaluated for suitability of release for disposal or recycle. The major elements of this process are described below.

4.1 Determination of Potential for Contamination

The determination of the potential for contamination is an administrative decision based on the radiological characterization of the area in which the material resides as opposed to an assessment of the material itself.

4.2 Determination of Surface Versus Volume Contamination

The determination of surface contamination versus volume contamination is based on the physical configuration of the material as well as the contamination.

4.3 Release of Material with Potential Surface Contamination

Property shall be surveyed for removable and total surface contamination including contamination under any coatings. Contamination must be below the levels proceduralized by the Radiological Control Department in SP-P-35-023 and be subjected to a disposition evaluation. DOE 5400.5 also requires an ALARA evaluation for materials with surface contamination less than the specified levels.

4.4 Disposition Evaluation

DOE 5400.5 guidelines allow the release of materials with detectable surface contamination. The Disposition Evaluation is an assessment used to identify whether the risk associated with a specific release is acceptable or if additional administrative controls should be placed on the material prior to release.

4.5 Surface Contamination with Inaccessible Surfaces

Materials with features which are difficult to survey due to the nature of the material or the contaminant may require alternate survey/sampling techniques. If alternate survey/sampling techniques are not feasible, Figure 1 allows for disposal, treatment, or storage.

4.6 Determination of Residual Radioactive Material

DOE 5400.5 requires DOE approval of the analytical procedures used to assess volume contamination. Such materials may be released only if the authorized limits established for release of the material and survey techniques used to characterize the material are approved by DOE.

4.7 Material in Storage or Undergoing Treatment

Materials which cannot be released are sent to on-site storage and/or treatment.

5.0 IMPLEMENTATION

5.1 Determination of Potential for Contamination

The two principle categories for disposition include: (1) materials not potentially contaminated; and (2) materials potentially contaminated.

The designation of the category of "not potentially contaminated" is an administrative decision based on the contamination status (radiological posting) of the location in which the material resides.

The driver for radiological posting is DOE 5480.11 and the DOE Radiological Controls Manual, with implementation directed by Environmental Safety and Health procedure SP-P-35-025, "Radiological Posting," Rev 2, March 31, 1993. Section 4.4 of SP-P-35-025 assigns the responsibility of maintaining an inventory of posting status to the Radiological Compliance Section within the Radiological Controls Department of the Environmental Safety and Health Division.

5.2 Determination of Surface versus Volume Contamination

The determination of surface contamination is accomplished by the Radiological Control Department. The determination is based on the physical configuration of the material and the contaminant.

Volume contaminated material and material with inaccessible surfaces require DOE approved survey/sample protocols.

5.3 Determination of Surface Contamination

Procedures for determining the radiological status of potentially contaminated material are developed and implemented by the Radiological Controls Department. The requirements for assessing fixed and/or loose contamination are contained in SP-P-35-023, "Routine Radiological Contamination Surveys."

The Radiological Engineering Section shall maintain procedures which ensure that survey instruments and techniques are appropriate for detecting the limits stated in SP-P-35-023.

5.4 Disposition Evaluation

Material with contamination less than the specified limits, including non-detectable levels, are subjected to a disposition evaluation. The evaluation will consider the threat to

human health and the environment and determine if any additional reduction in contamination is "reasonably achievable." The disposition evaluation will assist in determining if any restrictions should be placed on the release of the material. The disposition analysis will include an assessment of the potential human health and environmental risks and liabilities which may result from the specific proposed disposition of the material.

5.5 Surface Contamination with Inaccessible Surfaces

In the event that survey techniques are not feasible for materials with inaccessible surfaces, or if the material is determined to be contaminated with levels greater than site-specific guidelines, the material will be sent for storage, treatment, or disposal as low-level radioactive waste. For purposes of this section, decontamination, dismantling, etc., are considered "treatment."

5.6 Determination of Residual Radioactive Material

Acceptable analytical/survey methodologies for determining residual radioactive material for volume (bulk) type materials must be submitted to DOE EH-1 for approval. After method approval has been obtained, material with no residual radioactive material can be released for unrestricted use.

Materials determined to contain residual radioactive material which are not classified as mixed waste may be released for disposal. Mixed waste and materials not suitable for disposal may undergo treatment and reevaluation for release.

Material with no residual radioactive material can be released for unrestricted use.

5.7 Material in Storage or Undergoing Treatment

Materials which undergo treatment, are stored in a different location, or are stored under different radiological conditions must be reevaluated prior to release.

Safety Procedures	Title: Unrestricted Release of Materials from the FEMP	SP-P-35-010
		Department: IRS&T Section: RS

Authorization: S.L. Humiefield

Supersedes: None
Revision Date: 8/07/92

1.0 PURPOSE

To assign responsibility and establish the procedure for the unrestricted release of materials from the FEMP.

2.0 SCOPE

This procedure establishes the requirements necessary for the unrestricted release of materials from the FEMP. This procedure does not apply to the release of liquids or bulk material such as soil and concrete.

3.0 DEFINITIONS

3.1 Material - An all inclusive term used to refer to building materials, tools, office equipment, etc.

4.0 RESPONSIBILITIES

4.1 The Manager(s) of personnel required to perform work per this procedure shall ensure that affected personnel are informed or trained to the extent necessary, prior to the initiation of that work.

4.2 Radiological Safety Technicians are responsible for performing all surveys required by this procedure.

5.0 GENERAL

5.1 The predominant radionuclides of concern at the FEMP are natural and low-enriched Uranium and their short-lived decay products. Contamination with thorium and radium is also possible in some areas such as the waste storage area and the Thorium storage warehouses.

5.0 GENERAL (continued)

5.2 Acceptable surface contamination levels for known radionuclides are set forth in Attachment A, "Surface Contamination Limits".

5.3 Surveys for removable contamination need not be performed when direct survey indicates contamination levels are below the removable contamination limits.

5.4 When U-238 is the isotope of concern direct beta surveys alone are acceptable for determining unrestricted release limits.

5.5 Contamination surveys may be performed with hand held instruments or automated equipment provided that the contamination limits given in Attachment A can be detected.

5.6 Liquids and bulk materials such as concrete and rubble can not be released as unrestricted per this procedure.

5.7 The Manager of Radiological Safety shall be contacted for "special case" items such as radium dial watches, thoriated camera lenses, etc..

6.0 PROCEDURE

6.1 Verify that survey equipment is in calibration and has been successfully source checked for the day.

6.2 Perform surveys per SP-P-35-023, "Radiological Contamination Surveys" or use automated contamination monitoring instruments such as tool monitors.

6.3 Materials with inaccessible surfaces which are likely to be contaminated but are of such size, construction, or location as to make them inaccessible for survey shall be assumed to exceed the limits for unrestricted release.

6.4 When material is surveyed for unrestricted release at locations other than Controlled area exits and meets applicable criteria, material identification and control shall be maintained as follows:

6.4.1 An Article Surveyed Tag, Attachment B, containing the following information shall be attached to the article or lot of articles surveyed.

