

REMEDIAL WASTE MANAGEMENT PRACTICES RESULTING IN THE DECLINE OF AIRBORNE
PLUTONIUM ADJACENT TO A LIQUID WASTE DISPOSAL DITCH AT THE HANFORD SITE

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ABSTRACT

Ambient air sampling at the 216-Z-19 Ditch identified the need for interim stabilization (a waste management procedure that includes covering with soil and revegetation) of the site. The 216-Z-19 Ditch, a low-level liquid waste disposal ditch in the Hanford Site 200 West Area, received multigram quantities of $^{239,240}\text{Pu}$ during its 10-year service history (1971 to 1981). Since 1977 there has been an ambient air sampler stationed near the head end of the ditch. This station consistently measured elevated levels of $^{239,240}\text{Pu}$ (ranging from a concentration of 0.003 to 0.044 picocurie per cubic meter (pCi/m^3) with an average of $0.015 \text{ pCi}/\text{m}^3$). Resuspension of the plutonium in the ditch soil was determined to be the source of these elevated levels. Through the use of temporary, site-specific air sampling stations near the ditch, it was determined that these levels were limited to the head end of the ditch. Following interim stabilization of the ditch, the levels of $^{239,240}\text{Pu}$ in air declined to less than 1% of their former levels and are now at Hanford background levels ($0.00008 \text{ pCi}/\text{m}^3$).

INTRODUCTION

Rockwell Hanford Operations (Rockwell), as a prime U.S. Department of Energy (DOE) contractor, manages the fuel reprocessing and radioactive waste management facilities in the Hanford Site 200 Areas. The Hanford Site is located within the Pasco Basin in southeastern

Washington State, ~270 km southeast of Seattle and 200 km southwest of Spokane (Fig. 1). The 200 Areas are approximately in the center of the Hanford Site, 11 km south of the Columbia River. Rockwell conducts an environmental surveillance program to determine overall impact of operations and waste management practices on the environment of the 200 Areas at the

