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Z Plant Aggregate Area Management Study Technical Baseline Report

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ACRONYMS

CCl ⁴	carbon tetrachloride
DBBP	dibutyl butyl phosphonate
DOE	U.S. Department of Energy
MSL	mean sea level
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PRF	Plutonium Reclamation Facilities
PVC	polyvinyl chloride
RSWIMS	<i>Richland Solid Waste Information Management System</i>
RL	U.S. Department of Energy, Richland Operations Office
SWITS	<i>Solid Waste Information and Tracking System</i>
TBP	tributyl phosphate
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
TRU	transuranic
UPR	unplanned release
VCP	vitrified clay pipe
WHC	Westinghouse Hanford Company
WIDS	waste information data system

1.0 INTRODUCTION

This document was prepared in support of the development of a Aggregate Area Management Study of Z Plant, 200 West Area, at the U.S. Department of Energy (DOE) Hanford Site near Richland, Washington. It provides a technical description and operational history of the aggregate area and results from an environmental investigation undertaken by the Technical Baseline Section of the Environmental Engineering Group, Westinghouse Hanford Company (WHC) which is currently the Waste Site and Facility Research Office, Natural Resources, Bechtel Hanford, Inc. (BHI). It is based upon review and evaluation of numerous Hanford Site current and historical reports, drawings and photographs, supplemented with site inspections and employee interviews. No intrusive field investigations or sampling were conducted in support of this report.

This document was written in 1991 and has been edited for publication as a BHI document to allow the information to be referenced in current documents. Some information identified as current, as of 1991, may not be current as of 1995 because of changes in mission, scope, plan, or political climate.

Most of the historical documents from which data was extracted for this report provide dimensions in nonmetric units of measure. In the interest of accuracy, data is reported here as it was provided in reference documents and no conversions to metric are provided.

The Z Aggregate Area is made up of three operable units, 200-ZP-1, 200-ZP-2, and 200-ZP-3, and consists of liquid and solid waste disposal sites in the vicinity of Z Plant. 200-ZP-1 and 200-ZP-2 are liquid waste sites related to Z Plant operations. 200-ZP-3 sites are solid waste sites that support Hanford-wide and offsite operations.

An environmental summary for the aggregate area is not provided here. An excellent summary may be found in *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing 1990) that describes geology and soils, meteorology, hydrology, land use, population, and air quality.

Each waste site in each operable unit is described separately. Close relationships between waste units, such as overflow from one to another, are also discussed. Photographs are provided in Appendix A. Unplanned releases (UPRs) are described in BHI (1994). Impacts of UPRs upon waste sites are noted in the waste site descriptions that follow.

Most of the historical documents from which data was extracted for this report provide dimensions in nonmetric units of measure. In the interest of accuracy, data is reported here as it was provided in reference documents and no conversions to metric are provided.

2.0 BACKGROUND

Z Plant is currently referred to as the Plutonium Finishing Plant (PFP). It is a complex of chemical processing facilities designed to process Hanford Site generated plutonium to its final product form. Uranium bearing fuel rods were irradiated in one of the several Hanford production reactors; a process that creates plutonium from uranium. The irradiated rods were processed through one of the Hanford Site's chemical separation facilities where the plutonium was extracted and transferred as plutonium nitrate to Z Plant.

Z Plant then processed the plutonium nitrate to its final form on one of three process lines; RG-RB from 1949 to 1953, the RMA Line from 1953 to 1979, and the RMC Line from 1960 to 1973. Each of these process lines created waste streams that contained small quantities of plutonium. The RECUPLEX and Plutonium Reclamation Facilities (PRF) were established to recover plutonium from these waste streams and are additional contributors of liquid wastes to Z Plant soils.

Chemical and radiological wastes from the many Hanford Site production facilities have been segregated according to potential radionuclide contamination and stored or disposed of accordingly. High-level wastes are stored in underground storage tanks while intermediate level wastes were, until 1973, routed to underground cribs for disposal. Low-level wastes such as cooling water were routed to ponds and open ditches.

3.0 200-ZP-1 OPERABLE UNIT

The 200-ZP-1 Operable Unit consists of the following thirteen liquid waste sites and eight UPRs in the vicinity of the 234-5Z Building. The primary sources of waste to these sites were the 234-5Z Building, RECUPLEX, and PRF.

216-Z-1A	Tile Field
216-Z-1&2TF	Crib
216-Z-3	Crib
216-Z-12	Crib
216-Z-13	French Drain
216-Z-14	French Drain
216-Z-15	French Drain
216-Z-18	Crib
241-Z-361	Settling Tank
2607-Z	Settling Tank
232-Z	Incinerator
234-5Z HWSA	Hazardous Waste Storage Area
241-Z	Treatment Tank
UN-200-W-11	Spill
UN-200-W-23	Spill
UN-200-W-74	Spill
UN-200-W-75	Spill
UN-200-W-89	Spill
UN-200-W-90	Spill
UN-200-W-91	Spill
UN-200-W-103	Spill
UN-200-W-159	Spill

As described above, PFP operations have contributed liquid wastes to the 200-ZP-1 waste sites since 1949. RECUPLEX and PRF operated from 1955 through 1985 to recover plutonium from PFP waste streams, utilizing organic solvent extraction column technology that employed large quantities of carbon tetrachloride (CCl₄).

RECUPLEX began operation in 1955. Its operation was discontinued after a criticality incident in April 1962 and it was replaced in 1964 by PRF which operated until 1979; and again from 1984 to present (Ballinger and Hall 1989).

RECUPLEX and PRF wastes were both chemically and radiologically contaminated but their disposition was accomplished in accordance with their radiological content. The organic solvent bearing wastes were classified as intermediate level wastes and, until 1973, were disposed of to the several cribs that supported Z Plant operations. Such waste has since been directed to underground tanks.

Two types of cribs exist at Z Plant. The first is an underground chamber that received liquid wastes into a box-like, open bottomed structure, usually made of wooden timbers. The second is a drain field or tile field, that introduced liquid wastes to soil through many yards of perforated underground pipe.

Both types typically rest in a gravel bed to aid in rapid dispersion of liquid to soil. Particulate matter contained in the waste liquid tend to be filtered by the first few inches or feet of soil and thus were effectively contained in the soils immediately beneath the crib.

The two types of waste units were sometimes combined to provide a chambered crib overflowing into a drain field; as with 216-Z-1 and 216-Z-2 Cribs overflowing into the 216-Z-1A Train Field.

Concerning ongoing PFP waste water generation activities, DOE-RL (1991a) states the following:

"The definitive design activities for the PFP waste water treatment system was scheduled to start on January 1, 1990 ... The schedule has been reassessed and design was initiated on November 1, 1990, and scheduled for completion on April 30, 1992. Start of construction has been delayed from January 1, 1991, to June 21, 1992, with project completion scheduled for June 1994."

UPRs are described in BHI (1994). Impacts of UPRs on 200-ZP-1 Operable Unit waste sites are noted in the waste site descriptions that follow.

3.1 CARBON TETRACHLORIDE DEPOSITED TO Z PLANT SOILS

About 280,000 L of carbon tetrachloride are estimated to have been deposited to 200 ZP-1 soils through the 216-Z-1A Tile Field and the 216-Z-18 Crib between 1955 and 1973. An additional 83,000 to 300,000 L are estimated to have been deposited to soil through the nearby 216-Z-9 Crib; not part of this operable unit (DeFord 1991 and DOE-RL 1991b).

3.2 216-Z-1A TILE FIELD

The 216-Z-1A Tile Field is described by Hanford drawings as an underground drain field. It is immediately south of the 216-Z-1 Crib and consists of a 280-ft long north-south running trunk with seven pairs of 70-ft laterals spaced at 35-ft intervals in a herring-bone pattern. All tile field piping is approximately 19 ft below grade and rests near the surface of a 5-ft deep gravel bed. Perforated 8-in. vitrified clay pipe (VCP) was used throughout. The tile field was divided into three operational

sections to preclude waste build-up at the front (upper) end of the field (Hanford drawings H-2-16459; H-2-16421).

As originally constructed, the tile field received liquid waste as overflow from the 216-Z-1 and 216-Z-2 Cribs. These cribs were later bypassed and wastes flowed directly to the tile field. The following history describes the use of 216-Z-1A and related cribs (Owens 1981).

Service Dates		Function
From (mo/yr)	To (mo/yr)	
06/49	06/52	The 216-Z-1 and 216-Z-2 Cribs and the 216-Z-1A Tile Field received process, analytical and development lab wastes from the 234-5Z Building via the 241-Z-361 Settling Tank.
06/52	03/59	The 216-Z-1 and 216-Z-2 Cribs were bypassed; the 216-Z-1A Tile Field received the above wastes via overflow from the 216-Z-3 Crib.
03/59	05/64	All portions of this site were inactive.
05/64	08/64	The 216-Z-1 and 216-Z-2 Cribs were still inactive; the 216-Z-1A Tile Field received aqueous and organic waste from PRF.
8/64	05/66	Same as above plus 242-Z Waste Treatment and Americium Recovery (236-Z Building) waste.
05/66	06/66	The 216-Z-1 and 216-Z-2 Cribs and the 216-Z-1A Tile Field received 236-Z Building aqueous and organic waste and 242-Z Building waste while the distribution point in the 216-Z-1A Tile Field was moved from the A section 100 ft down the main trunk to the B section.
06/66	10/67	The 216-Z-1 and 216-Z-2 Cribs were inactive; section B of the 216-Z-1A Tile Field received aqueous and organic waste from the 236-Z Building and from the 242-Z Building.
10/67	10/67	The 216-Z-1 and 216-Z-2 Cribs received 236-Z Building and 242-Z Building wastes while the discharge point was moved 75 ft further down the main trunk from the B section to the C section.
10/67	03/68	The 216-Z-1 and 216-Z-2 Cribs were inactive; the 216-Z-1A Tile Field received 236-Z Building and 242-Z Building wastes.
03/68	04/69	The 216-Z-1A Tile Field continued to receive the above wastes; the 216-Z-1 and 216-Z-2 received uranium wastes from the 236-Z Building.
04/69	--	All portions of the 216-Z-1, 216-Z-2, and 216-Z-3 Cribs and the 216-Z-1A Tile Field were retired.
04/69	05/73	The 216-Z-18 Crib received waste from the 236-Z and the 242-Z Buildings.
Source: Owens (1981).		

The 216-Z-1A Crib Complex is located about 500 ft south of the 234-5Z Building at Hanford coordinates N39190 W76601. It is 676 ft above sea level and about 200 ft above groundwater (BHI 1994).

Approximately 6,200,000 L of liquid waste were introduced to soil through the 216-Z-1A Tile Field (Law 1991). The waste information data system (WIDS) reports only 5,210,000 L.

216-Z-1A was one of several Z Plant sites to receive significant quantities of organic solvents, including carbon tetrachloride, tributyl phosphate (TBP), and dibutyl butyl phosphonate (DBBP). English and Mercer (1984) reports the following volumes of specific wastes:

CCl ₄	2.37 x 10 ⁵ kg
TBP	3.0 x 10 ⁴ kg
DBBP	2.03 x 10 ⁴ kg

3.3 216-Z-1 AND 216-Z-2 CRIBS

The 216-Z-1 and 216-Z-2 Cribs are closely related and are treated as a single waste site in all reference documents. They will be similarly treated in this report.

The 216-Z-1 and 216-Z-2 Cribs are located about 400 ft south of the 234-5Z Building at Hanford coordinates N39411 W76601. They are 676 ft above sea level and about 190 ft above groundwater. They consist of two wooden box structures arranged in a north-south line. Each is 12 ft by 12 ft by 14 ft high and is constructed of 6-in. by 6-in. timbers and has an open bottom. Each stands in a 14-ft² by 21-ft deep backfilled excavation. 216-Z-2 overflowed into 216-Z-1 which, for part of its history, overflowed to the 216-Z-1A Tile Field (BHI 1994).

These cribs received 234-5Z Building wastes from June 1949 until June 1952, were inactive until March 1968 and then received 236-Z and 242-Z Buildings process waste until April 1969 (Bramson 1987). Approximately 34,000,000 L of waste were disposed of at this site. Waste is described as slightly acidic (pH 8 to 10) (BHI 1994). PRF aqueous and organic wastes, including carbon tetrachloride, were transferred to this site for one month in 1966 and for another month in 1967 (Owens 1981).

Wastes arrived at the cribs through an 8-in. stainless steel pipe. The cribs were also connected by a similar 8-in. pipe so that overflow from the 216-Z-2 Crib ran into the 216-Z-1 Crib.

The 216-Z-1 and 216-Z-2 Cribs site is today enclosed by a chain-link fence that also surrounds the 216-Z-3 Crib and the 216-Z-1A Tile Field. Surface contamination warning signs are posted. Each crib is identifiable by a 6-ft by 6-ft concrete pad on the surface immediately above the crib. Metal riser pipes protrude through the concrete pad on which recent surveillance has identified 5,500 dpm of nonsmearable contamination (site inspection; BHI 1994).

The 216-Z-1 and 216-Z-2 Cribs are described on Hanford drawings H-2-44511, Sheet 87; H-2-16459; and H-2-24924.

3.4 216-Z-3 CRIB

The 216-Z-3 Crib received 178,000,000 L of neutral/basic process, analytical and development laboratory wastes from the 234-5Z Building via the 241-Z Settling Tank. It operated from June 1952 until March 1959.

Located about 400 ft south of the 234-5Z Building at Hanford coordinates N39385 W76521, the 216-Z-3 Crib is 676 ft above sea level and 195 ft above groundwater (BHI 1994).

Hanford drawing H-2-12292 describes the 216-Z-3 Crib as a 66-ft long tubular-shaped underground crib constructed of three 22-ft sections of 4-ft diameter corrugated culvert pipe laid end to end. It rests near the surface of a 17-ft deep bed of gravel, the upper surface of which is about 8 ft below grade. The upper surface of the culvert pipe is about 10 ft below grade. Wire screen is welded across the ends of the culvert pipe to form the crib and to prevent gravel from intruding into the pipe. The culvert pipe is perforated with 1-in. holes spaced every 6 in. circumferentially around the pipe and every 12 in. longitudinally. The gravel bed in which the culvert pipe rests is covered with two layers of asphalt roofing paper and the excavation backfilled to grade.

Aliases for this site include 216-Z-3 Culvert, 216-Z-8, 234-5 No. 3 and 4 Crib (BHI 1994).

This site is described by Hanford drawings H-2-44511, Sheet 87 and H-2-12292.

3.5 216-Z-12 CRIB

The 216-Z-12 Crib operated from May 1959 to March 1973 to receive 281,000,000 L of "process waste and analytical and development lab waste from the 234-5Z Building via the 241-Z-261 Settling Tank. The waste is slightly acidic. Low salt waste was adjusted to a pH of 8 to 10 before disposal." The site is estimated to have received 25,100 g of plutonium (BHI 1994).

Located immediately west of the 216-Z-1A Tile Field and 530 ft south of the 234-5Z Building, the 216-Z-12 Crib is 680 ft above sea level and about 200 ft above groundwater (BHI 1994).

Hanford drawing H-2-20987 describes the 216-Z-12 Crib as a 300-ft long 12-in. perforated VCP lying near the surface of a 5-ft deep bed of gravel at the bottom of a 19-ft deep backfilled excavation. Two 8-in. steel gauge wells extend upward from the excavation bottom to 3 ft above grade and are supported by 16-in. by 16-in. concrete pads. An additional 16-in. steel Stevens recorder well extends from a point 2 ft below the crib bottom to 30 in. above grade. A 1.5-in. steel sensing bulb well extends downward 23 ft from a point 30 in. above grade. A polyethylene barrier separates the gravel bed from the backfill (Hanford drawing H-2-20987; BHI 1994).

Aliases for this site include 241-Z-12 (BHI 1994).

This site is described on Hanford drawings H-2-44511, Sheet 87; H-2-20986 through H-2-20989; and Wood (1958), Part 2.

3.6 216-Z-13 FRENCH DRAIN

The 216-Z-13 French Drain is an active waste unit that began operation in 1949 receiving waste effluent from the ET-8 steam turbine and the 291-Z Building. It is located about 50 ft northeast of the 291-Z-1 Stack at Hanford coordinates N39769 W76762 and is constructed of two gravel filled, 36-in. diameter tile culverts. These are placed vertically, end to end, forming a 6-ft long pipe with a 2-in. thick wooden plank cover. The site is marked by a concrete post.

It is buried to a depth of about 15 ft with its upper surface about 9 ft below grade. Two 4-in. diameter effluent pipes enter the drain just below its wooden cover. It receives steam condensate from the ET-8 exhaust fan steam turbine and from the floor drain of the 291-Z Building (Owens 1981; Hanford drawings H-2-16412; H-2-74441; H-2-44511, Sheet 87).

Radionuclide levels in the Drain are unknown and low-level contamination may be assumed. Aliases include 234-5 Dry Well #1 and 216-Z-13 Dry Well (BHI 1994; Owens 1981).

3.7 216-Z-14 FRENCH DRAIN

The 216-Z-14 French Drain is an active liquid waste facility located 190 ft south of the 234-5Z Building, about 50 ft northwest of the 291-Z-1 Stack and directly behind the 234-5Z Building at Hanford coordinates N39774 W76822. It is constructed of two gravel filled, 36-in. diameter tile culverts. These are placed vertically, end to end, forming a 6-ft long pipe with a 2-in. thick wooden plank cover. The site is marked by a concrete post.

It is buried to a depth of about 15 ft with its upper surface about 9 ft below grade. Two 4-in. diameter effluent pipes enter the drain just below its wooden cover. It receives steam condensate from the ET-9 exhaust fan steam turbine and from the floor drain of the 291-Z Building (Owens 1981; Hanford drawings H-2-16412; H-2-74441; H-2-44511, Sheet 87).

Radionuclide levels in the Drain are unknown and low-level contamination may be assumed (Owens 1981).

Aliases include 234-5 Dry Well #2 and 216-Z-14 Dry Well (BHI 1994; Owens 1981).

3.8 216-Z-15 FRENCH DRAIN

The 216-Z-15 French Drain is an active waste site located 50 ft south of the 234-5Z Building at Hanford coordinates N39911 W76810. It consists of two gravel filled 3-ft diameter tile culverts placed vertically, end to end, 16 ft below grade with a 2-in. wooden cover. It received liquid wastes from the S-12 evaporator cooler in the 291-Z Building from June 1949 to present. The site is marked by a concrete post.

The Drain receives waste through a 4-in. diameter effluent pipe entering the unit below its wooden lid (Hanford drawings H-2-16412; H-2-74441).

Radionuclide levels in the Drain are unknown and low-level contamination may be assumed (Owens 1981).

Aliases for this site include 234-5 Dry Well #3 and 216-Z-15 Dry Well (BHI 1994; Maxfield 1979).