6.4.1.1 Description of article(s).

6.4.1.2 Contamination levels.

6.4.1.3 Area from which the article was moved.

6.0 PROCEDURE (continued)

6.4.1.4 Name, printed and signature, of the RST performing the survey.

6.4.1.5 Date and time of survey.

6.5 If material is found to have removable contamination the following steps shall be taken:

6.5.1 Materials shall be bagged to minimize the potential of spreading contamination.

6.5.2 A tag with the words "Caution - Radioactive Material" (Attachment C) shall be secured to the bag indicating the type and level of contamination detected.

6.5.3 Material shall be transported to an appropriate area for decontamination or storage.

6.6 Materials shall be released from the FEMP only after survey results adequately demonstrate compliance with the release limits.

6.6.1 Material not released within eight hours or one work shift of the time of the previous survey shall be resurveyed unless the following conditions are met:

6.6.1.1 The material or articles must be placed in radiologically clean containers after the survey.

6.6.1.2 The containers must be sealed using a tamper proof seal with a unique identification number. Containers may be anything that prevents contamination such as drums, sealands etc..

6.6.1.3 The seal identification number shall be recorded on the survey form.

6.6.1.4 If the container is to be released with the materials inside, its external surface must be surveyed prior to release.

6.6.2 The RST stationed at the control point through which material is released may choose to resurvey material even though it has been previously surveyed within the prescribed time.

6.6.3 The control point RST shall remove any Article Surveyed Tags prior to release

7.0 APPLICABLE DOCUMENTS

7.1 SP-P-35-023, "Radiological Contamination Surveys".

7.2 DOE Order 5400.5, "Radiation Protection of the Public and Environment".

8.0 FORMS USED

8.1 Article Surveyed Tag, FMPC-IRS&T-1545.

8.2 "Caution - Radioactive Material" Tag.

9.0 ATTACHMENTS

9.1 Attachment A, "Surface Contamination Limits".

9.2 Attachment B, "Article Surveyed Tag".

9.3 Attachment C, "Caution - Radioactive Material" Tag.

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Attachment A

SURFACE CONTAMINATION LIMITS[a]

NUCLIDE	FIXED PLUS REMOVABLE		REMOVABLE[b,e]
	AVERAGE[b,c]	MAXIMUM[b,d]	
U-nat, U-235, U-238, and associated decay products, alpha emitters.	5,000 dpm /100 cm^2	15,000 dpm /100 cm^2	1,000 dpm/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm /100 cm^2	15,000 dpm /100 cm^2	1,000 dpm /100 cm^2

[a] Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with a appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Attachment B

ARTICLE SURVEYED TAG

Fernald Site
IRS&T

Article Surveyed

DESCRIPTION:

ALPHA	BETA-GAMMA
Fixed & Removable: dpm/frisk	Fixed & Removable: dpm/frisk
Removable: dpm/100 cm²	Removable: dpm/100 cm²

COMMENTS:

DATE: TIME:

RST (PRINTED):

RST (SIGNATURE):

FS-F-1545 (REV. 3 ... 92)

Attachment C

"CAUTION - RADIOACTIVE MATERIAL" TAG

CAUTION

RADIOACTIVE MATERIAL

ACCOUNTABILITY NO.

OR ☐ NONE REQUIRED

DESCRIPTION OF MATERIAL

CONTAMINATION DATA

SURFACE CONTAMINATION ON MATERIAL

Beta-Gamma _____ DPM/100 cm2

Alpha _____ DPM/100 cm2

RADIATION DATA

SURFACE DOSE RATE

mrem/hr

ESTIMATED CURIE CONTENT

millicuries

SPECIAL INSTRUCTIONS

SIGNED | DATE

EXAMPLE , "CAUTION RADIOACTIVE MATERIAL" TAG

ISSUE AND REVISION RECORD

DATE OF CHANGE	REVISION NUMBER	AFFECTED PAGES	REASON FOR REVISION
10/25/88	0	ALL	Original issue of procedure
11/17/88	1	1,2	To correct limits for unrestricted release.
03/13/90	2	All	To assign limits for unrestricted release based on radioisotopic data.
08/07/92	3	All	To allow for direct beta survey techniques to determine unrestricted release criteria when U-238 is the isotope of concern and to provide for the use of automated monitoring equipment.

Safety Procedures	Title: Routine Radiological Contamination Surveys	SP-P-35-023
		Department: ES&H Section: RC

Authorization: [signature] Supersedes: None
Revision Date: 3/31/93

1.0 PURPOSE

Assign responsibilities and establish the procedure for performing radiological contamination surveys.

2.0 SCOPE

This procedure defines the method to schedule, perform, and document contamination surveys.

3.0 DEFINITIONS

3.1 Contamination - Radioactive material that is not contained or is present where it is unwanted. Classified as:

3.1.1 Removable - Radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing or washing. Refer to SD-ES&H-BAS-3011 for further description.

3.1.2 Fixed - Radioactive material that cannot be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing or washing.

3.2 Frequency - The time frame in which a scheduled survey shall be completed.

3.2.1 Daily - Shall be completed each calendar day, with the exception of weekends and holidays.

3.2.2 Weekly - Shall be completed between 0000 hours Monday and 2400 hours the following Sunday.

3.0 DEFINITIONS (continued)

3.2.3 Quarterly - Shall be completed four times per year, once in each calendar quarter. The calendar quarters are:

1st - January 1 to March 31.
2nd - April 1 to June 30
3rd - July 1 to September 30
4th - October 1 to December 31

3.2.4 Semi-Annual - Shall be completed two times per year; once between January 1 and June 30, and the other between July 1 and December 31 each calendar year.

3.2.5 Annual - Shall be completed during the calendar year.

3.3 Minimum Detectable Activity (MDA) - The smallest amount of activity that can be detected at a given confidence level.

3.3.1 The MDA for Geiger-Mueller (G-M) pancake probes is considered to be:

3.3.1.1 1000 dpm/100 cm^2 (100 cpm above background) for direct frisk techniques. This corresponds to a correction factor of 10 if reporting activity per 100 cm^2.

3.3.1.2 400 dpm/probe area (100 cpm above background) for smear techniques. This correspond to a correction factor of 4.

3.3.2 The MDA for alpha-scintillator type probes is considered to be:

3.3.2.1 200 dpm/100 cm^2 (20 cpm above background) for direct frisk techniques.

3.3.2.2 200 dpm/probe area (20 cpm above background) for smear techniques.

3.4 Gross Area Smears - Large area smears taken as an indication of the presence or absence of contamination.

4.0 RESPONSIBILITIES

4.1 The Manager(s) of personnel required to perform work per this procedure shall ensure that affected personnel are informed and/or trained to the extent necessary prior to initiation of that work.

4.2 The Radiological Assessment Manager shall ensure the performance and recording of all surveys within the specified frequencies.

4.0 RESPONSIBILITIES (continued)

4.3 The Radiological Dosimetry Manager shall ensure the electronic storage (as applicable) and retention of all radiological survey records.

