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SOLID WASTE MANAGEMENT UNIT AND CONTINUING RELEASE INFORMATION AT THE INEL PER RCRA SECTION 3004(u)

Idaho National Engineering Laboratory

U.S. Department of Energy • Idaho Operations Office

SOLID WASTE MANAGEMENT UNIT AND CONTINUING RELEASE INFORMATION AT THE INEL PER RCRA SECTION 3004(u)

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1. INSTALLATION DESCRIPTION

1.1 Location

The INEL, formerly the National Reactor Testing Station (NRTS), was established in 1949 by the U.S. Atomic Energy Commission as an area to build, test, and operate various nuclear reactors, fuel processing plants, and support facilities with maximum safety and isolation. In 1974, the NRTS was redesignated as the INEL to reflect the broad scope of engineering activities conducted at the site.

The INEL Site covers approximately 2300 square kilometers (890 square miles) of sagebrush- and basalt-covered land on the Snake River Plain in southeastern Idaho. The nearest INEL boundary is 47 kilometers (29 miles) west of Idaho Falls, 52 kilometers (32 miles) northwest of Blackfoot, 80 kilometers (50 miles) northwest of Pocatello, and 11 kilometers (7 miles) east of Arco. The site encompasses portions of five Idaho counties: Butte, Jefferson, Bonneville, Clark and Bingham. Figure 1.1 provides a vicinity map of the INEL.

The U.S. Government used portions of the Site prior to its being established as the NRTS. During World War II, the U.S. Navy used about 270 square miles of the Site as a gunnery range. An area southwest of the naval area was once used by the U.S. Army Air Corps as an aerial gunnery range. The present INEL Site includes all of the former military area and a large adjacent area withdrawn from the public domain for use by DOE. The former Navy administration shop, warehouse, and housing area is today the Central Facilities Area of the INEL. These pre-DOE operations will be considered in this report.

There are no permanent residents within the INEL; the nearest populated area is Atomic City (about 35 residents), located less than one mile from the southern INEL boundary. Figure 1.2 shows population distribution around the INEL, with the radii centered in the south-central

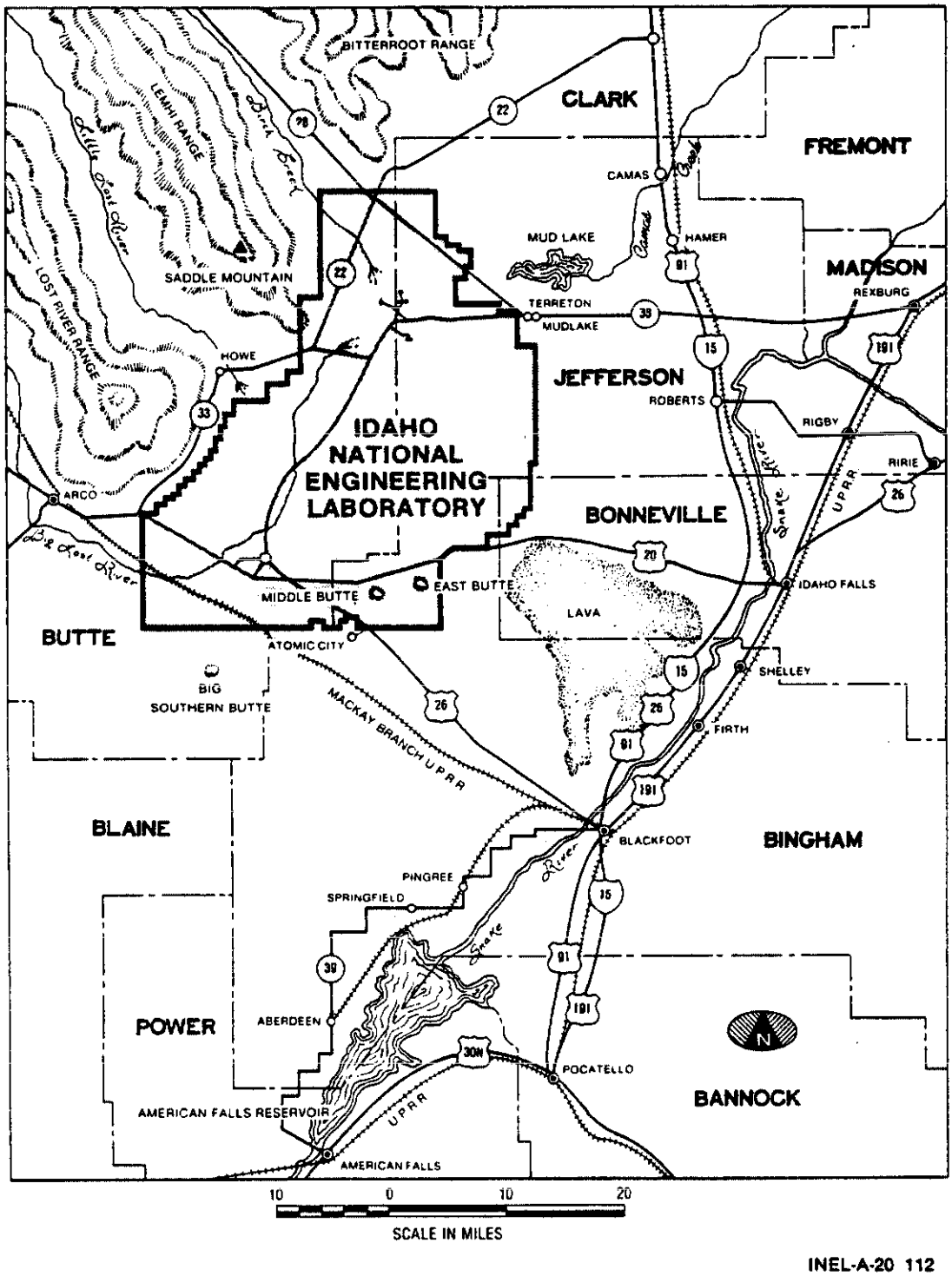
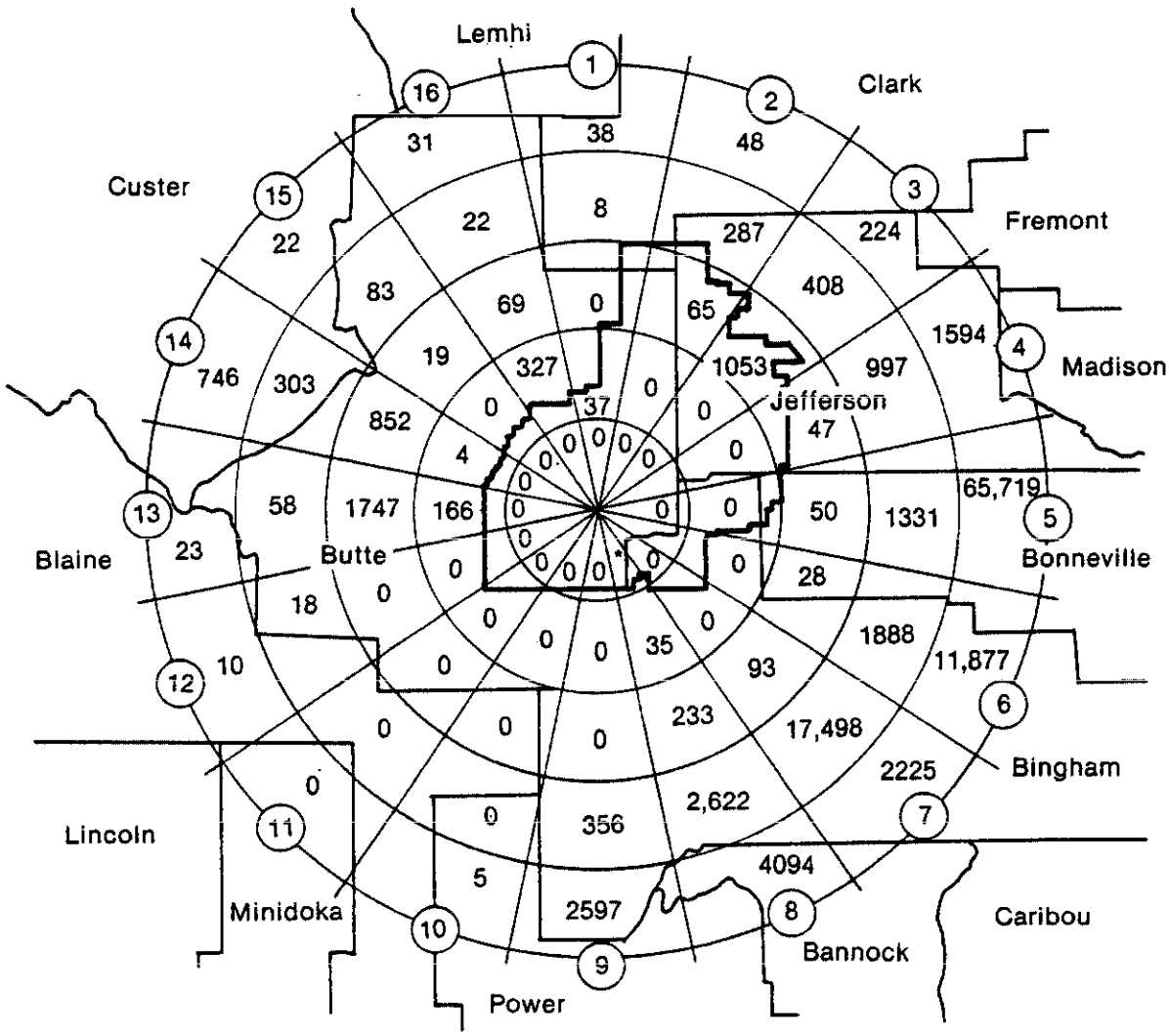


Figure 1.1. INEL Site vicinity map.



*The computer listing of six persons living in this area is erroneous, because of the program's assumption that persons within a given mi^2 section are uniformly distributed in that area. No persons reside in this area.

INEL 4 4892

Figure 1.2. Human population distribution around the INEL.

portion of the Site in the area of the TRA-ICPP complex. Population estimates are based on the 1980 census, but include a growth prediction by the Idaho Falls Chamber of Commerce of a growth rate of 2.7% per year for the City of Idaho Falls. This projection adds an additional 4,452 people to the fifth sector at the 40- to 50-mile segment through CY 1984. It is assumed that the population in other sectors will remain stable. The population residing within a 30-mile radius is shown in Figure 1.2 to be 4,625, and within a 50-mile radius, 119,957.

As of June 1984, the INEL employed 9986 persons, including both Site and nonsite workers. Approximately 6,500 employees are present at the INEL during the day shift; about 700 are on site during each of the other shifts. These are average numbers that vary with changes in operational requirements and construction work. No one is allowed to reside on the INEL. Employees live in more than 30 communities adjacent to the INEL, the largest percentage residing in Idaho Falls. Contractor-operated bus service is provided from the major communities.

1.2 Organization and Mission Summary

The INEL is a government-owned reservation, or test site, managed by DOE. A large variety of laboratory activities and test facilities support DOE and other government-sponsored research and development programs and projects. Major INEL research and development programs involve fusion energy, geothermal energy, low-head hydropower, industrial energy conservation, strategic and critical materials, code development, materials testing, and instrumentation. The INEL contains the largest concentration of nuclear reactors in the world. Fifty-two reactors, most of them first-of-a-kind, have been built on the Site. Fifteen of these reactors are currently operable, the others have phased out upon completion of their research missions.

Most INEL facilities are operated by one of five government contractors: Argonne National Laboratory-West (ANL-W); EG&G Idaho, Inc. (EG&G); Exxon Nuclear Idaho Company (ENICO); Westinghouse Electric Corporation (WEC); and Westinghouse Idaho Nuclear Company (WINCO). As

shown in Figure 1.3, these contractors conduct various programs at the INEL under the administration of three DOE offices: Idaho Operations Office (ID), Pittsburgh Naval Reactors Office (PNRO), and Chicago Operations Office (CH). Another government contractor, American Protective Service, provides security services for the INEL under the administration of DOE-ID. Figure 1.3 also identifies the facilities operated by the primary contractors.

DOE-ID is the INEL Site manager and is responsible for common Site services, Site environmental control and management, and overall Site safety and emergency planning functions. It provides certain of these services directly and the rest through its contractor, EG&G. However, the other DOE program/project operations offices (PNRO and CH) working at the INEL are responsible for activities within their own designated test facility boundaries. DOE-ID performs functions or services at these designated sites only through interface agreements with the other DOE operations offices.

EG&G Idaho is a prime operating contractor and the Site services contractor for the INEL. As such, EG&G provides a variety of programmatic and support services related to nuclear reactor design and development, nonnuclear energy development, materials testing and evaluation, operational safety, and radioactive waste management. EG&G currently operates six research reactors at the INEL and provides all services for total Site operation, including support services to four other contractors. EG&G is also responsible for the management, to include decontamination and decommissioning, of facilities that have completed their research missions. This responsibility encompasses facilities operated by past Site services contractors as well as by EG&G, and also includes facilities operated by other contractors for which the Site services contractor has accepted responsibility. For example, the Boiling Water Reactor Experiment (BORAX) site was operated by ANL-W, but the inactive site is managed by EG&G.

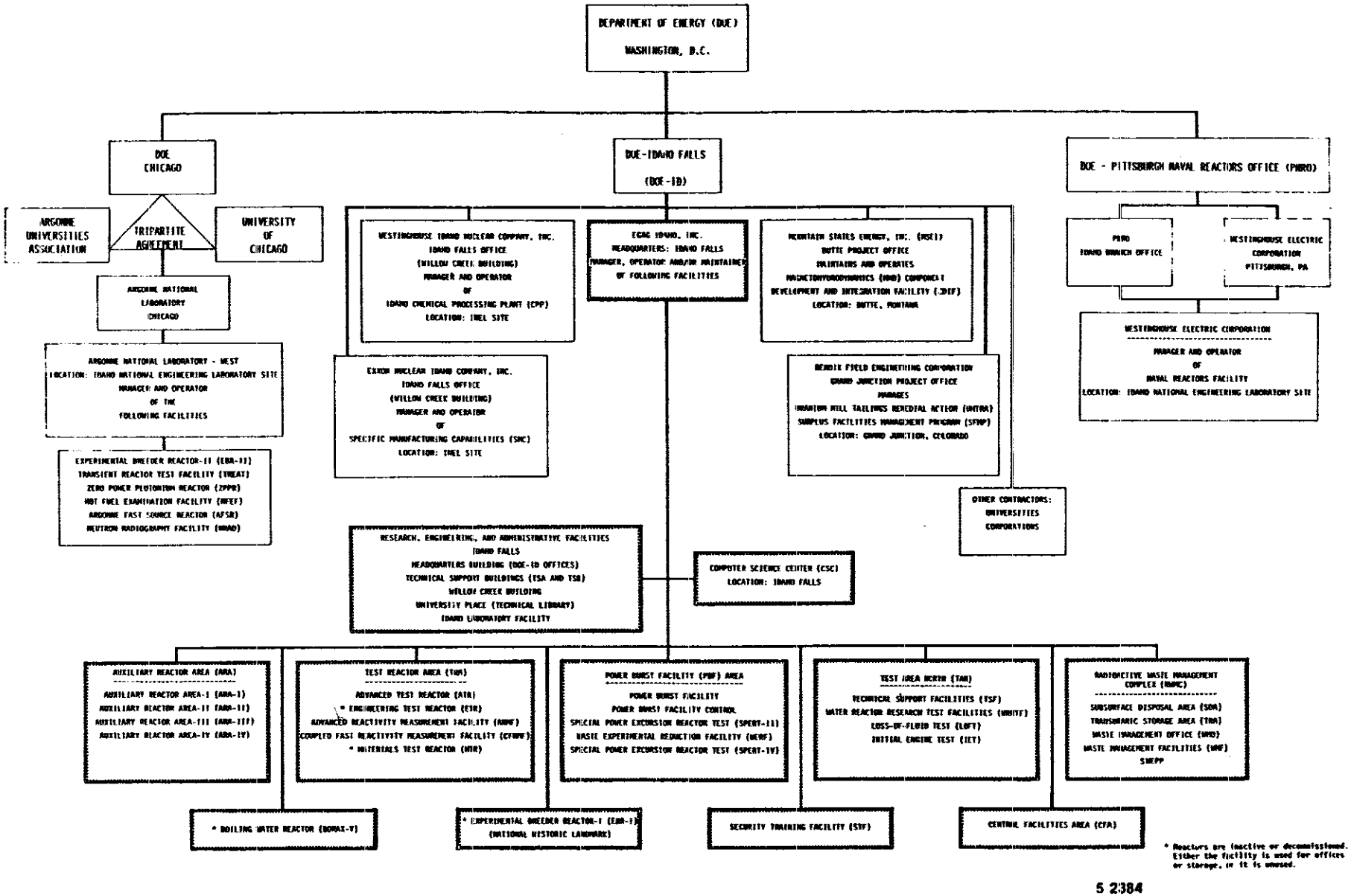


Figure 1.3. Organization chart.