3.9 216-Z-18 CRIB

The 216-Z-18 Crib received 3,860,000 L of 236-Z Building high salt, acidic, organic waste with phosphate and carbon tetrachloride between April 1969 and May 1973 (BHI 1994).

Located southwest of the 216-Z-1A Tile Field and about 1,000 ft south of the 234-5Z Building, 216-Z-18 is 673 ft above sea level and about 197 ft above groundwater.

Hanford drawings and WIDS describe this site as five parallel, north-south oriented, excavations, each 207 ft by 10 ft by 18 ft deep. A 300-ft long, 3-in. diameter steel pipe runs east and west bisecting the length of each excavation. Two 100-ft long, 3-in. diameter perforated, fiberglass reinforced, epoxy pipes exit each side of the steel pipe in each excavation (two lines north and two lines south). The distribution lines are 1 ft above the crib bottom in a 2-ft thick bed of gravel. The excavation is backfilled to grade. The gravel bed is covered with an unspecified "membrane barrier" (BHI 1994; Hanford drawings H-2-26093; H-2-26094).

English and Mercer (1984) estimates that 2.6×10^5 kg of CCl_4 , 2.2×10^4 kg of TBP, and 1.5×10^4 kg of DBBP were deposited to 216-Z-18. DeFord (1991) reports that it also received both extraction column solvent and aqueous waste from the PRF.

The site has no known aliases.

3.10 2607-Z SEPTIC TANK AND DRAIN FIELD

The 2607-Z Septic Tank is an active liquid waste facility located approximately 110 ft east of the 236-Z Building at Hanford coordinates N76462 W39730. The drain field is located approximately 61 ft east of the 2607-Z Septic Tank. It has received sanitary wastewater and sewage from the 234-5Z and 2704-Z Buildings.

The 2607-Z Septic Tank is a 360-ft by 11-ft by 23-ft deep concrete box. This active waste site has a 25,000 gal capacity and has a two chamber tank. Three 30-in. diameter manholes are provided for personnel entry.

The drain field consists of 36 rows of 6-in. drain tile spaced at 8-ft intervals. It lies in a gravel bed that extends a minimum of 18 in. below the drain pipe. The excavation is backfilled forming a surface that is below original grade. The drain field is, therefore, identifiable as a large rectangular recess in an otherwise flat field.

No radionuclides or hazardous chemicals have been associated with this waste unit.

3.11 234-5Z BUILDING HAZARDOUS WASTE STAGING AREA

The 234-5Z Building Hazardous Waste Staging Areas are active waste storage sites located near the 234-5Z Building. They consist of concrete pads north of the northwest corner and east of the northeast corner of the 234-5Z Building. The first began operation in 1985 and the second in 1986. All wastes are now stored on the second pad (i.e., the pad east of the northeast corner) (BHI 1994).

The following wastes are known to have been stored here (none of which are known to have leaked): waste nitrates and other oxidizers; benzenes and halogenated benzenes; toxic process chemicals; carbon tetrachloride and other hazardous hydrocarbons; acids, sodium hydroxide and alkaline liquids; sodium hydroxide and alkaline liquids; miscellaneous laboratory chemicals; flammable liquids; poisonous laboratory chemicals; paints, thinners, resins, and asphalts; and nonflammable refrigerant gas (Cramer 1987).

3.12 241-Z TREATMENT TANK

The 241-Z Treatment Tank (Tank D-5) is located in the 241-Z Building at Hanford coordinates N40100 W76800. Operating since 1948, it is used to receive and treat corrosive waste from 234-5Z PFP.

This tank is used for batch processes consisting of the addition of sodium hydroxide, ferric nitrate, and sodium nitrite to PFP waste. Sodium hydroxide raises the free hydroxide ion concentration of the treated liquid to greater than 1.5 molar. Ferric nitrate solution is added to provide 1% stable solids. Sodium nitrite is added to inhibit corrosion. Treatment of the mixed waste ensures that the aluminum compounds are solubilized and permits pumping of the treated liquid through double-encased lines to the collection tank in the 244-TX receiver building, that is located approximately 1 mi north of the 241-Z Building. The ultimate destination of the mixed waste is the 241-TX Tank Farm double-shell tanks. Tank D-5 is designed to treat a maximum of 5,300 gal/d (DOE-RL 1988; Hanford drawings H-2-16024; H-2-44511, Sheet 87; H-2-74441).

Before treatment, the waste is corrosive (less than 2.0 pH), containing predominately nitric acid. Additional constituents known to be present include chromium, lead, aluminum nitrate, aluminum fluoride, and lower concentrations of potassium hydroxide, potassium fluoride, magnesium nitrate, ferric nitrate, calcium nitrate, and other trace metal ions (DOE-RL 1988).

Aliases include Tanks D-5 and TK-D5 (DOE-RL 1988).

A UPR is associated with this site. UN-200-W-79 occurred in 1978 because of failure of a pH line at the 241-Z Sump. Two small areas were contaminated. Decontamination of the soil areas was completed on October 30, 1978 (BHI 1994).

Occurrence Report 78-108 describes the UPR.

"During replacement of steam valves and lines at the 241-Z sump, D-7 and D-8 sample cabinets, Radiation Monitoring detected alpha contamination in excess of 40,000 d/m on an out of service pH control line behind the D-8 sample cabinet. Other locations which were contaminated in excess of 40,000 d/m includes the

concrete pad under the D-7 and D-8 sample cabinets, and the steam line to the D-7, D-8 sample cabinets."

"A five foot square dirt area under the pH meter lines was contaminated to 2,000 d/m and another five foot square dirt area north of the D-7 and D-8 sample cabinets outside of the 241-Z sump radiation zone fence was contaminated to 500 d/m alpha. The apparent cause was the failure of the pH line due to normal deterioration. The line has not been used or worked on for many years."

Aliases for the UPR include UPR-200-W-79.

3.13 241-Z-361 SETTLING TANK

The 241-Z-361 Settling Tank operated from 1949 to 1976 to receive "radioactively contaminated liquid estimated to contain 30 to 75 kg plutonium (1 mRem/h gamma; 0.8 mRem/h neutron) (BHI 1994).

It is an underground, steel lined, concrete tank located about 350 ft south of the 234-5Z Building at Hanford coordinates N39500 W76600. It measures 28 ft by 15 ft by 20 ft high, has a sloped bottom, and 2-ft thick walls. Its upper surface is 2 ft below grade and two 36-in. manholes and several metal riser pipes are visible at the surface. Three manholes are shown on drawings.

It served as a settling tank for liquid wastes enroute to the 216-Z-1, 216-Z-2, 216-Z-3, 216-Z-12, and 216-Z-18 Cribs and to the 216-Z-1A Tile Field. All wastes enroute to these waste sites have presumably passed through this tank. Two 6-in. schedule 40 pipes enter the tank from the north; one from the 241-Z Retention Basin and the other from the 241-Z Tank Pit. An 8-in. stainless steel line exits the tank through its south wall and runs to a diversion box from which wastes were diverted to the desired crib. All three lines enter or exit the tank at points about 1 ft below its top. No floor drains exist. Steel lining is made up of 3/8-in. steel plate (Hanford drawings H-2-16024; H-2-44511, Sheet 87).

Cramer (1987) notes that:

"prioritization of this facility for decommissioning classifies the relative radiological hazard as high in comparison with other 200 Area surplus facilities."

4.0 200-ZP-2 OPERABLE UNIT

The 200-ZP-2 Operable Unit consists of the following thirteen liquid waste sites and two UPRs in the vicinity of the 234-5Z and 231-Z Buildings. The primary sources of waste to these sites were the 231-Z and 234-5Z Buildings.

207-Z	Retention Basins
216-Z-4	Trench
216-Z-5	Crib
216-Z-6	Crib
216-Z-7	Crib
216-Z-8	French Drain
216-Z-9	Crib
216-Z-10	Reverse Well
216-Z-16	Crib
216-Z-17	Trench
2607-W-8	Septic Tank
2607-WA	Septic Tank
2607-Z-8	Septic Tank
UN-200-W-79	UPR
UN-200-W-130	UPR

4.1 207-Z RETENTION BASIN (216-Z-21 SEEPAGE BASIN)

The 207-Z Retention Basin is an inactive waste facility located in the 200 West Area at Hanford coordinates N39573 W76530. It is a concrete structure divided into two basins separated by a 1-ft thick concrete wall. There is a 6-ft woven wire fence around the top. Each basin contains a sump and pump. The site received potentially contaminated waste, steam condensate and cooling water, via the D-3 piping system. Waste was sent to this holding facility then released to the 216-Z-1 Ditch (BHI 1994; Hanford drawings H-2-44511, Sheet 87; H-2-16422).

Hanford drawing H-2-44511, Sheet 87 refers to this site as the 241-Z Retention Basin. Hanford drawing H-2-16022 describes the basin as being about 50 ft by 40 ft by 10 ft deep.

This site is considered a mixed waste site with a Pacific Northwest Laboratory (PNL) Hazardous Ranking System Migration Score of 1.03.

Engineering Change Notice 41098 changes its name to 216-Z-21 Seepage Basin.

4.2 216-Z-4 TRENCH

The 216-Z-4 Trench is an inactive waste facility located 250 ft east of the 231-Z Building and 500 ft north of the 2709-Z Building. This unit served as a temporary percolation trench for a single month in 1945 when it received process and laboratory waste from the 231-Z Building (BHI 1994; Hanford drawings H-2-32528; M-2600-W, Sheet 15).

The site was deactivated when the effluent flow exceeded the infiltration capacity of the pit. The pipeline from the 231-Z Building to the Trench was capped west of the 231-W-151 Diversion Box. This unit was backfilled after use. The site was a 15-ft deep open pit with a bottom area of 10 ft by 10 ft. Its contaminated soil volume is 56 m³ with an overburden soil volume of 780 m³ (BHI 1994).

References that describe the 216-Z-4 Trench include Curren (1972); Ruppert (1953); Clukey (1954); Clukey (1956); Wood (1958); Doud (1964); and Maxfield (1979).

Aliases for the 216-Z-4 Trench include 231-W-3 Pit, 231-W-3 Sump, 231-W-3 Crib, 216-Z-4 Crib, and 231-W-151 Sump (BHI 1994).

4.3 216-Z-5 CRIB

The 216-Z-5 Crib is an inactive waste facility, 150 ft east of 231-Z Building and 600 ft north of the 2704-Z Building. It operated from 1945 to 1947 to receive process waste from the 231-Z Building via the 231-W-151 Sump Tank. The site was retired in 1947 when replaced by the 216-Z-7 Crib (BHI 1994; Doud 1964; Hanford drawings H-2-32528; H-2-32682; M-2600-W, Sheet 15).

Hanford references Curren (1972); Anderson (1973); Clukey (1956); Wood (1958); Doud (1964); and Maxfield (1979) describe the crib.

The crib consists of two 12-ft by 12-ft by 4-ft wooden box-like structures, each resting in a 18-ft deep backfilled excavation. The structures are 65 ft apart. Each box is constructed of 800 linear ft of 6-in. by 6-in. timbers (BHI 1994; Hanford drawing H-2-55176, Part 2).

There are two 18 ft lengths of 2-in. vent pipe, one rising from each crib box to 2 ft above grade; 90 ft of 3-in. stainless steel effluent pipe placed horizontally about 11 ft below grade and extending down to each crib; 65 ft of 1.5-in. pipe placed horizontally 13 ft below grade; 91 ft of copper tubing inside the above pipe; two 8 ft lengths of 0.5-in. stainless steel tubing in each of the above pipes (BHI 1994).

The pipeline to the unit was capped west of the 231-W-151 Diversion Box. The sludge in the waste sealed the soil, rendering the site useless. BHI (1994) reports that 3,000 g of plutonium were disposed of at this site but suggests that this is probably a high estimate because of questionable detection capability. Eight wells drilled around the first box accounted for only 0.5 g of plutonium. It is believed that most plutonium activity is in or directly below the unit. Owens (1981) concurs with the idea that the 3,000 g of plutonium inventory is high and provides an estimate of 340 g (BHI 1994; Owens 1981.)

Cribs 1 and 2 are surrounded by an outer barricade of light chain posted "Caution Underground Radioactive Material." They both have inner barricades that surround the immediate area of each Crib. These barricades are posted with "Caution Underground Radioactive Material" and "Caution Surface Contamination." The surface of the crib area is depressed about 36 in., suggesting that the wooden cribs have caved in. This unit has a high cave-in potential (site inspection; BHI 1994).

Aliases for the 216-Z-5 Crib include 231-W Sumps, 231-W-1 and 231-W-2 Cribs (BHI 1994).

4.4 216-Z-6 CRIB

The 216-Z-6 Crib is an inactive liquid waste facility located 300 ft east of the 231-Z Building and 200 ft north of 19th Street. An outer light weight chain barricade, labeled "Caution Underground Radioactive Material," surrounds the Crib. An inner light weight chain barricade with the same label covers about a 3-ft by 12-ft surface area. Inside the barricade is a 3-in. diameter stand pipe extending about 4 ft above grade. The site received process waste from the 231-Z Building via the 231-W-151 Sump Tank for a single month in June 1945. The waste is neutral/basic (BHI 1994).

The Crib received 98,000 L of waste. This contributed to a contaminated soil volume of 44 m³ and an overburden soil volume of 420 m³.

The 216-Z-6 Crib is a 50-ft by 6.5-ft by 2 ft high wooden box structure in an excavation. A 2-ft by 2-ft by 1-ft high wooden vent box is on the crib top with 8.75 ft of 3-in. iron vent pipe rising to grade. There is 8 ft of 3-in. iron effluent inlet pipe that angles from the northern end of the crib to grade (BHI 1994).

The pipeline to the unit was capped west of the 231-W-151 Diversion Box. Above-ground piping has been removed. Surface subsidence, indicating crib cave-in, was reported as early as 1953 (BHI 1994; Owens 1981).

Because of high cave-in potential, a survey was performed along the outside perimeter of this site. No contamination was detected, although previous surveys had detected some surface contamination (BHI 1994).

The 216-Z-6 Crib is described in Hanford drawings H-2-00508; H-2-32528; H-2-34762; H-2-44511, Sheet 103; and M-2600-W, Sheet 15. It is also shown in Hanford photograph 122440-161-CN. Hanford references that describe this site include Anderson (1973); Maxfield (1979); Clukey (1956); Doud (1964); Wood (1958); Curren (1972); Tabasinske (1958); and Clukey (1954).

Aliases for the 216-Z-6 Crib include 231-W-4 Crib; 231-Z-6, 216-W-4, and 231-W "Trench" Cribs; 216-Z-4, 216-Z-6, and 6A Cribs (BHI 1994).

4.5 216-Z-7 CRIB

The 216-Z-7 Crib is an inactive crib located 500 ft east of the 231-Z Building and 500 ft north of 19th Street. The site received process waste from the 231-Z Building via the 231-W-151 Sump Tank from 1947 until 1953. From 1953 to 1965, the site received Hanford Laboratory waste from the 231-Z Building via the 231-W-151 Sump Tank. After November 1965, the site received waste from

PNL operations in 231-Z Building and 300 Area laboratory waste from the 340 Facility. The Crib received 79,900,000 L of waste, 590 m³ of contaminated soil. The site was retired in February 1967 (BHI 1994).

Looking at the Crib today would show an uneven vegetated surface that has been stabilized. The Crib is surrounded by a light weight chain barricade labeled "Caution Underground Radioactive Material."

The Crib is made up of two wooden structures in parallel in a 210-ft by 44-ft by 5-ft deep excavation. Each wooden structure is three-tiered and constructed of wooden planking. A 150-ft long, 4-in. diameter perforated distribution pipe runs above the second tier. Each of the two trenches is covered by 1,650 ft² of 2-in. planking and then tar paper. The large excavation has been backfilled (BHI 1994).

The Crib includes four wooden vent boxes, 2 ft by 2 ft, one on each end of each crib, constructed of 2-in. by 100-in. lumber; 40-ft of 3-in. vent pipe, 10 ft rising from each vent box to a flange above grade; 500 ft of 3-in. effluent piping, 200 ft running between the two trenches and ending in a flange (spare). There are 2,100 ft³ of gravel under the edge of the crib planking (BHI 1994).

The pipeline was capped west of the 231-W-151 Diversion Box. Early in 1967, the west end of this unit was opened down to the planking. The tar paper covering the planking and the planking itself showed no signs of deterioration (BHI 1994).

In 1948, after 10 months of use and an estimated discharge of 10 g of plutonium in 1.2 E+06 gal of waste, no plutonium was found in the soil samples taken from wells 60 ft away. Groundwater samples taken from around the unit showed beta activity of 1,336 pCi/cc and alpha activity of 2.0 pCi/cc. Wells W15-7, W16-72, W15-63, W15-64, W15-76, W15-77, and W15-78 monitor this unit. Scintillation probe profiles indicate breakthrough to groundwater could have occurred at this site. The PNL Hazardous Ranking System Migration Score for the 216-Z-7 Crib is 50.34.

Aliases for the 216-Z-7 Crib include 231-W Crib, 231-W Trench, and 216-Z-6 (BHI 1994).

4.6 216-Z-8 FRENCH DRAIN

The 216-Z-8 French Drain is an inactive unit 300 ft east of the 234-5Z Building and 350 ft south of 19th Street at Hanford coordinates N40000 W76250 (center). This unit is a registered underground injection well. The French Drain received neutral to basic RECUPLEX waste via overflow from a nearby silica slurry tank from July 1955 to April 1962.

The location of the French Drain and its associated silica storage tank can be found on Hanford drawing H-2-44511, Sheets 94 and 95. As described on Hanford drawing H-2-16653 the drain is made up of two sections of 3-ft high by 3-ft diameter standard clay tile culverts, stacked vertically underground. The culverts are filled with gravel and rest on a 5-ft by 3-ft deep bed of gravel. The culverts have a 4-in. thick concrete top that is 8 ft below grade. The bottom of the gravel bed is 17 ft deep.

The 216-Z-8 French Drain received 9,590 L of waste. There are 58 m³ of contaminated soil and the drain has 250 m³ of overburden soil.

The PNL Hazardous Ranking System Migration Score is 1.03. Aliases include 234-5 RECUPLEX French Drain; and 216-Z-9 and 216-Z-8 Cribs.

The silica slurry tank is about 20 ft due west of the 216-Z-8 French Drain. The tank is surrounded by a light weight chain barricade marked "Caution Underground Radioactive Material." Inside the barricade on the north end are two capped 4-in. steel vent pipes. Tumbleweeds grow within the barricade. This unit is not listed in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Action Plan.

4.7 SILICA GEL WASTE STORAGE TANK

While not listed in either WIDS or the Tri Party Agreement, the Silica Gel Waste Storage Tank located east of the 234-5Z Building is described here because of its obvious potential as a hazardous waste site.