4.4 The Radiological Compliance Manager shall ensure timely review of contamination survey data by a member of the Radiological Compliance group in order to establish, confirm, and update site radiological postings.

4.5 RCT Supervisor(s) shall be responsible for scheduling and reviewing all surveys as prescribed by this procedure. RCT Supervisor(s) are also responsible for informing RCTs of follow-up survey requirements.

4.6 Radiological Control Technician(s), (RCTs), shall be responsible for performing and documenting surveys in accordance with the requirements of this procedure. RCTs are also responsible for notification of survey results.

5.0 GENERAL

5.1 The purposes of contamination surveys are:

5.1.1 Characterize the levels of contamination in an area.

5.1.2 Provide documentation of radiological conditions.

5.1.3 Detect trends and build-up of contamination in areas.

5.1.4 Provide a base for contamination control.

5.2 Frequencies of surveys in areas not stated in this procedure shall be determined by the responsible RCT Supervisor. Frequency is based on:

5.2.1 Changes in work routine.

5.2.2 Changes in the occupancy of the area.

5.2.3 Changes in personnel access to the area

5.2.4 Construction, demolition or decommissioning work that requires a Radiation Work Permit.

5.2.5 History of area contamination.

6.0 PROCEDURE

6.1 For fixed contamination surveys for depleted or natural uranium beta-gamma instruments alone may be used for activity determination.

6.2 Dry smears shall be taken whenever direct frisk indicates activity exceeding applicable limits for removable activity.

6.3 For direct survey techniques the instrument audio shall be turned "ON".

6.4 Direct frisk with a G-M pancake probe

6.4.1 If the background exceeds 300 cpm, the item being surveyed should be moved to an area where the background is <300 cpm if possible. If this is not possible the background should be noted on the survey form.

6.4.2 The probe shall not be moved faster than 3 inches per second to detect 100 cpm above background.

6.4.3 The beta-gamma probe window shall be within 1/2" of the surface that is being monitored.

6.4.4 Frisk the desired area and determine the average reading in cpm.

6.4.5 Subtract the background cpm and multiply the result by ten (10) to determine dpm per 100 cm^2.

6.4.6 Record the contamination level in the "Fixed Plus Removable" column of the Radiological Survey Report (RSR) (Attachments A and B).

6.5 Direct survey with an alpha instrument

6.5.1 If the background exceeds 50 cpm, attempt to decontaminate the probe. If background cannot be lowered, tag the instrument out of service in accordance with procedure SP-P-35-028.

6.5.2 The probe shall be held stationary for 5 seconds. If an audible signal or meter movement is detected, hold the probe stationary for an additional 15 seconds.

6.5.3 The alpha probe window shall be within 1/8" of the surface being frisked.

6.5.4 Frisk the desired area and determine the average reading in cpm.

6.5.5 Subtract the background cpm, and multiply the result by ten (10) to determine dpm per probe area. For alpha scintillator probes dpm per 100 cm^2 shall be considered equal to dpm per probe area.

6.0 PROCEDURE (continued)

6.5.6 Record the contamination level in the "Fixed Plus Removable" column of the RSR.

6.6 Smears

6.6.1 Protective gloves should be worn when taking smears.

6.6.2 Dry Smooth Surface Smears

6.6.2.1 Using dry paper or cloth smears, trace approximately a 40 cm (16") long "s" figure or approximately a 100 cm^2 area unless otherwise required by a specific procedure.

6.6.2.2 Apply moderate pressure with at least two fingers.

6.6.2.3 Analyze smears as outlined in step 6.6.5.

6.6.2.4 Record analysis data for the area smeared in the appropriate "Removable" column of the RSR. For areas where it is not feasible to smear 100 cm^2 a comment shall be included indicating the approximate area smeared.

6.6.3 Gross-area Smears

6.6.3.1 Gross-area smears are encouraged and should be used to supplement routine smear surveys in areas generally assumed to be not contaminated.

6.6.3.2 Wipe a large area, several hundred square centimeters or greater, with a standard smear or a large absorbent cloth, such as masslin.

6.6.3.3 Frisk the smear directly with a portable alpha or beta/gamma survey instrument for indication of the presence of contamination. Removable contamination detected should be averaged over the area smeared.

6.6.3.4 Gross-area smears that indicate activity below the MDA per probe area of the instrument used to count the smear shall be reported as "<MDA" in the appropriate "Removable" column of the RSR for the item or area smeared.

6.6.3.5 If gross-area smears indicate activity above the MDA per probe area of the instrument used to count the smear, a 100-cm2 dry smear survey shall be performed on the item or area as detailed in section 6.6.2.

6.0 PROCEDURE (continued)

6.6.4 Smears on other surfaces

6.6.4.1 Conduct surveys as described in step 6.6.2, except cloth smears shall be used when the material to be smeared is too coarse to adhere to smear paper, the surface is rough and porous, or the contamination loosely adheres to the surface.

6.6.4.2 It is permitted to smear wet areas, inside spill-area boundaries, or areas where loose surface contamination is expected but is not detectable using dry smears. Wet smears shall be allowed to dry before counting.

6.6.5 Smear Sample Analysis

6.6.5.1 Smears taken to detect activities above the portable instrument MDA may be counted with field survey instruments as outlined in procedure SP-P-35-046 "Counting Smears with Field Survey Instruments".

6.6.5.2 Smears taken to detect activities less than the MDA of the portable survey instrument shall be counted on a low background counting system (see SP-P-35-37 "Operation of the Tennelec Automatic Low Background Counting Systems (LB5100 Series II/III and LB5100/5500.)").

6.7 Documentation

6.7.1 Radiological contamination surveys shall be documented using the RSR or equivalent.

6.7.2 Any unusual events or conditions that may influence the survey results shall be noted in the "Reason for Survey" block of the survey report (i.e., porous surface, wet smears). Include any applicable I.D. numbers or document control numbers. An example would be the Radiation Work Permit identification number should be recorded in the "Reason for Survey" block if the performance of the survey was in support of the permit.

6.7.3 One of the RCTs performing the survey shall complete the "RCT", "Badge" and "Signature" blocks of the survey report.

6.7.4 Maps should be used wherever possible so that survey locations can be accurately documented. Computer generated maps including grid coordinates should be used whenever possible for characterization surveys. Each map page shall be included in the total pages of the "Page" block.

6.7.5 Standard building/area numbers and designations should be used in completing the "Location" block.

6.0 PROCEDURE (continued)

6.7.6 Floor levels, room numbers, sub-process area designations or functions and/or directions should be used in completing the "Level" block.

6.7.7 The "Reason for Survey" block shall include the following, as applicable:

6.7.7.1 Frequency of routine survey

6.7.7.2 Reference to a specific Radiological Work Permit (i.e. RWP Number)

6.7.8 All instruments used in performing the survey shall be recorded on the Radiological Survey Report. Documentation of the inspection and performance test of the instruments may be recorded on the survey report in accordance with procedure SP-P-35-028 "Inspection and Performance Testing of Portable Radiation Survey Instruments." Instrument model numbers shall be listed in accordance with Appendix A of SP-P-35-028.

