Rocky Flats Environmental Technology Site

Integrated Monitoring Plan
Background Document

Soil Monitoring

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6.0 SOIL MONITORING

6.1 Introduction

6.1.1 Contaminant History

Since nuclear materials were first processed at the Rocky Flats Environmental Technology Site (RFETS or the Site), the potential for dispersing contaminants into the atmosphere and onto the soils within the Industrial Area and throughout the Buffer Zone has existed due to the inherent hazards associated with handling and processing nuclear materials. Three events at the Site contributed widespread, observable radionuclide contamination of soils: the 1957 fire in Building 771, the 1969 fire in Building 776 and, most significantly, the release of contaminated cutting fluids into soils on the 903 Pad in the 1960s. The latter event culminated in the dispersion of measurable quantities of radionuclides [mostly plutonium (Pu) and americium (Am) isotopes] into the eastern Buffer Zone and off-Site areas previously identified as OU2 and OU3, respectively.

Soil "hot spots," regions of localized radionuclide contamination, are found in the Industrial Area and in some parts of the Buffer Zone. These hot spots are a result of spills, burial of contaminated drums and debris (such burial was standard operating disposal practice in the 50s and 60s), and runoff from other contaminated source areas.

Process buildings are also potential sources of contamination. However, high-efficiency particulate air (HEPA) filtration on the effluent stacks and vents of process buildings has controlled these potential emissions to the extent that this source of contamination is not considered a major contributor to surface soil contamination on and around the Site during routine operating conditions.

In addition, sediments in process-water ponds (primarily the Solar Evaporation Ponds) and surface water detention ponds (A, B, and C Series Ponds; used primarily for detention of stormwater runoff from the Industrial Area and treated sanitary waste effluent) are contaminated with radionuclides to varying degrees. These ponds hold contaminated sediments and are a potential source of contamination to subsurface soils and stream beds downstream of the ponds.

6.1.2 Existing Soil Contaminant Information

The history of spills and contaminant dispersion events at the Site is most accessible in the report commissioned by the Colorado Department of Public Health and Environment (CDPHE) entitled *Rocky Flats History - Rocky Flats Toxicologic Review and Dose Reconstruction Task 3/4 Report* (ChemRisk, 1992). Background soil contamination at the Site is primarily attributable to global fallout from atmospheric testing of nuclear weapons.

In addition, a rich database exists from which to determine the contaminant dispersion profiles at and around Rocky Flats. Surveys to determine the extent of contamination in surface soils were performed extensively in the 1970s and 1980s, and routine monitoring of surface soils was performed from 1972-1977 and 1984-1994 with limited sampling from 1978 to 1983. While such data cannot identify all areas of contamination, the results provide a good perspective on contaminants that were dispersed through larger airborne events. Limitations in survey data are related to specific hot-spots of contamination, which may exist due to burials and localized spills of contaminated materials. Many such locally contaminated areas have also been characterized during the environmental investigations of the early 90s. A discussion of soil sampling methods is discussed in *Rocky Flats Plant Final Environmental Monitoring Plan*, 1992.

The routine survey data reveal dispersed on-Site Pu 239 contaminant concentrations which range (averaging data from each location over the period of 1984 to 1994) from 11 picrocuries per gram (pCi/g) down to 0.06 pCi/g (near background level) with highest concentrations found east and east-southeast of the 903 Pad. Fence-line concentrations in the surface soil range from 5 pCi/g down to 0.24 pCi/g along the Indiana Street perimeter, again with the higher concentrations to the east and east-southeast of the 903 Pad. Along the west, north and south perimeter fences, near-background concentrations are generally observed. Soil sampling results are presented in *Rocky Flats Plant Final Environmental Monitoring Plan*, 1992 (EG&G, 1992).

6.2 Site-Wide Soil Monitoring

Inherent to the issue of contaminant dispersion in the environment are several questions:

- Are the contaminants continuing to be dispersed such that the environment is being further degraded?
- Are the contaminants that are present in the environment being redistributed in some manner that is important to the environment or public health?
- What level of environmental damage has resulted?
- Is the environment recovering from the original insult?