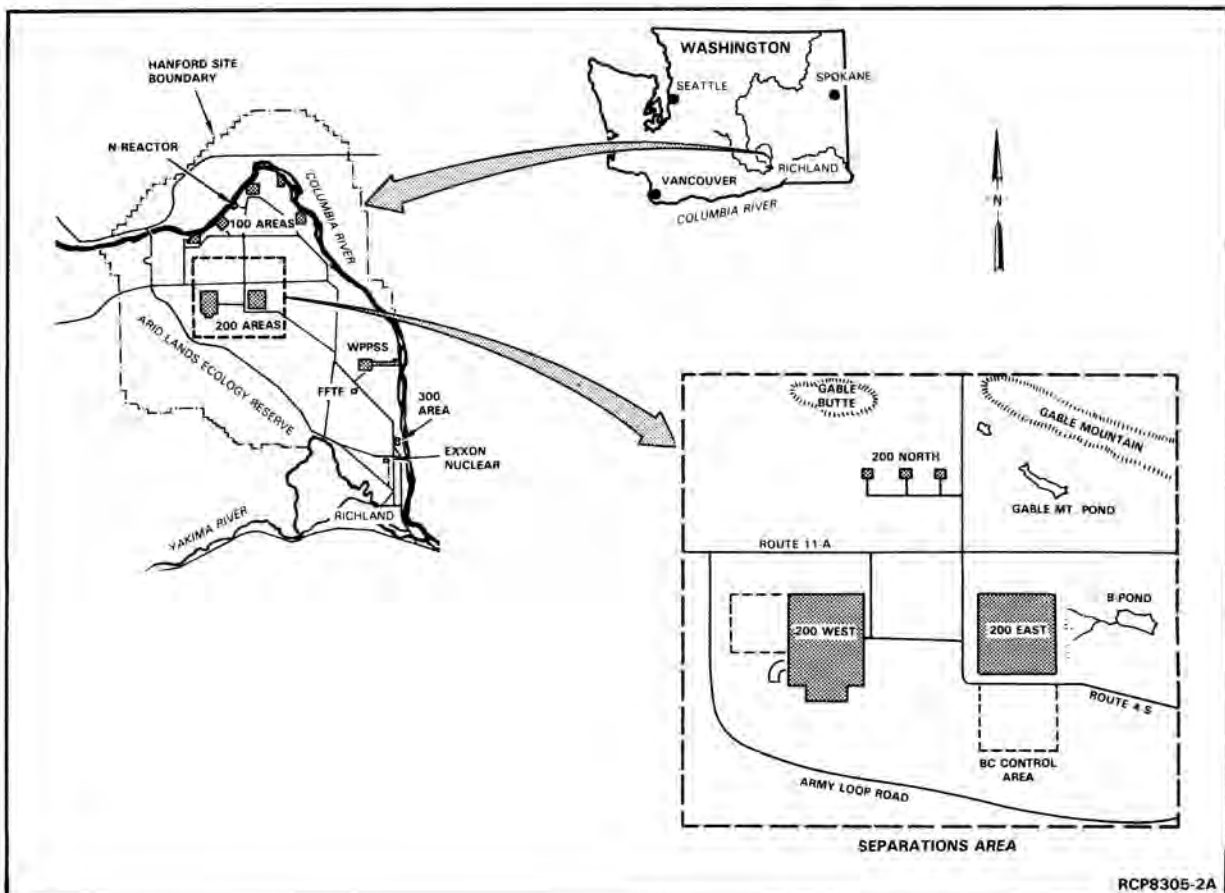


Fig. 1. Separations Area of the Hanford Site.

Hanford Site. As a part of this surveillance program, 37 permanent environmental air sample stations are positioned in and around the 200 Areas.

One of these sample stations, located at the head end of the 216-Z-19 (Z-19) Ditch in the 200 West Area, has detected elevated levels of $^{239,240}\text{Pu}$ in the air in past years. ¹

HISTORY

The Z-19 Ditch, located in the southwest quadrant of 200 West Area (Fig. 2), was 850 m long and ~2 m wide. It received low-level liquid waste from the 231-Z and 234-5Z complexes and transported it to the 216-U-10 Pond. The open ditch was active from 1971 through the end of 1981 when it was replaced by the 216-Z-20 Crib.

The 10-yr service history for the Z-19 Ditch resulted in a buildup of $^{239,240}\text{Pu}$ within the first few hundred meters of the ditch bottom. There are also, in the local area, other buried, contaminated ditches. ² Rockwell policy is now, and has been, to limit environmental discharges to concentrations less than Table II(a) guidelines (0.06 pCi/m^3 for $^{239,240}\text{Pu}$ in air) and as low as reasonably achievable (ALARA) below Table II. Soil sampling around the air sampler station indicated that there were elevated levels of plutonium in the area (Table I).

(a) Table II is the most restrictive limit from the DOE ⁴ governing various radionuclide concentrations in air or water. It is based on maintaining exposure below 500 mrem/yr even for an individual who stays at the location continuously for 1 yr. It is strictly applicable only to the offsite environment; however, it is routinely used as a benchmark for environmental concentration comparisons.

TABLE I. Soil Concentrations Near the 216-Z-19 Ditch Air Sample Station.

Soil Sample Location	Concentration $^{239,240}\text{Pu}$ (pCi/g)
At Air Sample Station	27
10 ft SE of Station	35
20 ft SE of Station	20
50 ft SE of Station	37
100 ft SE of Station	67
10 ft S of Station	107
20 ft S of Station	33
50 ft S of Station	6.8
100 ft S of Station	30
Average	40
Average background	0.02
Rockwell internal soil contamination limits	60
Approximate detection limit	0.009

Soil concentration guides developed by Rockwell state that average soil concentrations of $<60 \text{ pCi } ^{239,240}\text{Pu/g}$ would result in air concentrations less than Table II values even with conservative resuspension factors. ³ This was observed to be the case in the ambient air at the Z-19 Ditch. (It should be stressed that this is monitoring data and was not data from directed research.)