6.7.9 Completion of the "Count Time" block is only required for scaler-type instruments, such as automatic counting systems or data loggers. "N/A" (not applicable) shall be specified for ratemeter-type instruments, such as friskers.

6.7.10 An entry in the "Inspection & Performance Test Satisfactory?" field for low background automatic counting systems shall signify whether the Daily Checks for that system were completed, in accordance with procedure SP-P-35-019 "Quality Control of Radioactivity Counting Systems."

6.7.11 All reported readings shall be clearly specified as dpm/probe area, dpm/100 cm^2 or dpm/area smeared for gross-area smears.

6.7.12 Readings less than MDA shall be recorded as "< MDA". The value(s) for MDA for each instrument used shall be recorded on the survey report.

6.7.13 Height values are required for characterization surveys only. Height values shall be recorded as the distance above the floor of the current level. A height of 0 feet shall be used to indicate samples taken on floor or ground surfaces.

6.7.14 Unused lines or blocks shall be left blank unless otherwise instructed by this procedure. Ditto marks or duplication symbols for readings or derived values shall be prohibited.

6.7.15 All analysis data printouts shall be attached to the RSR if analysis data was transcribed from the printout to the RSR.

6.7.16 Completed Radiological Survey Reports shall be reviewed, dated and initialed in the provided blocks by the responsible RCT supervisor.

6.0 PROCEDURE (continued)

6.7.16.1 The RCT Supervisor shall inform the RCT of follow-up requirements and/or surveys when required. Follow-up surveys shall be cross-referenced to the original survey.

6.6.16.2 The RCT shall notify the facility supervisor, RCT Supervisor, and Radiological Assessment promptly of any areas requiring decontamination.

6.7.17 A copy of all survey reports shall be on file for one quarter in the custody of the RCT Supervisor. All reports exceeding one quarter of date of the survey shall be removed from the files and prepared for long term storage in the vault.

6.7.18 Copies of the completed RSR shall be distributed per the distribution list at the bottom of the pre-printed form or as directed by the responsible RCT Supervisor.

6.8 Schedule

6.8.1 Unless otherwise specified by this procedure, all scheduled surveys shall be for removable contamination only. More frequent surveys or performing fixed plus removable surveys may be specified by the responsible RCT supervisor or Radiological Engineer through the RCT supervisor.

6.8.2 Daily Surveys

6.8.2.1 Approved Drinking and/or Smoking areas within Controlled Areas and Radiological Buffer Areas.

6.8.2.2 Lunch rooms or approved eating areas near Radiological Buffer Areas.

6.8.2.3 Contamination Area control points, Controlled Area control points, and step-off pads.

6.8.3 Weekly Surveys

6.8.3.1 Outside of Contamination Area boundaries.

6.8.3.2 Water fountains/coolers inside Controlled Areas.

6.0 PROCEDURE (continued)

6.8.3 Monthly Surveys

6.8.3.4 Routinely occupied Radiological Buffer Areas. An example would be offices within the Controlled Area that are not designated Drinking and/or Smoking areas

6.8.4 Quarterly Surveys

6.8.4.1 Radioactive Material Storage Areas (or upon entry if entries are less frequent).

7.0 APPLICABLE DOCUMENTS

7.1 SP-P-35-046, "Counting Smears with Field Survey Instruments".

7.2 SP-P-35-028, "Inspection and Performance Testing of Portable Radiation Survey Instruments".

7.3 SP-P-35-037, "Operation of the Tennelec Automatic Low Background Counting Systems (LB5100 Series II/III and LB5100/5500.)".

7.4 SP-P-35-019, "Quality Control of Radioactive Counting Systems".

7.5 SP-ES&H-BAS-3011 "Statement of Clarification for Removable Contamination".

8.0 FORMS USED

8.1 FS-F-1993-1, Radiological Survey Report

9.0 ATTACHMENTS

9.1 Attachment A, Radiological Survey Report

ATTACHMENT A

RADIOLOGICAL SURVEY REPORT

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FEMP
RADIOLOGICAL SURVEY REPORT

DATE	LOCATION	RCT	BADGE	PAGE
TIME	LEVEL	SIGNATURE		1 of ___

REASON FOR SURVEY

INSTRUMENTS

MODEL	SERIAL NUMBER	TYPE (α, β, γ)	CALIBRATION-DUE DATE	BKGD. (cpm)	EFF./CF	COUNT TIME (min)	MDA (dpm)	RESP./PERFORMANCE TEST SAT? YES	NO

ITEM NUMBER	LOCATION AND/OR DESCRIPTION	HEIGHT (ft.)	DPM/100cm² ALPHA REMOVABLE	DPM/100cm² ALPHA FIXED PLUS REMOVABLE	DPM/100cm² BETA-GAMMA REMOVABLE	DPM/100cm² BETA-GAMMA FIXED PLUS REMOVABLE	CORRECTED DOSE RATE (MREM/HR) γ CONTACT	β CONTACT	γ AT ___ FT.	β AT ___ FT.

NO.	DISTRIBUTION OF COPIES
1	PCT Supervisor
2	Facility Supervisor
3	CRU Manager

NOTIFICATION OF SURVEY RESULTS

SUPERVISOR NOTIFIED	TIME	DATE	NOTIFIED BY	REVIEWED BY	DATE

FS-F-1993-1 (REV. 12/21/92)

ISSUE AND REVISION RECORD

DATE OF CHANGE	REVISION NUMBER	AFFECTED PAGES	REASON FOR REVISION
01/02/91	0	ALL	Original issue of procedure
06/21/91	1	ALL	To include procedure for performing Gross-area smears and to recommend field counting smears wherever applicable.
1/22/92	2	ALL	To denote that the MDA for direct frisk is different than the MDA of smear counting when using portable instrumentation, to allow direct frisks in higher background provided it is documented, to reformat schedule to be based on area classification, and to update Radiological Survey Report Form.
03/31/93	3	ALL	To change survey frequencies in accordance with DOE Radiological Controls Manual. Also to clarify and expand instructions for Documentation of surveys.

UNCONTROLLED

Control Number - 5298

FERMCO
Restoration Management Corporation

Revision: 3

Safety Procedures	Title: Radiological Posting	SP-P-35-025
		Department: ES&H Section: RC
Authorization:		Supersedes: Revision 2 Revision Date: 3/31/93

1.0 PURPOSE

To assign responsibilities and establish the procedure for posting radiologically controlled areas in compliance with Fernald Environmental Management Project (FEMP) administrative and Department Of Energy (DOE) guidelines.

2.0 SCOPE

This procedure identifies the FEMP administrative and DOE requirements for posting of radiologically controlled areas.

3.0 DEFINITIONS

3.1 Work - For the purposes of posting any area, room, or enclosure, "work" shall be defined as the performance of any activity other than observation. "Work" shall include touching, kneeling, and sitting. Observation is defined as simply watching area activity or walking through a controlled area.