Along with EG&G, WINCO and ENICO are the INEL operating contractors, performing programs under the administration of DOE-ID. WINCO operates the Idaho Chemical Processing Plant (ICPP) for the reprocessing of enriched "unburned" uranium from spent nuclear fuel elements, mostly from government-owned reactors. ENICO operates a special project for DOE.

ANL-W programs at the INEL are administered by DOE-CH and include the operation of four major facilities with five reactors, all in support of the Liquid Metal Fast Breeder Reactor Program. These facilities are Experimental Breeder Reactor-II, Transient Reactor Test Facility, Zero Power Plutonium Reactor, and Hot Fuel Examination Facility.

WEC manages the Naval Reactor Facility (NRF) at the INEL under the administration of DOE-PNRO. The NRF is used primarily as a base for training U.S. Navy personnel to operate the Navy's nuclear fleet. Included in the NRF are the Submarine Prototype Facility with one reactor, the Large Ship Reactor Facility with two reactors, the Natural Circulation Submarine Prototype Facility with one reactor, and the Expended Core Facility.

Also located at the INEL are facilities for the following:

1. The Radiological and Environmental Services Laboratory of DOE

2. The U.S. Geological Survey

3. The Field Research Office of the National Oceanic and Atmospheric Administration's Air Research Laboratories.

2. ENVIRONMENTAL SUMMARY

2.1 Meteorology

2.1.1 Data Source

The National Oceanic and Atmospheric Administration (NOAA) and its predecessor, the U.S. Weather Bureau, have operated a meteorological observation program at the INEL since 1949. Meteorological data have been collected at over 40 locations on and near the INEL since that time. The weather station at Central Facilities Area (CFA) was the first on-site station and appears on National Climatic Center records as "Idaho Falls 46 W." In addition to recording day-to-day weather data and providing daily operational forecasts for the INEL, the NOAA staff maintains an intensive research and development program to improve the reliability of prediction and measurement of meteorological parameters which influence safe conduct of operations on the INEL. A number of meteorological stations are located throughout the INEL to measure simultaneously the spatial variation of several meteorological parameters such as temperature and wind speed and direction, up to a height of 250 ft.

2.1.2 General Climatology

The location of the INEL in a flat valley surrounded by mountains, its altitude above sea level, and its latitude affect the climate and the day-to-day weather systems. All air masses entering the Snake River Plain first cross a mountain barrier, usually precipitating a large percentage of their moisture. Annual rainfall at the INEL is light, and the region has semiarid characteristics. The local northeast-southwest orientation of the plain and bordering mountain ranges tends to channel prevailing west winds so that a southwest wind predominates over the INEL; the second most frequent winds come from the northeast. The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid radiational cooling at night. These factors combine to give a wide diurnal range of temperature near the ground. Due to the

moderating influence of the Pacific Ocean, most of the air masses flowing over this area are usually warmer during winter and cooler in summer than air masses flowing at a similar latitude in the more continental climate east of the Continental Divide. The Centennial and Bitterroot Mountain Ranges keep most of the shallow, but intensely cold, winter air masses from entering the ESRP when they move southward from Canada. Occasionally, however, the cold air can spill over the mountains. When this happens, the cold air is then held in the ESRP by the surrounding mountains, and the INEL experiences low temperatures for periods lasting a week or longer.

2.1.3 Meteorological Overview

2.1.3.1 Temperature. Monthly and annual average temperatures for the INEL are provided in Table 2.1. Average monthly maximum temperatures range from 30°C (87°F) in July to -2°C (28°F) in January. Average monthly minimum temperatures range from 9°C (49°F) in July to -16°C (4°F) in January. The warmest temperature recorded was 38°C (101°F) and the coldest up through January 1982 has been -40°C (-40°F).

2.1.3.2 Wind. Wind directions at the INEL are mostly from the southwest or northeast quadrants, due to airflow channeling by the bordering mountains. During the summer months a very sharp diurnal reversal in wind direction occurs. Winds blowing from the southwest (upslope) predominate during daylight hours, and northeasterly winds persist at night. Winter winds are controlled almost exclusively by either large scale weather systems or by stagnation, which show no significant diurnal characteristics. The record of average wind speeds shows a minimum of about 2.2 m/s (5 mph) in December and maximum of 4 m/s (9 mph) in April and May. The highest maximum hourly average speed was 23 m/s (51 mph--measured at the 20-ft level at CFA) from the west-southwest. Peak gusts of 35 and 39 m/s (78 and 87 mph) were observed. Calm conditions prevail 11% of the time. Figure 2.1 provides seasonal wind roses as measured at CFA.

TABLE 2.1. PERIOD OF RECORD MONTHLY AND ANNUAL TEMPERATURE AVERAGES AND EXTREME AVERAGES[a]

	Maximum (°F)			Average (°F)			Minimum (°F)		
	High	Average	Low	High	Average	Low	High	Average	Low
January	37.9	27.6	19.5	25.1	15.8	6.5	13.1	3.8	-8.8
February	45.9	34.0	25.6	34.2	21.6	9.9	22.4	9.1	-6.5
March	51.5	42.9	33.6	37.5	30.7	19.1	24.6	8.4	4.5
April	64.7	55.3	46.1	45.9	41.3	35.4	32.0	27.2	22.5
May	76.1	66.3	59.9	58.3	51.3	46.7	40.7	36.2	33.3
June	85.3	76.1	69.9	67.5	59.9	56.2	49.7	43.7	40.4
July	91.2	87.0	82.5	71.8	68.2	66.1	53.1	49.3	46.5
August	90.2	84.8	75.4	70.2	65.9	60.3	53.4	47.1	43.2
September	81.2	73.4	64.1	61.1	55.5	48.6	45.2	37.4	31.9
October	67.7	60.5	53.7	49.2	43.5	38.2	32.1	26.5	21.2
November	50.7	42.5	37.8	36.4	29.9	24.5	24.3	17.3	10.3
December	37.1	31.2	22.3	26.8	19.6	10.2	17.6	7.5	-1.9
ANNUAL	59.5	59.0	53.8	44.3	41.8	39.1	29.9	28.1	24.0

a. Based on National Weather Service (NWS) archived CFA data from April 1954 through December 1982.

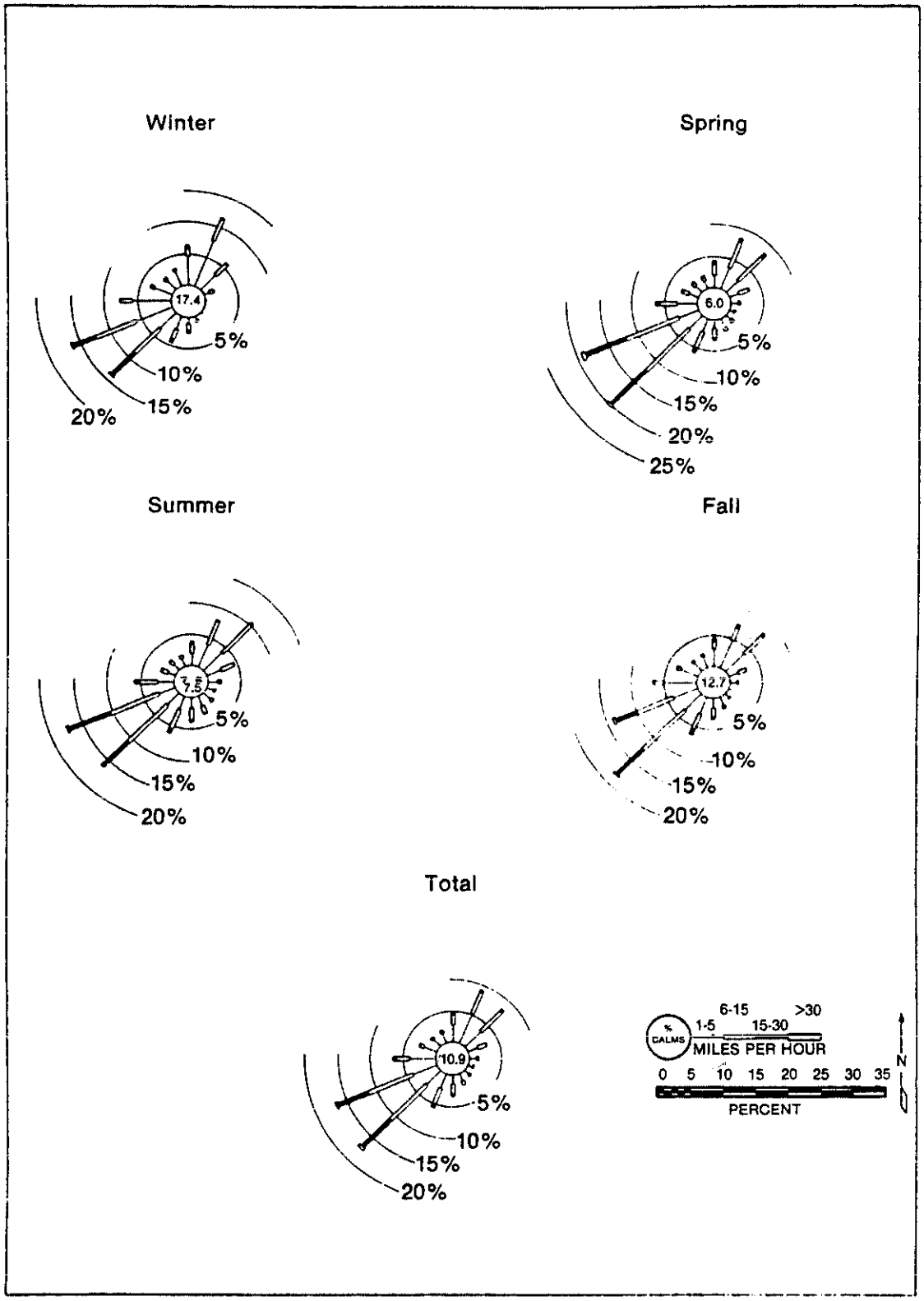


Figure 2.1. CFA 20-ft-level wind roses (January 1950-May 1962).

2.1.3.3 Precipitation. The average annual precipitation is 9.07 in. of water. The yearly totals range from 4.50 to 14.40 in. Individual months have had as little as no precipitation to as much as 4.42 in. Maximum observed 24-h precipitation amounts are less than 2.0 in. and maximum 1-h amounts are just over 1.0 in. Table 2.2 summarizes the average monthly and annual precipitation.

About 26.0 in. of snow falls each year. The maximum yearly total was 40.9 in. and the smallest total was 11.3 in. The greatest 24-h total snowfall was 8.6 in. The greatest snow depth observed on the ground was 27 in. January and February average about 7.0 in. for a monthly maximum depth on the ground. The ground is usually free of snow from mid-April to mid-November.

2.1.3.4 Evaporation. While extensive evaporation data have not been collected on the INEL, evaporation information is available from Aberdeen and Kimberly in southeastern Idaho. These data, which should be representative of the INEL region, indicate that the average annual evaporation rate is about 36 in. About 80% of this (29 in./yr) occurs from May through October.

2.1.3.5 Severe Weather Conditions. On the average, two or three thunderstorm days occur during each of the months from June through August. The surface effects from thunderstorms over the Snake River Plain are usually much less severe than are experienced east of the Rocky Mountains or even in the mountains surrounding the plain. Strong wind gusts can occur in the immediate vicinity of thunderstorms. These gusts are usually quite localized and of short duration. The highest instantaneous speed recorded at 20 ft above the ground was 78 mph from the west-southwest. Although small hail frequently accompanies the thunderstorms, damage from hail has not occurred at the INEL.

Five funnel clouds (vortex clouds which do not reach the ground) and two tornadoes (which caused no damage) have been documented in the 23-yr period of observation at the INEL.

TABLE 2.2. MONTHLY AND ANNUAL PRECIPITATION AT INEL[a]

	Average[b] (in.)	Highest (in.)	Lowest (in.)
January	0.81	2.56	Trace
February	0.64	2.40	0.01
March	0.59	1.44	0.07
April	0.78	2.50	0.00
May	1.28	4.42	0.07
June	1.27	3.89	0.02
July	0.40	1.70	0.00
August	0.56	3.27	Trace
September	0.70	3.52	0.00
October	0.54	1.53	0.00
November	0.65	1.53	0.00
December	0.85	3.43	0.05
ANNUAL[c]	9.07	14.40	4.50
Mean uncertainty in monthly totals[d]	±0.07	±0.12	±0.02

a. From January 1950 through December 1982.

b. Average based on data measured from March 1954 through December 1982.

c. Considers only full calendar year.

d. Based on 1950-1982 values.

2.2 Geology and Soils

2.2.1 Setting

The Snake River Plain is the largest continuous structural element in southern Idaho. It stretches from the Oregon border in a curving arc across Idaho to Yellowstone National Park in northwestern Wyoming. It slopes upward from an elevation of about 2,500 ft at the Oregon border to over 6,500 ft at Henry's Lake near the Montana-Wyoming border. The plain can be roughly divided into eastern and western parts lying east and west of Bliss, Idaho. The Snake River has cut a valley through Tertiary basin-fill sediments and interbedded volcanic rocks from Bliss west to the Oregon border. The stream drainage is well developed except in a few areas covered by recent thin flows of Snake River basalt. East of Bliss the complexion of the plain changes as the Snake River carves a vertical-walled canyon through thick sequences of Quaternary basalt. Drainage on the plain is in a youthful state. The central portion of the plain is generally higher than the north and south edges. The Snake River flows along the southern and southeastern edges of the plain, pushed south by basalt flows.

Located entirely on the northern side of the eastern Snake River Plain, the INEL adjoins mountains to the northwest that comprise the northern boundary of the plain. Three mountain ranges end at the northern and northwestern boundaries of the INEL Site: The Lost River and Lemhi Ranges and the Beaverhead Mountains of the Bitterroot Range, as shown in Figure 2.2. Saddle Mountain, near the southern end of the Lemhi Range, reaches an altitude of 10,795 ft and is the highest point in the area. Figure 2.3. shows Birch Creek, Little Lost River, and Big Lost River all descending southeastward into the Snake River Plain from the mountains adjacent to the INEL.

