DENVER RADIUM SUPERFUND SITE
OPERABLE UNIT IV/V
FIVE YEAR REVIEW REPORT

PREPARED
BY
REGION VIII
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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 Acting Regional Administrator

9/30/83 Date
I. BACKGROUND

INTRODUCTION

Region VIII of the United States Environmental Protection Agency (EPA), has conducted a Five-Year Review and prepared this report in accordance with the requirements of Section 121(c) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended and Section 300.430(f)(4)(ii) of the National Contingency Plan (NCP). Operable Unit IV/V (OU IV/V) of the Denver Radium Superfund Site deals exclusively with radiologic contaminants found on the site and their remediation. Heavy metals contamination on-site and their remediation are addressed under Operable Unit IX (OU IX) of the Denver Radium Site.

This Five-year review is intended to evaluate whether the response action taken remains protective of public health and the environment. The purpose of this review is to confirm that the remedy remains effective. If the review determines the remedy is no longer protective, appropriate action to correct the remedy may be initiated. Deletion of the site from the National Priorities List (NPL) does not affect the need for five-year reviews or prevent restoring the site to the NPL without application of the Hazard Ranking System (HRS).

OU IV/V, is located at 500 South Santa Fe Drive (See Figures 1 & 2) in south-central Denver, Colorado and includes two properties: 1) the Robinson Brick Company (Robco – Operable Unit IV); and 2) a railroad right-of-way owned by the Denver & Rio Grande Western Railroad (D&RGW – Operable Unit V). Although originally designated as separate Operable Units in 1984, the properties were addressed together in a Remediator Investigation Feasibility Study (RIFS) and in the Record of Decision (ROD) issued by EPA on September 30, 1988.

SITE HISTORY

The Robco property was the site of a radium processing facility established by the National Radium Institute (NRI) in 1913. The NRI facility was created for the purpose of developing and demonstrating the commercial feasibility of radium extraction techniques. This facility operated on the site for approximately four years and then shut-down after producing 7.5 grams of radium and successfully demonstrating commercially feasible extraction processes. Robco later acquired the property and used it as a brick and tile manufacturing site from approximately the mid-1940's to the mid-1980's. Robco ceased operations at this 17.3 acre site and now conducts its business from other locations.

The radium contaminated area of the D&RGW right-of-way covers 1.6 acres. This property is crossed by several main rail lines and sidings and contains a complex network of electronic controls to operate railway lights and switches.
Figure 1. Denver Radium Operable Units
The Robco and D&RGW properties were added to the National Priorities List (NPL) as part of the Denver Radium Site, in September 1983.

REMEDIAL OBJECTIVES

A Record of Decision for Operable Unit IV/V was issued by EPA on September 30, 1986. EPA's preferred alternative and the remedy selected was removal and permanent off-site disposal of radiologic contaminated materials above the cleanup standards found in 40 CFR, Section 192.12. The objectives of this remedy were to prevent: 1) radiation exposure due to inhalation of radon gas and its daughter products; 2) radiation exposure due to inhalation and ingestion of long-lived radionuclides; and 3) direct exposure to gamma radiation.

At the time the ROD was signed, there were no disposal facilities in the nation that accepted radium waste. For this reason, the ROD included temporary on-site storage and stabilization measures to be implemented while EPA and the State of Colorado searched for a permanent repository. During the programs remedial design phase, EPA learned that a commercial facility in Utah was expected to be licensed to accept radium contaminated soil and debris.

EPA and the State of Colorado entered into a State Superfund Contract (SSC) for remedial implementation at the Denver Radium NPL site on May 1, 1988.

SUMMARY OF REMEDIAL ACTION

Remedial action operations at OU IV/V included the following: 1) excavation of radium-contaminated soils to meet target residual levels established in 40 Code of Federal Regulations (CFR), Part 192; 2) the demolition of certain radium-contaminated buildings; 3) the analysis of the contaminated materials to be disposed of to ensure compliance with transportation regulations; and 4) load-out and shipment of contaminated materials to the permanent off-site facility.

Phase A

A total of 57,586 tons of radiologic-contaminated material were excavated during this phase of the cleanup. This material was temporarily stockpiled on-site during the period the transportation and disposal contract was being negotiated. The stockpile was stabilized with an encrusting agent while awaiting load-out. A soil deposit containing elevated levels of Thorium-230 was discovered during Phase A excavation. This Thorium-230 deposit was subsequently removed during a later phase of this project.
Phase B

The stockpiled material as well as an additional 9,677 tons of contaminated material situated immediately below the stockpile were shipped during this phase of the Cleanup. Total tons excavated and shipped during Phases A and B amounted to 67,263.

Phase C

During this phase, a total of 29,721 tons of radiologic-contaminated material were excavated and shipped to the off-site repository. Of this total, 2,100 tons represented RCRA characteristic/exempt material. Approximately 1,290 tons of thorium-contaminated waste material were also removed and shipped during this phase.

Remedial action operations commenced at OU IV/V on April 25, 1988 and were completed nearly three years later on March 14, 1991. During this period, a total of 96,984 tons of radiologic-contaminated material were excavated and shipped to an off-site disposal facility at a remedial design, construction and disposal cost of $22,900,000. EPA signed a Remedial Action Completion Report for OU IV/V on September 30, 1991.