3.2 Controlled Area - Any area, room, or enclosure to which access is controlled to protect individuals from exposure to radiation and radioactive materials, or where radioactive material may be present. The surface contamination levels are not to exceed the limits specified in Attachment A for the isotope of concern. Personnel exposure to radiation is not expected to exceed 100 mrem in one year while working in a designated Controlled Area.

3.3 Fixed Contamination Area - For the isotope of concern, any area, room, or enclosure where fixed surface contamination meets or exceeds the limit specified for Total (fixed plus removable) contamination in Attachment A. Removable surface contamination levels are not to exceed the limits specified in Attachment A for the isotope of concern.

3.4 Contamination Area - For the isotope of concern, any area, room or enclosure where removable surface contamination levels exceed (or are likely to exceed) the limits specified in Attachment A.

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3.0 DEFINITIONS (continued)

3.5 High Contamination Area - For the isotope of concern, any area, room, or enclosure where removable surface contamination levels exceed (or are likely to exceed) one hundred (100) times the limits specified in Attachment A.

3.6 Airborne Radioactivity Area - For the isotope of concern, any room, enclosure, or operating area within a Controlled Area where airborne radioactivity concentrations exceed (or are likely to exceed) 10% Derived Air Concentration (DAC) as specified in Attachment B at any time during a shift.

3.7 Radiation Area - Any area, room, or enclosure, accessible to personnel, where the dose equivalent rate meets or exceeds 5.0 mrem per hour but remains less than 100 mrem per hour at 30 cm from the radiation source or from any surface through which the radiation penetrates. Refer to SP-P-35-048, Radiation Surveys.

3.8 High Radiation Area - Any area, room, or enclosure accessible to personnel, where the dose equivalent rate meets or exceeds 100 mrem per hour and is equal to or less than 500 rad per hour at 30 cm from the radiation source or from any surface through which the radiation penetrates. Refer to SP-P-35-048, Radiation Surveys.

3.9 Very High Radiation Area - Any area, room, or enclosure, accessible to personnel, where the dose rate, exceeds 500 rad per hour at 1 meter from the radiation source or from any surface through which the radiation penetrates. Refer to SP-P-35-048, Radiation Surveys.

3.10 Control Point - The designated entry and exit point of a controlled area. A control point, at the minimum, will contain a step-off-pad and appropriate radiation survey instrument for the frisking station. All personnel, material, and equipment shall use the control point as the primary means of entry or exit except during emergencies.

3.11 Boundary Posting - Perimeter posting of a Controlled Area.

3.12 Radioactive Material Area - Any area, room, or structure where radioactive material is present, handled, or stored.

3.13 Waste Storage Area (WSA) - Location of covered and uncovered waste pit areas and the K-65 waste storage silos.

3.14 Radiation Work Permits (RWP) - A specific radiological control plan for all work functions which involve exposure (or the potential for exposure) to radiation or radioactive materials. The RWP identifies the work activity, the radiological conditions, and the protective measures required to accomplish the work plan.

3.0 DEFINITIONS (continued)

3.15 Radiological Buffer Area (RBA) - An intermediate area established to prevent the spread of radioactive contamination and to protect personnel from radiation exposure. The area surrounds or is contiguous with "Contamination Areas", "High Contamination Areas", "Airborne Radioactivity Areas", "Radiation Areas", or "High Radiation Areas".

4.0 RESPONSIBILITIES

4.1 The manager(s) of personnel required to perform work in accordance with this procedure shall ensure that affected personnel are informed and/or trained to comply with the requirements of this procedure.

4.2 The responsible Radiological Control Technician (RCT) Supervisor shall ensure that radiologically controlled locations within their affected areas are posted in accordance with the requirements of this procedure. In addition, responsible supervisors shall perform a quarterly surveillance of all areas to confirm posting compliance and maintenance of signs and control points.

4.3 The Radiological Control Technician (RCT) shall be responsible for posting radiologically controlled areas and conducting weekly walkdowns for maintenance of radiological postings in their areas of responsibility. Radiological Compliance (RC) and the Facility Owner shall be notified when an area posting status changes. Notification is required by the end of the shift in which the change was made.

NOTE: During backshift or weekends, notification is required immediately upon the following work day.

4.4 Radiological Compliance shall be responsible for maintaining an inventory of fixed contamination locations and area posting status. In addition, RC shall maintain the Surface Contamination Limits (Attachment A) consistent with regulatory and DOE guidance. RC shall also identify the isotope(s) of concern in all controlled areas.

5.0 GENERAL

5.1 Site perimeter fences enclosing controlled areas shall be posted in accordance with this procedure. Signs should be hung at a height of 1 to 2 meters above the ground at appropriate distances so they may be seen from all directions of approach.

5.2 Required postings on buildings and control points should be constructed at eye level when possible or at 1 to 2 meters above the ground or floor. Avoid posting directly on doors or where other moveable objects can obstruct the view of the posting.

5.0 GENERAL (continued)

5.3 Posting is required in areas where radioactive materials are stored or handled in a manner which requires radiological controls. Post applicable sign(s) at the boundary so it may be seen from all approaches to the barrier.

5.4 In some cases posting signs may be used without rope or other barriers if those barriers are inappropriate due to vehicular traffic or Fire and Safety concerns. In these cases, signs may be hung on stanchions and placed at appropriate distances so they may be seen from all directions of approach. This exception also applies to area control points.

5.5 Redundant posting of signs inside a posted area shall be avoided. For example, avoid posting a "Contamination Area" which is already within a "Contamination Area".

5.6 Posting of control point entrances shall identify the area (i.e. Controlled, Contamination, etc.) being entered. Special or modifying instruction, including the minimum level of protective clothing, shall be posted at the control point entrance on a task specific Radiation Work Permit (RWP). Updated surveys and/or RWPs shall be posted, as required, close by the control point entrances.

5.7 "PERSONNEL AND MATERIAL MONITORING REQUIRED BEFORE PROCEEDING BEYOND THIS POINT" shall be posted at all control point exits. Special requirements or instructions for exit shall also be posted.

5.8 Exits from buildings that are not specified as control points, shall be posted "EMERGENCY EXIT ONLY", at the door.

5.9 Manholes, sealed pits, or below ground confined spaces may have signs mounted directly on the manhole cover, cover block, or posted around the perimeter with boundary rope. If posting a manhole is accomplished by mounting the sign on the manhole cover, a temporary area using a posted barrier shall be erected around the manhole when the cover is removed.

5.10 Attachment C, Example of Minimum Required Control Point Setup, illustrates the manner in which areas and control point step-off pads should be posted.

5.11 Designated breakrooms within the Controlled Area shall be posted Smoking/Drinking Permitted". Updated survey information for these areas shall be posted using attachment D.

5.12 Attachment E, Sign Insert Terminology and Hierarchy of Posting, shall be used for all postings. Posting terminology and hierarchy shall be consistent for all signs.

6.0 PROCEDURE

6.1 General Posting Requirements - Unless otherwise specified by RC or approved procedure, post in accordance with Attachment A natural uranium and beta-gamma limits.