The part of the plain occupied by the INEL Site may be separated into three minor physical subdivisions: a central trough that extends to the northeast through the Site, and two flanking slopes that descend to the

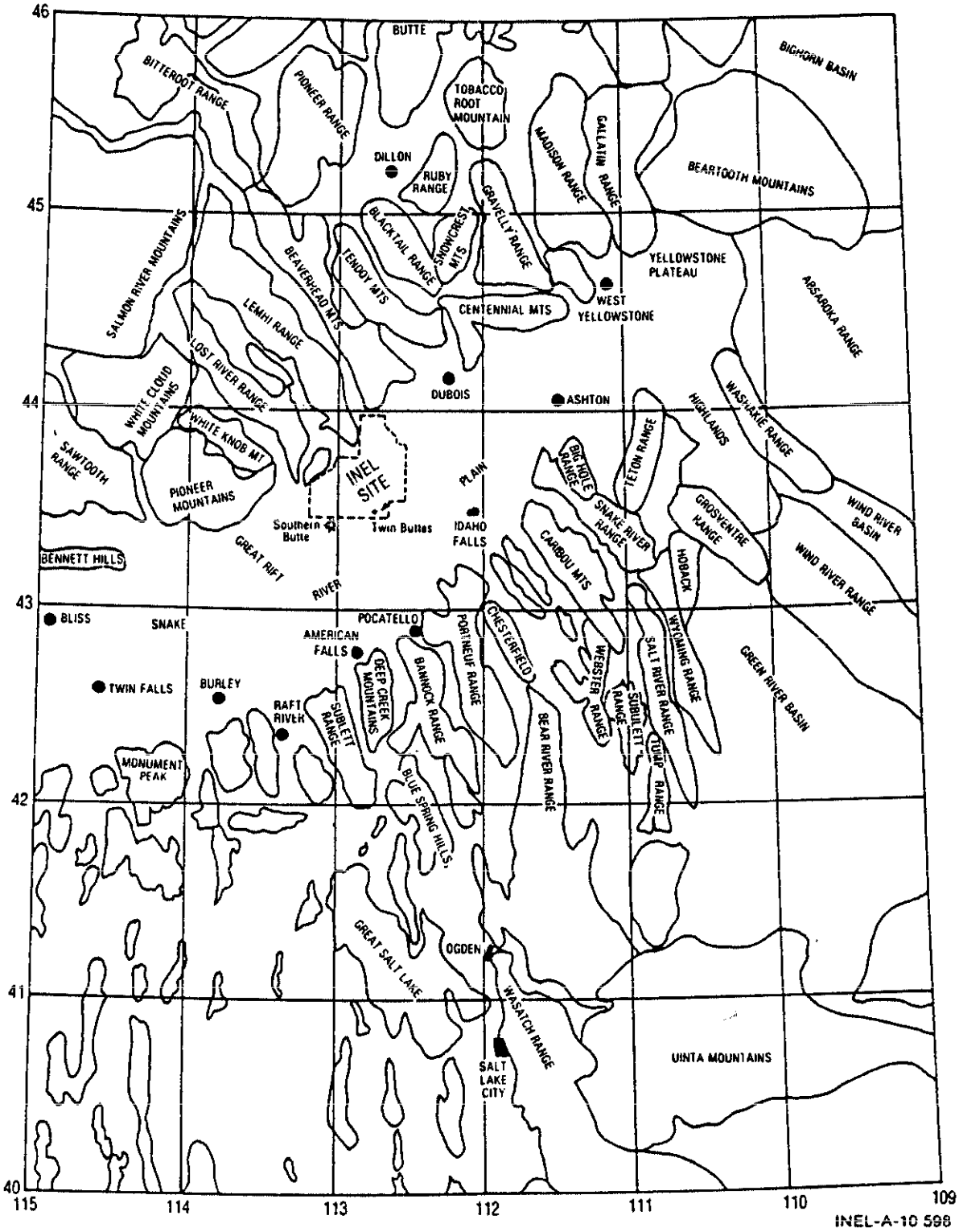


Figure 2.2. Physiography in the region of the INEL.

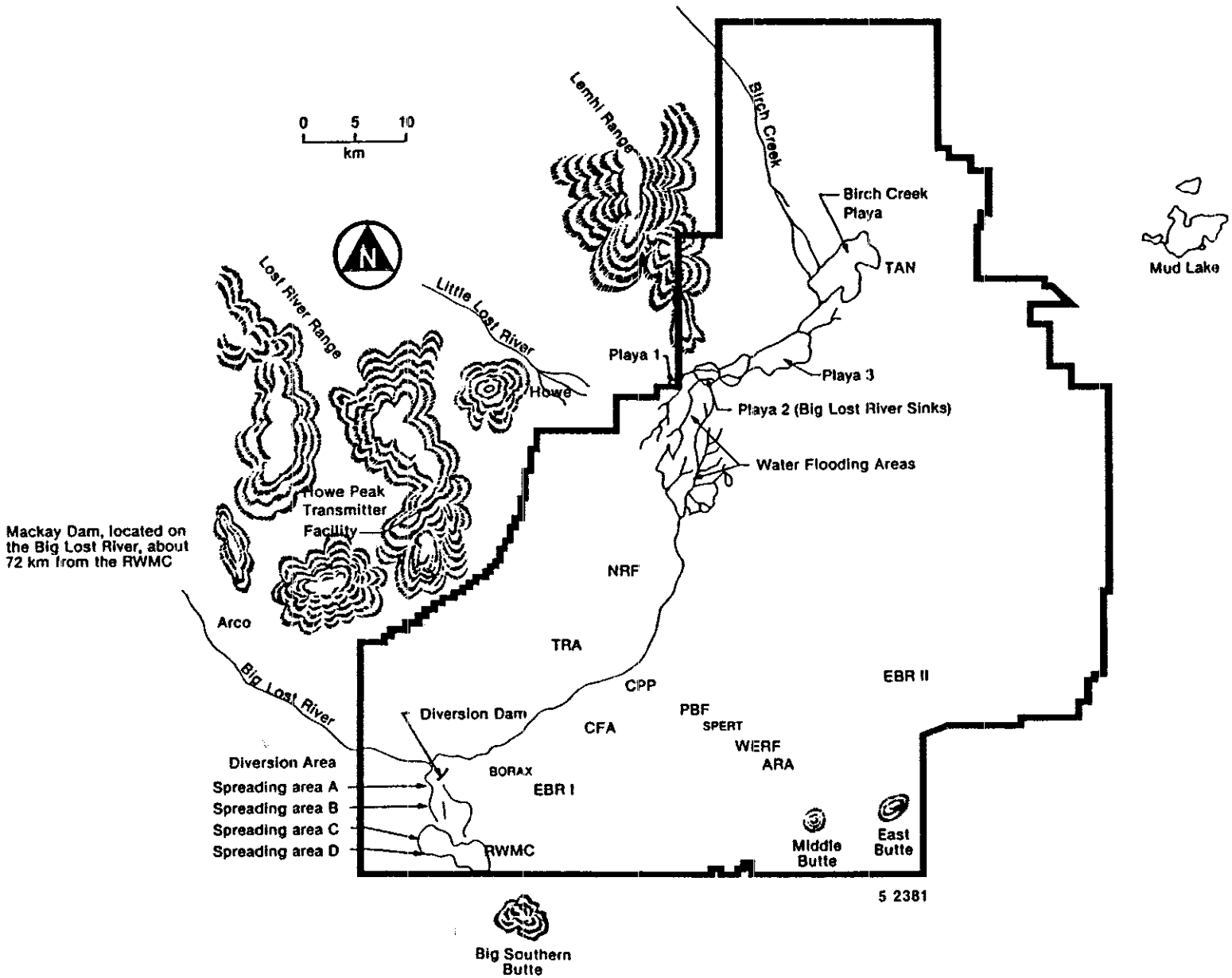


Figure 2.3. Map showing major facilities and surface water features in the vicinity of the INEL.

trough, one from the mountains to the northwest and the other from a broad ridge on the plain to the southeast. The slopes on the northwest flank of the trough are mainly alluvial fans from the mountains and the valleys of Birch Creek and the Little Lost River; however, some basalt flows, as seen in Figure 2.4, like that on the west side of the valley of Birch Creek, have spread from the mountains toward the plain. The slopes on the southeast flank of the trough are basalt flows which spread from an eruption zone that extends northeastward from Cedar Butte. The lavas which erupted along this zone built up a broad topographic swell that pushed the Snake River to the southern and southeastern edges of the plain. Big Southern Butte and Middle and East Buttes are aligned roughly along this zone; however, they are formed of volcanic rocks older than the surface basalts of the plain.

The central lowland of the INEL Site broadens to the northeast and joins the extensive Mud Lake basin. The waters of the Big and Little Lost Rivers and Birch Creek drain into this trough and toward a broad depression between Howe and Circular Butte. The streams flow through playa-like depressions on the INEL where their waters are dissipated by seepage and evaporation. The lowest part of the INEL Site, at an altitude of about 4,755 ft, is in this trough.

2.2.2 Snake River Plain Formation

The Snake River Plain began to form in mid-Tertiary time. The Pleistocene age (the last million or so years) has been marked by sporadic outbursts of lavas, which have led to the accumulation of several thousand feet of basalt on the INEL Site. The basalt is formed chiefly from fluid (low-viscosity--approximately 1 poise), high-temperature (900 to 1,200°C), pahoehoe lavas. The flows have been extruded from rifts and from volcanoes whose locations are rift-controlled. These form layers of hard rock of varying thicknesses, from 10 to 100 ft. The physical characteristics and horizontal distribution of the flows also vary. Unconsolidated material, cinders, and breccia are interbedded with the basalt. The size and pattern of flows, when considered in space and time, indicate that individual flows are small when compared with the entire plain and were separated in time by

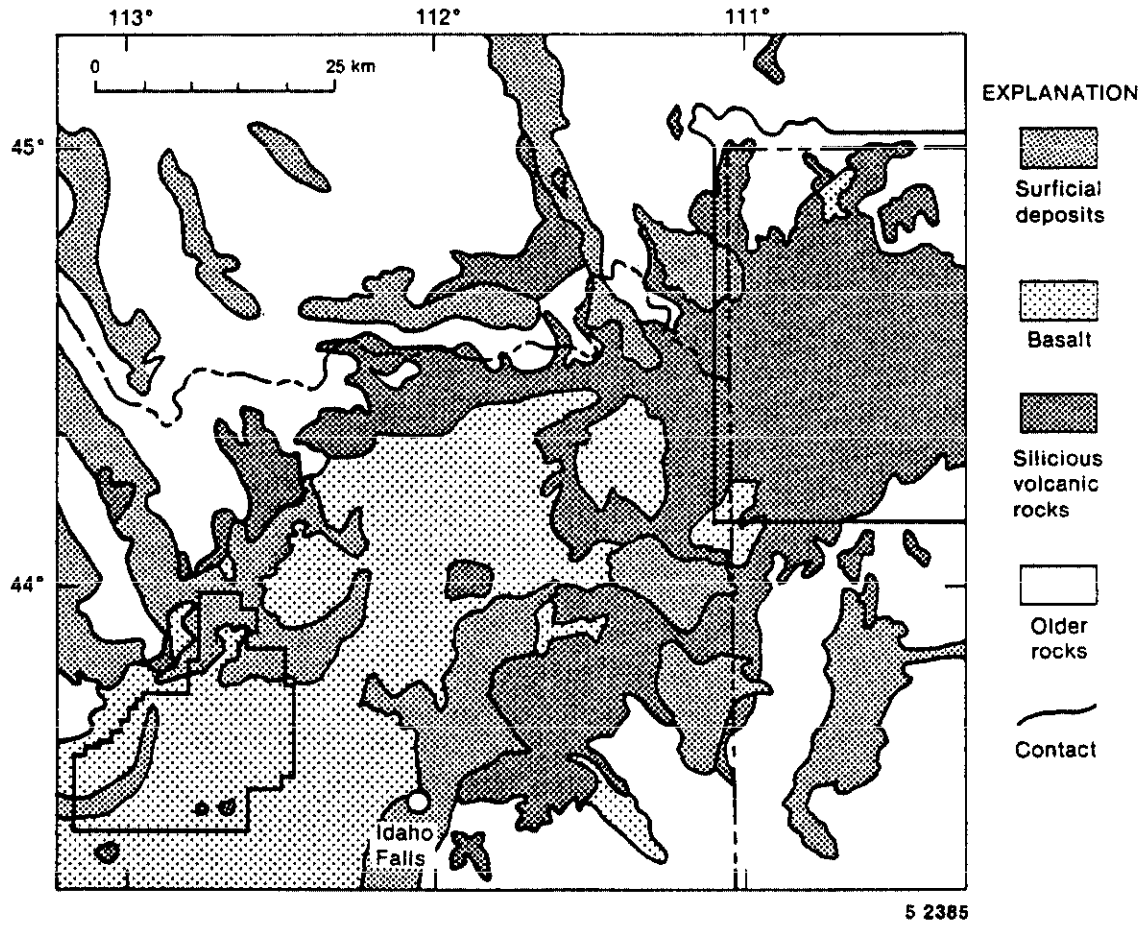


Figure 2.4. Generalized geologic map of the eastern Snake River Plain, Idaho and vicinity.

hundreds or thousands of years. Separate flows are interbedded with sediments of aeolian, lacustrine, and fluvial origins (windblown, lake and stream deposits, respectively).

Thus, underlying the plain are composite layers of interbedded volcanic and sedimentary rocks, principally basaltic lava flow, and interflow beds of sedimentary materials. These layers partly fill a basin of older limestone and volcanic rocks. The older rocks, which are not water-bearing, are exposed in the mountains northwest and southeast of the plain and presumably underlie all of the plain at depths that may be as great as 5,000 ft.

Mountain ranges bordering the plain consist of Mesozoic miogeosynclinal rocks folded during Laramide orogenesis and later uplifted along normal faults during basin and range tectonism. These ranges terminate abruptly against both sides of the low-lying basalt and sediment-filled Snake River Plain. Except for narrow strips of green along the banks of the Snake River where irrigation makes farming practicable, clumps of dry sage cover the plain, interrupted by hummocks of basalt flows. Formation of the plain and filling to an unknown depth with tuffs, lavas, and sediments began in middle Pliocene and apparently continues at present. The last volcanic eruption at Craters of the Moon, 21 kilometers (13 miles) southwest of the INEL Site, occurred about A.D. 400.

2.2.3 Soils

As described previously, a central trough extending northeastward through the INEL Site intercepts the Big and Little Lost Rivers and Birch Creek which descend from the mountain ranges northwest of the Site. The surface soils and mantle rock along the streams are made up of alluvial sands and gravel of varying thicknesses. These grade into more finely textured sediments toward the terminal ends of the streams. The surface soils over the remainder of the INEL are formed by windblown deposits of varying thicknesses. Sandy soils derived from windworked beach and bar deposits formed in old playa lakes or ponds are especially common in the

northern part of the INEL. In many places, the basalt is not covered. Local playa areas contain deposits 10 to 15 ft thick. Alluvial fans occur along the mountain fronts.

2.3 Hydrology and Hydrogeology

2.3.1 Surface Water

Most of the INEL is located in the Pioneer Basin, an informally named and poorly defined closed drainage basin. Surface water at the Site consists mainly of streams draining through intermountain valleys to the northwest and into Pioneer Basin. The major streams are the Big Lost River, Little Lost River, and Birch Creek. Refer to Figure 2.3. Local rainfall and snowmelt contribute to surface water, mainly during the spring months. Most of the flow from the Little Lost River and Birch Creek is diverted for irrigation purposes prior to reaching the INEL. However, in very high flow years, Birch Creek flows into the Birch Creek Playa (Playa 4 in Figure 2.3) on the north end of the INEL and infiltrates into the subsurface.

The Little Lost River flows on site during high-flow years and infiltrates into the subsurface. The flow of Birch Creek is remarkably uniform because it is primarily fed by groundwater inflow. During periods of extremely rapid thawing and runoff, such as happened in the early spring of 1969, water from the Birch Creek drainage can become a flood threat to facilities at Test Area North (TAN) which is on the southeast edge of the Birch Creek Playa. The high runoff in 1969 was caused almost entirely by rapid snowmelt on the lower reach of the Birch Creek valley, not from the discharge of Birch Creek. The flow over Highway 22 was estimated at 14.2 m^3/s (500 cfs) in April 1969. The average discharge for Birch Creek is about 7.03×10^7 m^3/yr (57,000 acre-ft/yr) near Reno, Idaho. The average discharge of Little Lost River, 7 miles northwest of Howe is, about 6.2×10^7 m^3/yr (50,000 acre-ft/yr). For comparison, the Big Lost River discharges an average of 2.6×10^8 m^3/yr (210,800 acre-ft/yr). Birch Creek and Little Lost River have a minimal effect on INEL hydrology. Therefore, most of the interest in surface water at INEL is directed toward the Big Lost River.