Described on Hanford drawing H-2-16653, the tank is a 36-ft by 8-ft diameter carbon steel tank utilized in support of the RECUPLEX operations that ended in 1962.

Raab (1974) comments on this tank as follows:

"The 216-Z-8 carbon steel 15,000-gallon, eight-foot diameter, horizontal silica gel waste settling tank was used as a solids settling tank for a backflush of the feed filters for the Recuplex Process. The center line of the tank is located approximately 11 feet below grade. Silica gel was used as a settling agent on the dissolved feed for the Recuplex process. The feed was subsequently filtered with the backflush solution being routed to 216-Z-8 settling tank. The waste overflowed from this settling tank to a crib located approximately 36 feet away. The tank was taken out of service in April of 1962 with the shutdown of the Recuplex facility. The last liquid level readings found were taken in October 1958 and July 1959, which indicated that the tank was full to overflow at seven feet, two inches. Design information does not indicate an installed capability for removal of the tank contents other than at the normal overflow point. A liquid level reading of 50 inches taken on April 6, 1974, indicated a volume of 8,150 gallons (7,653 gallons liquid, 497 gallons sludge). Weekly readings since that time have remained constant. Samples of the tank indicate a pH of 6. A "worst case" approach calculates the plutonium associated with this tank at 1,592 grams."

Raab (1974) provides several references, some of which are referred to in the above quotation, that may prove valuable in research.

This author has taken action to include this waste site in WIDS.

4.8 216-Z-9 TRENCH

The 216-Z-9 Trench operated from 1955 to 1962 to receive all solvent and aqueous wastes discharged to soil by the RECUPLEX facility. No other waste sites were used for this purpose. The 216-Z-9 Trench received wastes from no other facility.

The 216-Z-9 Trench is an open bottomed earthen trench with a concrete cover, located about 700 ft east of the 234-5Z Building and about 500 ft south of 19th Street. It is 60 ft by 30 ft by 21 ft deep. Waste was transferred by gravity through two 1.5-in. (3.8-cm) stainless steel lines that entered the crib about 17 ft above its bottom (BHI 1994).

A series of studies determined that by 1969 the Trench had accumulated about 100 kg of plutonium. A potential for criticality was recognized and cadmium nitrate (a neutron absorber) was sprayed onto the trench floor. Subsequent studies determined that the risk of criticality had been less than originally believed. Even so, removal of the upper layer of contaminated soil from the Trench bottom was viewed as a means of reducing the risk of environmental contamination. This was completed in July 1978 through a mining operation that successfully removed 58 kg of plutonium from the top 30 cm of the trench floor (Ludowise 1978).

The trench received 4,090,000 L of RECUPLEX current acid waste and aqueous and organic waste from the 234-5Z Building. The waste is low in salt and is acidic.

Between 83,000 and 300,000 L of carbon tetrachloride may have been introduced to soil through this site (DeFord 1991; DOE-RL 1991b).

The location of the Trench is shown on Hanford drawings H-2-20986; H-2-32528; H-2-44510, Sheet 9; and H-2-44511, Sheets 86 and 94. Dimensions of the trench can be found on Hanford drawings H-2-15491; H-2-15492; and H-2-26872. Two 1.5-in. stainless steel pipes discharged liquid 17 ft above the bottom. The unit is covered with a 120-ft by 90-ft by 0.75-ft thick concrete trench cover at grade. Six 23-ft tall concrete columns support the cover. Six 9-ft by 9-ft by 1.75 ft concrete footings, 5 ft below crib bottom, support the columns. About 11,000 ft² of acid-split brick cover all interior concrete surfaces except the columns.

Wells number 1508, W15-9, W15-82, W15-84, W15-85, W15-86, and W15-95 monitor this unit. Scintillation probe profiles indicate breakthrough to the groundwater has not occurred. The PNL Hazardous Ranking System Migration Score for this unit is 2.27.

4.9 2607-WA SEPTIC TANK

The 2607-WA Septic Tank is an active waste facility located immediately south of the Z Plant mobile office complex south of 19th Street and west of Camden Avenue. This site began service in 1968 and remains active. It includes two active 1,000 gal septic tanks and an abandoned one plus an active drain field and an abandoned one. Sanitary waste water and sewage went to this unit at a rate of 5.83 m³/d (Hanford drawing H-2-91886; BHI 1994).

4.10 2607-W8 SEPTIC TANK

The 2607-W8 Septic Tank is an active waste facility located northeast of the 231-Z Building at Hanford coordinates N40950 W76700. The site is marked by a light weight chain barricade marked "Sanitary Tile Field." The field is sunken about 3 ft below grade with abundant vegetation. The sanitary waste water and sewage estimated rate of waste generation is 5.45 m³/d. The Septic Tank has a capacity of 5,070 gal of waste. It has been serving the 231-Z Building since its start up in 1959. This unit is included in the Tri-Party Agreement Action Plan (BHI 1994).

Hanford drawing W-71192 describes the Septic Tank in detail. The septic tank has reinforced steel concrete walls with three man hole covers. A vitrified pipe enters the septic tank with an automatic sewage siphon. A vitrified pipe exits the tank to the tile field.

4.11 2607-Z8 SEPTIC TANK

The 2607-Z8 Septic Tank is an active waste facility located in the 200 West Area, Hanford coordinates N39475 W76200. This site began service in 1965 and is currently active. This unit includes a drain field. Sanitary wastewater and sewage went through this unit at a rate of waste of 0.75 m³/d.

A UPR occurred within the boundaries of this operable unit. UN-200-W130 describes a contamination that occurred in January 1967 in the area east of the 231-Z Building. It involved soil around a waste line on the east side of the 231-W-151 sump near the 231-Z Building. An excavation uncovered a leaking flange. Alpha, beta, and gamma readings to 40,000 dpm, consisting of 100 mRem/h of beta and 500 mRem/h of gamma. The waste line was repaired and covered with 6 in. of clean soil. Aliases for this UPR include UPR-200-W-130 (BHI 1994).

5.0 200-ZP-3 OPERABLE UNIT

The 200-ZP-3 Operable Unit consists of seventeen waste sites and ten UPRs, as follows. All 200-ZP-3 waste sites are 218-W series solid waste burial grounds, or related UPRs, located in the Hanford Site's 200 West Area. Not all are included in the Tri Party Agreement list of waste sites for this operable unit.

218-W-1	Burial Ground	UN-200-W-44	Spill
218-W-1A	Burial Ground	UN-200-W-132	Spill
218-W-2	Burial Ground	UPR-200-W-16	Spill
218-W-2A	Burial Ground	UPR-200-W-26	Spill
218-W-3	Burial Ground	UPR-200-W-45	Spill
218-W-3A	Burial Ground	UPR-200-W-53	Spill
218-W-3AE	Burial Ground	UPR-200-W-72	Spill
218-W-4A	Burial Ground	UPR-200-W-84	Spill
218-W-4B	Burial Ground	UPR-200-W-134	Spill
218-W-4C	Burial Ground	UPR-200-W-158	Spill
218-W-5	Burial Ground	Z Plant Burn Pit	
218-W-6	Burial Ground	Waste Receiving and Processing Facility	
218-W-11	Burial Ground		
2607-WWA	Septic Tank		

Brown et al. (1977) comments on the history of solid waste burial sites as follows:

"Solid wastes contaminated with radioactivity have been disposed of by shallow earth burial at the Hanford site since the beginning of operations in 1944. Burial grounds were provided and used in all of the operating areas. A total of 26 sites in the 100 Areas, 28 sites in the 200 Areas and 11 sites in the 300 and 600 Areas have been used for the storage and burial of solid radioactive wastes."

"Burial grounds in the 100 and 300 Areas are relatively close to the Columbia River and are mainly underlain with permeable materials. Depth to water varies from about 5 to 25 meters. Wastes buried in the 100-F burial grounds are very near the water table, while those at other 100 Areas are approximately 10 meters above the water table. Burial grounds located on the 200 Areas plateau are underlain by considerable thicknesses of low permeability materials. Wastes buried here are 55 meters or more above the water table. Vadose water movement beneath these burial grounds has virtually undetectable flow and the soil has a large capacity for ion exchange, which will remove and retain radionuclides."

"Historically, virtually all of the radioactive wastes were buried in the area in which they were generated. Beginning in 1968, however, increasing amounts of waste were transported to the 200 Areas for disposal. Since 1973, essentially all of the solid waste generated at Hanford has been stored or buried in the 200 Areas. Since May 1, 1970, all of the radioactive solid wastes contaminated or potentially contaminated with more than 10 nCi/g transuranic (TRU) radionuclides have been packaged and stored in the 200 Areas for retrieval during an interim period of up to 20 years duration, in response to ERDA Manual Chapter 0511."

5.1 INVENTORIES AND CURRENT RECORDS

Records were not kept on the amount and types of radionuclides buried as solid waste in the early days of the project. During the 1950's and the 1960's, some documents were issued on waste disposal activities, but these records were not complete. Beginning in the late 1960's, routine reports of radioactive waste disposal in the 100 and 200 Areas have been more complete, including the land area used, the volume of waste, the curies of the specific radionuclides, and the coordinates of the location. Studies have been made that estimate the volume and radioactivity of previously unrecorded wastes buried in the 100 and 200 Areas based upon the ratio of the nuclides present in the fuel elements and on other known and deduced waste generation and disposal information.

Inventories are kept on an automated management information system entitled *Richland Solid Waste Information Management System (RSWIMS)* which is soon to be replaced with *Solid Waste Information and Tracking System (SWITS)*. RSWIMS radionuclide inventories, by burial ground, are summarized annually in the *Summary of Radioactive Solid Waste Received in the 200 Areas During Calendar Year 1990* (Anderson et al. 1991). Anderson et al. (1991) contains detailed inventories of radionuclides for each burial site. These inventories are lengthy and will not be listed in this report, but are provided in Appendix B.

Burial grounds may be divided into two general types: transuranic (TRU) and non-TRU. With respect to TRU storage, Brown et al. (1977) comments as follows:

"The facilities and operating practices now in use have been selected to provide 20 year retrievable storage in compliance with ERDA MC 0511. Some uncertainties exist in the areas of probable life of the containers, probable means and difficulty of retrieval, and stability of the wastes in storage"

"Storage of the packaged TRU waste on an asphalt pad, enclosed in sheet plastic and covered with earth is expected to provide the necessary 20 year retrievable life so long as waste stability and package integrity are maintained. One of the present concerns about waste stability is the possibility of package rupture due to explosion of radiolytically generated hydrogen."

"The containers are expected to provide 20 year retrievable containment, but this capability has not been verified. Corrosion of the 55-gallon drums may be a route to failure. It is known that the painted surfaces are scratched through to the metal on some occasions during the handling operations, but it is not known whether these penetrations of the protective coating will cause corrosive attack on the inside surface of the drums. Another area of concern is the possible deterioration of the

packages and the accumulation of earth and trash in the interstices between the packages during the time they are uncovered."

"The caisson storage provides adequate protection to personnel from high radiation level TRU wastes. Measured activity at the ground surface is low. However, because the waste packages are allowed to drop into the caissons, the packages sometimes rupture, resulting in contamination of the caisson interior. Retrieval of the stored TRU waste in caisson storage is based upon excavation and recovery of the entire caisson. This method of retrieval will be very expensive due to the facts that: (1) it is very large (2.7 meters diameter by 3.25 meters high) and deeply buried (4.3 meters earth cover), (2) it is not designed or approved as a transportation container, and (3) a receiving and processing facility has not been identified."

"Retrieval of TRU contaminated wastes from the alpha trenches will also present problems. It will be necessary to exhume the various size boxes and drums, some with relatively high surface radiation rates, from earth burial without risking damage to their integrity. They will then have to be moved to an as yet unidentified facility for further processing and storage."

"Large, highly contaminated items are stored on rail cars in the Purex railroad tunnel. For retrieval the cars can be pulled into the Purex building canyon area where hoisting equipment is available for remote handling. Processing for final disposal may be difficult, however, because much of this equipment is quite large and contains piping and other enclosures which may contain contamination. The stainless steel construction of much of this equipment will be more difficult to decontaminate and cut up than mild steel."

Concerning non-TRU waste burial, this document (Brown et al. 1977) continues as follows:

"Disposal of nonTRU waste by burial in trenches is a routine and inexpensive method of waste disposal. The Hanford soil, which consists largely of gravel and sand, sloughs off to an angle of repose of about 45 degrees during excavation. This requires the movement of much earth for the preparation and backfilling of waste trenches. Also, the wide top and relatively narrow bottom of the resulting trench coupled with the practice of covering all radioactive wastes by the end of the day results in an unfavorably low ratio of waste volume to land area."

"The caisson (silo) system provides an effective method for disposal of high dose rate nonTRU wastes while keeping exposure low. As with the TRU caissons, however, the waste packages are dropped without restraint into the caisson, which raises the concern of possible problems resulting from rupture of the falling container."

"Totally new types of caissons will be needed, starting in FY 1979, to accept the extremely high activity rate (up to 10^5 R/hr) wastes from the operation of the Fast Flux Test Facility (FFTF)."

Brown et al. (1977) provides the following table of Solid Radioactive Waste Storage and Burial Sites in the 200 West Area.

Table 5-1. Solid Radioactive Waste Storage and Burial Grounds, 200 West.

Number	Type	Area (m ²)	Waste Volume (m ³)	Plutonium (kg)	B,G (Ci)
218-W-1	Trenches	2.1 x 10 ⁴	7.0 x 10 ³	94	8.4
218-W-1A	Trenches	3.8 x 10 ⁴	1.6 x 10 ⁴	2	2,100
218-W-2	Trenches	2.8 x 10 ⁴	8.2 x 10 ³	126	24
218-W-2A	Trenches	8.1 x 10 ⁴	1.9 x 10 ⁴	6.4	13,300
218-W-3	Trenches	3.7 x 10 ⁴	1.1 x 10 ⁴	68	48
218-W-3A	Trenches	5.9 x 10 ⁴	2.4 x 10 ⁴	16	4.4 x 10 ⁵
218-W-4A	Trenches (Caissons)	6.6 x 10 ⁴	1.8 x 10 ⁴	35	199
218-W-4B	Trenches (Caissons, Asphalt Pad, V Trench)	4.2 x 10 ⁴	1.0 x 10 ⁴	45	1.56 x 10 ⁵
218-W-4C	Trenches (Asphalt Pad)	--	--	--	--
218-W-7	Vault	23	1.6 x 10 ²	<.001	205
218-W-8	Vault	23	2,400	<.001	33
218-W-9	Trenches	--	68	N/A	--

N/A = Not applicable.
Source: Brown et al. (1977).

5.2 218-W-1 BURIAL GROUND

The 218-W-1 Burial Ground is an inactive TRU/mixed solid waste burial ground located on the east side of Dayton Avenue, approximately west of the 241-TX Tank Farm. It is about 1,500 ft northwest of the 234-5Z Building and lies between the 218-W-2 and 218-W-11 Burial Grounds. Inactive, in the case of solid waste burial grounds, means that each burial ground excavation has been backfilled and no opportunity for further waste burial exists.

The 218-W-1 Burial Ground operated from 1944 until 1953 to receive over 7,000 m³ of miscellaneous dry wastes. It is 521 ft by 458 ft and consists of fifteen trenches that run east to west. Twelve of these are 8 ft deep and 238 ft long. The other three are 9 ft deep and 488 ft long. Trench arrangement and dimensions are shown in detail on Hanford drawing H-2-75149. All waste is to be buried to a minimum depth of 4 ft below grade. Approximately 9,000 m³ of contaminated soil are estimated to exist (BHI 1994).

This site appears as a fenced field with an apparently undisturbed flat surface. It has been seeded with field grass. EPA notes that a small area near the center of the site contains contaminated mulch with a maximum reading of 12,000 dpm and that there is evidence that waste boxes have been observed to have been buried less than 4 ft from the surface. The site is fully fenced with chain-link fencing and is marked with permanent concrete posts with brass name plates.

Three UPRs are reported to have impacted this burial ground. They are as follows:

- UPR-200-45 occurred in 1957 when a burial box collapsed during burial operations and contaminated about 1,800 acres with ruthenium to a maximum reading of 1,100 mR/h. Most of the grossly contaminated burial ground was restored to normal use by plowing, road grading, and water flushing. Adjacent road surfaces were cleaned by flushing by water. Contaminated areas that resisted cleaning were posted as radiation zones.
- UPR-200-W-84 occurred in 1980 when a contaminated pump being buried leaked liquid onto the floor of the burial trench. The contaminate soil was picked up and placed in the trench.
- UPR-200-W-134 involved the improper burial of a TRU labeled drum in 1975. The site contains 8,983 m³ of contaminated soil (see BHI [1994] for UPR details and Appendix B for radionuclide inventory).

Aliases for this site include 200 West Area Dry Waste No. 001 Solid Waste Burial Ground. Hanford drawings that describe the site include H-2-75149; H-2-36442; H-2-31268; H-2-00123; and M-2600-W, Sheet 15.

5.3 218-W-1A BURIAL GROUND

The 218-W-1A Burial Ground is an inactive mixed waste site located north of the 241-T Tank Farm and about 2,000 ft northwest of the 221-T Building.

It operated from 1944 until 1954 to receive 13,705 m³ of unknown industrial waste from various Hanford operations. It consists of about ten trenches. Several areas were used as individual burial holes whose definite locations are unknown. Exact dimensions of some trenches are also unknown. Trench and hole depths are available only for Trench #6, which is 5 ft deep, and Trench #7, which is 20 ft deep. Overall size of the burial ground is 864 ft by 765 ft. Reported depth is 25 ft. The site is estimated to contain over 20,000 m³ of contaminated soil (BHI 1994).

This site was the first large equipment burial site in the 200 West Area. Most of the equipment was buried in wooden boxes that eventually rotted and caved in, causing surface subsidence, or sink holes. These holes were filled in 1975. Some surface contamination was detected in the past on a large number of 6-ft thick concrete cell blocks but has since decayed away. No surface contamination has been located in recent semiannual surveillances.

The site is marked with permanent concrete posts with brass name plates.

Aliases for this site include 200 West Area Industrial Waste Burial Ground #1, Industrial Waste No. 01A, and Industrial Waste No. 001 (BHI 1994).

Hanford drawings that describe this site and its location include H-2-44511, Sheets 149 and 157; and H-2-02516.

No UPRs are associated with this waste site (see Appendix B for radionuclide inventory).

5.4 218-W-2 BURIAL GROUND

The 218-W-2 Burial Ground is an inactive TRU/mixed solid waste burial ground located immediately south of the 218-W-1 Burial Ground and north of the 218-W-4B Burial Ground; about 1,800 ft northwest of the 234-5Z Building.