6.2 Specific Area Posting Requirements - For those areas specified by RC or approved procedure, post in accordance with Attachment A - for the isotope of interest.

6.3 Controlled Area

6.3.1 Any area where radioactive materials or radiation fields may be present shall be posted "CONTROLLED AREA"

6.3.2 "TLD BADGE REQUIRED FOR ENTRY" shall be posted at the access to a Controlled Area.

6.4 Fixed Contamination Area

6.4.1 Any area, room, or enclosure where fixed surface contamination exceeds the limits specified by Attachment A for Total (fixed plus removable) contamination shall be posted as a "FIXED CONTAMINATION AREA".

6.4.2 Removable surface contamination shall not exceed the levels specified in Attachment A, for the isotope of concern.

6.4.3 Contact RC for additional guidance.

6.5 Contamination Area

6.5.1 Any area where removable surface contamination exceeds (or is likely to exceed) the removable limits specified in Attachment A shall be posted as a "CONTAMINATED AREA". Removable contamination should not be expected to exceed one hundred times the Attachment A limits in these areas.

6.5.2 "RWP REQUIRED FOR ENTRY" shall be posted at the access to any Contamination Area.

6.5.3 The most recent contamination survey should be posted at all Contamination Area control points. (A map with smear results greater than the Attachment A limits will meet this requirement.) For areas where maps can not be posted, the highest contamination level in the area, with location, shall be noted on the control point J-sign.

6.0 PROCEDURE (continued)

6.6 High Contamination Areas

6.6.1 Any area where removable surface contamination exceeds (or is likely to exceed) one hundred times the removable contamination limits specified in Attachment A shall be posted as "DANGER HIGH CONTAMINATION AREA".

6.6.2 "RWP REQUIRED FOR ENTRY" shall be posted at the access to any High Contamination Area.

6.6.3 The most recent contamination survey should be posted at all High Contamination Area control points. (A map with smear results greater than the Attachment A limits will meet this requirement.) For areas where maps can not be posted, the highest contamination level in the area, with location, shall be noted on the control point J-sign.

6.7 Radiation Area

6.7.1 Any area, room, enclosure, or structure that meets the criteria in 3.7 shall be posted as a "RADIATION AREA". Posting of Radiation Areas shall be based on surveys in accordance with SP-P-35-048, Radiation Surveys.

6.7.2 "RWP REQUIRED FOR ENTRY"shall be posted at the access to any Radiation Area.

6.7.3 The perimeter gamma dose rate shall be noted on signs along the area boundary or exterior wall surfaces, with the RCT initials and the date of the survey.

6.7.4 The maximum radiation level, with location, shall be posted at the entrance to Radiation Areas.

6.8 High Radiation Area

6.8.1 Any area, room, or enclosure that meets the criteria in 3.8 shall be posted as "DANGER HIGH RADIATION AREA". Posting of High Radiation Areas shall be based on surveys in accordance with SP-P-35-048, Radiation Surveys.

6.8.2 "RWP REQUIRED FOR ENTRY" shall be posted at the access to any High Radiation Area.

6.0 PROCEDURE (continued)

6.8.3 High Radiation Areas shall be enclosed by physical barriers (i.e., brick walls, concrete block walls) and locked or guarded. Keys to permit access shall be controlled by the Facility Owner. Continuous RCT attendance is required when High Radiation Areas are not enclosed by locked physical barriers.

6.8.4 The perimeter dose rate shall be noted on signs along the area boundary or exterior wall surfaces with the RCT initials and the date of the survey.

6.8.5 The maximum radiation level, with location, shall be posted at entrances to High Radiation Areas.

6.10 Very High Radiation Area

6.10.1 Any area, room, or enclosure meeting the criteria of 3.9 shall be posted as a "GRAVE DANGER VERY HIGH RADIATION AREA". Posting of Very High Radiation Areas shall be based on surveys in accordance with SP-P-35-048, Radiation Surveys.

6.10.2 "SPECIAL CONTROLS REQUIRED FOR ENTRY" shall be posted at the access to any Very High Radiation Area.

6.10.3 Very High Radiation Areas shall be enclosed physical by barriers (i.e., brick walls, concrete block walls) and locked or guarded. Keys to permit access shall be controlled by the Facility Owner. Continuous RCT attendance is required when Very High Radiation Areas are not enclosed by locked physical barriers.

6.10.4 The perimeter dose rate shall be noted on signs along the area boundary or exterior wall surfaces with the RCT initials and the date of the survey.

6.10.5 The maximum radiation level, with location, shall be posted at entrances to Very High Radiation Areas.

6.11 Airborne Radioactivity

6.11.1 Access to any area, room or enclosure where airborne radioactivity concentrations meet the level defined in 3.6 shall be posted "AIRBORNE RADIOACTIVITY AREA" and "RWP REQUIRED FOR ENTRY".

6.0 PROCEDURE (continued)

6.11.2 When posting for airborne radioactivity based on long-lived alpha activity (refer to SP-P-35-026, Occupational Air Sampling For Radioactivity), use the Derived Air Concentration Limits (DAC) listed in Attachment B. Use Class Y solubility for U-238 unless otherwise specified by RC or approved procedure.

6.11.3 When posting for airborne radioactivity based on the short-lived daughters of Rn-220 (Thoron) and Rn-222 (Radon) gas, use the Working Level (WL) limits in Attachment B. Refer to SP-P-35-029, Measuring Radon and Thoron Daughter Concentrations.

NOTE: Respiratory Protection requirements shall be determined as outlined in SP-P-35-016, Radiation Work Permits.

6.12 Radiological Buffer Area (RBA)

6.12.1 Post "RADIOLOGICAL BUFFER AREA" when ongoing work activities can create airborne radioactivity or the spread of contamination. DO NOT post an RBA around inactive areas.

6.12.2 At a minimum, the RBA should include the area adjacent to the control points for any type of "Contamination Area" (except fixed), "Airborne Radioactivity Areas", and any type of "Radiation Area".

6.12.2.1 An RBA is not required for a "High Contamination Area" which is completely surrounded by a "Contamination Area".

6.12.2.2 The RBA boundary surrounding any type of "Radiation Area" should surround or be contiguous with the area boundaries: the RBA boundary and the area boundary may be the same in this case.

NOTE: If the RBA and area boundaries are the same, the RBA need not be posted.

6.12.2.3 Contact RC for evaluation of RBA use in conjunction with "Radioactive Material Areas".

6.12.3 The size of an RBA shall be commensurate with the possibility for the spread of contamination. At the minimum, an RBA shall be 1 meter wide.

6.12.4 The RBA shall not be used for the passage of personnel or materials into or out of any area except when designated by the cognizant RCT.

6.0 PROCEDURE (continued)

6.13 Soil Contamination Areas

6.13.1 Soil not releasable in accordance with DOE 5400.5 shall be posted "SOIL CONTAMINATION AREA".

6.13.2 "NOTIFY RADIOLOGICAL SAFETY PRIOR TO DIGGING OR DISTURBING SOIL" shall be posted at Soil Contamination Areas.