The Big Lost River flows southeastward through the Big Lost River Basin past Arco, and passes onto the Eastern Snake River Plain. The river flows onto the INEL near its southwest boundary, curves to the northeast, and flows northward to the Big Lost River Playas (sinks). After entering the plain, the river continuously loses water by infiltration through the channel bottom and sides. Therefore, depending on discharge and infiltration conditions, sometimes flow does not even reach the INEL, and at others it continues as far as Playa 3 or even overflows into Playa 4. As flow approaches Playas 1 and 2, the channel branches into many tributaries, and the flow spreads over several flooding and ponding areas.

Storage and diversion systems on the Big Lost River include Mackay Dam (an earthen structure used primarily for the impoundment of irrigation water) 48 km (30 mi) upstream of Arco, several irrigation diversions between Mackay and the plain, and the INEL flood-diversion dam. The INEL flood-diversion system was built in 1958 to divert high flows on the Big Lost River that might create flood hazards to INEL facilities. This system consists of a small dam which diverts flow from the main river channel into four spreading areas (A, B, C, and D in Figure 2.3). Nearly all flow is diverted during winter months to avoid ice jams in the main river channel. The effectiveness of the INEL flood-control system was calculated in 1972 by the U.S. Geological Survey by means of mathematical models. Results indicated that floods in the Big Lost River would have overflowed the INEL diversion dam about once every 55 years. However, dikes were raised 2 m (6 ft) in January and February 1984, providing a diversion system that will be able to contain a flood with an average return period well in excess of 300 yr.

As part of recent environmental studies for a new facility at the INEL, a detailed flood-routing analysis was conducted for a hypothetical failure of Mackay Dam. Results indicate potential flooding of some locations on the INEL in the event of the probable maximum flood. The analysis determined flood conditions resulting from an assumed inflow to Mackay Reservoir equal to the probable maximum flood for the watershed and subsequent failure of Mackay Dam. The failure made was assumed to be

overtopping and subsequent breaching of the earthen structure. Figure 2.5 illustrates the approximate extent of the flood inundation for the probable maximum flood conditions analyzed. It should be noted that Figure 2.5 not only depicts a conservative estimate of the probable maximum flood, but it was accomplished before the INEL flood diversion system was upgraded; a physical change that would increase the system's ability to handle high flows.

2.3.2 Subsurface Water

Figure 2.6 shows that the Snake River Plain aquifer, which flows beneath the INEL, is approximately 330 km (206 mi) long, 48 to 96 km (30 to 60 mi) wide and covers an area of about 24,800 km^2 (9600 mi^2). The aquifer is composed of a series of thin basalt flows interbedded with sediments of aeolian, fluvial, and lacustrine origin. Aquifer permeability consists of intergranular and intercrystalline pore spaces, fractures, fissures, and other voids. The hydraulic properties of the aquifer are not spatially homogeneous and the direction of local groundwater movement is complicated. However, the overall flow pattern is to the south and southwest.

The aquifer could contain 2.5×10^{12} m^3 (2×10^9 acre-ft) of water, of which about 6.2×10^{11} m^3 (5×10^8 acre-ft) are recoverable. The aquifer discharges about 8×10^9 m^3 (6.5×10^6 acre-ft) annually through springs in the area from Milner to Bliss, and from Blackfoot to American Falls Reservoir in the region west of Pocatello. Groundwater pumpage for irrigation totals about 1.8×10^9 m^3 (1.5×10^6 acre-ft) annually. The discharges from the springs significantly contribute to the flow of the Snake River downstream of Twin Falls, Idaho.

Groundwater flows to the south and southwest at 1.5-6 m/day (5-20 ft/day). The average slope of the aquifer is about 0.2% from the northeast to southwest. The aquifer transmissivity, measured in wells on the INEL,

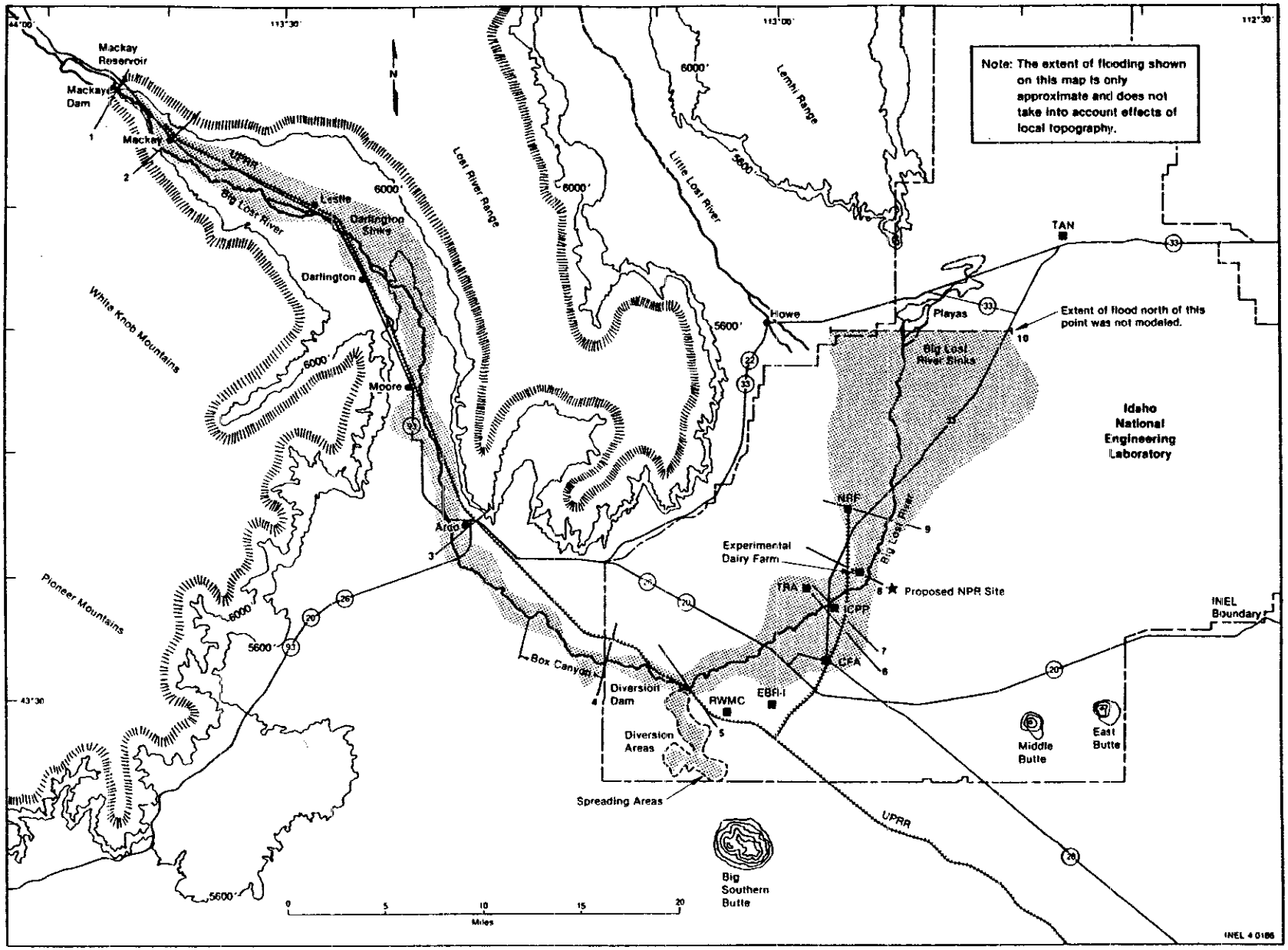


Figure 2.5. Base case inundation map.

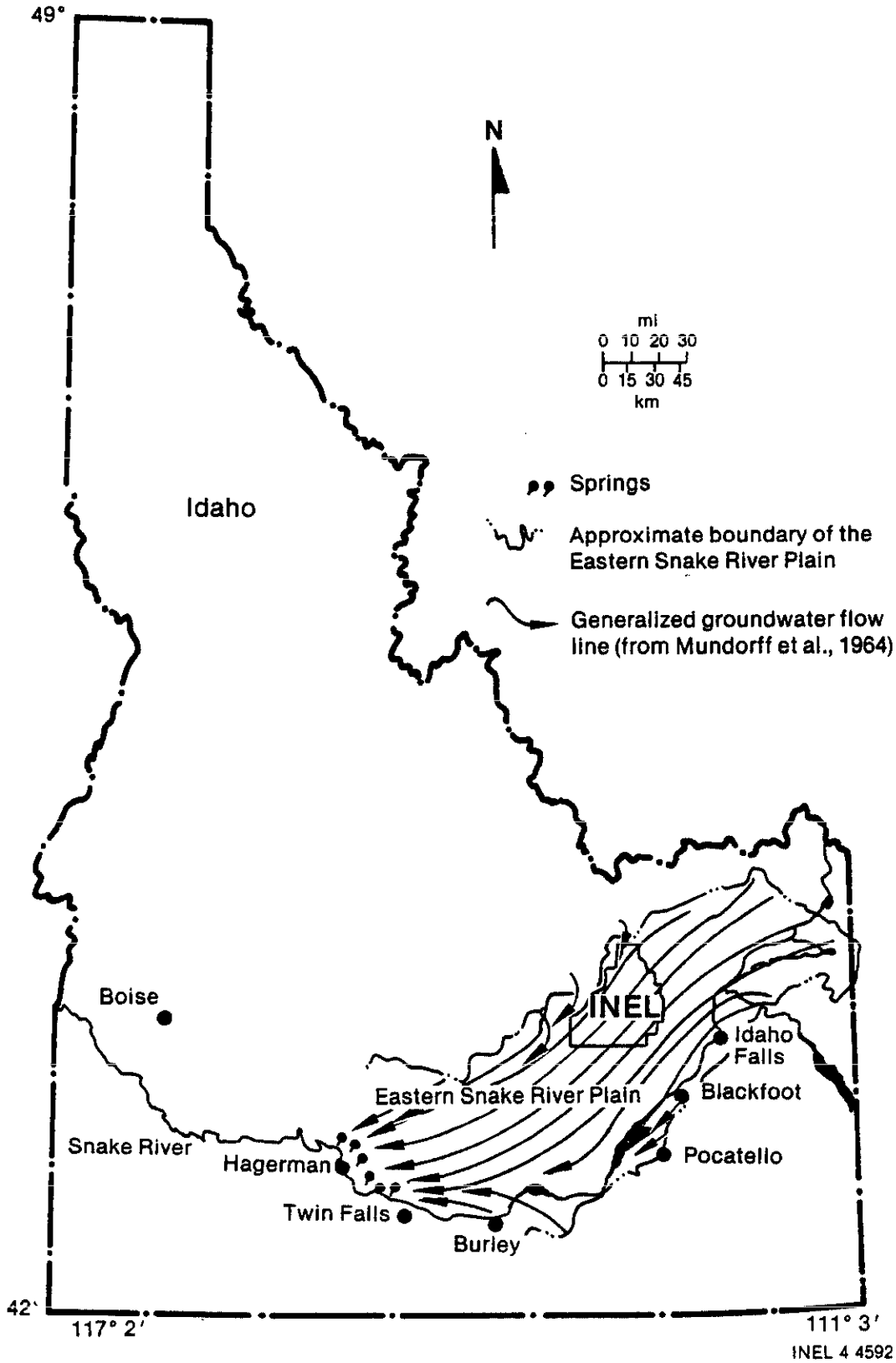


Figure 2.6. Location of generalized groundwater flow lines hypothesized for the Snake River Plain aquifer.

ranges from 3×10^4 to 1.8×10^7 gallons per day per ft (gpd/ft). Storage coefficients range from 0.01 to 0.06[x]. Generalized altitude contours[y] are shown in Figure 3.7. Depth to the water table from land surface ranges from about 60 m (200 ft) in the northeast corner of the INEL to 300 m (1000 ft) in the southeast corner.

In 1983, the entire INEL water supply was provided by 24 production wells which tapped the Snake River Plain aquifer. The wells pumped a total of 7.9×10^6 m^3 (1.8×10^9 gallons) for the year. Over half of the volume pumped was returned to the surface or subsurface by waste water disposal operations. (Subsurface injection of wastewater has since been ceased.) An additional unknown amount also returns underground by infiltration from lawn irrigation and other water uses. A significant amount (about one third) of the pumped water is consumed by evaporation and transpiration to the atmosphere, principally from reactor cooling towers. It has been calculated that roughly 2,000 cfs flows beneath the INEL Site at its widest point which is equivalent to 1.8×10^9 m^3/yr. Therefore, in 1983 the INEL pumped less than 1% of the INEL underflow and less than 0.1% of the volume that surfaces as springs down gradient from the Site.

Recharge to the Snake River Plain aquifer is primarily in the form of infiltration from the rivers and streams draining the areas to the north, northwest, and northeast of the Eastern Snake River Plain. Significant recharge from increased flows in the Big Lost River has caused a regional rise in the groundwater table over much of the INEL. Water levels in some wells rise as much as 2 m (6 ft) within a few months following very high flows in the river.

Perched water tables occur beneath the plain in areas where water infiltrating the ground surface is delayed by layers of fine-grained sediments with low permeability. Perched water occurs below the Big Lost River, the waste-seepage ponds at the Test Reactor Area (TRA), and other areas of the INEL.

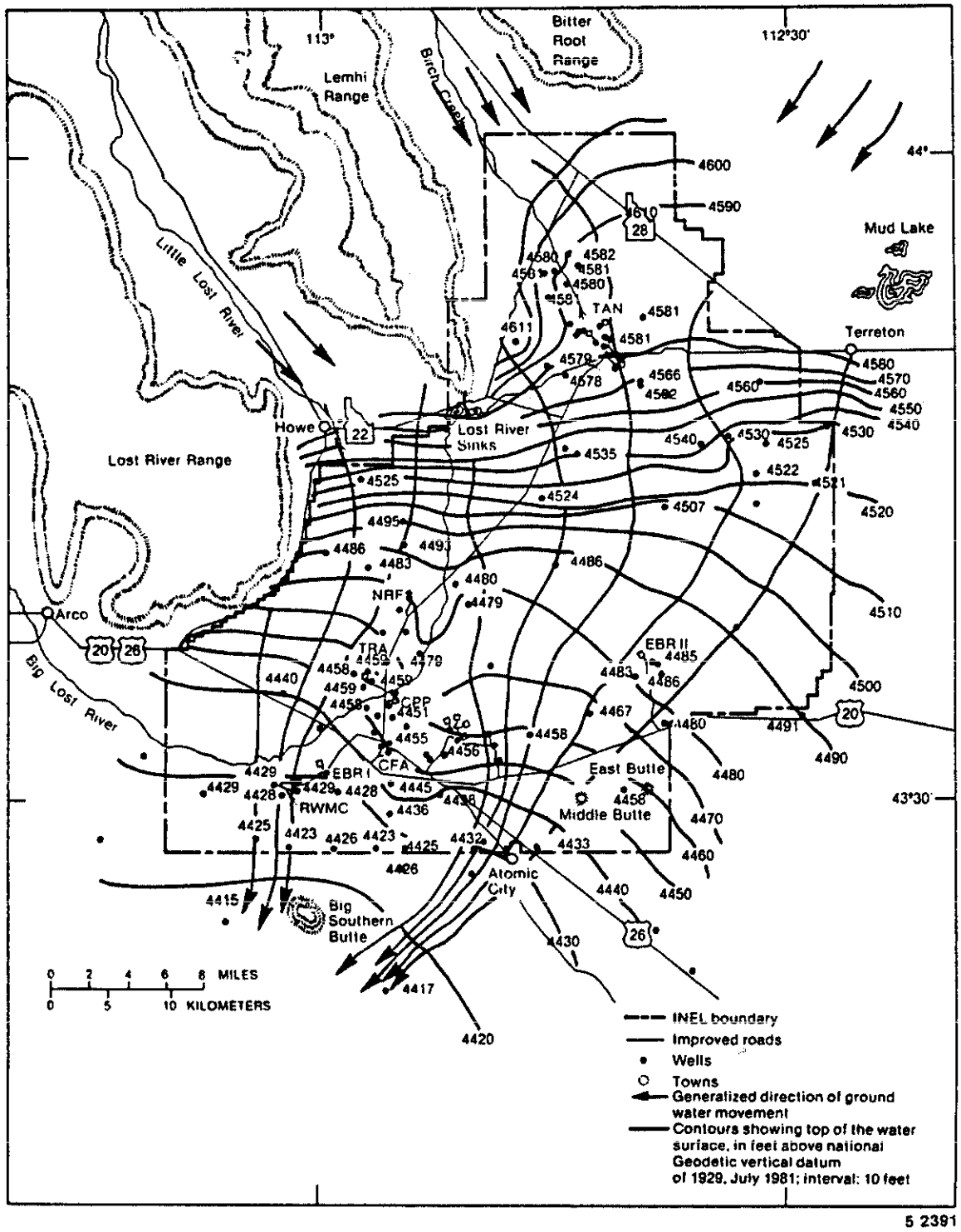


Figure 2.7. Generalized altitude contours on the regional water table, and inferred directions of groundwater flow, INEL and vicinity (July 1981).