Radium-contaminated soils with concentrations exceeding target residual levels were left in place below the ground water table of two areas situated in the western portion of the Robco property as described above.

The remedy as implemented, differs in several respects from the remedy chosen in the 1986 ROD. These differences are as follows:

Difference 1  All radium deposits above the numerical standards in 40 CFR162 were not removed. Radium and Thorium-230 deposits that lie below groundwater were left in place. Such areas would have to have been dewatered prior to excavation. Treatment of the water prior to discharge makes the remedial action unreasonably costly relative to the long term benefits. The residual radioactive material left in place at the Site meets the criteria for the application of supplemental standards. The residual radioactive materials do not pose a clear present or future hazard.

Difference 2  Soils containing elevated concentrations of Thorium-230 were discovered during remedial action. EPA determined that it was necessary to remove the Thorium-230 contaminated soils since Thorium-230 degrades into radium. The cleanup goal for Thorium-230 was established by using the radionuclide decay equations to calculate the maximum
concentration of Thorium-230 that could be left in place in order to ensure the cleanup standard for radium would not be exceeded within 1,000 years. The cleanup level attained assured that the cleanup standard for radium would not be exceeded for 920 years.

**Difference 3**  The volume of radium-contaminated soils removed (96,984 tons) was almost nine times greater than the amount estimated in the 1986 ROD (11,000 tons).

**Difference 4**  Several shipments of radioactive-contaminated soils (2,100 tons) failed the EP Toxicity test for lead and cadmium. This indicated the waste was a RCRA characteristic waste which could not be placed in a landfill without treatment. This waste was found to be exempt from RCRA based on the Bevill Amendment. The Bevill Amendment excludes mining waste from RCRA regulations.

### II SITE CONDITIONS

#### SUMMARY OF FIVE-YEAR REVIEW

This five-year Statutory Review was conducted according to procedures in OSWER Directive 9355.7 –02, Structure and Components of Five-year Reviews. Activities included in this review were as follows:

- Review of site related documents and agreements;
- ARARs review;
- Site visit and inspection;
- Preparation of five-year review report.

Documents reviewed for this report included the following:

- Superfund Record of Decision, Operable Units IV/V, 1986
- Explanation of Significant Differences (Draft), Operable Units IV/V, 1993
- Remedial Action Completion Report, Operable Units IV/V, 1991
- Closeout Report Operable Units IV/V, 1991
- Closeout-Report Operable Units IV/V, 1992
- Final Draft, Remedial Investigation, Denver Radium Site, 1986
- Final Feasibility Study, Operable Units IV/V, 1986

#### RESULTS OF FIVE-YEAR REVIEW

Remedial Action activities began at Operable Unit IV/V on February 25, 1988. A Statutory five-year Review is required no less often than every five years after initiation of the selected remedial action. A "Level I", five-year Statutory review was undertaken at Operable Unit IV/V early in 1993 and completed in September 1993. The purpose of this five-year review was to
evaluate whether the remedial response action taken remains protective of public health and the environment.

ARARs REVIEW

As an integral part of this five-year review, a detailed assessment of existing ARARs was made. Pertinent ARARs applicable to this Operable Unit include the following:

1) EPA standards for remedial action at inactive uranium processing sites - 40 CFR, Part 192.12

2) Supplemental Standards - 40 CFR, Sections 192.21 and 192.22

3) Supplemental Standard, Area B-1 on DRGWR property - 40 CFR, Section 192.21 (c)

4) Radon daughter concentration in buildings - 40 CFR, Section 192.12(b)

5) Colorado Department of Health, radiation control - CRS 25-11-1 et seq.

6) National Committee on Radiation Protection and Measurements (NCRP) and International Commission on Radiological Protection (ICRP) guidelines

7) The Colorado Historical Society, historic preservation - 36 CFR, Part 800

Since the ROD was issued, there are no new or modified ARAR's which bring into question the protectiveness of the chosen and implemented remedy.

SITE VISIT AND INSPECTION

A Site visit and inspection was held for OU IV/V in early September, 1993. The purpose of this Site visit and inspection was an in-depth assessment of the remediation completed at OU IV/V and to determine its current status. Remedial operations on portions of OU IX (Robco-Metals) remain to be completed. However, it was determined that the remedial construction undertaken at OU IV/V remains intact and the remedy is protective of human health and the environment. No areas of noncompliance were observed. The Colorado Department of Health contact for this operable unit is Larry Bruskin (303-692-3384).

RECOMMENDATIONS

A. Statement of Protectiveness

An application to the supplemental standards (40 CFR Part 192) is
being prepared for the radiological contamination which remains on the Site. This contamination is located below the long-term average depth to groundwater. Institutional controls may be required as part of the application to the supplemental standards.

No modifications or improvements to the remedy that was implemented are required. This remedy remains protective of public health and the environment.

B. Next Five-year Review

A five-year review will be conducted in 1998 or earlier by EPA and no less often than every five years thereafter unless existing on-site radiologic contamination is removed to allow unrestricted access and unlimited use of the property. Future reviews will entail a Site visit and inspection to review the status of the implemented remedy and determine its protectiveness of human health and the environment.

FCD: September 22, 1993, Elkington, R.B.,