The 218-W-2 Burial Ground operated from 1953 until 1956 to receive 8,240 m³ of miscellaneous dry waste from various Hanford operations. It is made up of 20 east-west running trenches, each of which is between 463 ft and 471 ft long, 5 ft wide at the bottom, and about 16 ft deep. All waste is to be buried to a minimum depth of 4 ft. No asphalt bottom surface is called for. Overall size of the burial ground is 589 ft by 521 ft. It is estimated to hold approximately 23,000 m³ of contaminated soil (BHI 1994).

This site appears today as a fenced field with an apparently undisturbed flat surface. It has been seeded with field grass. EPA notes that a small area near the center of the site contains contaminated mulch with a maximum reading of 12,000 dpm and that there is evidence that waste boxes have been observed to have been buried less than 4 ft from the surface, some waste boxes having been observed to be within 18 in. of the surface. The site is fully fenced with chain-link fencing and is marked with permanent concrete posts with brass name plates.

Aliases for this site include the 200 West Area Dry Waste No. 002 and Dry Waste Burial Ground No. 2. Hanford drawings H-2-02503; H-2-36442; H-2-31268; and H-2-44511, Sheets 104 and 112 describe this site.

No UPRs impact this site (see Appendix B for radionuclide inventory).

5.5 218-W-2A BURIAL GROUND

The 218-W-2A Burial Ground is an inactive mixed solid waste site located north of 23rd Avenue, directly east of the 218-W-3 Burial Ground and about 3,500 ft west of the 221-T Building.

The 218-W-2A Burial Ground operated from 1954 until 1985 to receive 25,000 m³ of mixed waste. Contaminated soil volume is calculated as 94,777 m³.

The site is irregularly shaped and includes 19 trenches of various lengths numbered #1 to #11 and #20 to #27. Trenches #11 through #15 were used to bury contaminated cell blocks. Trenches were dug with centerlines running northwest from the railroad tracks, except trenches #1 to #3, which are shorter trenches, grouped in the extreme southwest corner of the site, and trench #16 located outside the fence east of trench #24 (BHI 1994).

Trenches were 15 ft deep and 16 ft wide at the base. Hanford drawing H-2-32095, Sheet 2, shows trenches #25 and #26 as being only partially backfilled. Both have been completely backfilled since the date of the drawing.

The burial ground contains, for the most part, miscellaneous radioactive solid waste from facilities in the 200 West Area. The solid waste consists mainly of tanks, concrete blocks, facility wastes, and process equipment. Sixteen trenches are filled with dry industrial waste. Trench #27 contains contaminated soil scraped from the 216-T-4-1 Pond. Waste buried since November 1980 does not

contain hazardous materials. It is possible that wastes disposed of before this date may contain hazardous wastes. Of the 887,000 ft³ of waste contained in the unit, only 12,000 ft³ were disposed of after November 1980. The waste disposed of before November 1980 is both low-level and byproduct, while the waste disposed of since that date is strictly low-level (BHI 1994).

No UPRs are known to have occurred at this site. Semiannual surveillance has detected no surface contamination (see Appendix B for radionuclide inventory).

The site is described by Hanford drawings H-2-32095, Sheets 1 and 2; H-2-31268; H-2-44511, Sheets 135, 143, 150, and 151; and Area Map H-2-44510. Hanford drawing H-2-44510 mistakenly refers to the site as 218-W-3A.

Aliases for this site include Industrial Waste No. 002; 218-W-02A Burial Ground; and 200 West Area Industrial Waste No. 02A.

5.6 218-W-3 BURIAL GROUND

The 218-W-3 Burial Ground is an inactive TRU/mixed solid waste burial ground located on the east side of Dayton Avenue, directly west of the 218-W-2A Burial Ground. It lies between the 218-W-3A and 218-W-4A Burial Grounds and is about 4,000 ft west of the 221-T Building.

The 218-W-3 Burial Ground operated from 1957 until 1961 to receive almost 11,000 m³ of pre-1970 miscellaneous unsegregated mixed TRU and non-TRU waste from various Hanford operations. It is estimated to contain over 25,000 m³ of contaminated soil. The site is 716 ft by 510 ft and consists of 20 dry waste trenches. Trenches #1 to #3 are 400 ft long and trenches #4 to #20 are 475 ft long. Each trench location is identified by a permanent concrete post with brass name plate (BHI 1994).

This site appears today as a fenced field with an apparently undisturbed surface. It has been seeded with field grass and rabbit brush. No UPRs are known to have occurred at this site and semiannual surveillance has detected no surface contamination (see Appendix B for radionuclide inventory).

Aliases for this site include Dry Waste No. 003. Hanford drawings that describe the site include H-2-44511, Sheets 136 and 144; H-2-32095; H-2-03398; and H-2-31268.

5.7 218-W-3A BURIAL GROUND

The 218-W-3A Burial Ground is an active TRU/mixed solid waste burial ground located on Dayton Avenue and 27th Street; immediately southeast of their intersection. It is immediately north of the 218-W-3 Burial Ground.

The 218-W-3A Burial Ground has operated since 1970 to receive over 99,000 m³ of TRU/mixed solid waste from various Hanford operations. BHI (1994) notes that the site holds over 51,000 m³ of contaminated soil and describes its waste types and amounts as follows:

"Trench #8 contains non-TRU and TRU waste. Trenches #17 and #5 contain TRU waste. Trench #40 contains industrial waste. Trench #14 contains ten large concrete burial boxes of radioactive soil from the 241-S Tank Farm following a salt

waste spill from the 102-S Tank transfer piping in 1973. Dose rates at the site of the spill before removal of the soil ranged to a maximum of 9mR/hr. Trench #17 contains fiberglass reinforced polyester (FRP) plywood boxes in various sizes from the Division of Military Application and related weapons decommissioning programs. Trench #7 contains waste from the cleanup efforts at Three Mile Island Nuclear Plant (TMI-2). This site also received irradiated fuel elements from General Electric, Vallecitos, CA. All remaining filled trenches contain dry and industrial waste. This site also received waste from Livermore National Labs, Colorado Springs; General Electric, Walla Walla, WA; 100 N Areas; HEHF; Energy Systems Group; Battelle Columbus Labs; and various other onsite and offsite locations."

The site is 1,250 ft long and of irregular shape. It includes 61 dry and industrial waste trenches running in an east-west direction. Seven are 535 ft long, thirty-five are 930 ft long, and ten are 900 ft long. The remaining trenches range in length from 403 ft to 512 ft. Trench depths range from 12 ft to 19 ft. Each trench location is identified by a permanent concrete post with brass name plate (BHI 1994). Only seven of the 61 trenches remain open and subject to receive additional waste. All others have been fully backfilled and the surface stabilized (Hanford drawing H-2-34880).

Aliases for this site include Dry Waste No. 003A. Hanford drawings that describe the site include H-2-34880, Sheets 1 and 2; H-2-31268; and H-2-44511, Sheets 151, 152, 160, and 167 (see Appendix B for radionuclide inventory).

5.8 218-W-3AE BURIAL GROUND

The 218-W-3AE Burial Ground is an active mixed solid waste burial ground located directly east and adjacent to the 218-W-3A Burial Ground. 27th Avenue defines its northern border and the railroad tracks its eastern border.

The site has operated since 1981 and has received 21,390 m³ of waste to date. It is irregularly shaped and has 28 trenches of varying sizes. Trench #2E is 1,246ft by 18 ft (bottom), 1,330 ft by 46 ft (surface), and 16 ft deep with a minimum of 8 ft of backfill. Trench #5E is 1,075 ft by 48 ft (bottom), 1,385 ft by 108 ft (surface), and 20 ft deep with a minimum of 8 ft of backfill. Trench #10E is 1,195 ft by 40 ft (bottom), 1,505 ft by 94 ft (surface), and 18 ft deep, with a minimum of 8 ft of backfill (BHI 1994). Each trench location is identified by a permanent concrete post with brass name plate.

Waste type includes miscellaneous wastes such as rags, paper, rubber gloves, disposal supplies, and broken tools; and industrial waste such as failed equipment, tanks, pumps, ovens, agitators, heaters, hoods, jumpers, and accessories.

Hanford drawings that describe this site include H-2-75351, Sheets 1, 2, and 3; and H-2-44511, Sheet 150 et al. Typical trench cross sections are described on H-2-75351, Sheet 2 (see Appendix B for radionuclide inventory).

Aliases for this site include Industrial Waste No. 3AE and Dry Waste No. 3AE.

5.9 218-W-4A BURIAL GROUND

The 218-W-4A Burial Ground is an inactive low-level/pre-1970 TRU/mixed solid waste burial ground located at the southeast intersection of 27th Avenue and Dayton Avenue.

The 218-W-4A Burial Ground operated from 1958 until 1968 to receive almost 18,000 m³ of miscellaneous dry, unsegregated mixed TRU and non-TRU waste. Specific trench contents are described on Hanford drawing H-2-32487 and are too lengthy to list here. Trenches that are not listed on the drawing hold operations and laboratory facility wastes. About 26,500 m³ of contaminated soil reside in the trenches.

The site contains 21 filled trenches that run east to west. A small miscellaneous trench runs north to south at the east end of trench #11. All trenches are 30 ft wide and 16 ft deep and range in length from 490 ft to 969 ft. Each trench location is identified by a permanent concrete post with brass name plate. Two caissons are located between trenches #17, #18, and #19 at their east end. Both consist of 12 gage well casing, 26 in. in diameter, and extend 48 ft below grade. Both have 33-in. thick concrete cover blocks.

Six 15-ft deep dry wells were installed in trench #16. These are made of 55-gal steel drums welded together with ends cut out (except the bottom of the lower drum) and placed on the end with the upper surface at ground level. Soil was shoveled into these wells to shield the high gamma radiation given off by the waste.

Four UPRs are associated with this burial ground. They are as follows:

- UPR-200-W-16 describes a fire in the dry waste in one of the trenches near the center of the burial ground. Plutonium contamination to 200,000 dpm was spread inside the burial ground and 30,000 dpm outside the burial ground. Contaminated soil on the south side of the trench was bulldozed into the trench. Soil on the north side was stabilized with road oil and nearby roads were washed down with water to remove spotty contamination.
- UPR-200-W-26 describes spotty ruthenium contamination to 2 Rem/h within the burial grounds and along the railroad tracks resulting from burial operations.
- UPR-200-W-53 describes another ruthenium contamination resulting from a 1959 collapse of a reduction and oxidation burial box. ¹⁰⁶Ru contamination with readings to 50 mR/h spread across the burial ground and across the fence to the east.
- UPR-200-W-72 describes a 1975 50-ft by 50-ft spread of alpha and mixed fission product contamination to 100,000 cpm and 70,000 dpm resulting from previously buried laboratory wastes. The contaminated waste was picked up and the area covered with 6 in. of sand, a layer of urea bore, a layer of 10-mil plastic, 12-in. to 14-in. of dirt and 3-in. to 4-in. of rock.

Hanford drawings H-2-44511, Series; H-2-32487; and H-2-33692 describe the site (see Appendix B for radionuclide inventory).

5.10 218-W-4B BURIAL GROUND

The 218-W-4B Burial Ground is an active TRU/mixed waste burial ground located 500 ft northwest of the 234-5Z Building, directly west of the 231-Z Building.

It has operated since 1967 and has received 10,466 m³ of miscellaneous radioactive solid waste. The majority of waste came from facilities in the 200 West Area. Solid waste consists of rags, paper, cardboard, plastic, pumps, tanks, process equipment, and other miscellaneous dry waste. Trenches #1 through #6 and #8 contain unsegregated mixed TRU and non-TRU waste. Trench #9 contains unsegregated TRU waste. Trenches #10, #12, and #13 contain non-TRU waste. Trenches #7 and #11 contain 20 yr retrievable TRU storage pads. The site contains 114,300 ft³ of segregated (post-1970) TRU waste (BHI 1994).

The burial ground consists of 13 trenches and 12 caissons. Each trench location is identified by a permanent concrete post with brass name plate. All trenches and all but one caisson are inactive. Trenches have been backfilled and the surface stabilized with field grass. Trenches are approximately 1,600 ft long and 12 ft deep (Hanford drawing H-2-33055; Site Visit).

One section of Trench #7 is an experimental trench for TRU storage containing barrels of TRU waste in a concrete-lined V Trench (Hanford drawing H-2-37035). Another section of the same trench is floored with 1.5-in. thick asphalt (Hanford drawing H-2-37077). Both sections are designed to serve as retrievable TRU burial sites.

Caisson sites may be located on Hanford drawing H-2-33055. The row of 12 caissons includes five alpha caissons for TRU waste, one UNI silo type caisson (for high activity waste from N Reactor), and six MFP caissons (for non-TRU and nonsegregated waste). The six MFP caissons consist of one silo type (#6), one alpha type (#5), and four dry waste caissons. The alpha type caissons weigh 26,000 lb. They have an 8.75 ft diameter and are 10 ft high, constructed primarily of concrete and have a steel cover fitted with lifting lugs. The silo type caissons are 30 ft tall with a 10 ft diameter and have a concrete base. Waste is placed beneath a concrete slab 15 ft below grade. Dry waste caissons are 8 ft in diameter and 10 ft high, constructed of corrugated metal with a concrete top and bottom. Caissons are ventilated with electric blowers that exhaust caisson air through filters and prevent contamination from occurring when wastes are dropped into the caissons (see Hanford drawings H-2-35570; H-2-35279; H-2-34375; and H-2-33971 for details on caissons). The caisson trench is the only active area of the site. All caissons are inactive except the MFP caisson #6 and Alpha caissons #4 and #5. Alpha caisson #5 has not been used (BHI 1994; Hanford drawings).

This site appears today as a fenced field with an apparently undisturbed surface. It has been seeded with field grass and some rabbit brush growth has occurred. No UPRs are known to have occurred at this site. There is a large area of wind eroded soil at the north end of the fenced area. There is a small area of contaminated mulch at the center of the fenced area with a maximum reading of 12,000 dpm. The fenced area includes 218-W-1, 218-W-2, 218-W-4A, 218-W-4B, and 218-W-11 (BHI 1994).

Aliases for this site include Dry Waste No. 04B. In addition to the drawings mentioned above, see Hanford drawing H-2-44511, Sheets 96 and 104 (see Appendix B for radionuclide inventory).

Additional descriptions of waste buried at the burial ground may be found in RHO (1980 a, b, and c). A brief mention of a surface cave-in may be found in RHO (1985).

5.11 218-W-4C BURIAL GROUND

The 218-W-4C Burial Ground is a large active TRU/mixed solid waste burial ground located immediately west of the 234-5Z Building. A second section of the site is located immediately south of the 234-5Z Building.

It has operated since 1974 and has received over 16,000 m³ of waste from numerous on and offsite sources. Over 9,000 m³ of contaminated soil are estimated to exist (BHI 1994).

Hanford drawing H-2-37437 shows 65 trenches in this burial ground, and space has been allowed for several more. Forty-eight trenches run east to west in the part of the site that borders Dayton Avenue. Twenty-four of these are 602 ft long, nineteen are 719 ft long, four are 594 ft long, and one trench is 299 ft long. Seventeen trenches run north to south in the part of the site located directly south of the 234-5Z Building. Of these, fourteen are 665 ft long and three are 508 ft long. Average depth is about 25 ft. Most of these trenches have been surveyed but have not yet been excavated (BHI 1994; Hanford drawing H-2-37437). Many of the trenches in this burial ground have, or will have, asphalt paving on their floors (see Hanford drawing H-2-37437, Sheets 2 and 3, for excavation and paving details. Each trench location is identified by a permanent concrete post with brass name plate. Hanford drawing H-2-37437, Sheet 4 provides exact locations of marker posts.

The northern-most trench is the Naval Reactor Core Trench and contains a number of core barrels from Bettis Naval Station near Seattle, Washington. Trench #1 contains drums with plutonium-contaminated soil from the 216-Z-9 Crib mining operation and noncombustible TRU waste. Trench #4 contains drums of assorted combustible TRU waste and one module of noncombustible TRU waste. Trenches #1, #4, #7, #20, #24, #25, and the easterly end of #19 contain retrievable waste. Trenches #23, #28, #48, #53, #58 and the remainder of #19 receive low-level waste. The remaining trenches are proposed (unexcavated). This site also received waste from 100-N, 100-K, and 100-B Reactor Areas, General Electric, Babcock and Wilcox, Fermi National Labs, Exxon, Bartleville Energy Technology Center, Battelle Columbus Labs, and Chemical Nuclear Systems. Spent fuel is also stored at this site (BHI 1994).

No UPRs are associated with this site. Aliases for this site include Dry Waste No. 004C (see Appendix B for radionuclide inventory). Hanford drawings that describe this site include H-2-44511, Sheets 64, 72, 80, and 88; and H-2-37437, Sheets 1 through 4.

5.12 218-W-5 BURIAL GROUND

The 218-W-5 Burial Ground is an active low level/mixed solid waste burial ground located at the southwest corner of the intersection of 27th Street and Dayton Avenues. It is a large burial ground made up of a few active trenches and many planned trenches.

The 218-W-5 Burial Ground has operated since 1986 to receive 32,500 m³ of mixed and retrievable TRU wastes. It contains 56 active or planned trenches, all oriented east to west. The trench widths and depths of 34 trenches have been determined. Twenty-seven trenches are 15 ft wide (bottom) and

17 ft deep. Of these, eighteen are 1,160 ft long, four are 430 ft long, three are 530 ft long, and two are 1,060 ft long. Seven trenches are 1,160 ft long, 40 ft wide (bottom) and 17 ft to 20 ft deep. Each trench location is identified by a permanent concrete post with brass name plate (BHI 1994).

Five storage and disposal areas have been designated at this burial ground: (1) Fast Flux Test Facility and Fuels and Materials Examination Facility Disposal Cask Area; (2) Ultra-heavy Reactor Component Disposal Area; (3) Large Concrete Box and Navy Core Barrel Disposal Area; (4) Low Specific Activity Rubble and Nonstackable Waste Disposal; and (5) Packaged (stackable) Non-TRU Waste Disposal Area. There is also a non-TRU expansion area located in the northwest section (BHI 1994).

An internal Rockwell Hanford Operations white paper describes lead that has been buried in Trenches #9 and #21. It reports that 450 lb of lead are buried in Trench #21 and 3,710 lb in Trench #9 (RHO 1986).

No UPRs are associated with this site (see Appendix B for radionuclide inventory). Hanford drawings that describe this site include H-2-44511, Series; H-2-93718; H-2-93719; H-2-94677; H-2-34762; SK-2-57216; and SK-2-57217.

5.13 218-W-6 BURIAL GROUND

The 218-W-6 Burial Ground is a proposed burial ground that will include 28 trenches for storage of low-level/mixed solid waste. It will be located north of the 218-W-1A Burial Ground. No wastes have been introduced to this site.

