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**ERA REMOVALS & REMEDIALS ACTIONS  
NON-PROCESS AND SUSPECT REMOVAL PLAN  
(REV. 3)**

**03-27-90**

**WMCO/WMCO  
12  
WORK PLAN**

E R A  
*Removals & Remedial Actions*  
Non-process and Suspect Areas  
REMOVAL PLAN (REV. 3)

## I. Introduction

Some areas indentified during the site investigation for the RI/FS process for Facilities and Suspect Areas contain materials such that they may require immediate removal actions. These areas represent inactive sites which contain abandoned items from past useage for training, incineration, dumping, and/or other storage. These activities will be undertaken as such to render the area stable and present no further hazard to personnel or the environment until the RI/FS process has been completed to determine if further action is required.

The criteria identified for previous removal actions were 52 parts per million (ppm) total uranium and/or 46 ppm total thorium. These concentrations were adopted from the NRC Branch Technical Position as presented in the Federal Register on October 23, 1981, and are based on activity levels of 35 pCi/gm (picoCuries per gram) for depleted uranium, and 10 pCi/gm for thorium. Expression of the cleanup criteria for uranium in parts per million is done for convenience and the conversion calculations assume natural equilibrium of the major isotopes of uranium. The criteria conversion calculations, to concentration level in ppm for thorium, are based on evaluations of the relative concentrations of the various isotopes in samples collected at the sites. The calculations to convert the pCi/gm to ppm were the same as those set forth by Argonne National Laboratory, in their report on dose to source conversion. Their report, titled "Derivation of a Uranium Residual Radioactivity Guideline for the National Guard Armory in Chicago, Illinois", was submitted to the Department of Energy in May, 1987.

These criteria were used as removal action cleanup levels pending the development of final residual radioactivity guidelines for the FMPC through the risk assessment process of the ongoing site-wide Remedial Investigation / Feasibility Study (RI/FS). The selected criteria represent a conservative action level which are both protective of public health and the environment, and are consistent with DOE, NRC, and proposed USEPA policies and guidance.

The site-wide RI/FS is being performed at the FMPC for the purpose of selecting remedial action alternatives to address identified environmental concerns at the facility. A critical element of the RI/FS process is the completion of a comprehensive baseline risk assessment to evaluate the potential impacts associated with existing facility conditions and to define cleanup criteria for future remedial actions. Pending the final development and approval of definitive cleanup criteria through the RI/FS process, interim cleanup criteria must be developed to support removal

actions. Removal action cleanup criteria must be protective of human health and the environment and support final remedial activities.

## II. Background

### 1.0 SUMMARY OF POTENTIAL THREAT

As part of the on-going remediation efforts at the FMPC, the additional areas requiring cleanup or removal actions were identified through field surveys and historical files. Each of these sites may be a contributor to groundwater contamination.

#### North Area

The fire training area is located on the north side of the site outside the production area. Three sites within the training area are to be investigated, a fire training building, an oil fire pond, and a metal trough containing oil and water. Each of these areas are to be sampled for radiological and HSL analyses. The purpose is to determine if any oil or other hazardous materials used in the area have migrated into the soils surrounding the site.

#### East Area

An old incinerator which is located in the vicinity of the sewage treatment plant was used in the past for burning of refuse from the process area. The area surrounding the stack may have some levels of contamination resulting from particulate fallout. Historical rad level mapping has shown some indication of this possibility.

#### South Area

The South area has historically been used for flyash and other construction rubble/refuse disposal. A number of unidentified drums and other containers which were in various states of repair have been removed after monitoring as part of area cleanup. Localized areas which are identified during the RI/FS process must be characterized and removed to eliminate potential hazards and/or future inquiries as to their content or origin. The specific areas identified in the South Area are the Stormwater Outfall Ditch, Old Flyash Pile, Construction Debris, and other miscellaneous sites as identified.

#### Production Area

The production area is defined as all area within the perimeter fence. Non-process areas within the production area are mostly administrative with the exception of the laboratory which routinely handles various radionuclides. The subsequent handling and storage of these samples has left areas to the west of the laboratory contaminated. The area west and SW of the Laboratory building has been stripped of monitor detectable radionuclides by the Laboratory Expansion project of the EHSI line item

as part of site preparation. RI/FS engineering has received DOE concurrence in the site assessment and planned method of accomplishment. The scope of this work will not include any involvement in this area.