6.14 Radioactive Material Area

6.14.1 Any area, room or enclosure within a Controlled Area where radioactive material is present, handled or stored shall be posted a "RADIOACTIVE MATERIAL AREA".

NOTE: Not required when inside a Contamination or Airborne Radioactivity Area.

6.14.2 Any area, room or enclosure outside a Controlled Area where radioactive material is present, handled or stored shall be posted as "RADIOACTIVE MATERIAL AREA" and "TLD BADGE REQUIRED".

6.14.3 Areas containing underground radioactive materials (pipelines,radioactive cribs, covered ponds, covered ditches, catch tanks, inactive burial grounds, and sites of known, covered, unplanned releases) shall be posted "UNDERGROUND RADIOACTIVE MATERIAL AREA" and "NOTIFY RADIOLOGICAL SAFETY PRIOR TO DIGGING OR DISTURBING SOIL".

6.15 POSTING FOR RADIONUCLIDES OTHER THAN URANIUM

6.15.1 Thorium and radium contamination are suspect at specified locations in the former process area. Areas where these contaminants are known to be present or potentially present, are identified in Attachment A. Consult RC for further information.

7.0 APPLICABLE DOCUMENTS

7.1 DOE Order 5400.5

7.2 DOE Order 5480.11, Radiological Protection for Occupational Workers.

7.3 DOE Radiological Control Manual.

7.4 SP-P-35-010, Unrestricted Release of Materials from the FEMP.

7.5 SP-P-35-016, Radiation Work Permits

7.6 SP-P-35-023, Radiological Contamination Surveys.

7.7 SP-P-35-026, Occupational Air Sampling For Radioactivity.

7.8 SP-P-35-029, Measuring Radon and Thoron Daughter Concentrations.

7.9 SP-P-35-046, Counting Smears with Field Survey Instruments.

7.10 SP-P-35-048, Radiation Surveys.

8.0 FORMS USED

8.1 None

9.0 ATTACHMENTS

9.1 Attachment A, Surface Contamination Limits

9.2 Attachment B, Derived Air Concentrations

9.3 Attachment C, Example of Minimum Required Control Point Setup

9.4 Attachment D, Drinking/Smoking Area Survey Information Form

9.5 Attachment E, Sign Insert Terminology and Hierarchy of Posting

ATTACHMENT A

SURFACE CONTAMINATION LIMITS

NUCLIDE (note 1)	REMOVABLE (dpm/100cm²) (note 2)	Total(FIXED+REMOVABLE) (dpm/100cm²) (note 3)	TYPICAL AREA DESIGNATIONS
U-nat,U-235,U-238, AND ASSOCIATED DECAY PRODUCTS	1,000	5,000	Administrative Areas (non-process) Breakrooms,offices, and restrooms within controlled areas.
TRANS-U,Ra-226,Ra-228,Th-230, Th-228,Pa-231,Ac-227 I-125,I-129	20	500	Identified areas in the WSA. Identified areas in the Refinery Area Plant 1 Ore Silos
Th-nat,Th-232,Sr-90, Ra-223,Ra-224,U-232, I-126,I-131,I-133	200	1,000	Pilot Plant, Bldg.13 Annex. Identified areas in Plants 6, 8, and 9. Thorium Storage Buildings. Identified areas in the WSA.
Beta-gamma emitters, except Sr-90 and those noted above.	1,000 ß-δ	5,000 ß-δ	Administrative areas (non-process) Breakrooms, offices, and restrooms within controlled areas.

NOTES:

(1) The values in this table apply to radioactive contamination deposited on, but not incorporated into the interior of contaminated item. When contamination by both α and ß-δ emitters is present the limits of Attachment A for α and ß-δ are applied independently (i.e. if an item exceeds the α limit, but is less than the ß limit, the item is considered to be contaminated).

(2) Removable radioactive material is determined by dry swipe over 100 cm² of surface area and assessment with appropriate survey instrumentation. For items with less than 100 cm² surface, the activity per unit area should be based on the actual surface area. When direct scan surveys of all surfaces indicate residual contamination less tha the limits for removable contamination, dry swipes are not required (dry swipes are always required if transuranic Ra-226, Ac-227, Th-228, Th-230, Pa-231, and α emitter contamination is suspect).

(3) These limits may be averaged over 1 square meter provided the maximum activity in any area of 100 cm² is less than three times the values listed in the table above.

ATTACHMENT B

TABLE 2: DERIVED AIR CONCENTRATIONS

Derived Air Concentrations (μCi/ml)

Nuclide	Class D	Class W	Class Y
U-238	6 E-10	3 E-10	2 E-11
U-236	6 E-10	3 E-10	2 E-11
U-235	6 E-10	3 E-10	2 E-11
U-234	5 E-10	3 E-10	2 E-11
Th-232	--	5 E-13	1 E-12
Th-230	--	3 E-12	7 E-12
Ra-226	--	3 E-10	--
Ra-228	--	5 E-10	--
Rn-222 (radon)	3 E-08*	--	--
Rn-220 (thoron)	8 E-09	--	--

* Assumes 100% equilibrium with radon decay products. If air sampling is performed for radon decay products (i.e., Working Level measurements), DACs are:

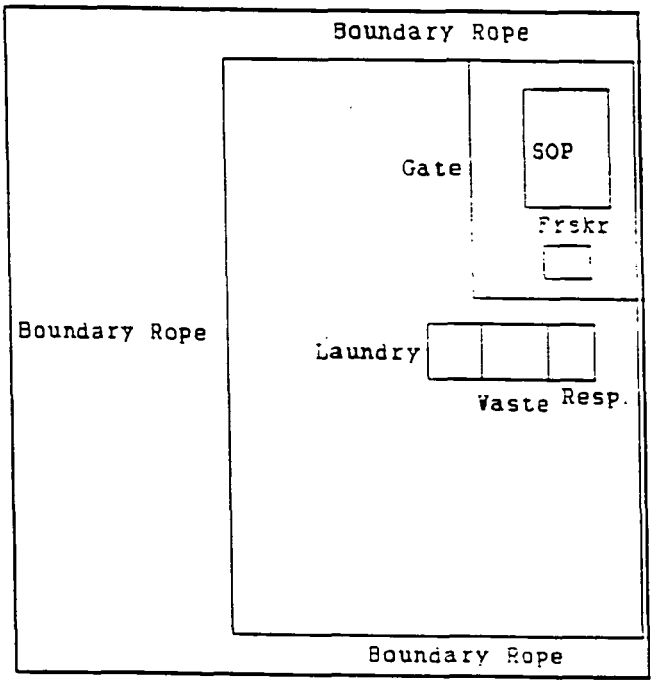
Rn-222 (radon) decay products - 0.33 WL
Rn-220 (thoron) decay products - 1.0 WL

For nuclides not included in this table, consult DOE Order 5480.11.

ATTACHMENT C

EXAMPLE OF MINIMUM REQUIRED CONTROL POINT SETUP

Example of control point construction. Drawing shows minimum required materials - NOTE: Size and shape will vary with individual areas and most areas will require an RBA.