2.4 Air and Water Quality

2.4.1 Air Quality

Air pollutant emissions which result from industrial operations at INEL or from surrounding communities are small. In addition, atmospheric dispersion at INEL is not constrained by topography, and the site has no significant air stagration problems. The air quality at INEL is very good; data available indicates the air quality is well within Primary and Secondary Standards as established by EPA.

Since air quality is within established guidelines, no parts of the INEL have been designated as non-attainment areas by the State of Idaho. The closest such area to the INEL is Pocatello, about 50 miles to the south. The area of Pocatello has been identified as a non-attainment area for not meeting the total suspended particulate standards. However, this is a localized condition and does not impact air quality at the INEL.

2.4.2 Water Quality

The chemical quality of groundwater of the INEL reflects the different sources of recharge and the minerals dissolved from rocks with which it comes in contact. Chemical analyses of surface waters from the Big Lost River, Little Lost River, and Birch Creek are given in Table 3.3. These rivers flow through fractured carbonate rocks consisting of relatively soluble calcite and dolomite. As a result, surface waters from this region contain calcium and magnesium bicarbonate. Small quantities of sodium, potassium, and silica are also present.

Water from the Snake River Plain aquifer containing a relatively larger percentage of sodium and potassium underlies the eastern half of the INEL. Some of this water originates in the mountains to the north and northeast. The mountainous recharge areas are underlain by silicic volcanic rocks which are much higher in sodium, potassium, and silica than are the rocks to the west.

TABLE 2.3. CHEMICAL ANALYSES OF SURFACE WATER AND GROUNDWATER FROM THE REGION NORTH, NORTHEAST, AND NORTHWEST OF THE INEL[a]

Analyses	Big Lost River Near Moore, ID 08/27/63 (1020 h)	Little Lost River Near Howe, ID 09/03/63 (1020 h)	Birch Creek South of Blue Dome 09/03/63 (1145 h)	Medicine Lodge Creek Near Medicine Lodge 09/03/63 (1305 h)	Well 2N26E 36aal Near Arco, ID 08/30/57 (Depth: 57.9 m)
Silica	12.0	12.0	8.8	18.0	24.0
Calcium	48.0	39.0	39.0	64.0	67.0
Magnesium	11.0	15.0	14.0	17.0	18.0
Sodium	6.9	6.7	5.0	8.6	9.0
Potassium	1.4	1.2	1.0	2.5	1.8
Bicarbonate	192.0	177.0	164.0	233.0	274.0
Carbonate	0.0	0.0	0.0	0.0	0.0
Sulfate	18.0	16.0	25.0	48.0	24.0
Chloride	3.5	8.8	4.5	6.0	7.5
Fluoride	1.9	0.2	0.2	0.1	0.3
Nitrate	0.5	0.6	0.6	0.1	1.7
Specific conductance (μmhos at 25°C)	333.0	323.0	309.0	453.0	489.0
pH (pH units)	7.7	7.7	8.0	7.8	7.6
Residue on evaporation at 180°C	191.0	192.0	186.0	284.0	289.0
Temperature °C	--	12.2	14.4	12.8	13.0

a. Analyses in mg/L, except as indicated.

The waters from the Snake River Plain aquifer on the INEL are relatively low in the sum of dissolved constituents (an average of slightly more than 200 mg/L). The low mineralization reflects the moderate-to-abundant precipitation in the mountainous source areas, the absence of extensive deposits containing soluble minerals, and the low solubility of the basalt that forms the principal aquifer system. The water in the aquifer is of high quality and with modest treatment can be made suitable for most uses. Table 2.4 provides the high, low, and average chemical analysis values for groundwater samples taken at various locations in the area of the INEL. The data are based upon single-sample results from 35 different wells. The individual samplings occurred at various dates from 1951 to 1968.

The Snake River Plain aquifer is the only source of water used at the INEL. Water pumping and the effect on water levels in the aquifer are closely monitored by the U.S. Geological Survey. Pumping has very limited and localized effect on annual water-level changes in the aquifer in the vicinity of the INEL because the amount pumped is a small portion of the total storage and recharge.

2.5 Environmentally Sensitive Conditions

2.5.1 Protection of Groundwater Quality

The single most sensitive environmental characteristic associated with hazardous waste disposal practices at the INEL is probably the Snake River Plain aquifer. As described in Section 2.3.2, this vast aquifer underlies the entire INEL and provides all of the industrial, irrigation and culinary water for the Site. The down gradient portion of the aquifer also provides the primary source of water for the arid plain area stretching southwest from the Site to the area around Hagerman where the aquifer surfaces in springs. At that point the surfacing water contributes significantly to the flow in the Snake River. The aquifer is considered a valuable natural resource of the State and its contamination could have far-reaching impacts.

TABLE 2.4. CHEMICAL ANALYSES OF THE SNAKE RIVER AQUIFER IN THE VICINITY OF THE INEL

Analyses	Results (mg/L unless otherwise stated) Average	High	Low
Dissolved Solids			
Ca	39.6	93.0	26.0
Mg	15.6	43.5	3.9
Na	13.2	42.0	6.3
K	3.0	6.9	1.2
HCO_3	162.0	218.0	81.0
CO_3	0.5	9.8	0.0
SO_4	24.9	57.0	9.1
Cℓ	19.7	160.0	6.5
NO_3	2.9	29.0	0.5
F	0.3	0.9	0.03
SiO_3	25.8	39.0	15.0
Fe	0.08	0.52	0.0
Hardness as $CaCO_3$			
Total	161.8	368.0	94.0
Noncarbonate	26.7	215.0	0.0
pH (no units)	7.9	8.4	7.6
Specific conductance (μmhos at 25°C)	356.0	963.0	225.0
Residue on evaporation at 180°C	226.0	583.0	153.0
Temperature when collected (°C)	12.8	16.7	10.0

The U.S. Geological Survey routinely monitors the Snake River Plain aquifer around the INEL and has documented the migration of radionuclide contamination caused by operations there. A limited number of nonradioactive parameters are considered in the routine sampling; their migration has also been well documented. Concentrations of tritium, which is not diminished by sorption on earth minerals, have been detected in the aquifer as far as 14.5 km (9 mi) down gradient from their point of disposal; a migration that may have started as early as 1952. Other radionuclides have migrated shorter distances. Some chemical parameters that have been measured, such as sodium, chloride, sulfate and nitrate, have also formed waste plumes. However, none of these wastes can be detected more than about 8 km (5 mi) from the disposal site. Radionuclide plume size and concentrations are controlled by aquifer flow conditions, the quantity discharged, radioactive decay, sorption, dilution by dispersion, and perhaps other chemical reactions. Chemical parameters are subject to the same processes except for radioactive decay.

Several public action groups have already expressed concern over maintaining the quality of the Snake River Plain aquifer and will probably continue to do so. INEL actions that may impact the aquifer either negatively or positively, will be of concern to these groups. Protection of the groundwater quality is not only an environmentally sensitive issue, but will likely become a very politically sensitive one.

2.5.2 Seismology

Prior to 1970 the INEL was classified in Seismic Zone 2 of the Uniform Building Code of the International Conference of Building Officials. In 1970 the classification was changed to the higher-risk Zone 3, which imposed more stringent design criteria on facilities constructed thereafter. Data cataloged by the National Geophysical and Solar Terrestrial Data Center of the National Oceanic and Atmospheric Administration (NOAA) indicate that regional earthquakes are historically

centered around, but do not occur on, the Eastern Snake River Plain. However, ground motion produced by earthquakes in the mountains can be transmitted onto the plain.

The largest historical earthquake event in the Idaho seismic zone, which lies north and northwest of the INEL, occurred on October 28, 1983, and had a Richter magnitude of 7.3. The epicenter for this event was located along the western flank of Borah Peak in the Lost River Range approximately 64 km (40 mi) northwest of Arco. Another major earthquake occurred August 17, 1959 at Hebgen Lake, approximately 160.9 km (100 mi) from the INEL and had a Richter magnitude of 7.1. Shocks from both earthquakes were felt at the INEL, but neither caused structural or safety related damage.

The data compiled by NOAA and other studies accomplished since 1970 appear to suggest that the plain is rather aseismic. Although the plain is certainly not free of seismic risk, many had felt all factors pointed toward there being less risk than the Zone 3 classification would imply. Therefore, in October 1981 the INEL and surrounding area were again reclassified, this time back to a Seismic Zone 2.

2.5.3 Flooding Potential

The potential for flooding problems on the INEL was discussed in Section 2.3.1. In 1962 and again in 1969 rapid snow melt and heavy precipitation caused flooding of the burial ground at the Radioactive Waste Management Complex (RWMC). Since those events, significant work has been done on the Big Lost River drainage to prevent flooding problems, but the possibility of diversion structure or upstream dam failure, although slight, does exist. Flooding in the northern area of the INEL from Birch Creek is also a potential problem. Control measures have also been in the northern area, but with much of the INEL located in a closed drainage basin, the possibility of surface water accumulations in some areas of the Site is still present.

2.5.4 Endangered Species

Two species of milk vetch currently under Federal review for endangered or threatened status were found on the INEL (Astragalus ceramicus var. apus and Astragalus purshii var., ophigenes). These species were located during a 1981-1982 survey of rare plants on the INEL conducted by the University of Idaho. Three taxa on the Idaho State Watch List are also found on the INEL, and four other species were found and recommended for the list. Taxa on the Idaho State Watch List are considered rare and of special interest, but their populations are not in jeopardy and they may be common elsewhere.

The bald eagle and the American peregrine falcon are the only species observed on the INEL that are classified as endangered or threatened wildlife. Several bald eagles (endangered status) usually winter on or near the INEL. The peregrine falcon (endangered status) has been observed infrequently on the northern portion of the INEL. Several species of wildlife observed on the INEL are of special concern to the Idaho Department of Fish and Game and the Bureau of Land Management. These species include the ferruginous hawk, merlin, gyrfalcon, osprey, burrowing owl, white-faced ibis, long-billed curlew, and bobcat. However, only the ferruginous hawk, burrowing owl, long-billed curlew and bobcat occur regularly on the INEL.

2.6 Biological Pathways

The biological pathway of primary concern at the INEL is through the water of the aquifer underlying the Site. This is of primary concern because of the aquifer's extent, its wide usage on site and off site (down gradient), and its being the primary means of off-site migration of contaminants resulting from past disposal practices. This water is consumed by both humans and animals (livestock) and is utilized as an irrigation source, all potential biological pathways for water

contaminants. On the other hand, naturally occurring surface waters on site have no significant downstream usage, and actually terminate on site where they either evaporate or become part of the aquifer by infiltration.

Probably the next most significant biological pathway is a result of process waters being discharged to evaporation/seepage ponds which are then used by animals. This pathway is extended to humans when game animals use these contaminated surface waters and subsequently move off site where they are harvested and consumed by hunters. The potential transport of radioactivity to individuals via this pathway has been studied for many years. Although not covered specifically in these studies, it can be assumed that some of the hazardous chemical constituents that might be found in these waters will also be available for biological uptake. Studies on radionuclide transport suggest that ingestion of meat from waterfowl that have resided on contaminated ponds presents the most important pathway through game animals. Transport by morning doves, sage grouse and antelope residing for some time on site and eventually being killed and consumed has also been studied.

Air transport and direct vegetation uptake of contaminants also present potential biological pathways. Air dispersion of dry pond or spill sediments, subsurface contaminants brought up by burrowing animals, and other such materials, as well as their uptake by vegetation, are possible. The fact that the INEL is remote and has no permanent population and no agricultural usage appears to make the significance of these potential pathways minimal.

SECTION 3. Findings From EG&G

3. FINDINGS FROM EG&G ACTIVITIES

Past activities involving both waste generation and disposal were reviewed to assess the hazardous waste operations that generated inactive disposal sites at the INEL. This section contains the findings of the activity reviews by individual activity. For convenience, the reviews are grouped by general locations within the INEL. These general locations and the sections in which they are discussed are as follows:

1. Test Reactor Area (TRA)--Section 3.1

2. Test Area North (TAN)/Technical Support Facility (TSF)--Section 3.2

3. TAN/Loss-of-Fluid Test (LOFT) Facility--Section 3.3

4. TAN/Initial Engine Test (IET) Facility--Section 3.4

5. TAN/Water Reactor Research Test Facility (WRRTF)--Section 3.5

6. Auxiliary Reactor Area (ARA)--Section 3.6

7. Power Burst Facility (PBF) Area/SPERT--Section 3.7

8. Experimental Organic Cooled Reactor (EOCR) Area--Section 3.8

9. Organic Moderated Reactor Experiment (OMRE)--Section 3.9

10. Boiling Water Reactor (BORAX) Area--Section 3.10

11. Experimental Breeder Reactor-1 (EBR-1)--Section 3.11

12. Zero Power Reactor (ZPR)--Section 3.12

13. Liquid Corrosive Chemical Disposal Area (LCCDA)--Section 3.13

14. Munitions/Ordnance Areas--Section 3.14

15. Central Facilities Area (CFA)--Section 3.15

16. Radioactive Waste Management Complex (RWMC)--Section 3.16

File information, past reports, interviews, and site visits provided identification of hazardous material usage and hazardous waste generation from operations within the above locations. If investigation determined that hazardous materials were not used and hazardous wastes were not produced at a particular operation, then it is not addressed further in the main text.

Since 1976 records have been kept on incidents occurring at EG&G (and the previous site contractor) facilities which have disrupted operations or presented unusual problems. The records, Unusual Occurrence Reports (UORs), are maintained by EG&G Health and Safety Division and include documentation of most spills that have occurred since 1976. UORs and interviews were the major sources of spill information used in preparation of this document.

Also included in this section is an identification of the individual disposal sites at the general locations considered. All sites are documented and, for any appearing to have a potential for migration, a hazardous assessment score using the Hazard Ranking System (HRS) is provided in the Section 4 conclusions. The HRS was used as a means of getting a feel for the relative significance of the various sites.

3.1 TRA Past Activity Review

3.1.1 TRA Description

The Test Reactor Area (TRA) of the INEL provides facilities for studying the performance of materials and equipment under high neutron flux conditions. While originally intended primarily for furthering the reactor development programs of DOE and its predecessors, the irradiation facilities have occasionally been made available to educational, research, industrial, and commercial users, as well as to other federal agencies. This irradiation testing can ascertain in weeks or months what might take years to discover in reactors designed for purposes other than testing.