## 2.0 RELATED ACTIONS

This information is primarily obtained from the final report of the manhole 180 removal action. This will provide the basis for consistent policy on these removal actions.

Background concentrations for total uranium in the southwestern Ohio area have been estimated to range from 2.2 to 6.5 ppm, assuming natural equilibrium of the major isotopes of uranium (1). The same study identified Th-232 concentrations ranging from 6.5 to 7.3 ppm.

The soil characterization program in the vicinity of manhole 180 identified a localized area of soil with above background concentrations of total uranium and total thorium. On June 19, 1989, the FMPC completed the removal of approximately 125 cubic feet of soil from an approximate 64 square foot area immediately adjacent to manhole 180. Confirmatory soil samples were collected following completion of the excavation to provide certification data that the selected cleanup levels were attained at manhole 180. This cleanup activity was authorized by DOE as a "time - critical" removal based on its responsibility as the lead agency for removal actions described in section 300.415 of the proposed rule 40 CFR 300 "National Oil and Hazardous Substance Contingency Plan", 53 FR 51500-51502.

### Manhole 180 Removal Action Cleanup Criteria

During the manhole 180 removal action, the FMPC employed cleanup criteria of 35 pCi/g and 10 pCi/g for total uranium and total thorium, respectively. These residual radioactivity guidelines were adopted from the NRC Branch Technical Position as presented in the Federal Register on October 23, 1981. The 35 pCi/g was recommended by the NRC for residual material containing depleted uranium. The guideline for depleted uranium was selected on the basis of isotopic analysis of collected samples from the vicinity of manhole 180.

In order to provide an effective cleanup criterion consistent with established field and analytical protocols, the activity based cleanup criteria presented in the Branch Technical Position were converted to concentration guidelines. A removal action cleanup criterion of 52 ppm of total uranium in soil (dry weight basis) was derived for use at manhole 180 assuming natural equilibrium of the major isotopes of

- (1) "Determination of Concentrations of Selected Radionuclides in Surface Soil in the U.S."; T. Myrick - B. A. Berven & Fred Haywood, ORNL; Health Physics; Vol. 45 No. 3; September, 1983.

uranium (U-238, U-234). A concentration based cleanup level of 46 ppm total thorium in soil (dry weight basis) was derived based upon an evaluation of the relative concentrations of the major isotopes of thorium (Th-232 and Th-230) in the samples collected at manhole 180.

The NRC Branch Technical Position presents five options for the disposal or onsite storage of thorium or uranium wastes from past nuclear operations. Option 1 of the NRC Position paper proposes residual radioactivity guidelines for natural thorium and depleted and enriched uranium for properties with no future land use restrictions (2).

In addition, the activity concentration guidelines are sufficiently low so that no individual would receive an external exposure in excess of 10 microrentgens per hour above background. Background exposure rates in the southwestern Ohio area range between 7 and 10 microrentgens per hour (1).

Employing these radiation dose guidelines the NRC completed a pathway analysis to determine the residual radioactivity concentrations in soil which would limit dose to the maximally exposed individual to not more than that proposed by the U.S.E.P.A. This pathways model utilized a resident farmer scenario whereby an individual lives on and grows his crops on a large area containing a uniform concentration of the given radionuclides. The scenario also includes the consumption of groundwater from wells located within this area of uniform concentration. Table 4 provides a listing of the residual radioactivity guidelines presented by the NRC for Option 1 in its Branch Technical Position.

- (1) "Determination of Concentrations of Selected Radionuclides in Surface Soil in the U.S."; T. Myrick - B. A. Berven & Fred Haywood, ORNL; Health Physics; Vol. 45 No. 3; September, 1983.
- (2) Federal Register; Vol. 46 No. 205, October 23, 1981, p. 52062

The referenced document states as follows:

"Under this option the activity concentration of the isotopes are set sufficiently low so that no member of the public would be expected to receive in excess of 1 millirad per year to the lung or 3 millirad per year to the bone from inhalation and ingestion under any foreseeable use of the material or property."

Note: millirad is a unit of absorbed dose. The unit millirem is typically used when addressing radiation dose to humans. A millirem, which is a unit of dose accounting for the relative biological damage due to the type of radiation involved, is equivalent to 1 millirad times a quality factor. The quality factor for alpha radiation from sources like uranium is 20.