1. Perimeter must be identified from all directions of approach, use Attachment E for sign verbiage.

2. Control Point entrance shall be posted on both the entry and exit sides. Refer to Attachment E.

3. Frskr indicates the frisking station. Location may vary.

4. Resp indicates the respirator barrel, this is optional, depending on the area.

5. SOP indicates the step off pad.

6. Donning and doffing instructions shall be placed at the control point.

7. Post the RWP near the control point entrance. Hanging the RWP on the control point rope gate or stanchion is not appropriate.

8. Post dose rates, contamination levels, and/or airborne radioactivity level on posting signs in grease pencil or other suitable marker. Refer to SP-P-35-025 procedural section 6 for more information.

9. Refer to Attachment E for proper sign verbiage and hierarchy.

ATTACHMENT D

DESIGNATED DRINKING AND SMOKING AREA SURVEY INFORMATION FORM

__SMOKING/DRINKING__ **PERMITTED**

ALL AREAS SURVEYED:

_____dpm/100cm^2 alpha; _____dpm/100cm^2 beta-gamma

REMARKS:_____

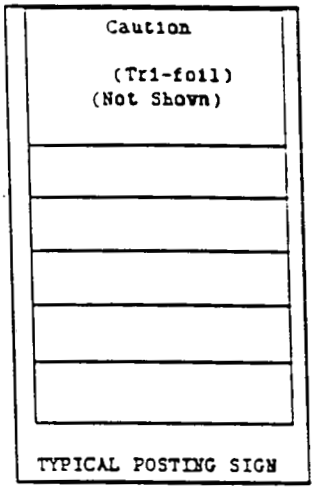
_____

_____

SURVEY DATE: _____ **SURVEYOR:** _____

ATTACHMENT E (page 1 of 3)

SIGN INSERT TERMINOLOGY AND HIERARCHY OF POSTING



INSERT HIERARCHY

Insert Section 1 - Hazard Level

Insert Section 2 - Area Modifications
Insert Section 3 - Notifications or other postings

NOTES: 1. Section 1 shall be used for the area hazard level. (i.e. Controlled. Contamination. etc.) only. The only exception for this section is to avoid double posting.

2. Section 2 - Area Modifications refers to the secondary postings required in some areas. For example, if an "Airborne Radioactivity Area" was being posted, the modifier could be "Contamination Area". If no area modifications are required, place section 3 requirements in this section.
3. Section 3 - Place informational inserts here.

HIERARCHY OF POSTING:

1. Hazard Level shall always be placed in sign first except when avoiding double posting.
2. The hierarchy of areas is as follows:
   a. Controlled Area
   b. Type of Radiation Area (i.e. Very High, High, or Radiation)
   c. Airborne Radioactivity Area
   d. Type of Contamination Area
   e. Radioactive Material Storage Area or Waste Storage Area
3. Special instructions, modifications, or general information shall be placed in the RWP and shall NOT be posted on J-Signs. For areas without RWP's, informational inserts may be posted at the discretion of the RCT.

ATTACHMENT E (page 2 of 3)

SIGN INSERT TERMINOLOGY AND POSTING HIERARCHY

LIST OF APPROVED TERMINOLOGY FOR POSTING INSERTS

HAZARD LEVEL	NOTIFICATIONS	OTHER POSTINGS
CONTROLLED AREA	TLD BADGE REQUIRED	EMERGENCY EXIT ONLY
VERY HIGH RADIATION AREA	CONTROL POINT ENTRANCE	PERSONNEL AND MATERIAL MONITORING REQUIRED BEFORE PROCEEDING BEYOND THIS POINT
HIGH RADIATION AREA	SPECIAL CONTROLS REQUIRED FOR ENTRY	UNDERGROUND RADIOACTIVE MATERIAL
RADIATION AREA	RADIOACTIVE MATERIAL	MAXIMUM RADIATION LEVEL: __ mr/hr LOCATION: _____ DATE: _____ INITIALS: ____
AIRBORNE RADIOACTIVITY AREA		MAXIMUM CONTAMINATION LEVEL: __ dpm α/100cm² __ dpm β/100cm² LOCATION: _____ DATE: _____ INITIALS: ____
HIGH CONTAMINATION AREA		SPECIAL CONTROLS REQUIRED FOR ENTRY
CONTAMINATION AREA		NOTIFY RADIOLOGICAL SAFETY PRIOR TO ENTRY __ PHONE __ RADIO
FIXED CONTAMINATION AREA		NOTIFY RADIOLOGICAL SAFETY PRIOR TO DIGGING OR DISTURBING SOIL __ PHONE __ RADIO
RADIOLOGICAL BUFFER AREA		
SOIL CONTAMINATION AREA		
RADIOACTIVE MATERIAL AREA		
WASTE STORAGE AREA		

ATTACHMENT E (page 3 of 3)

SIGN INSERT TERMINOLOGY AND POSTING HIERARCHY

AREA[1]	CRITERIA	POSTING	J-SIGN TYPE
Controlled Area	Potential for Exposure to Radiation or Radioactive Materials	CONTROLLED AREA TLD BADGE REQUIRED FOR ENTRY	CAUTION
Very High Radiation Area	> 500 rad/hr	VERY HIGH RADIATION AREA SPECIAL CONTROLS REQUIRED FOR ENTRY	GRAVE DANGER
High Radiation Area	> 0.1 rem/hr and ≤ 500 rad/hr	HIGH RADIATION AREA	DANGER
Radiation Area	> 0.005 rem/hr and ≤ 0.1 rem/hr	RADIATION AREA	CAUTION
Hot Spot	5 Time the General Area Dose Rate and > 0.1 rem/hr	HOT SPOT	CAUTION
Airborne Radioactivity Area	> 10% DAC	AIRBORNE RADIOACTIVITY AREA	CAUTION
High Contamination Area	> 100 times Attachment A Limits	HIGH CONTAMINATION AREA	DANGER
Contamination Area	> 1 time, but ≤ 100 times Attachment A Limits	CONTAMINATION AREA	CAUTION
Fixed Contamination Area	No removable contamination and Total (fixed + removable contamination) < Attachment A Limits	FIXED CONTAMINATION	CAUTION
Radiological Buffer Area	Potential of the spread of Airborne Radioactivity or Removable Contamination	RADIOLOGICAL BUFFER AREA	CAUTION
Soil Contamination Area	Soil not releasable in accordance with DOE 5400.5	SOIL CONTAMINATION AREA	CAUTION

NOTE: This table represents the minimum required posting and in many cases would not be satisfactory as is - refer to procedure section 6.0 for more detailed guidance.

ISSUE AND REVISION RECORD

DATE OF CHANGE	REVISION NUMBER	AFFECTED PAGES	REASON FOR REVISION
04/26/91	0	ALL	Original issue of procedure.
01/22/92	1	ALL	5480.11/ORO Implementation.
06/60/92	2	ALL	Procedure revised to clarify review requirements, and update Department acronyms.
03/31/93	3	ALL	DOE Radcon Manual Implementation.