The TRA is located in the south central part of the INEL, as shown in Figure 2.3. It can be divided functionally into a reactor area and a utility area. The reactor area contains the inactive Materials Test Reactor (MTR) and Engineering Test Reactor (ETR) and the still operating Advanced Test Reactor (ATR). In addition to the three primary reactors, four low-power reactors, the Advanced Test Reactor Critical (ATRC) facility, two Advanced Radioactivity Measurement Facilities (ARMFs), and the inactive Engineering Test Reactor Critical (ETRC) facility, are located in the reactor area. This area also includes the offices, warehouses, and maintenance facilities that support the reactor facilities. The utility area contains nonnuclear support equipment and facilities. Figure 3.1.1 is a plot plan of TRA.

3.1.2 TRA Wastes Generated by Specific Activity

3.1.2.1 TRA Reactor/Utility Operations (Shops, Labs and Processes). A screening of the areas within TRA produced a list of shops, labs, and processes which were considered to pose a potential for contamination. Table 3.1.1 provides the refined list of facilities and also provides the hazardous waste constituents involved, the timeframes in which the hazardous wastes were produced, and the disposal methods. The facilities in Table 3.1.1 are further discussed in the following paragraphs.

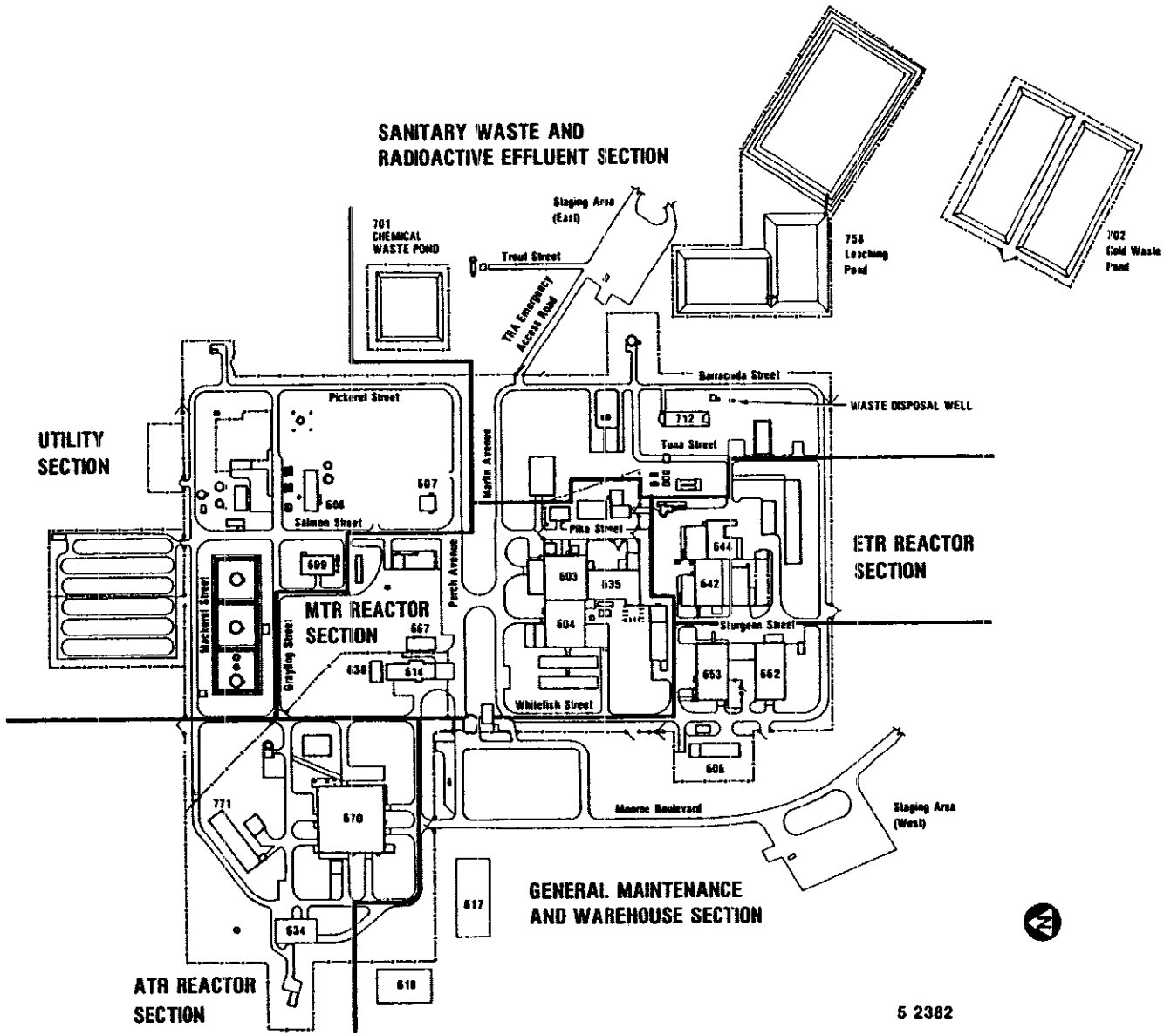


Figure 3.1.1. Test Reactor Area plot plan.

TABLE 3.1.1. TEST REACTOR AREA FACILITIES WASTE GENERATION

Shop Location	Function	Waste Stream	Timeframe	Estimated Quantities (If Known)	Treatment/Storage/Disposal
TRA-606	Paint shop	Waste thinners and solvents	1957-1982	420 l/yr	Open ditch east of building
		Waste thinners and solvents	1982-present	420 l/yr	Drummed and shipped off site as HW
		Empty and partially empty cans			
		1-gal cans (lead base primers, latex and epoxy)	1957-present	20 cans/mo.	CFA landfill
		5-gal cans (lacquer)	1957-present	2 cans/mo.	
TRA-608	Demineralization plant	Regeneration discharge from ion exchangers			
		Sodium hydroxide (NaOH)	1952-1961	6×10^5 kg	Warm-waste leach pond (TRA-758)
		Sodium hydroxide	1962-1984	1.8×10^6 kg	Chemical waste pond (TRA-701)
		Sodium hydroxide	1984-present		Neutralized prior to discharge to TRA-701
		Sulfuric acid	1952-1961	3.3×10^6 kg	Warm-waste leach pond
		Sulfuric acid	1962-1984	9.9×10^6 kg	Chemical waste pond
		Sulfuric acid	1984-present		Neutralized prior to discharge to TRA-701
		Regeneration discharge from water softener			
		Salt	1952-1961	4.8×10^5 kg	Warm-waste leach pond (TRA-758)
		Salt	1962-1971	4.4×10^5 kg	Chemical waste pond (TRA-701)
TRA-609	Steam plant	Blowdown water--makeup water treated with Ferrosperse, sulfite and phosphate	1952-1963	5.0×10^5 l	Warm-waste leach pond (TRA-758)
			1964-1982	7.9×10^5 l	TRA injection well
			1583-present	110 l/day	Cold-waste pond (TRA-702)
TRA-632	Hot cells	Degreasing waste--mixed radioactive	1952-present		Idaho Chemical Processing
		Acetone		20 l/yr	Plant (ICPP) for processing
		Methylene Chloride		210 l/yr	through the Process Equipment
		Ethyl Alcohol		40 l/yr	Waste (PEW) evaporator and calciner system

TABLE 3.1.1. (continued)

Shop Location	Function	Waste Stream	Timeframe	Estimated Quantities (If Known)	Treatment/Storage/Disposal
TRA-632	Hot Cells (continued)	Methal-etching waste--mixed radioactive	1952-Present		ICPP-PEW and calciner
		Nitric Acid		10 L/yr	
		Hydrochloric Acid		10 L/yr	
		Hydrofluoric Acid		1 L/yr	
TRA-642	ETR bypass demineralizer	Spent cation resins--no regeneration	1957-1982		RWMC
		Anion resin regeneration (50% NaOH solution)	1957-1973	10,000 L/yr	Warm-waste leach pond
			1974-1981	1,000 L/yr	Warm-waste leach pond
TRA-604/661	TRA chem labs	Ignitable wastes	1952-1984	3,250 kg	Warm-waste leach pond
			1952-1984	1,250 kg	ICPP-PEW and calciner
		Reactive wastes	1952-1984	45 kg	Warm-waste leach pond
			1952-1984	15 kg	ICPP-PEW and calciner
		Corrosive wastes	1952-1984	2,150 kg	Warm-waste leach pond
			1952-1984	850 kg	ICPP-PEW and calciner
		EP toxic wastes	1952-1984	45 kg	Warm-waste leach pond
			1952-1984	15 kg	ICPP-PEW and calciner
		All hazardous lab wastes	1984-Present		Drummed and shipped off site as HW
TRA-666	Hydraulic test facility	Wastewater--lightly contaminated with chromium (2.6 ppb)	1964-1982	0.6 kg	TRA injection well
			1982-1983	<0.1 kg	Cold-waste pond (TRA-702)
TRA-670	ATR bypass demineralizer	Spent cation resins--no regeneration	1969-Present		RWMC
		Spent anion resins--no regeneration	1969-Present		RWMC
TRA-751	MTR & ETR cooling towers (wastes actually produced at MTR & ETR)	Cooling water blowdown--Prior to 1972 chromates were added as part of the corrosion control treatment. Quantities listed are for chromium (Cr^{+6})	1952-1964	12,600 kg	Warm-waste leach pond (TRA-758)
			1964-1972	13,400 kg	Injection well

The paint shop at TRA-606 generates approximately 420 liters per year of a mixture of waste thinners, solvents and paint strippers. A typical sample of the mixture might contain 50% mineral spirits, 20% xylene, 20% toluene, 5% acetone, and 5% water. Prior to 1983, this waste was dumped into a storm drainage runoff ditch located just east of the shop. Since about the beginning of 1983 these wastes have been poured into 55-gal drums and shipped off site as hazardous wastes. The paint shop also generates a considerable number of empty cans and dirty rags that are thrown into a dumpster and eventually find their way to the sanitary landfill at CFA. Approximately 20 1-gal cans (primarily from latex paints, but some from epoxies and lead-base primers) and two 5-gal cans (usually from lacquer) are thrown in the dumpster each month. It is likely that some of these cans are not totally empty; estimated numbers or content quantities are, however, unavailable.

The demineralization plant (TRA-608) has been providing demineralized water for reactor operations since 1952. Water is treated by ion exchange, which means the ion-exchange columns must be periodically regenerated. Sulfuric acid and sodium hydroxide are used to regenerate the cation and anion units. From 1952 through 1961 these regenerants of alternating high and low pH were discharged to the warm-waste leach pond (TRA-758). From 1962 to about August 1984, the regenerant discharge was rerouted to a chemical waste pond (TRA-701) specifically constructed for this waste.

Over the last 13 years this discharge has averaged about 100 million liters per year. Both acidic and basic solutions have been discharged to the same location, but at different intervals. As shown in Table 3.1.1, the acidic discharge has been significantly greater than the basic. Therefore, prior to August 1984, neutralization in ponds may have occurred but probably not to an extent that would always prohibit wastes with hazardous characteristics (corrosive) from being released to the environment. Since August 1984, regenerants have been routed through an existing brine tank, where they are held until they can be neutralized before discharge to the chemical waste pond.

The demineralization plant also houses two zeolite water softeners which have been used in the past but are not currently in use. Regeneration of these units produced a waste salt solution. As with the discharge from the ion-exchange regeneration, this salt solution was sent to the warm-waste leach pond (TRA-758) from 1952 to 1961 and then rerouted to the chemical waste pond (TRA-701) in 1962. These water softeners have not been used since 1971, but when in operation they used about 3,600 kg of salt per month.

The hot cells (TRA-632) are designed for the remote examination of nuclear fuels and radioactive materials. These examinations often include degreasing/cleaning operations and metal etching, using small quantities of solvents and acids respectively. The figures in Table 3.1.1 represent estimated quantities of waste of the specific chemicals involved. These quantities are based on chemical usage and do not include any consumption or evaporation which may be significant, particularly in the case of solvents.

The waste products from the hot cells (which are mixed wastes because they include radioactive materials) are washed to drains that lead to hot-waste tanks serving the hot cells. These tanks are periodically pumped and the contents taken to the Idaho Chemical Processing Plant (ICPP) for treatment. Some of the hot-cell wastewater has, at short intervals in the past, been discharged to the warm-waste leach pond because of low radionuclide activity. However, it was found that this practice caused some unwanted radionuclide species to accumulate in the pond sediments, so the practice was discontinued. Because of the short period of time and small quantities of hazardous contaminants involved, it is assumed that wastewater from the hot cells has been an insignificant source of hazardous waste contamination for the warm-waste leach pond.

The primary cooling water loop of the ETR used a bypass demineralizer system (located in TRA-642) to maintain water quality. The system consists of two cation and two anion resin tanks. The cation resins have a relatively long life, and a disposable-type resin was used. Depleted

cation resin beds were flushed to a shielded container, drained of water (to warm-waste collection system), and shipped to the RWMC for disposal. The anion resin beds were periodically regenerated with a sodium hydroxide solution. An anion bed was regenerated approximately every week to ten days with about 50 to 60 gallons of a 50% sodium hydroxide solution. This schedule held from 1957 until about 1974, when ETR operations were curtailed. From 1974 to its August 1981 shutdown, the anion beds were regenerated only a few times each year. In fact, from November 1980 to August 1981 it is estimated that only a single anion bed was regenerated. The regenerant solutions were drained to the TRA retention basin and then to the warm-waste leach pond. The radioactivity was always low enough after a minor holding period to allow discharge to the pond. ATR has a similar bypass demineralizer system on its primary water loop, but in this case, both cation and anion resin beds are replaced after they are depleted; no regeneration is accomplished.

Prior to mid-1984, the primary TRA chemistry labs (TRA-604 and TRA-661) routinely poured waste or used chemicals and reagents down laboratory drains. These drains are connected to the TRA warm-waste collection system which eventually either goes to the warm-waste leach pond or, if radionuclide activity is too high, is shipped to the ICPP for treatment through the Process Equipment Waste (PEW) evaporator and the calciner system. The breakdown shown in Table 3.1.1 shows an assumed 72/28 percent split between wastes going to the pond and those going to the ICPP. This split was obtained from 1983 records and is representative of what had happened in past years. Since mid-1984, these laboratory wastes have been placed in lab packs for ultimate disposal/treatment off site as hazardous waste. The waste stream shown in Table 3.1.1 for this source actually represents basic groupings of numerous chemicals and solutions. Specific chemicals found in the waste stream from these labs were identified in a waste characterization study done in late 1984. A majority of the laboratory waste was considered to be byproduct because it became radioactive through contact with special nuclear material. It is quite

likely that because of the large volumes of wastewater going to the ware waste pond and the small quantities of lab waste involved, these wastes were not detectable by the time they reached the pond.

The hydraulic test facility (TRA-666) performed mock-up testing of reactor core components using clean demineralized water. From 1964 to August 1983, when it was last used, the facility produced about 300,000 gal/mo of what was considered nonhazardous wastewater. This wastewater was discharged to the TRA injection well until March 1982, at which time it was rerouted to the newly constructed cold-waste pond (TRA-702). One reason the facility stopped testing in 1983 was the buildup of metal contamination in the water loop due to corrosion and scouring. Among the problem metals was chromium, which is considered hazardous at high enough concentrations. However, for the needs of the hydraulic test facility, the metal levels of concern were all in the parts-per-billion range. Chromium averaged only 2.5 ppb over six samples, which was still below the allowable level for drinking water. Although Table 3.1.1 shows the total amount of chromium that would have been discharged at 300,000 gal/mo from 1964 to 1983, the hydraulic test facility is considered an insignificant source of contamination.

Past practices followed in the disposal of cooling tower blowdown added chemicals to the make-up water to prevent corrosion of the cooling system. The secondary cooling water systems of the TRA reactors remove heat from their corresponding primary water loops through heat exchangers. Secondary cooling waters are then passed through cooling towers to dissipate the heat gained. Some of the water in the secondary loop evaporates, while some is lost to blowdown.