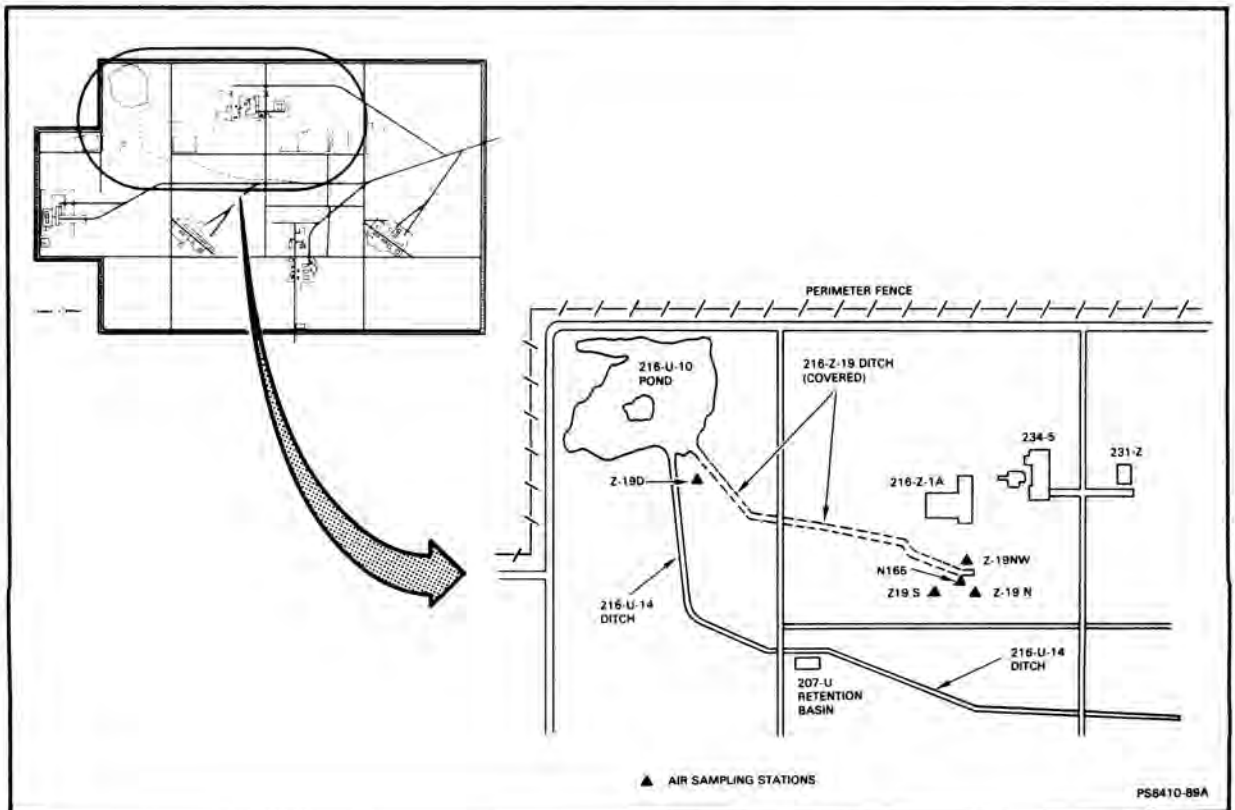


Fig. 2. Location of the 216-Z-19 Ditch and Associated Air Sample Stations within 200 West Area.

AIR SURVEILLANCE

Environmental surveillance is conducted in the 200 Areas, in part, as a tool of waste management; i.e., to assess the integrity of waste disposal sites and other facilities. A major portion of this effort is directed toward ambient air surveillance. The ambient air surveillance at the Z-19 Ditch began in 1977. Initially, the air sample filters were analyzed only for total alpha and beta. Specific radionuclide analysis on a monthly basis began in 1978. The present analysis methodology of compositing filters for one calendar quarter and then performing specific radio-isotopic analysis began in 1979. One air sample station was originally established at the head end of the Z-19 Ditch and was designated as Station N165 (see Fig. 2).

During the initial operation of the Z-19 Air Sample Station (N165), elevated levels of total alpha and later $^{239,240}\text{Pu}$ were noted (ranging from a concentration of 0.003 to 0.044 pCi $^{239,240}\text{Pu}/\text{m}^3$ with an average of 0.015 pCi/m³). The $^{239,240}\text{Pu}$ levels remained around 10% of the Table II Concentration Guide with some seasonal fluctuations evident. These concentrations were always the highest levels of airborne plutonium contamination in the 200 Areas.

The elevated concentrations of plutonium in the air were attributed to local resuspension of low levels of plutonium in the soil near the air sampling station. Therefore, the following four special air sampling stations (see Fig. 2) were started in 1981 to determine the areal extent of the situation:

- Z-19 (one quarter later moved across ditch to Z-19 NW)
- V-19 NW
- V-19 S
- V-19 D