**TABLE 1**  
**NRC Option 1 Guidelines for Uranium and Thorium**

Kind of material	Concentration (pCi/gm)
Natural thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium-----	10
Depleted Uranium-----	35
Enriched Uranium-----	30
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium-----	10

Pathways of exposure evaluated by the NRC included direct radiation from ground surfaces, ingestion of contaminated food, inhalation of suspended radionuclides and drinking contaminated water. The pathways analysis methodology employed by the NRC was consistent with nuclear industry accepted protocols and can be found in detail in Radiological Assessment: Textbook on Environmental Dose Analysis; John E. Till and H. Robert Meyer; NUREG/CR-3332; September, 1983. Example pathway analyses may be calculated for two scenarios:

1. Radiation Doses to Man Via Grazing Cow Pathway
2. Radiation Doses to Man Via Food Crop Ingestion Pathway

The dose calculations completed as part of the pathways analysis considered both internal and external exposures resultant from the residual radioactivity. All internal doses were based upon a 50-year dose commitment; that is, the total dose an individual would receive from one year of intake integrated over the next 50 years of his/her life. Exposures were assumed to continue on an annual basis over the life of the individual. Internal dose conversion factors (used for converting internal exposure to dose) were consistent with the International Commission on Radiological Protection (ICRP, Report # 30) guidelines for internal dose conversion.

Technical Justification

Definitive residual radioactivity standards for long lived isotopes such as uranium and thorium have not, as yet, been established by the DOE, NRC or USEPA. To this date definitive guidance on the subject has not been issued by either the ICRP or the International Atomic Energy Agency. USEPA standards (40 CFR 192) have been established for the control of residual radioactivity at designated processing or depository sites under Section 108 of the Uranium Mill Tailings Radiation Control Act of 1978.

This federal regulation establishes a maximum allowable residual radioactivity concentration standard for radium-226 and radium-228 in soil at unrestricted use sites. These standards were developed based upon pathways modeling assuming natural equilibrium of all the daughters of the parent radionuclides uranium-238 and thorium-232. These standards are of limited use at facilities such as the FMPC where processing operations have, for the most part, involved pure uranium and thorium compounds essentially free of radium and its daughter products.

Implementing DOE guidance on 40 CFR 192 provide that the remedial criteria for residual concentrations in soil of all radionuclides other than radium-226 and radium-228 shall be derived by means of an environmental pathways analysis using site specific data. Such a site specific pathways model is being completed at the FMPC as part of the ongoing site-wide RI/FS. Since such analyses have not been completed at the facility, the residual radioactivity guidelines defined in the 1981 NRC Branch Technical Position paper were adopted for use at the FMPC to support the soils removal action at manhole 180. These criteria were selected because they represent conservative actions levels which are both protective of human health and the environment and are consistent with proposed USEPA guidance.

As stated above, the risk based activity concentration guidelines presented in the NRC Branch Technical Position paper are set sufficiently low so that no member of the public would receive a radiation dose commitment from the residual radioactivity in excess of 1 millirad per year to the lungs or 3 millirads per year to the bone from inhalation and ingestion, under any foreseeable use of the property. These radiation dose guidelines were recommended by the USEPA for protection against transuranic elements present in the environment as a result of unplanned contamination (3). The current USEPA standards defined in 40 CFR 192.12 for uranium mill tailings remedial activities were developed based upon comparable dose commitments to the maximally exposed individual.

In addition, the NRC guidelines are set sufficiently low so that no member of the public will receive an external dose in excess of 10 microrentgens per hour above background. Current USEPA regulations in 40 CFR 192.12 limit the level of external radiation from residual radioactive materials to twice this level or 20 microrentgens per hour. Thus, the risk based criteria for residual radioactivity concentrations of long half-life radionuclides such as uranium and thorium as defined within the NRC Branch Technical Position provide conservative action levels employing dose commitments which are comparable to current USEPA guidance.

(3) 42 FR 60956-60959, November 30, 1977

As previously stated, the pathway model employed by NRC in developing its residual radioactivity guidelines utilized a resident farmer scenario. This scenario is based upon an area of sufficient size to allow the individual to reside and grow crops in the uniform concentration of the radionuclides.