5.14 218-W-11 BURIAL GROUND

The 218-W-11 Burial Ground is a small inactive burial ground that received low-level/mixed solid waste in 1960. It is located immediately north of the 218-W-1 Burial Ground.

The 218-W-11 Burial Ground is 500 ft by 200 ft and received 1,160 m³ of low-level mixed waste. 309 m³ of soil are estimated to be contaminated. This site is an above ground storage area and two filled burial trenches running east to west. Trench #1 is 258 ft long and trench #2 is 150 ft long.

This waste site was used for burial of low-level, contaminated sluicing equipment that had been used in the uranium recovery program at the 221-U Building. Some of the equipment was later removed for reuse in the strontium/cesium recovery program.

This site appears today as a fenced field with an apparently undisturbed flat surface. It has been seeded with field grass. EPA notes that a small area near the center of the site contains contaminated mulch with a maximum reading of 12,000 dpm. The site is fully fenced with chain-link fencing and is marked with permanent concrete posts with brass name plates.

Hanford drawings H-2-44511, Sheet 120 and H-2-94250 describe the site (see Appendix B for radionuclide inventory).

5.15 2607-WWA SEPTIC TANK

The 2607-WWA Septic Tank is an active waste site that supports the sanitary sewage needs of the 242-WA Building in the 200 West Area.

It includes a drain field and it handles sewage at an estimated rate of 3.41 m³/d.

Its exact location is defined on Hanford drawing H-6-00471, Sheet 34.

5.16 RADIOACTIVE MIXED WASTE STORAGE FACILITY

The Radioactive Mixed Waste Storage Facility consists of twelve small buildings used to temporarily store designated mixed waste. Designated on drawings as safety storage modules, these twelve metal buildings are located west of Dayton Avenue, immediately west of the 218-W-2 Burial Ground.

Constructed in 1988, this is an active site that includes buildings 2401-W, 2401-WB, 2401-WC, 2401-WD, 2401-WE, 2401-WF, 2401-WG, 2401-WH, 2401-WI, 2401-WJ, 2401-WK, and 2401-WL. Each is a prefabricated Butler type building (BHI 1994).

These may be located on Hanford drawing H-2-44510, Sheet 6, on which they are mislabeled as 2402 Buildings. Additional information and photographs are included in DOE-RL (1988).

5.17 Z PLANT BURNING PIT

The Z Plant Burning Pit operated for 10 years from 1950 to 1960 as a disposal site for combustible nonradioactive office and laboratory waste. An estimated 2,000 m³ of such waste were burned in this 50-ft by 40-ft by 10-ft deep pit. An amount of chemicals equal to less than 1,000 m³ was also burned there (BHI 1994).

The site was located at Hanford coordinates N39000 W77800, which would place it in the approximate center of 218-W-4C Burial Grounds. No drawing reference to the burn pit has been located. A site visit revealed no evidence of the pit.

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6.0 REFERENCES/BIBLIOGRAPHY

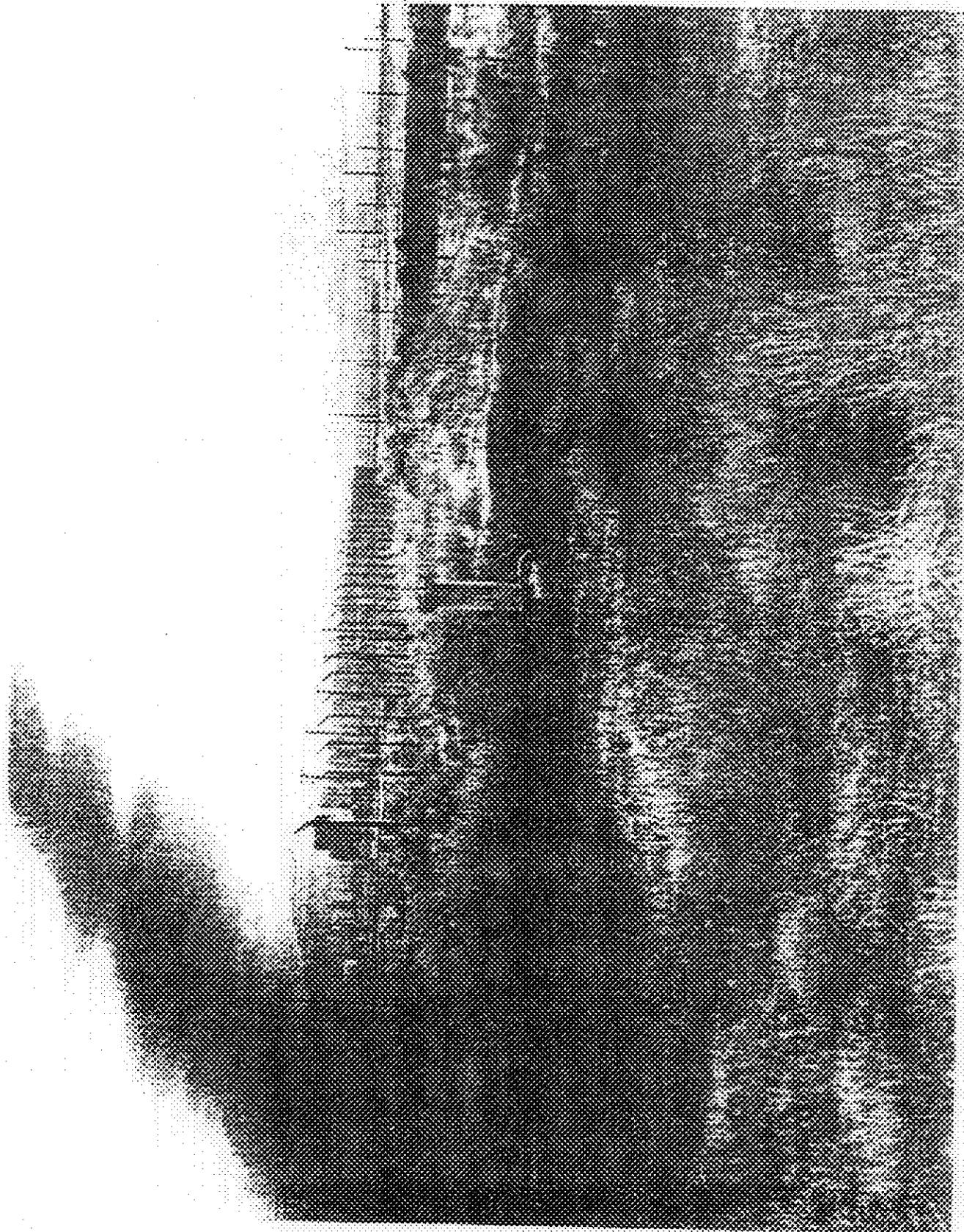
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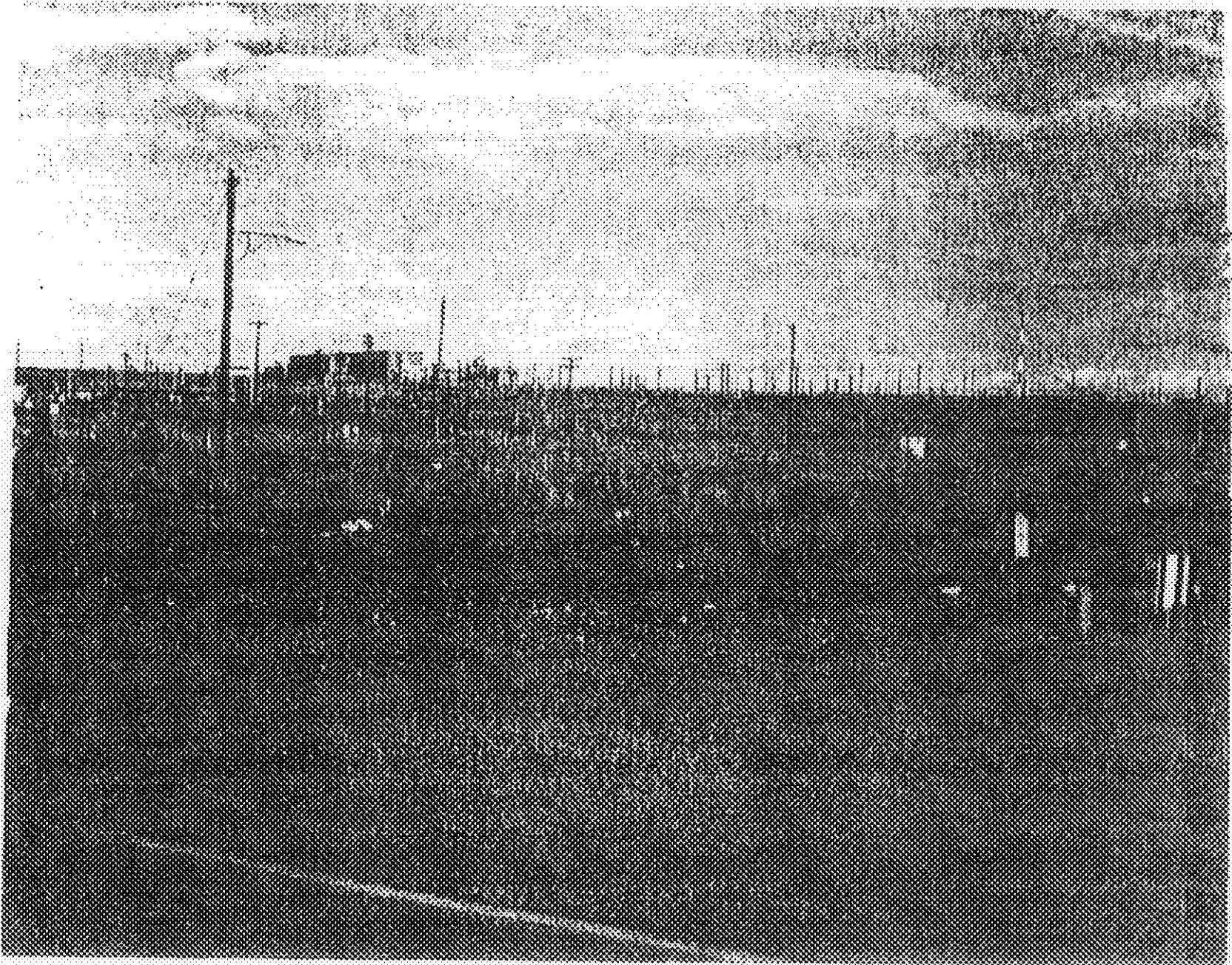
APPENDIX A

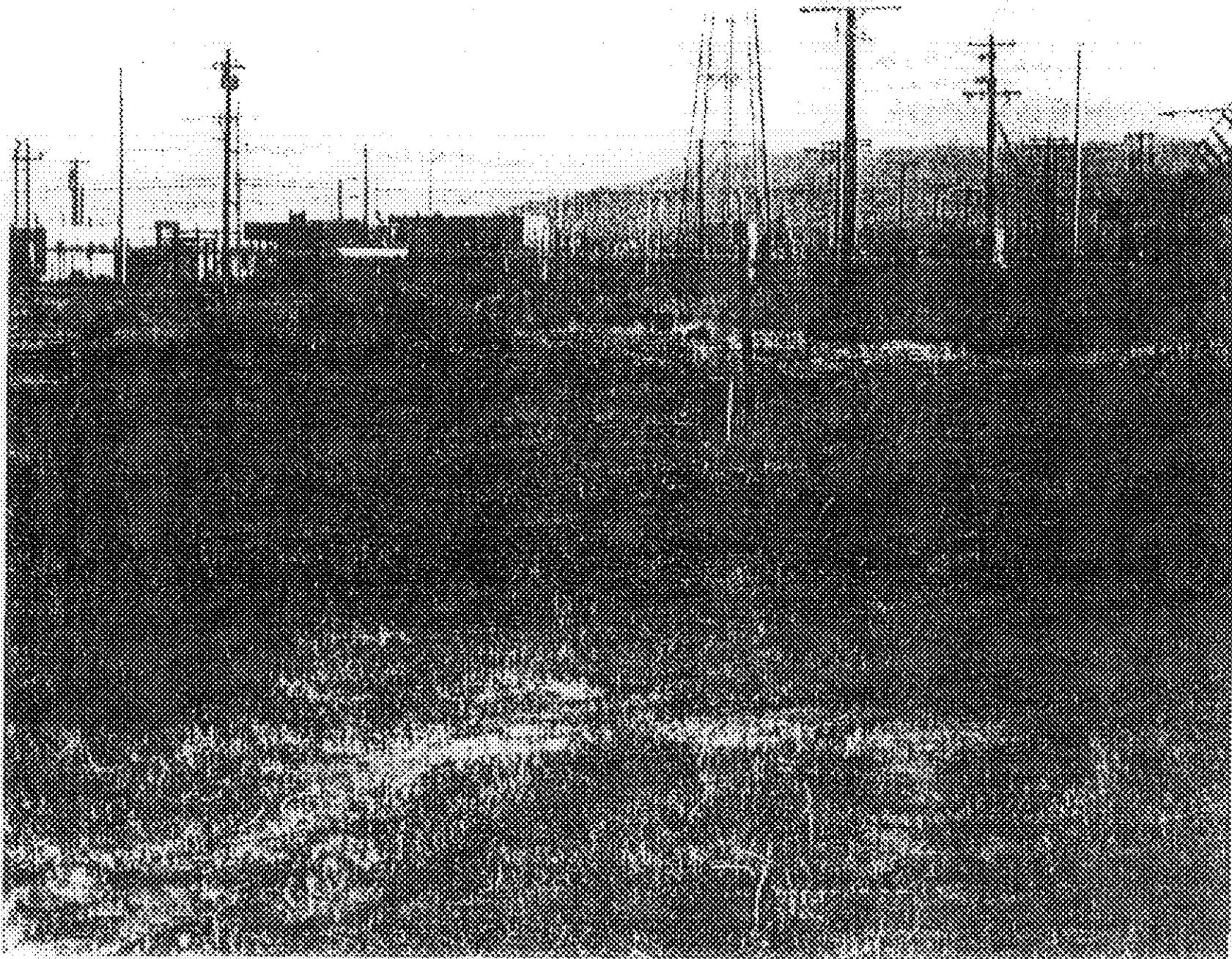
PHOTOGRAPHS

Photograph A-1. 316-Z-3 Crib



Photograph A-2 216-2-S Cont.



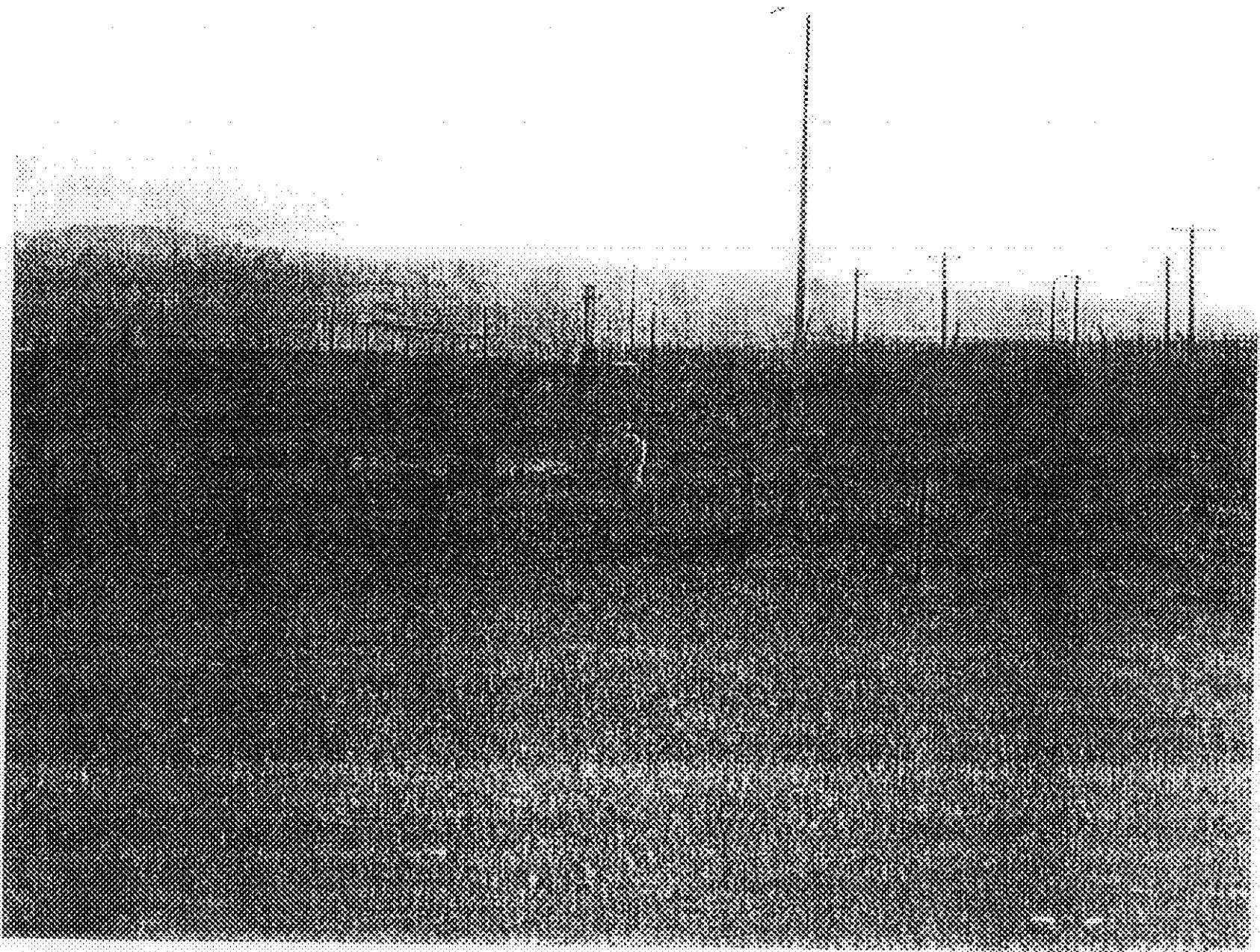


Photograph A.3. 116.2.6 Cont.