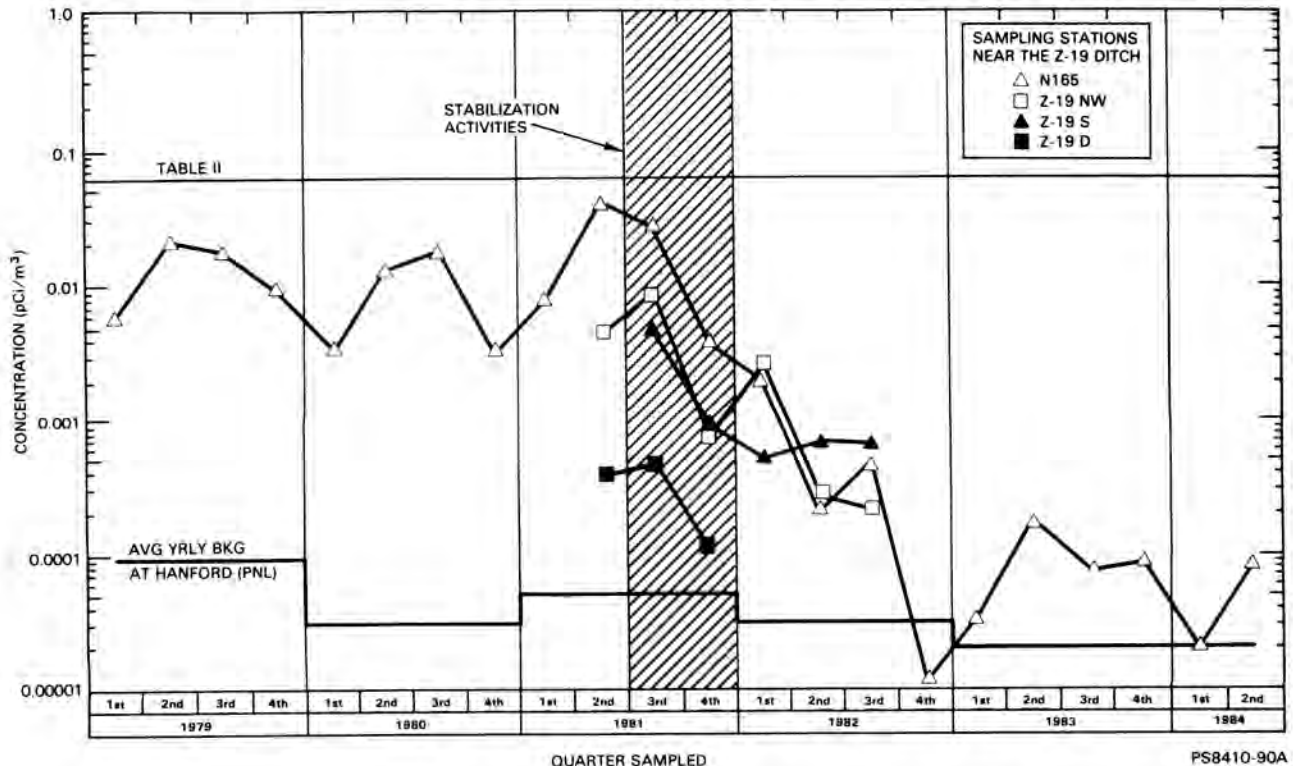


Fig. 3. Plutonium 239, 240 in Air Near the 216-Z-19 Ditch from 1979 to Present.

Results from these special sample stations (Fig. 3) indicated that the elevated levels of plutonium were confined to the head end of the ditch.

DECOMMISSIONING AND INTERIM STABILIZATION

Since it was being replaced by the 216-Z-20 Crib, decommissioning and interim stabilization of the ditch began in the middle of 1981, and it was completed by December 31, 1981. Interim stabilization, the waste management method used for isolation of the Z-19 Ditch, consisted of covering the site with ~2 ft of clean fill followed by revegetation of the site. Environmental surveillance of the site continues in order to determine the effectiveness of isolation.

The concentration of plutonium in air rapidly reflected the isolation achieved by interim stabilization of the ditch.⁵ There was a noticeable downward trend in air by the end of 1981 (see Fig. 3), and the airborne concentration has since leveled off near background levels of 0.00008 pCi/m³⁶ for $^{239,240}\text{Pu}$ with an annual average for 1983 of 0.000097 pCi/m³.⁷

Soil sampling for $^{239,240}\text{Pu}$ was conducted after the interim stabilization of the ditch was finished. The results of the sampling showed soil concentrations at all sample sites were <10 pCi/g with an average of 2.1 ± 2.1 pCi $^{239,240}\text{Pu}/\text{g}$. This compares to Hanford background levels of 0.094 ± 0.046 pCi $^{239,240}\text{Pu}/\text{g}$ (5).

CONCLUSIONS

The following conclusions can be reached as a result of the ambient air sampling around the 216-Z-19 Ditch.

- The remedial waste management practice of interim stabilization as demonstrated at the Z-19 Ditch was successful. Plutonium in air is now near Hanford background levels.

- Field observations are consistent with the Rockwell Soil Standards that were derived from soil particle resuspension models.

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