A residual radioactivity criterion of 35 pCi/g of total uranium in soil was recently employed in the cleanup of several private properties in the U. S. The criterion was employed in the cleanup and unrestricted release of properties in the vicinity of the NL Industries uranium fabrication facility in Colonie, New York. Remedial actions were completed at the Colonie site as part of the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP). This criterion was employed as a result of a negotiated agreement between the DOE and the State of New York.

The 35 pCi/g criterion was also employed in the cleanup and unrestricted release of two commercial facilities owned by Aerojet, Inc. These facilities were located in Jonesboro, Tennessee and Compton, California. In both cases the cleanup criteria employed were as a result of a negotiated agreement between the property owner and the respective State authorities.

Conclusion

Definitive criteria for residual radioactivity of long half-life radionuclides such as uranium and thorium have not as yet been established by the DOE, NRC, or the USEPA. Current DOE guidance recommends the establishment of uranium and thorium residual radioactivity guidelines through site specific pathway modeling. Site specific pathway modeling is currently underway at the FMPC as part of the ongoing site-wide RI/FS. In order to support the objectives of removal actions at the FMPC, the proposed criteria presented in the 1981 NRC Branch Technical Position paper as presented in the Federal Register on October 23, 1981 will be used. These criteria have been employed throughout the country in similar situations involving the cleanup of private properties for unrestricted use. The criteria defined within the NRC Branch Technical Position were employed for the manhole 180 removal action as they represent conservative action levels which are both protective of human health and the environment and consistent with proposed USEPA guidance.

3.0 ROLES OF PARTICIPANTS

Executive Order 12580 delegates Section 104 response authority to DOE for DOE sites. The state and local roles have been on of participation in the negotiations of the CERCLA Consent Agreement and technical information exchanges, and identification of state and local ARAR's. The agreement between DOE and USEPA is currently being reviewed.

4.0 PROPOSED REMOVAL ACTIONS

The actions to be taken will be consistent with the Preliminary Assessment and the Action Memorandum.

**III. Preimplementation Activities**

The inactive sites which contain abandoned items from past useage for training, incineration, dumping, and/or other storage may require immediate removal actions. The activities to be undertaken prior to implementation of removal actions are preliminary assessment of the site, decision as to the type of action, and approval of the work plan for that action.

The proposed objectives of this work are as follows:

- 1. Perform any and all necessary cleanup and repair work to the identified areas.
- 2. Remove all containers present before, during, and after cleanup to an appropriate FMPC location for future treatment and/or disposal.
- 3. Remove soils, contaminated with levels of uranium or other radionuclides above criteria levels, from the areas and replace with uncontaminated soil as necessary.
- 4. Store the contaminated soil on the FMPC site, in a confined condition, for future treatment and/or disposal.

The following distinct engineering phases will be performed to provide the necessary definition for development of accurate scope, cost, and schedule documents:

- 1. Project Planning Action: WMCO
  - a. Planning and Coordination
    - (1) Project Team
    - (2) Reviews and Approvals
  - b. Proposed Plan
    - (1) Finalized Plan
    - (2) Milestone Schedule
  - c. Evaluation of Action Taken
    - (1) List of Criteria
    - (2) Field Sampling
    - (3) Final Report

2. Area Identification Action: WMCO

- a. Boundary Definition
  - (1) Geographic Breakdown
  - (2) Field Marking Plan
  - (3) Documentation
- b. Field Investigation
  - (1) Field Survey
  - (2) Field Sampling
  - (3) Documentation

3. Removal Criteria Action: ASI

- a. Determination of Requirements
  - (1) Regs & ARAR's
  - (2) Field Work
  - (3) Verification
- b. Development of Feasible Solution
  - (1) Alternatives
  - (2) Cost & Schedule
  - (3) Concurrence
- c. Data Analysis
  - (1) Historical
  - (2) New Sample
  - (3) Accuracy

4. Site Work Action: WMCO

- a. Method of Accomplishment
  - (1) Equipment
  - (2) Training
- b. Preparation and Implementation of Procedures
  - (1) Draft SOP
  - (2) Approval
  - (3) Verification
- c. Work Evaluation
  - (1) Adherence to Plan
  - (2) Verification Samples
  - (3) Analysis of Results

#### IV. SAMPLING AND ANALYSIS

The field activities will follow the RI/FS sampling plan to include those actions necessary to obtain samples for analysis to further characterize the affected area. This will specifically include additional sampling as determined during the Preliminary Assessment.