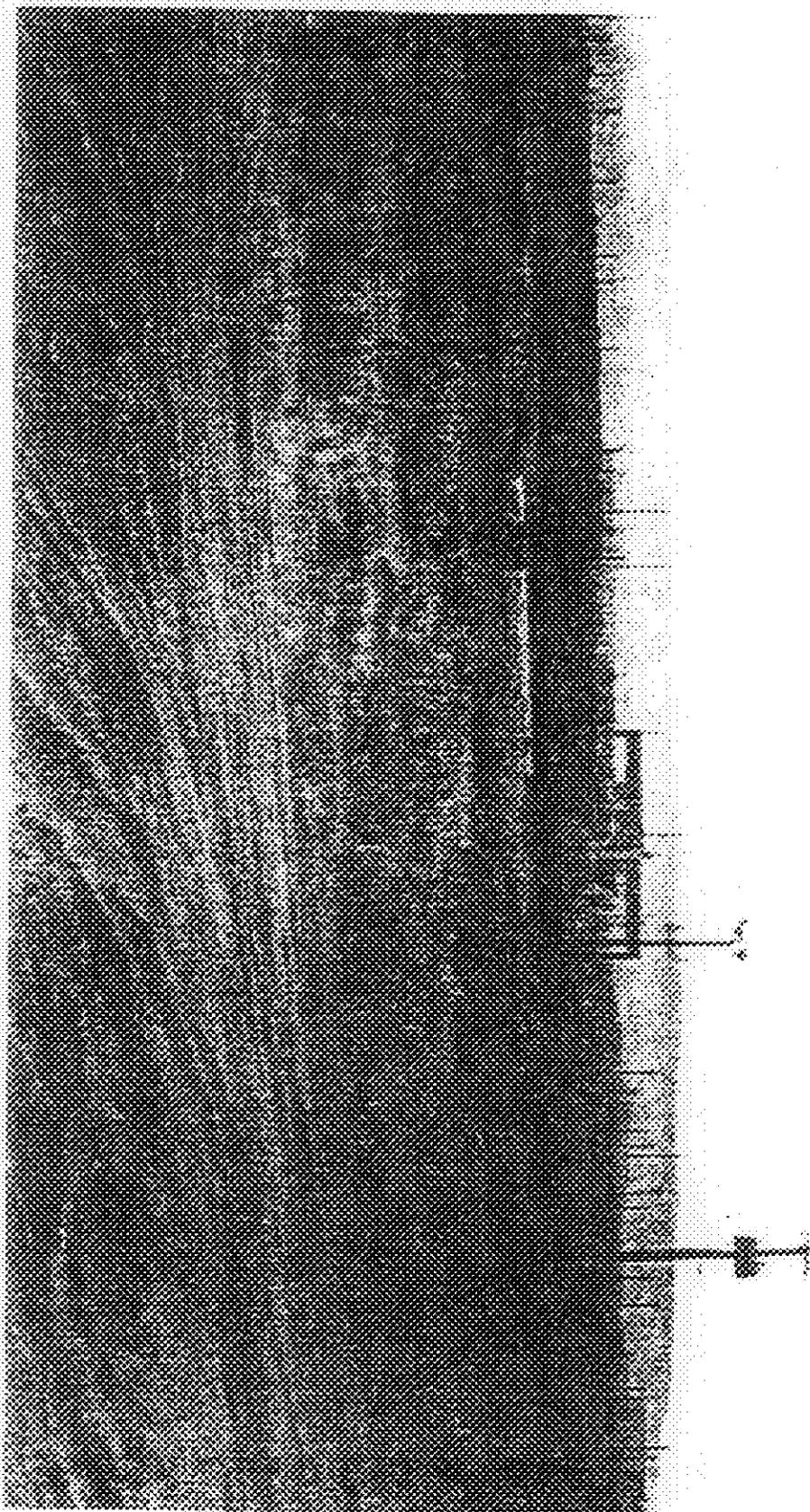
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Photograph A-4 116.2.1 Cont.





Photograph A.S. 16-1 X from A. D. ...

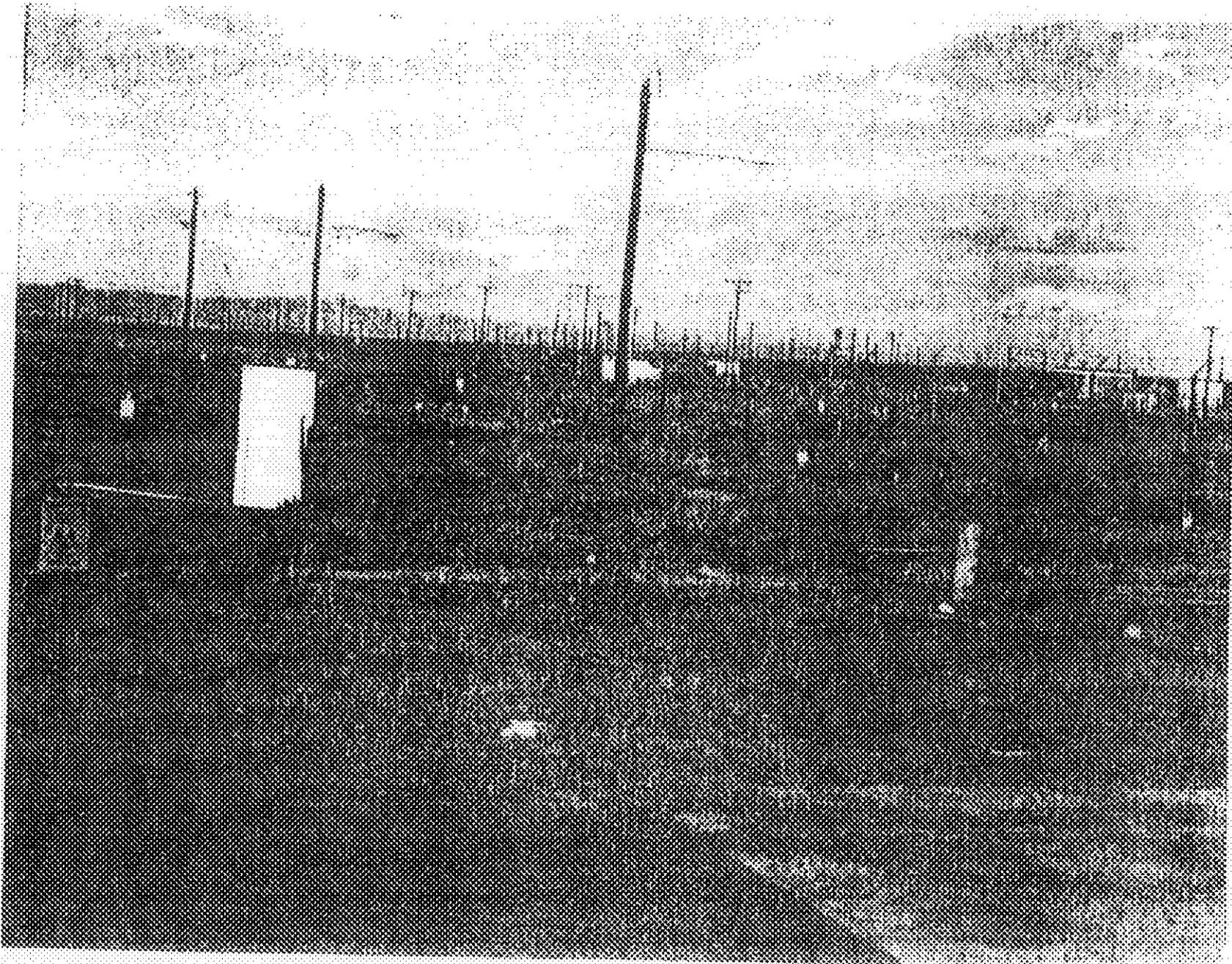


Photograph A-6. 216-2-8 Trench

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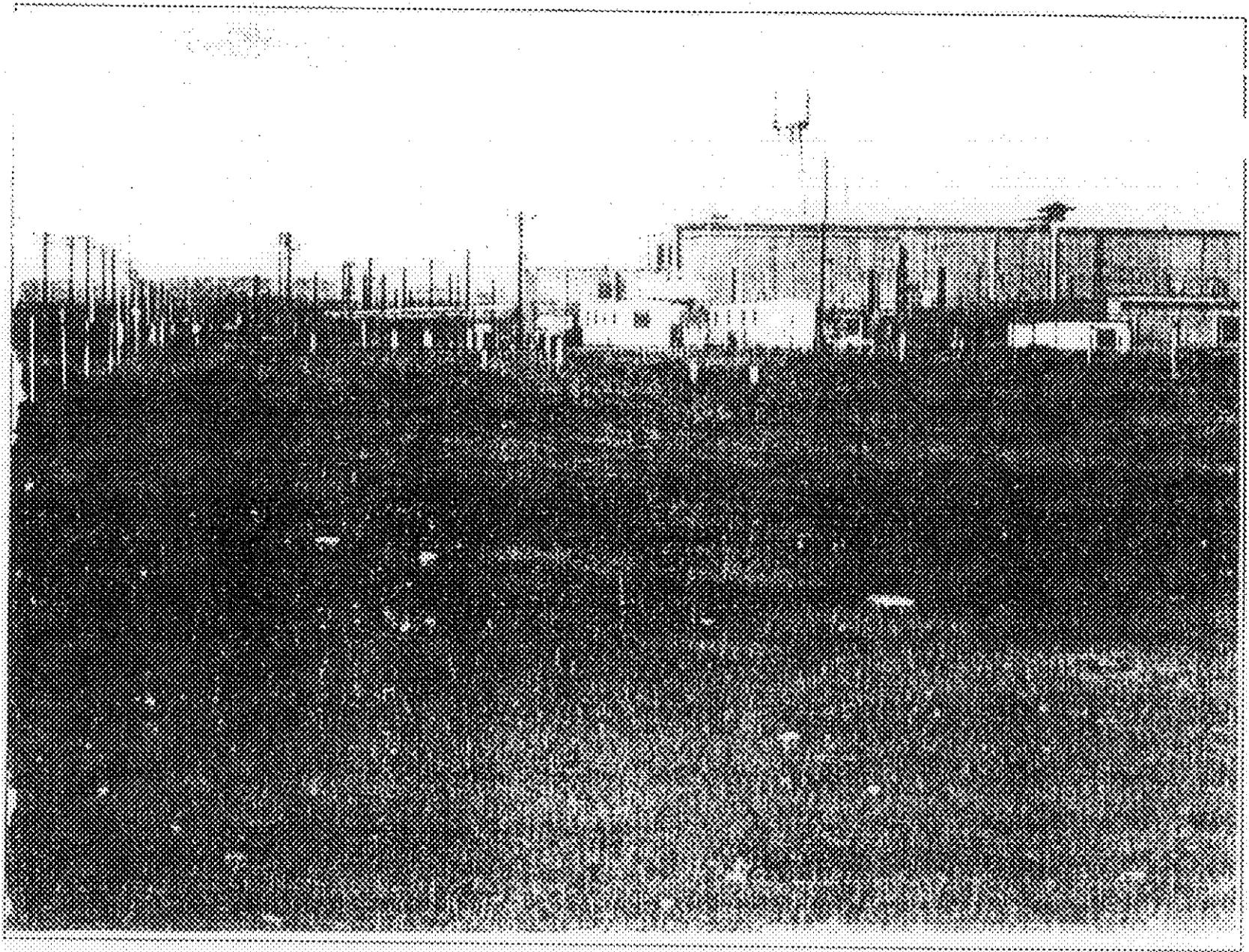
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Photograph A-1 216 2-10 8:48

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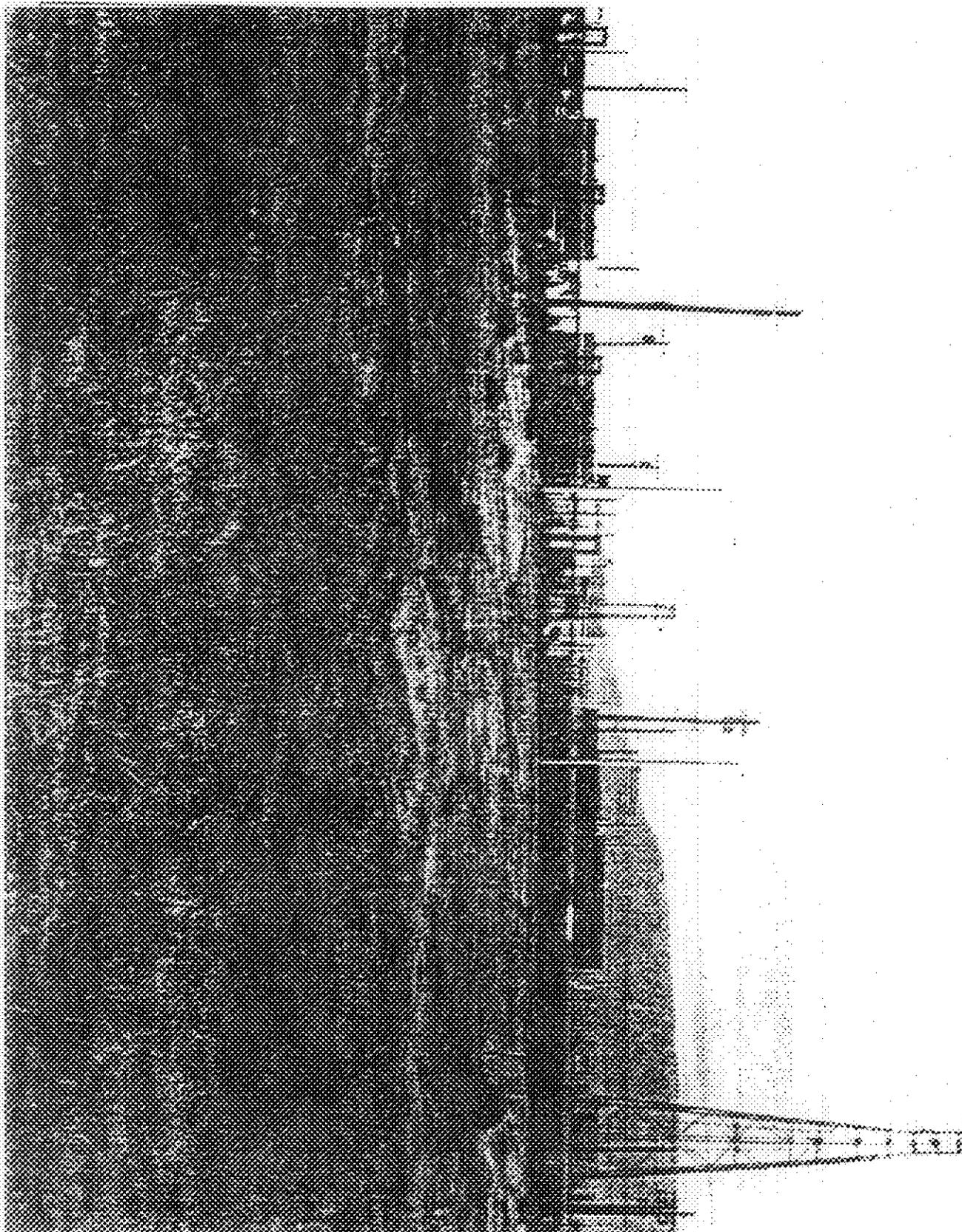