These questions can generally be answered only on a media-specific basis; the data quality objectives (DQOs) for monitoring to determine environmental impact depend on the sensitivity of the medium being measured and the purpose of the investigation. For example, a regulatory threshold to which soil emissions contribute, such as an air dose to the public or surface water concentration, may be quite different than the threshold for measurable impact on an animal species through ingestion from plant uptake. For this reason, soil investigations have more recently been focused on project-specific potential to impact regulatory standards.

As noted earlier, a routine Site-wide soil monitoring program was conducted for many years at the Site, with sampling performed by both CDPHE and Site personnel. The 11 years of data reviewed in the *1994 Annual Site Environmental Report* (Kaiser-Hill, 1995) do not indicate any changes or trends in soil contaminant levels that would be attributable to redistribution of the contaminants over the multiple-year time-scale. Should significant releases, or other events (or project requirements) at the Site suggest a need to recharacterize the generalized distribution of contaminants, routine soil monitoring could be revisited.

6.3 Project-Specific Soil Characterization Sampling

In addition to the general characterization of contamination in the environment, the Site frequently has requirements to characterize the immediate area around project activities that will disturb potentially contaminated soils. Requirements for such project-specific sampling are generally defined at the time the project is being planned, and will follow guidelines specified in the soil disturbance permitting procedures (1-B37-HSP-12.08, Excavation and Trenching and 1-F20-ER-EMR-EM.001, Environmental Approval Process for Construction/Excavation Activities) and soil sampling procedure (4-F99-ENV-OPS-FO.20), or in other less generic project plans. Many soil samples were collected in the early 1990s to characterize the contaminant dispersion around suspected burial and spill areas. These site characterization samples were used, along with the routine data, to generate a detailed contaminant dispersion map, featuring isopleths that present the contaminant dispersion profiles around the Industrial Area. Figure 6-1 is an example of these isopleths, showing Pu concentrations in this example. As with the routine samples, the general trend is for the highest concentrations to be found near and to the east and east-southeast of the 903 Pad with isolated hotspots located near other historical release areas.

Under the *Rocky Flats Cleanup Agreement* (RFCA) (DOE et al., 1996), this kind of sampling is defined through the project Proposed Action Memorandum (PAM) or an Interim Measure/Interim Remedial Action (IM/IRA) Plan, and the Field Implementation Plan (FIP) or Sampling and Analysis Plan (SAP). The contents of such plans include results of searches of historical records, identification of sampling locations and results from pre-project surveys, and specifications for sampling of soils in the project area.

6.4 Source Identification Sampling

Under RFCA, it may become appropriate to further investigate the soils in the vicinity of a surface water exceedance point or stream in order to characterize the nature of the potential contaminant sources in that area. These investigations will have spatial extent determined primarily by assuming the probable reach of contaminants that could influence the exceedance point. These investigations will otherwise be similar to the methods used to characterize soils around some project-specific activity. Soil and sediment samples are managed under procedure 4-F99-ENV-OPS-FO.23.

6.5 Outstanding Issues—Actinide Migration Study

Questions remain regarding the immediate and long-term potential for contaminated soils to disperse from the Site. These questions are being evaluated in a long-term study that is investigating actinide migration pathways and characteristics. These Actinide Migration Studies may result in the identification of additional soil data needed to facilitate the investigation. Such data needs, while not expected to result in a routine soil monitoring program, may result in short-term, more project-specific soil sampling. In the long term, the results of the study may point to long-range monitoring strategies for determining the efficacy of clean-up activities or to other parameters that must be characterized more routinely.

6.6 References

ChemRisk, 1992, *Rocky Flats History - Rocky Flats Toxicologic Review and Dose Reconstruction Task 3/4 Report* commissioned by the Colorado Department of Public Health and Environment.

EG&G, 1992. *Rocky Flats Plant Final Environmental Monitoring Plan.* Golden, Colorado.

Kaiser-Hill Company, L.L.C., 1995. *1994 Annual Site Environmental Report*. Golden, Colorado.

U.S. Department of Energy, Colorado Department of Health and Environment, and U.S. Environmental Protection Agency, 1996. *Final Rocky Flats Cleanup Agreement*, July.