##### POST EXCAVATION CERTIFICATION SAMPLING

The position of the certification samples taken right after the excavation was completed shall be carefully documented as to all requirements. A detailed sampling and analysis plan will be prepared. The samples are to be analyzed by approved methods and analytical results of the certification sampling are to be reviewed as to the effectiveness of the removal action and included in the final site report.

#### V. FIELD REMOVAL ACTIONS

The field activities will be those removal actions necessary to control or otherwise stabilize the affected area. This will specifically include the actions necessary to accomplish the work for compliance with CERCLA.

The activity will begin only after the preliminary assessment, action memorandum, and the work plan are approved and personnel training is complete. The layout of the site and the method of accomplishment are key factors in keeping on schedule and within budget.

The containers used and the method of loading will be determined by the level of contaminated material to be removed. The excavated soils are transported to the appropriate FMPC site, and placed in storage after assurance of proper packaging. The excavated area is required to be functionally restored with clean soil for the backfill process. The area will be appropriately graded and provided with erosion control measures.

##### North Area

The fire training area is located on the north side of the site outside the production area. Three sites within the training area are to be investigated, a fire training building, an oil fire pond, and a metal trough containing oil and water. Each of these areas are to be remediated by identification, removal, packaging, and disposal of the contaminated soil and/or equipment.

##### East Area

An old incinerator which is located in the vicinity of the sewage treatment plant was used in the past for burning of refuse from the process area. The area soils surrounding the stack will be remediated by sampling, removal, packaging, and disposal of contamination resulting from particulate fallout. The incinerator equipment will be removed or contained depending on the results of the preliminary assessment.

South Area

The South area has historically been used for flyash and other construction rubble/refuse disposal. A number of unidentified drums and other containers which were in various states of repair have been removed after monitoring as part of area cleanup. Localized areas which are identified during the RI/FS process must be characterized and removed to eliminate potential hazards and/or future inquiries as to their content or origin. The specific areas identified in the South Area are the Stormwater Outfall Ditch, Old Flyash Pile, Construction Debris, and other miscellaneous sites as identified.

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The production area is defined as all area within the perimeter fence. Non-process areas within the production area are mostly administrative with the exception of the laboratory which routinely handles various radionuclides. The subsequent handling and storage of these samples has left areas to the west of the laboratory contaminated. The area west and SW of the Laboratory building has been stripped of monitor detectable radionuclides by the Laboratory Expansion project of the EHSI line item as part of site preparation. RI/FS engineering has received DOE concurrence in the site assessment and planned method of accomplishment. The scope of this work will not include any involvement in this area.

**VI. HEALTH AND SAFETY PLAN**

A safety analysis is to be prepared for the planned activity. A site specific Health and safety Plan shall be developed for the planned activity and shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous operations. The site specific requirements will be prepared with the final work plan.

**VII. QUALITY ASSURANCE**

The overall quality assurance program at the FMPC is described in the site Quality Assurance Plan, FMPC 2139. The Quality Assurance Plan is based on the criteria specified in ASME NQA-1, Federal EPA Guideline QAMS-005/80 and DOE Orders 5700.6 and 5400.1. Specific quality assurance requirements will be incorporated into written and approved procedures and during personnel training. The Quality Assurance Department will conduct periodic surveillances to verify compliance.

ATTACHMENT I

Schedule Plan

General

All areas will require similar documentation and control procedures. This will include some or all of the following:

ACTIVITIES

- Historical review
- Soil sampling
- Lab analysis
- Data analysis
- Contamination removal
- Contamination control
- Reporting

MILESTONES

ACTION

DATE

- |                                     |          |  |
|-------------------------------------|----------|--|
| Draft plan for comment              | Issue    |  |
| Preliminary assessment              | Issue    |  |
| Action memorandum                   | Issue    |  |
| Final work plan to DOE              | Issue    |  |
| Grid sampling                       | Start    |  |
| Sample analysis                     | Complete |  |
| Training and SOP's                  | Complete |  |
| Contamination removal and packaging | Complete |  |
| Certification samples               | Complete |  |
| Complete records and reports        | Issue    |  |
| Closeout                            | Complete |  |

- NEED TO DEVELOP SPECIFIC ACTIONS FOR EACH AREA -