Prior to 1972, secondary cooling water at MTR and ETR was pretreated with corrosion-preventing solutions which contained chromates. Hexavalent chromium concentrations were maintained at about 11 to 14 ppm. The amount of chromium lost from the system via blowdown is recorded in the Industrial Waste Management Information System (IWMIS). However, the first IWMIS data

is for 1971, and the only records for chromium discharge are for 1971 and the first eight months of 1972, at which time the chromate-based corrosion preventative was changed to a phosphate-based solution. During the 20 months of record, 175 megawatts (MW) of power were produced by ETR. The pre-1971 data in Table 3.1.1 were obtained by assuming that the average chromium discharge per MW during those 20 months could be extrapolated to past operations. (The assumption is that the amount of blowdown is directly proportional to the power produced.) This assumption was applied to two periods: (1) When MTR and ETR were operating simultaneously (215 MW), and (2) when MTR was the only operating reactor (30 and later 40 MW). From 1952 through October 1964, cooling tower blowdown was discharged to the warm-waste leach pond; from November 1964 through March 1982, it was discharged to the TRA underground injection well; and since then it has been discharged to a new cold-waste pond (TRA-702). Table 3.1.1 provides no post-1972 data since the blowdown discharges have had no hazardous constituents since that time. ATR did start up in 1967 but only used phosphate-based corrosion preventatives in its secondary water. For that reason, ATR blowdown water has not been included either in this discussion or in Table 3.1.1.

Evaporated water from the cooling towers may also be considered an atmospheric contaminant since some hardness ions and chemical additives (such as the chromium in corrosion preventatives) are released to the atmosphere. In high winds, as much as 100 gpm of water with additives can be blown from a TRA cooling tower and deposited on the ground downwind. At 175 MW, and during normal conditions, ETR was also responsible for cooling tower evaporation of about 1,000 gpm. Loss of chemicals to the atmosphere in carryover and by evaporation has not been measured or estimated since they were dispersed over an unconfined area. Also, it can be assumed that a significant portion of the dissolved solids from the evaporated water remains in the cooling tower where it may adhere to baffles, return to the secondary water system, or contribute to the blowdown.

Historically, several TRA shops, particularly the steam plant (TRA-609) and the craft shops (TRA-625 and TRA-653), have occasionally used small amounts of solvent to clean or degrease tools and work materials. The solvent is generally applied by hand with rags, which are then thrown in with other nonradioactive refuse. (General refuse ultimately goes to the Central Facilities Area landfill.) The solvent appearing to be most available and most often used for this type of operation is methylene chloride. This waste stream is not included in Table 3.1.1 because it is assumed that the small, irregularly generated quantities of solvent evaporate before disposal takes place.

3.1.2.2 TRA Fuels/Petroleum Management. Bulk fuel usage at TRA is basically limited to No. 5 Fuel Oil (which is burned in the boilers) and diesel fuel, used in standby power generators. In both instances, the product is delivered to TRA in tank trucks where it is pumped to aboveground storage tanks via the fuel oil pumphouse (TRA-627). From stains on the ground around the piping manifold at the fuel oil pumphouse it appears that there is minor spillage during the filling operations. The large tanks feed several smaller day-tanks located at the place of consumption. Two underground gasoline tanks are also serviced by tank truck. Table 3.1.2 provides an inventory of the fuel/petroleum storage tanks at TRA.

New stock of oils, lubricants, and small amounts of solvents that are brought into TRA in 55-gal drums are often stored on an open loading dock (TRA-722) located between the boiler plant (TRA-609) and the cafeteria (TRA-616). Use of this dock for combustible liquid drum storage should soon be replaced by using space in the newly constructed Hazardous Chemical Storage Facility (TRA-640).

3.1.2.3 Spills within the TRA. Review of Unusual Occurrence Reports (UORs), personnel interviews, and site observations provided information on the spills identified in this section.

TABLE 3.1.2. TRA--FUEL/PETROLEUM STORAGE TANKS

Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMS #	Responsibility	Comments
TRA-605	Gasoline	--	U, O	--	--	--	Abandoned, south side of building
TRA-606	Unleaded gasoline	3,500	U, I	Aboveground gauge	01SSW403	Site Services	Protective coating
TRA-610	Gasoline	--	A, O	--	--	--	Abandoned; east side of building
TRA-616	Gasoline	--	U, O	--	--	--	Abandoned; filled with sand and capped
TRA-619	Gasoline	500	U, I	Aboveground gauge	--	TRA facility	--
TRA-619	Diesel No. 1	300	A, I	Aboveground gauge	--	TRA facility	Curbing
TRA-620	Diesel blend	5,000	U, O	Dipstick	01SSW411	Transportation	--
TRA-633	Diesel No. 1	750	A, I	Aboveground gauge	--	TRA facility	Curbing
TRA-643	Diesel	--	A, I	--	--	--	Abandoned
TRA-727A	No. 5 fuel oil	221,456	A, O	Gauge on outside of tank	01BFW459	TRA facility	--
TRA-727B	No. 5 fuel oil	221,456	A, O	Gauge on outside of tank	01BFW460	TRA facility	--
TRA-727C	Diesel No. 2	29,957	A, O	Gauge on outside of tank	01BFW450	TRA facility	--
TRA-727D	Diesel No. 2	91,896	A, O	Gauge on outside of tank	01BFW450	TRA facility	--
TRA-775	Diesel No. 2	34,940	A, O	Gauge on outside of tank	01BFW450	TRA facility	--

In February of 1977, one of the batteries used for standby power fell off a cart and ruptured, leaking the sulfuric acid electrolyte onto the floor of the ETR facility. The acid was washed down the nearest floor drain which led to the warm-waste leach pond (TRA-758).

A sulfuric acid spill occurred in March of 1980 during construction work which involved an acid supply line. The line was isolated so the amount of acid spilled was minimized, but heat from an adjacent steam pipe caused pressure buildup in the pipe so that it spurted when a valve was opened. The entire area involved in the spill was hosed down with water.

In the spring of 1983, approximately 100 gal of sulfuric acid were spilled at the ATR Secondary Pumphouse (TRA-671). The acid spread over a fairly large area of the hardpan soil on the southeast side of the building. The concentrated acid was at least partially neutralized by the addition of sodium bicarbonate. The top foot of soil was dug up and buried in a pit south of the Demineralization Plant (TRA-608). An estimated 500 to 1,000 ft^3 of soil were removed and buried at this time.

Although not identified in UORs or interviews as a spill, there may have been numerous small leaks or seeps from drums that have been stored on the open loading dock (TRA-722). At least part of the ground beneath the dock is covered with asphalt. Oily stains and puddles were visible beneath the dock both times it was inspected. The extent of contamination, if any, is unknown.

3.1.3 TRA Waste Disposal Sites

Areas or sites within the TRA at which hazardous and/or radioactive wastes may have been deposited at some time are discussed in the following paragraphs.

3.1.3.1 Warm (Radioactive) Waste Leach Pond (TRA-758).

3.1.3.1.1 Description--The low-level radioactive waste pond at TRA consists of three cells and is depicted as TRA-758 on the east side of the TRA facilities in Figure 3.1.1. The first of the three cells was excavated in 1952 and has a bottom dimension of 45.7 by 76.2 m with 2:1 side slopes and a depth of 4.6 m. Because of decreased permeability and additional discharge, a second cell was excavated in 1957. That cell bottom is 38.1 by 70.1 m with 2:1 side slopes and a depth of 4.6 m. When the water level is greater than 3.4 m, these cells form one pond. The combined capacity of the two cells when water is 4.6 m is about 3.7×10^7 L.

Since use of the pond began, a precipitate of silica gel partially sealed the bottom and lower sides, thus decreasing the infiltration rate. The gel was as thick as 15.2 cm in 1961. Fine-grained sediments, algae, and other chemical precipitates were also probable contributors to decreased pond permeability. Because permeability continued to decrease, the pond water level began to rise in 1963.[3]

The third and largest cell was excavated in 1964. The cell bottom is 76.2 by 121.9 m with 2:1 side slopes and a maximum depth of about 1.8 m. The capacity of this third cell is 1.5×10^7 L when the water is 1.5 m deep. The third cell is gravity fed by the second cell through a small canal which connects the two. None of the three cells making up the warm waste leach pond are lined, but some degree of sealing has occurred because of chemical precipitates and algae.

A schematic of TRA's liquid radioactive waste collection system is shown in Figure 3.1.2. The system was designed to receive low-level liquid wastes (those with radioactivity levels small enough not to exceed discharge limits) and intermediate-level liquid wastes (those too contaminated for immediate disposal to the lithosphere). As can be seen in Figure 3.1.2, wastewater in the system goes eventually either to the seepage (leach) pond or to the ICPP for processing. The destination depends on the level of radioactivity. In some instances, wastes are held

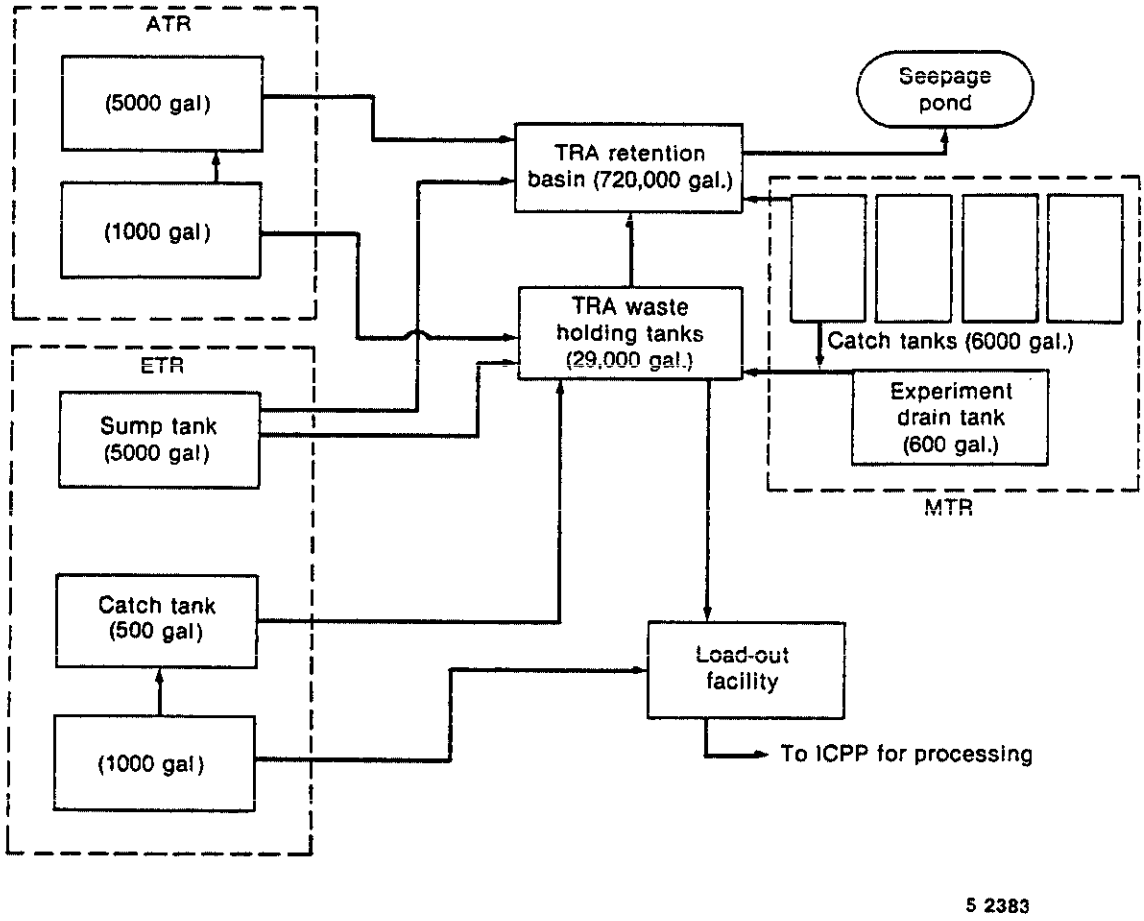


Figure 3.1.2. Past TRA radiological liquid waste collection systems.

in tanks long enough for decay to bring the waste's radioactivity down to levels acceptable for discharge to the lithosphere via the leach pond. The natural absorptive and ion-exchange properties in the soil are counted on to remove most of the radioactive impurities in the water. As mentioned in Section 3.1.2.1, recent records have shown that about 72% of the wastewater reaching the collection system eventually goes to the TRA retention basin and the leach pond.

3.1.3.1.2 Wastes Received--The TRA warm-waste leach pond and its associated collection system were designed to handle radioactive wastewater. However, from 1952 to 1962, all liquid wastes (except sanitary sewage) were discharged to this pond. Wastewater from the demineralization plant went to this pond until 1962 and other cold wastewater (including blowdown from the cooling towers) was discharged here until 1964. A summary of hazardous chemicals that reached the pond is provided in Table 3.1.3.

Radionuclides and water volumes discharged to the leach pond have been well documented in recent years and are part of the Radioactive Waste Management Information System (RWMIS).

Hazardous chemical discharges have been estimated from past operations and records. From 1952 to 1961 the main TRA demineralization plant discharged regeneration solutions from ion exchange columns to the warm-waste leach pond. Regeneration of these columns is accomplished with sulfuric acid for cation columns and sodium hydroxide for anion columns. From 1957 to 1982, regenerant from the bypass demineralizer on the ETR primary cooling water system was also discharged to this pond. But at ETR only the anion resins were regenerated (discharges of sodium hydroxide only). Discharges from ion exchange regeneration accounted for approximately 700,000 kg of sodium hydroxide and 3,300,000 kg of sulfuric acid.

TABLE 3.1.3. TRA HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Area Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Waste	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
TRA-756	Warm-Waste Leach Pond	1952 - present	22,000	Low-level radioactive wastewater with: Sodium hydroxide Sulfiric acid Characteristic lab waste Chromium	 700,000 kg 3,300,000 kg 5,500 kg 12,600 kg	Discharge to open, unlined seepage pond	Active--Discharge of hazardous, non-radioactive chemicals has been eliminated	Level land/ alluvial surface sediments over basalt. Pond discharge generated a shallow perched water table at depths of about 25 to 40 meters. Primary aquifer is about 145 meters below.	No specific action taken to exclude surface drainage from reaching pond	o Monitoring shows migration to perched water table and aquifer o Use of pond may be pushing contaminants further
TRA-712	Warm-Waste Retention Basin	1952 - present (leaking since early 1970s)	--	Leakage of wastewater going to warm-waste leach pond including: Sodium hydroxide Characteristic lab waste	 10,000 kg 600 kg	Leakage into soil beneath concrete basin	Active--Discharge of hazardous, non-radioactive chemicals has been eliminated	Level land/ alluvial surface sediments over basalt. Discharge contributes to perched water described above	Basin has concrete sides and top; surface drainage cannot enter	o Migration probable o Continuing leakage may be pushing contaminants further
TRA-701	Chemical Waste Pond	1962 - present	3,200	Ion exchange regenerant solutions including: Sodium hydroxide Sulfuric acid	 1.8×10^6 kg 9.9×10^6 kg	Discharge to open unlined seepage pond. Prior to 1984 no attempt was made to neutralize before discharge	Active--Acidic and basic solutions are now neutralized before discharge	Level land/ alluvial surface sediments over basalt. Discharge contributes to perched water and aquifer described above	Pond has bermed sides that exclude surface drainage	o Migration has been documented o Continued seepage may be pushing contaminants further
TRA	Waste Disposal Well	1964 - 1982	N/A	Nonradioactive, clean industrial discharge. From 1964 to 1972 contained chromium-contaminated cooling-tower blowdown	13,400 kg (chromium)	Discharged directly to deep disposal well with perforations between 156 and 386 m	Closed--Well capped and sealed.	Snake River Plain aquifer is approximately 145 m from surface. Well injects directly into acquifer	Well head is sealed against surface water intrusion	o Chromium still detectable in at least one well hydraulically down-gradient from site
TRA-606	Paint Shop Ditch	1957-1982	10	Paint thinners and solvents, specifically - Mineral Spirits - Xylene - Toluene - Acetone	 5460 L 2180 L 2180 L 550 L	Pouring in small quantities at a time into earthen ditch	Inactive-ditch used only for storm water collection	Level land/ alluvial surface sediments over basalt. Snake River Plain aquifer is approximately 145 m from surface	Ditch carries water to low areas outside facility area	

Until mid 1984, small quantities of laboratory wastes were poured down warm-waste drains that led to the warm-waste pond. An estimated 5,500 kg of chemicals having hazardous waste characteristics, as defined by EPA, were discharged to this pond from 1952 to 1984. However, it is suspected that the characteristics were undetectable by the time these wastes reached the pond.