Photograph A-3 2/16/2013 O&B

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Photograph A-9 216-Z-16 Cr8



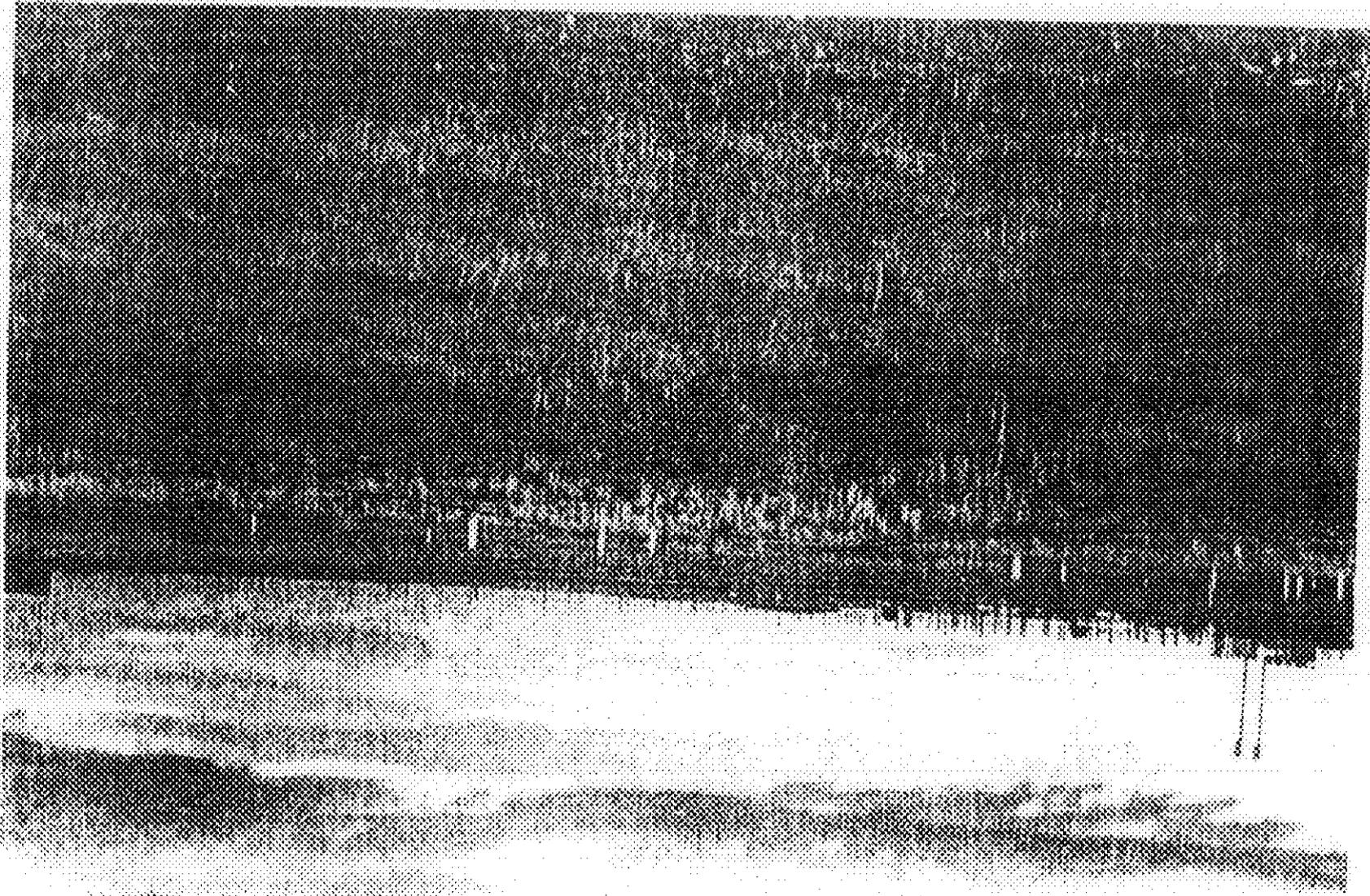


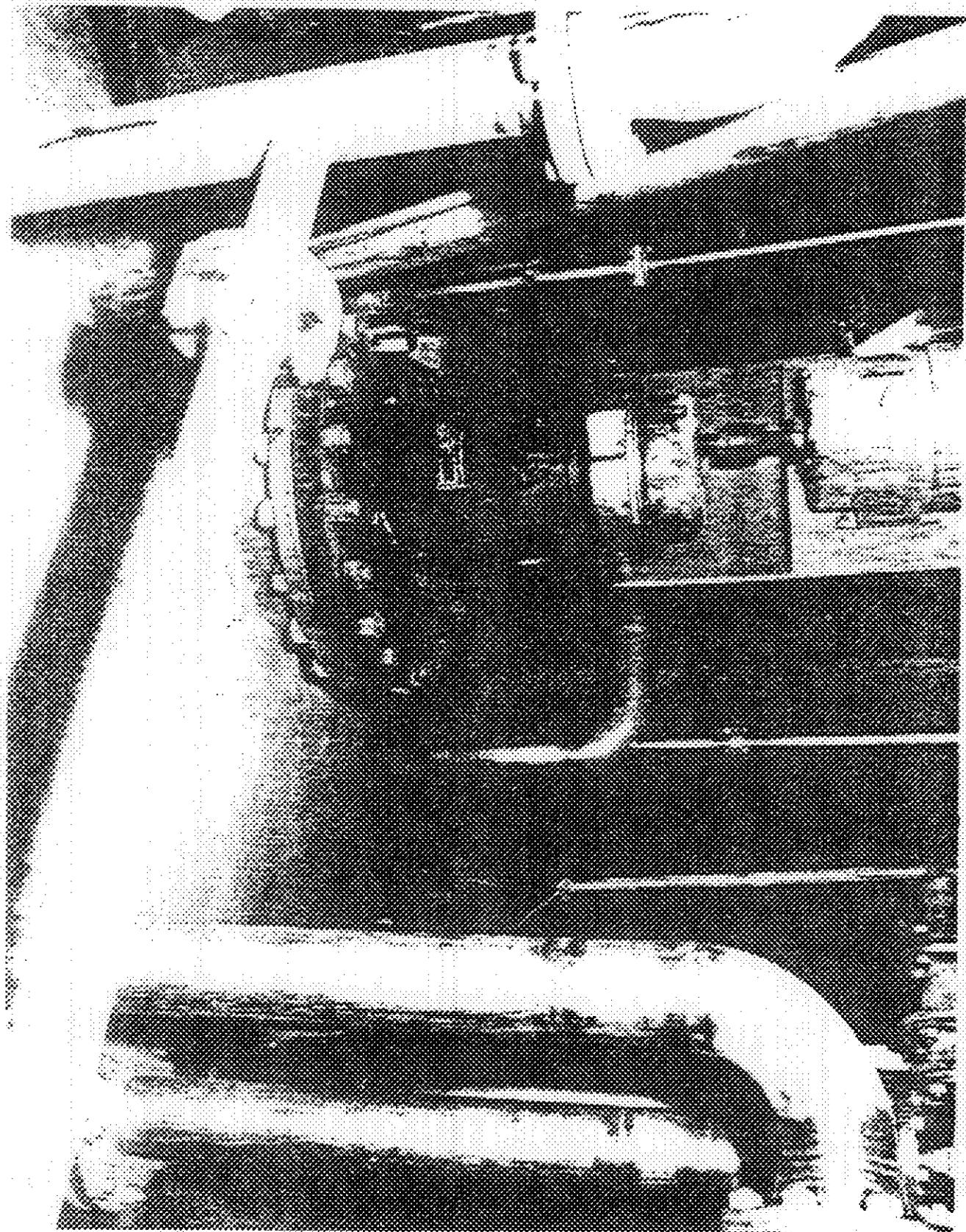
Photograph A-10, 216 Z-11, 11/1/68

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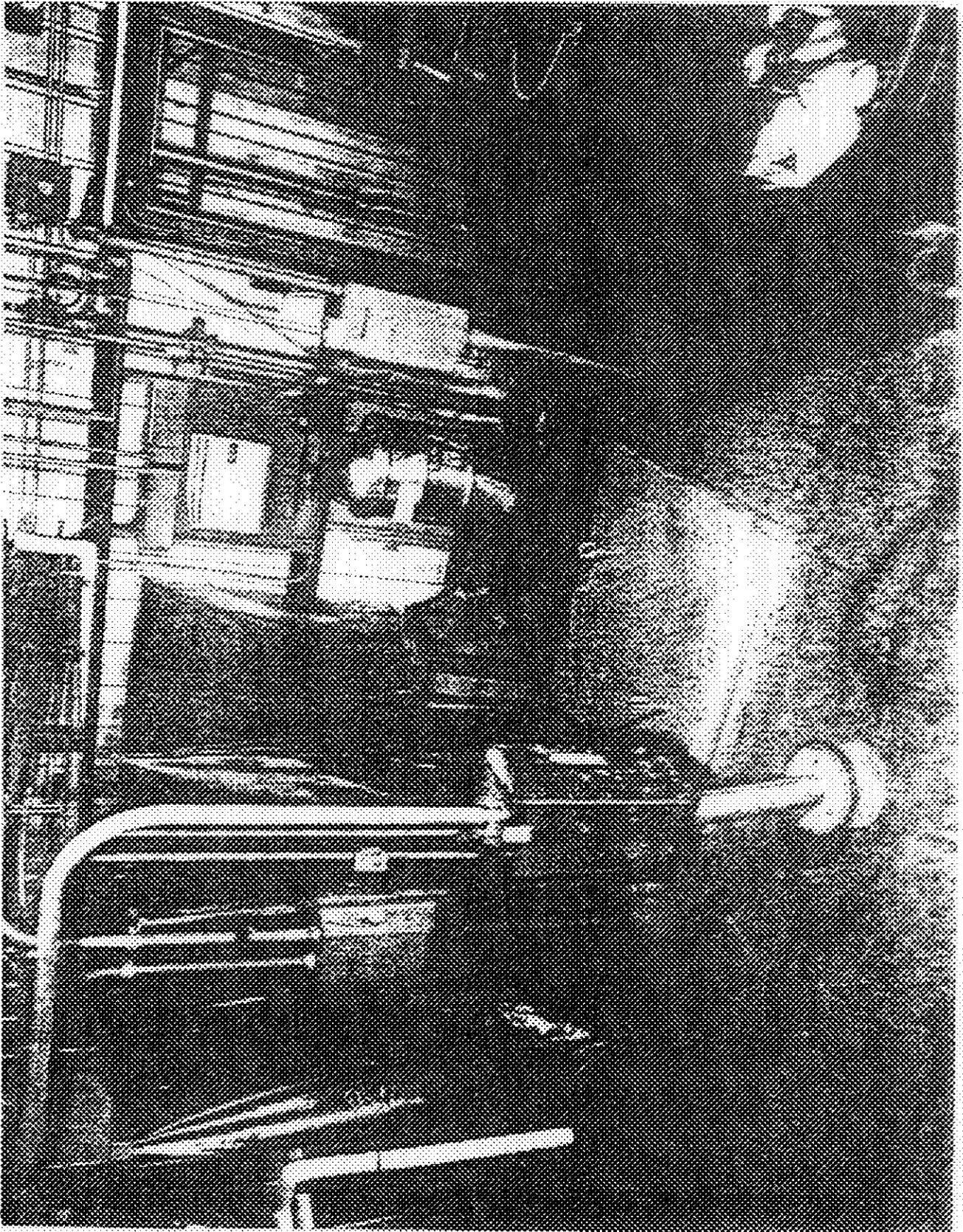
Photograph 6-11 2(b)-Z-18 Cell





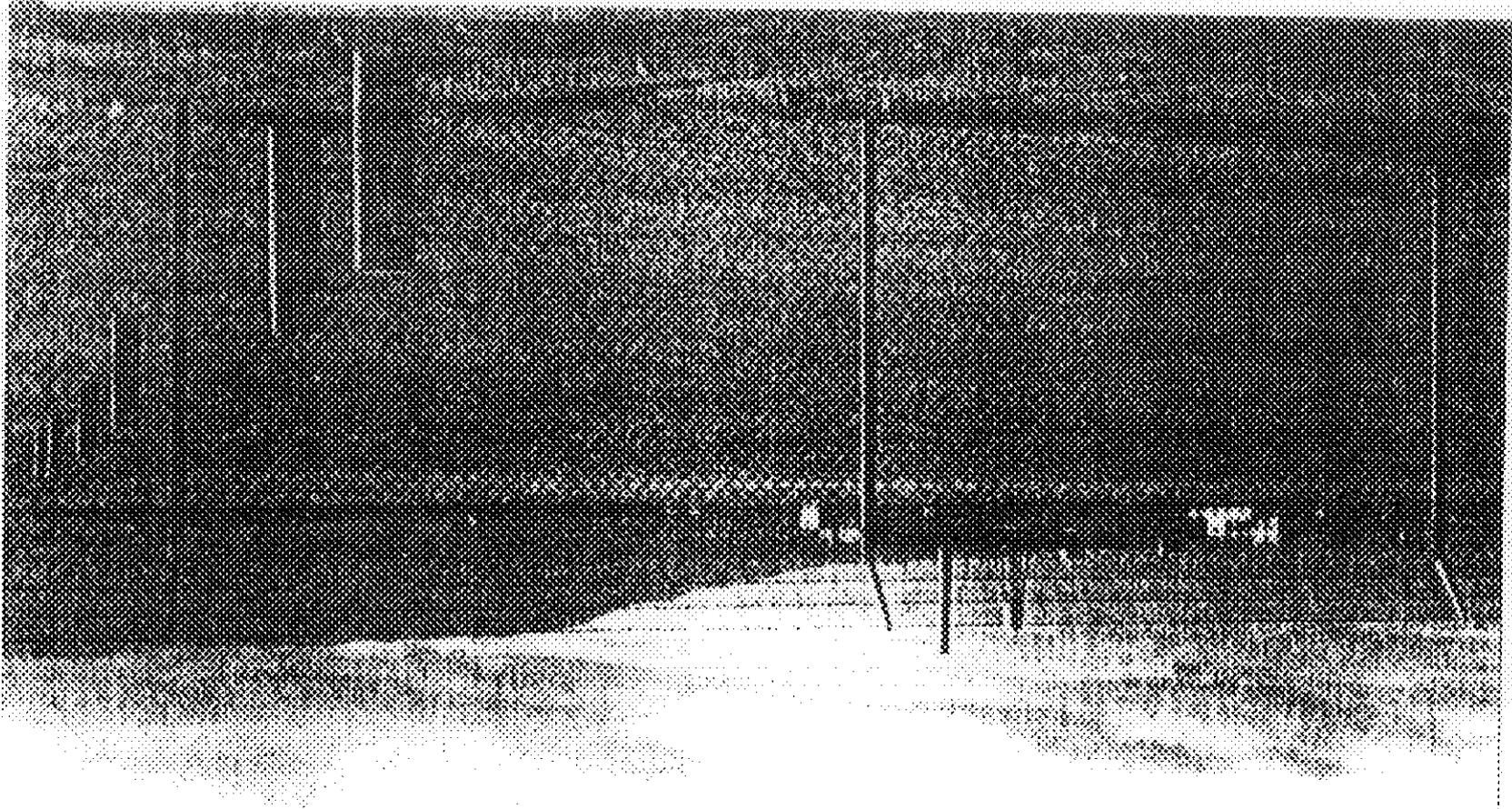
Photograph A-13 Tank D-5

Photograph A-12 Tank B-5 Vault Cover



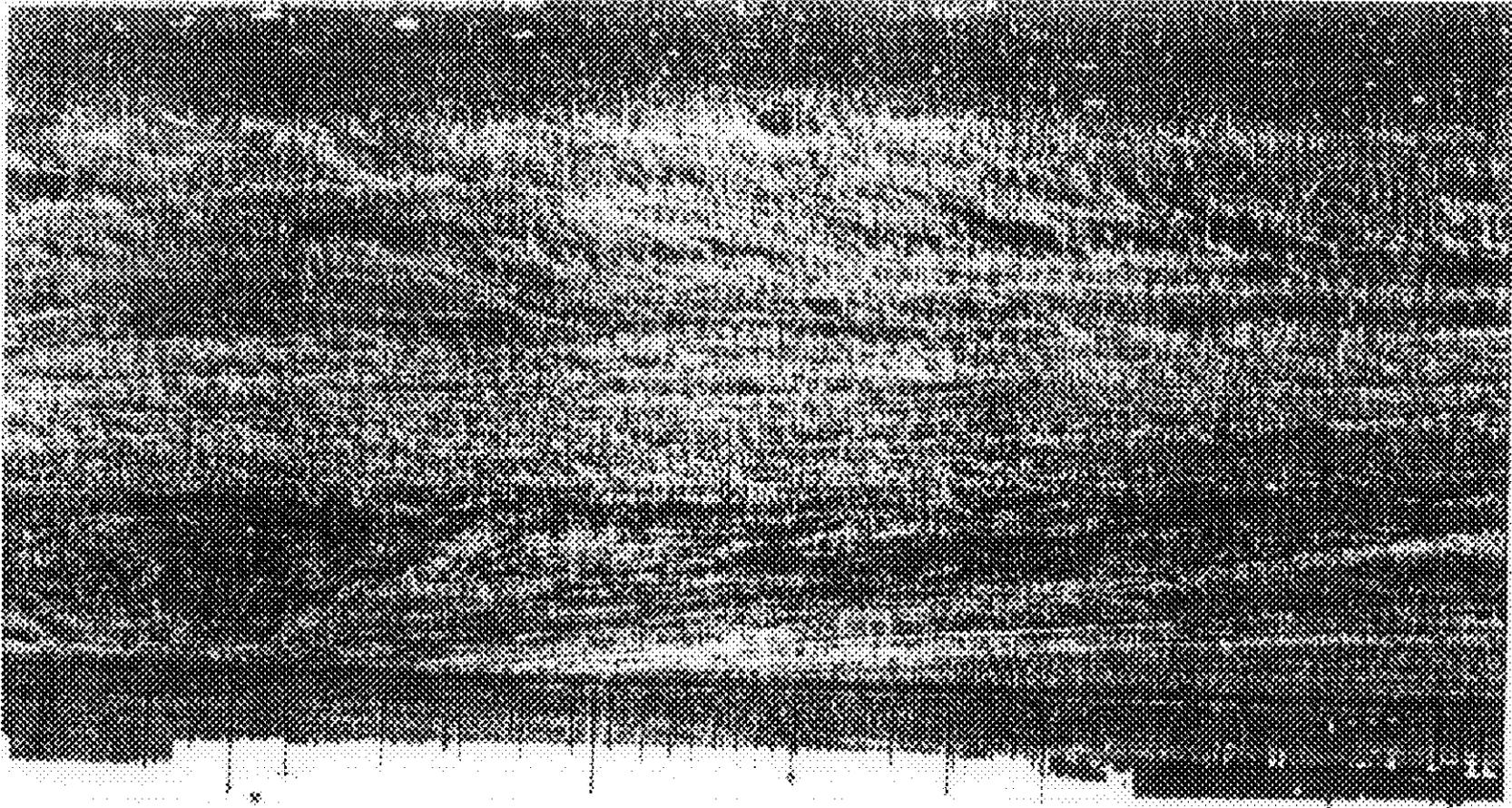
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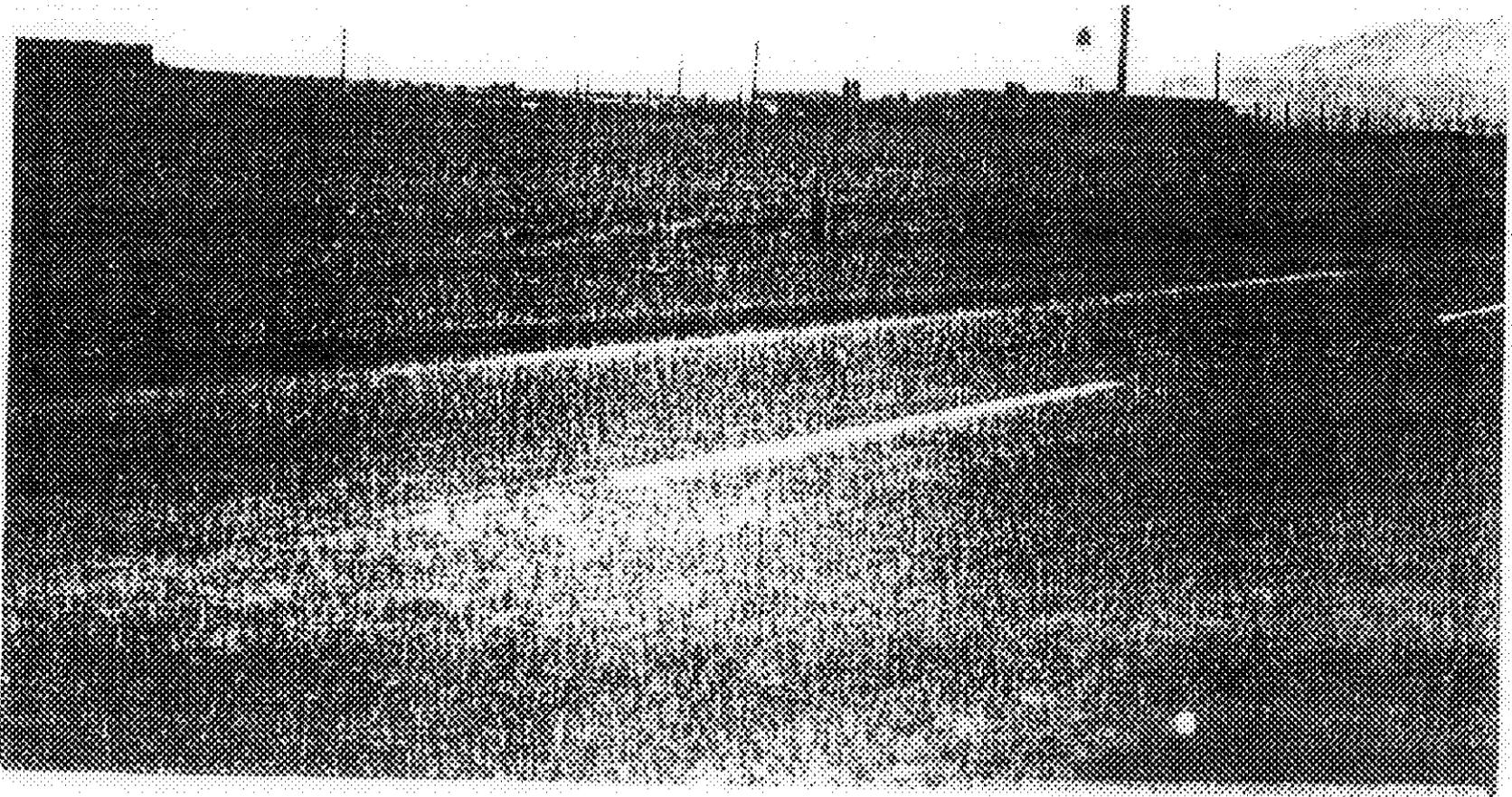
Photograph A-14. 218-W-1, 218-W-2, 218-W-4A, and 218-W-11