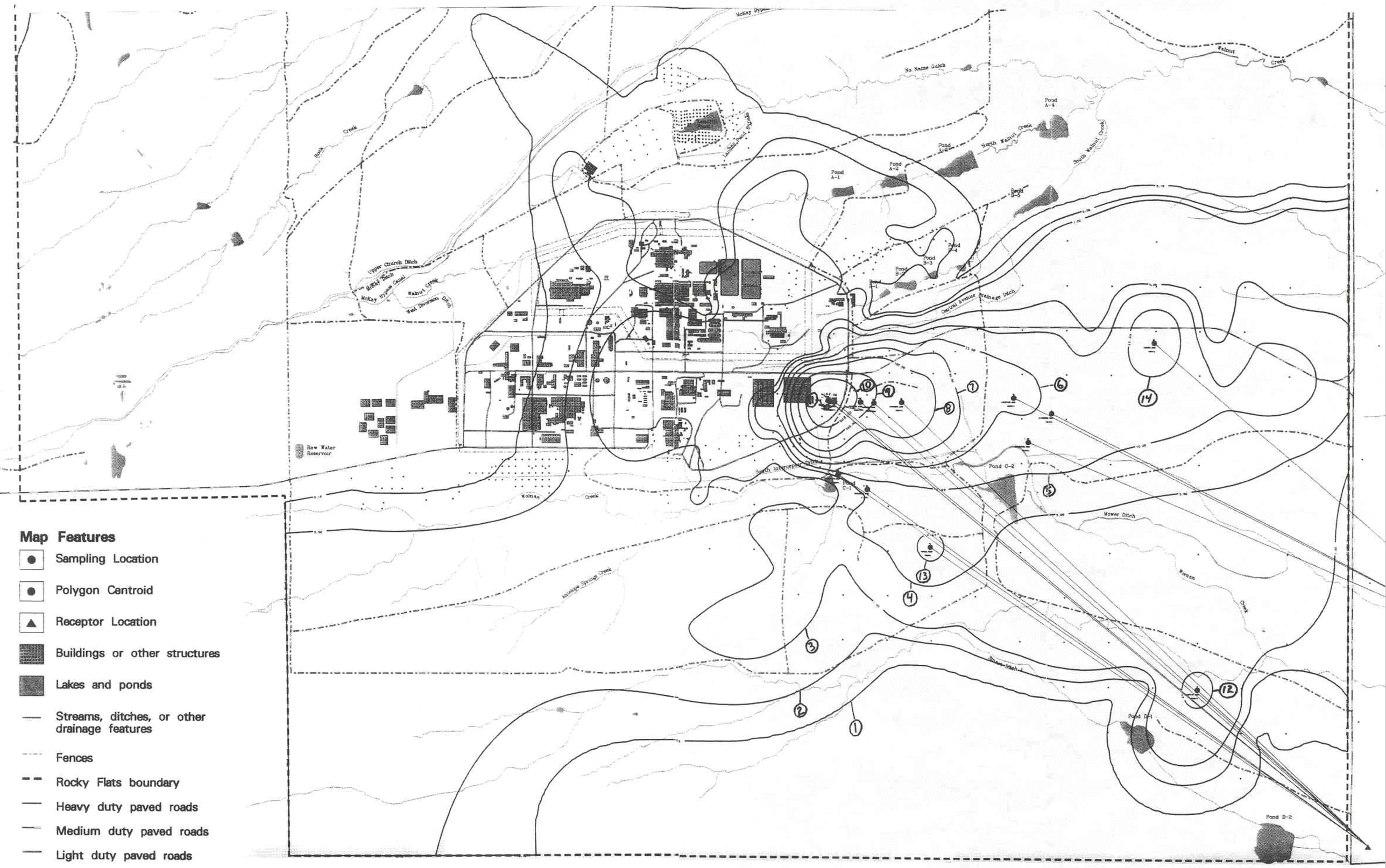

Figure 6-1
Example Soil Isopleth Map -
Pu-239/240 Concentrations of Surface Soil Sample