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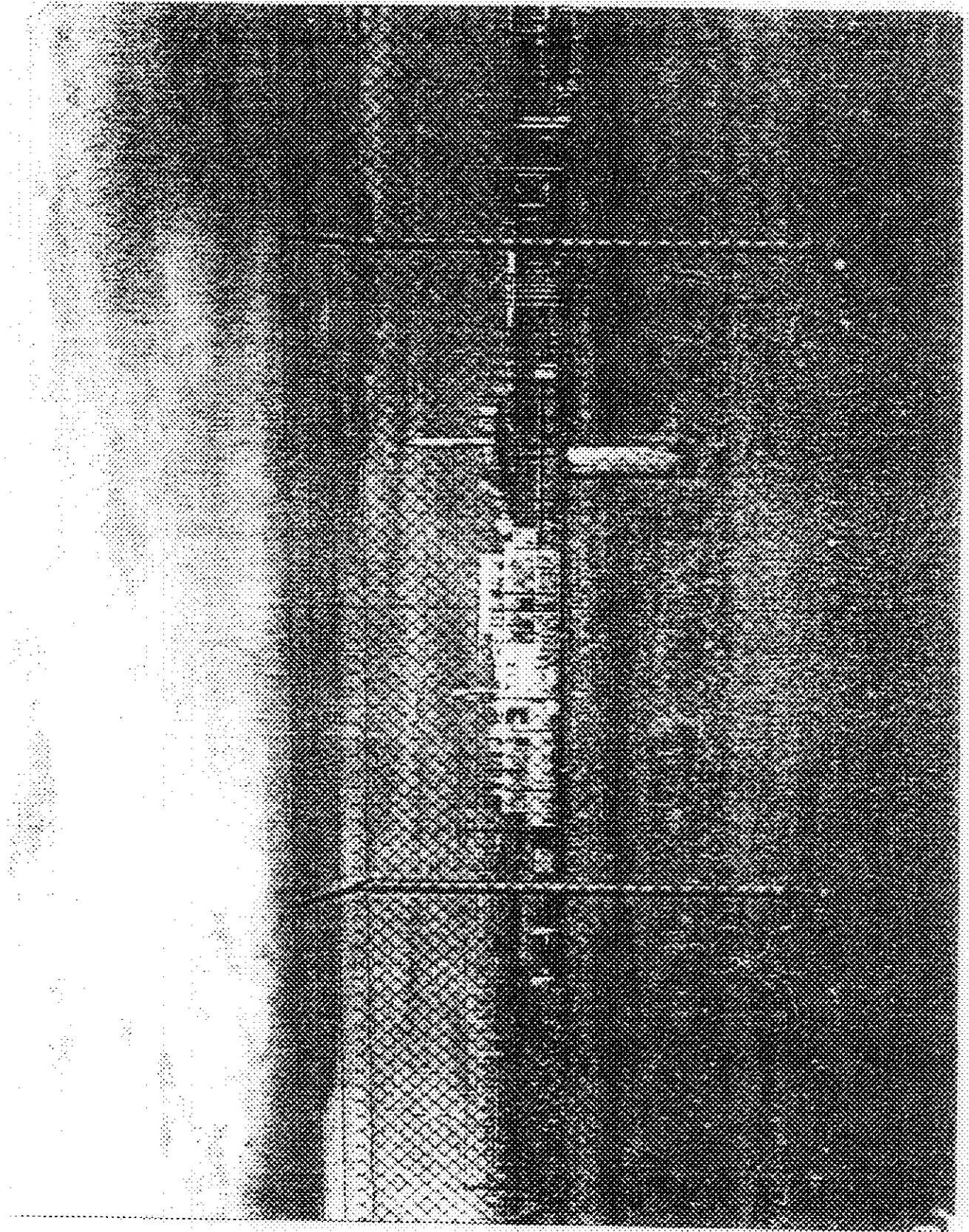
Photograph A-15 216 West A Burial Ground





Photograph A-16 218-W-3 Burial Ground

Photograph A-17. 218-W-48 Burial Ground.



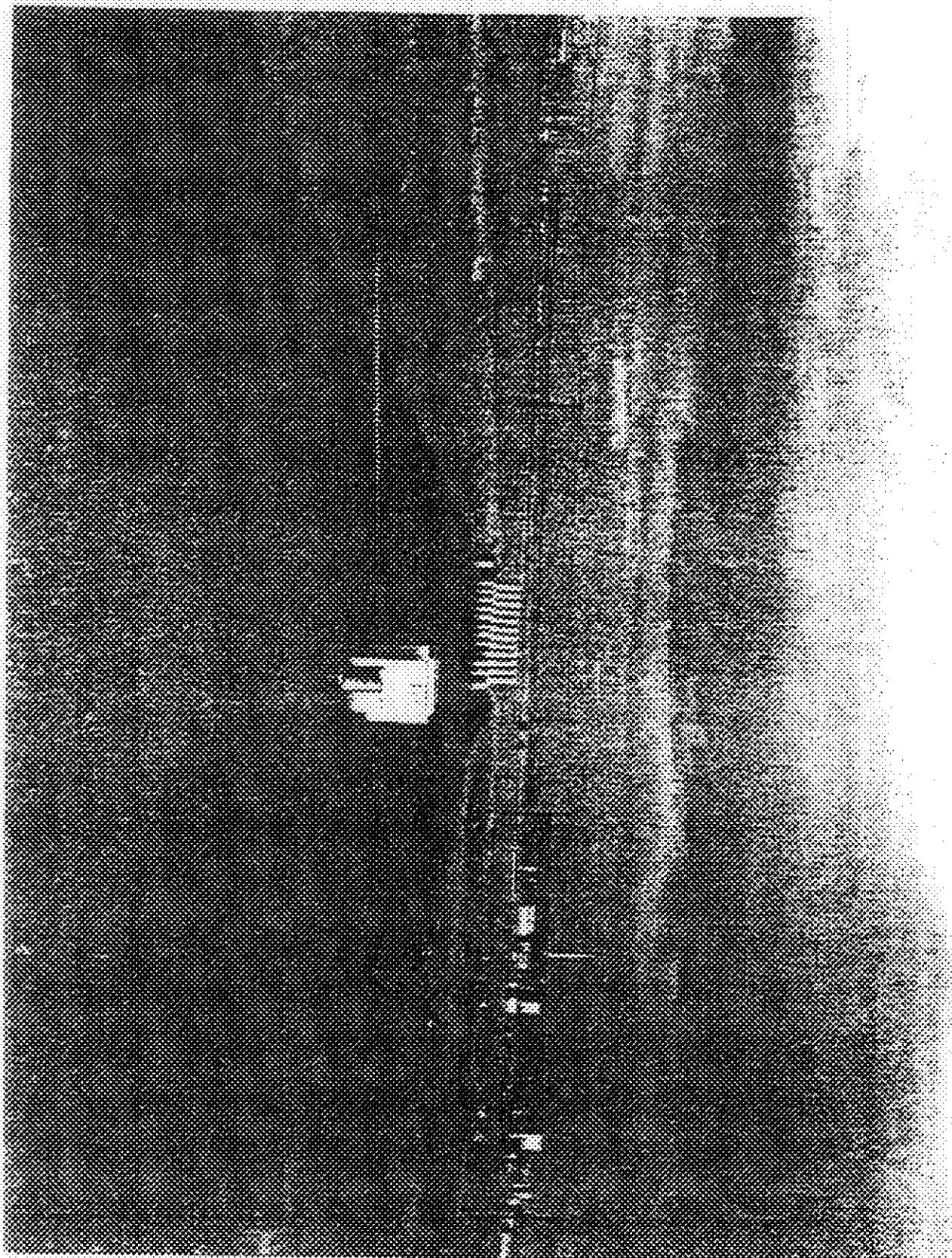
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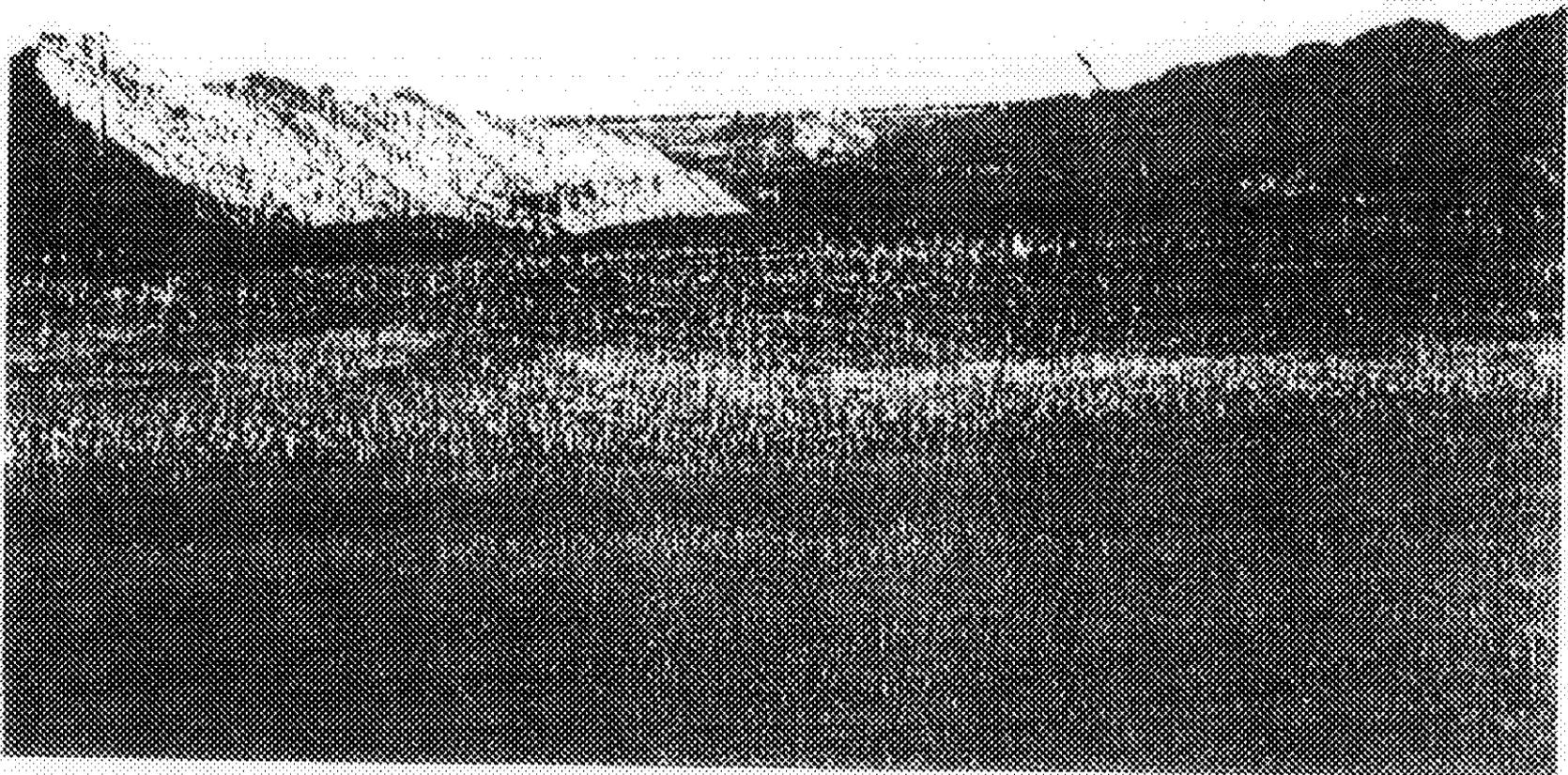
Photograph A-16. E18-W-3C Burial Ground



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Photograph A-19 218-W-4C Burial Ground



Photograph A-20. Typical Open 200-W Solid Waste Treatment

APPENDIX B

**SUMMARY OF RADIOACTIVE SOLID WASTE RECEIVED IN THE
200 AREAS DURING CALENDAR YEAR 1990, WHC-EP-0125-3**

APPENDIX B

SUMMARY OF RADIOACTIVE SOLID WASTE RECEIVED IN THE 200 AREAS DURING CALENDAR YEAR 1990, WHC-EP-0125-3

ADDENDUM TO Z AGGREGATE AREA MANAGEMENT STUDY TECHNICAL BASELINE REPORT

The following descriptive and historical data is provided as requested by H. K. Johnson, EBASCO, Bellevue, Washington.

216-Z-10 REVERSE WELL

The 216-Z-10 Reverse Well is a registered underground injection well located about 100 ft east of the 231-Z Building and 400 ft north of 19th Avenue at Hanford coordinates N40804 W76535. It operated from February 1945 until June 1945 to receive about 1M L of transuranic contaminated mixed liquid waste from the 231-Z Building. It is 670 ft above mean sea level (MSL) and the water table at this point is about 193 ft below grade (BHI 1994).

216-Z-10 consists of a 6-in. schedule 40 steel pipe that extends from about 1 ft above grade to a depth of 150 ft below grade. It was fed by two 3-in. stainless steel lines from the nearby 231-W-151 Sump Tank. A third 3-in. stainless steel line runs from 216-Z-10 to the 216-Z-5 Crib to handle overflow which the reverse well could not handle (Brown and Ruppert 1948; HW-76419, H-2-32682; Hanford drawing H-2-44511, Sheet 103).

This site received process and laboratory wastes from the 231-Z Building via the 241-W-151 Sump Tank. The waste was neutral/basic and contained about 50 g of plutonium in 260,000 gal of waste. No other radionuclides were reported (BHI 1994)

Brown and Ruppert (1948) reports the following concerning waste and contamination:

"No plutonium was found in any of the samples from three wells drilled in the 231-W-150 [an alias for 216-Z-10] reverse well area. These three wells were drilled to depths of 175 feet, 25 feet below the bottom of the reverse well. Contamination may have channelled out laterally from the well and not been detected by any of the three test wells, but the rate of discharge (20 gallons/minute) was so low that all the liquid could have moved downward and never reached the area drilled. Moreover, the relatively small amount of waste liquids discharged into the well (260,000 gallons) before the well was sealed suggests that contamination may be confined within the 30-foot diameter circle formed by the three wells. Other waste disposal units which have absorbed far greater amounts of wastes than the 231-W-150 well have created zones of plutonium contamination of far smaller diameter for the quantity of wastes discharged than the 30-foot diameter circle around the 231-W-150 well. Thus, on the basis of comparison with other units, the contaminated zone at 231-W-150 lies within the 3 wells drilled and need not go to considerable depth. The well stratified Ringold (?) formation into which the reverse well penetrates should certainly cause the waste solutions to spread laterally rather than vertically. The clay and silt bed which here forms the topmost

member of the formation undoubtedly retarded the movement of the solutions and probably sorbed much of the contamination. The clay and silt probably aided in sealing the well, by being washed into the casing during discharge of the wastes into the well."

Table I of the same document offers the following:

"Size = 6 inches X 150 feet deep
Total Volume Waste in Gallons = 260,000
Rate in gal/min = 20
Recorded radioactivity (Amts. Approx.) = 100 g. Pu
Calculated Radioactivity = None found in 15 foot radius
Calc./Recorded Radioactivity = None
In Use = No, sealed with sludge."

Concerning the above described test wells, BHI (1994) summarizes that "three test wells were dug 15 feet from this site in 1947. The 175-ft wells yielded soil samples every 5 ft, none of which showed any contamination."

The site was deactivated by capping the pipeline to the unit west of the 231-W-151 Diversion Box when the unit plugged with sludge (BHI 1994).

Surface contamination is reported at this site. 200 to 20,000 ct/min on surface and tumbleweed fragments are reported (Osborne and Johnson 1988).

The site has a hazardous ranking system migration score of 47.82 (Stenner et al. 1988). Aliases for this site include 216-Z-2, 231-W Reverse Well, 231-W-150 Dry Well, or Reverse Well (BHI 1994).

216-Z-16 CRIB

The 216-Z-16 Crib, located about 250 ft northwest of the 231-Z Building, operated from 1968 to 1977 to receive 102M L of neutral/basic liquid waste from 231-Z. The crib is estimated to have received 71.6 g of plutonium as well as 4.4 Ci Alpha and .001 Ci Beta contamination (BHI 1994; Aldrich 1984).

It is a drain field type crib consisting of 150 ft of perforated 4 in. polyvinyl chloride (PVC) pipe placed 4 ft above the bottom of a 15-ft deep excavation, within a 4-ft deep gravel bed. A polyethylene barrier is placed over the gravel and the excavation backfilled to grade. Eleven 21-ft monitoring wells made up of 6-in. PVC pipe extend from the surface of the crib to a point 3 ft above grade (BHI 1994; Hanford drawings H-2-32528; H-2-26074; H-2-26075; SK-2-21718).

Monitoring wells W15-10 and W15-11 monitor this site. Data indicate that breakthrough to groundwater has not occurred (Hanford drawings; Owens 1981).

No surface contamination has been detected at this site. It has a Hazardous ranking system migration score of .98 (BHI 1994; Stenner et al. 1988). No aliases are known for this site.

216-Z-17 TRENCH

The 216-Z-17 Trench is located about 300 ft east of the 231-Z Building which it supported and 250 ft north of 19th Street. It is parallel to and about 40 ft west of the 216-Z-1 Ditch.

The site received 36.8M L of neutral/basic liquid waste from the 231-Z Building over a one year period from February 1967 to February 1968 (BHI 1994).

It was a 200-ft by 10-ft by 8-ft deep open trench that received waste through an underground line. The trench remained open for about seven years after its use had been discontinued and was then backfilled. The surface in the area of the trench is free of contamination (BHI 1994; Hanford drawings H-2-32528; H-2-32682; Maxfield 1979).

Contaminates are estimated to include approximately 50 g of plutonium as well as 3.08 Ci of Alpha and .00045 Ci of Beta. Field surveys taken in the bottom of the trench before backfilling read generally 2,000 dpm of alpha activity (BHI 1994; Aldrich 1984).

This site is 670 ft above MSL, which is 191 ft above groundwater. Aliases include 216-Z-17 Ditch. The site has a hazardous ranking system migration score of 45.30 (BHI 1994).

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ADDITIONAL DATA

Also enclosed are WIDS data sheets for 216-Z-10, 216-Z-16, and 216-Z-17 which appear to have been omitted from the WIDS data sheet set previously provided to EBASCO.

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