Cooling tower blowdown from MTR and ETR operations was discharged to the warm-waste pond from 1952 to 1963. During this time, a chromate-based corrosion preventative was added to the cooling water, and the blowdown contained significant quantities of chromium. It is estimated that 12,600 kg of chromium were discharged in this manner.

3.1.3.1.3 Evidence of Migration--Subsurface radionuclide migration from the TRA warm-waste pond has been monitored by the U.S. Geological Survey (USGS) since the pond's construction. Through this monitoring effort and associated studies, it has been determined that the liquid waste disposal systems at TRA have actually developed one if not several perched water tables above the Snake River Plain aquifer. Figure 3.1.3 is taken from a USGS study and shows a hypothesized geologic cross section at TRA, including perched groundwaters and the aquifer. Radionuclide concentrations in the primary perched water table as well as those in the Snake River Plain aquifer have been plotted. Some chemical species have also been included in the monitoring effort, and concentration distributions for these species have also been determined. Figure 3.1.4 shows the water-level contours of the perched water beneath TRA and Figure 2.7 shows the water-level contours of the Snake River Plain aquifer. (Ground level at TRA is about 4,940 feet MSL.)

One of the chemical species that has been tracked is chromium. Figure 3.1.5 shows a set of recent concentration contours for chromium in the perched water table. Cooling tower blowdown, a source of chromium discharge, was eliminated from the warm-waste pond in 1963; Figure 3.1.5 represents data taken in 1981. As would be expected, the concentration and

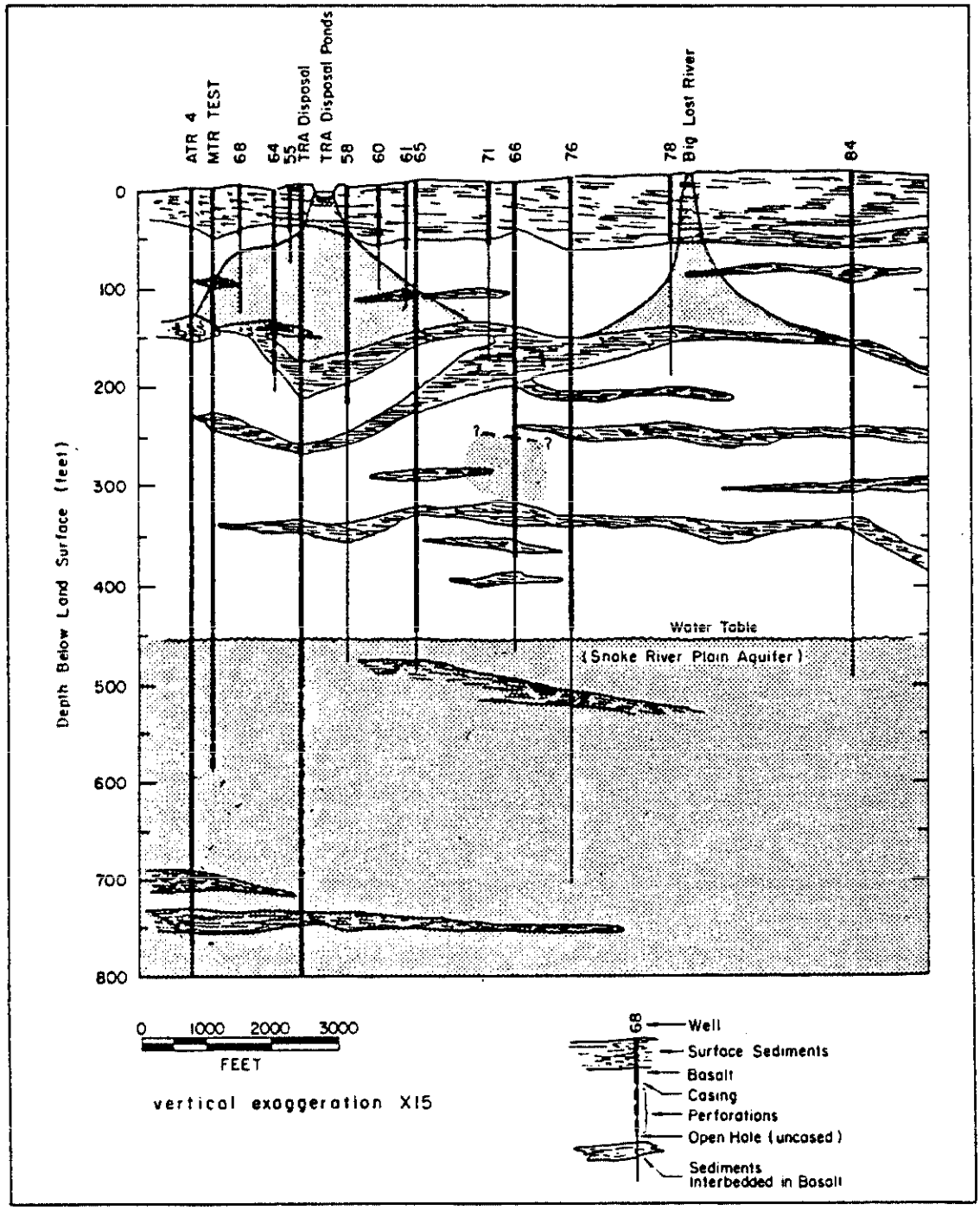


Figure 3.1.3. Geologic cross section at TRA showing the bodies of perched water and the Snake River Plain aquifer.

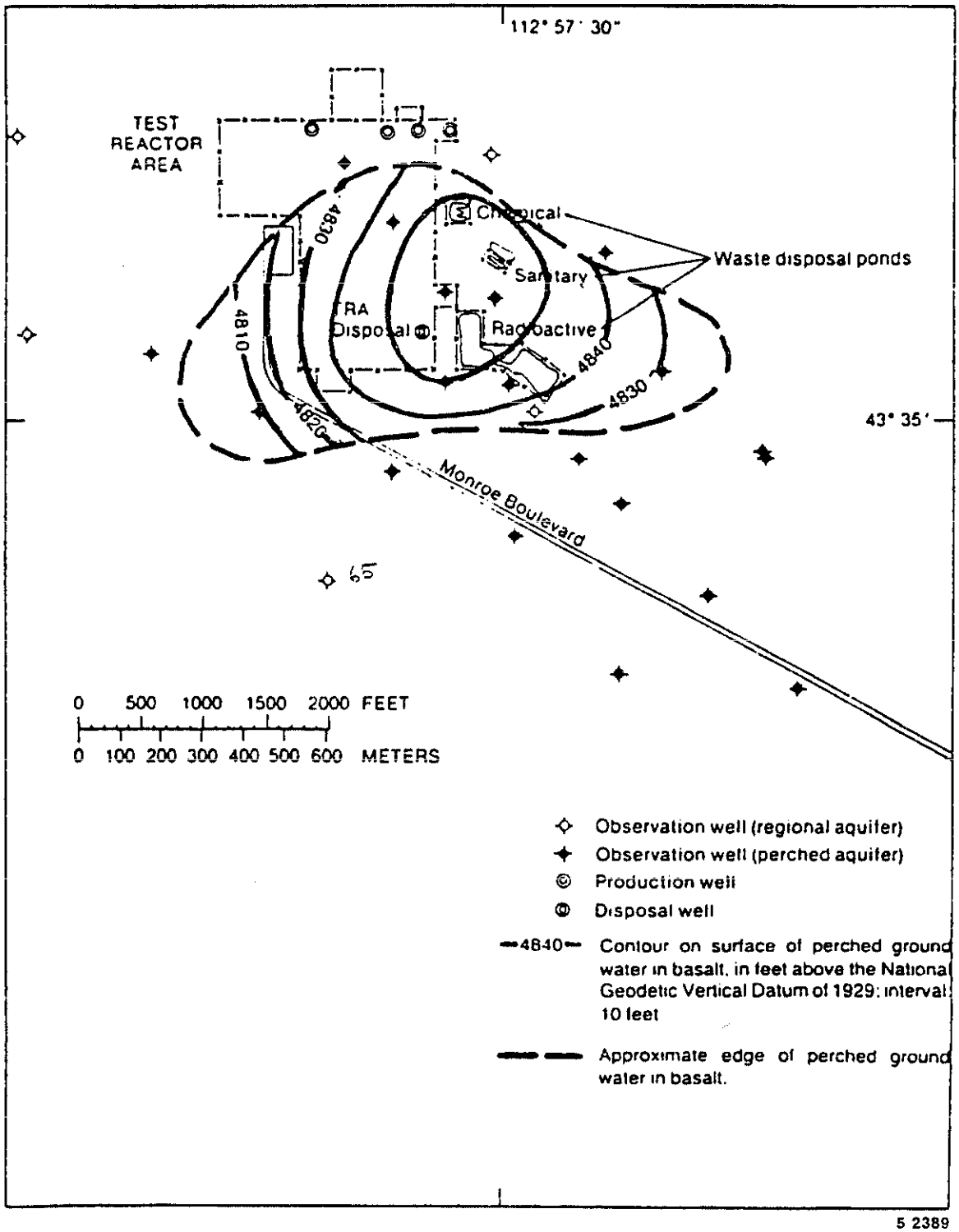


Figure 3.1.4. Water-level contours on the surface of the perched groundwater in the basalt at TRA, October 1981.

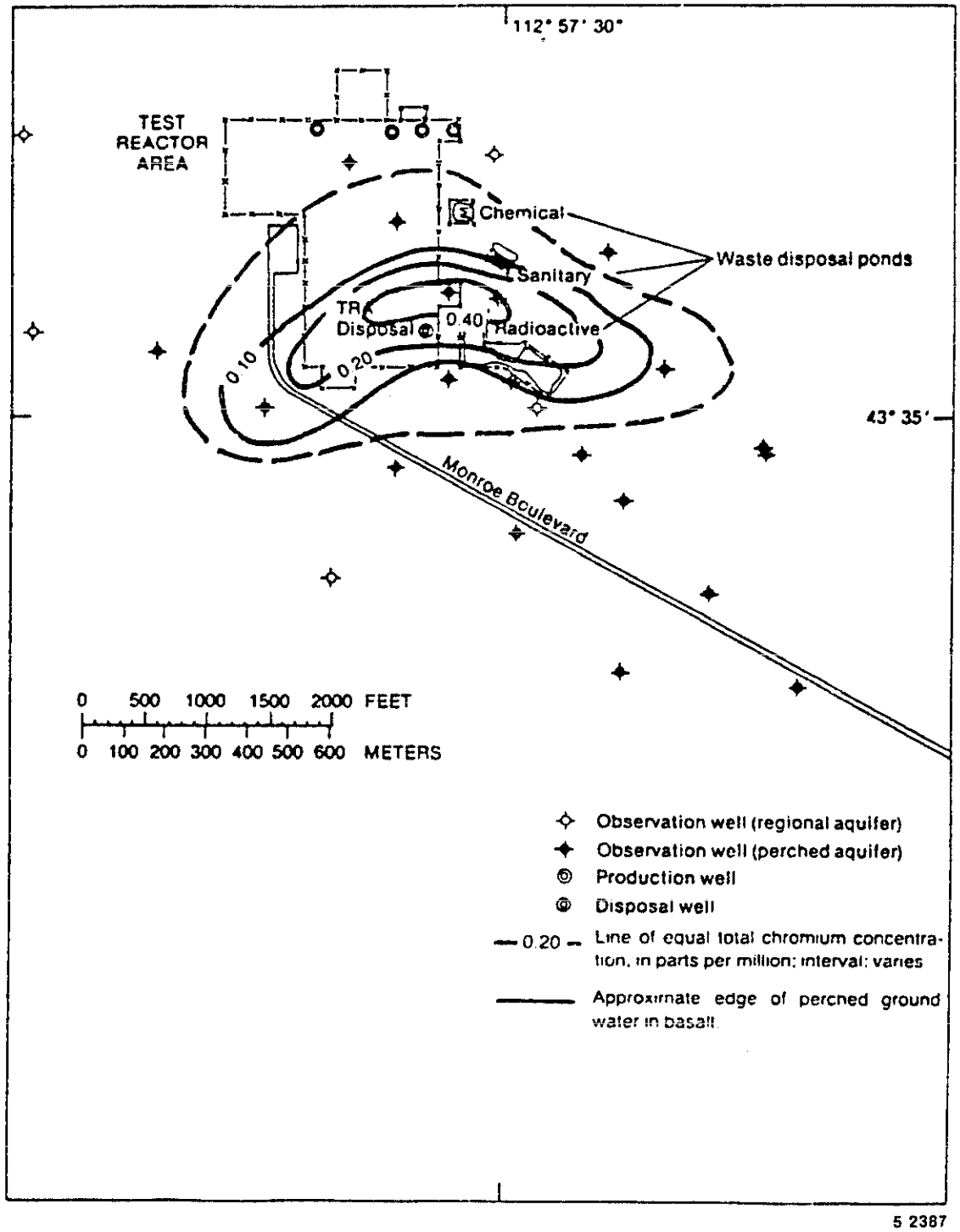


Figure 3.1.5. Total concentration of chromium in the perched groundwater in the basalt at TRA, October 1981.

altitude contours have changed significantly over the years as the quantity and quality of wastewater and natural recharges (Big Lost River) have changed, but the chromium is still present. The radionuclide tritium, which migrates and evaporates as does the water with which it is mixed, has also been monitored. Tritium and other radionuclides have been detected in the Snake River Plain aquifer and are assumed to have migrated from the warm-waste pond via the perched water table. It can be assumed that past discharges of chromium had the same route available, but the ion-exchange capacity of the ground may have had more impact on removal because no measurable chromium levels in the groundwater have been definitely linked to the pond operations.

Specific conductance has also been tracked in USGS monitoring wells and provides a good measure of the dissolved chemicals that have been discharged to the ground. In this instance, a prime source of dissolved chemicals is the regenerant from ion exchange columns. Recent specific conductance contours indicate elevated levels in both the TRA perched water table and the Snake River Plain aquifer directly below. The chemical disposal pond (TRA-701) has most recently been the disposal site for dissolved chemicals and will be discussed later, but again it can be assumed that the same migration took place when regenerants were discharged to the warm-waste pond.

3.1.3.2 Warm-Waste Retention Basin (TRA-712).

3.1.3.2.1 Description--All wastewater discharged to the TRA warm-waste leach pond must first pass through the retention basin as shown in Figure 3.1.2. The retention basin consists of two underground rectangular concrete tanks separated by a 1-ft-thick concrete wall. It is located just east of the ETR facility, and its outline is shown in Figure 3.1.1 as facility number 712. These tanks were designed to receive radioactively contaminated water and to delay its passage for a sufficient time for short-lived radioactive contaminants to decay before being

discharged to the leach pond. The total capacity of the basin is about 2.7 million liters (720,000 gallons) which can be equally divided between the two tanks.

3.1.3.2.2 Water Received--Since at least the early 1970s, the retention basin has been leaking at a rate of 10 to 20% of the total inflow. Operators do not know whether the basin was leaking prior to that time. Depending on when the leaking started, some or all of the hazardous constituents identified as going to the warm-waste leach pond can also be assumed to have been discharged in smaller quantities to the ground beneath the basin. Discharges of most hazardous chemicals to the warm-waste system were eliminated in the early 1960s. If it is assumed that the basin was not leaking at that time, then only portions of the lab wastes and the ETR bypass demineralizer regenerant were lost from the basin (along with the radioactive wastewater). As much as 5,000 to 10,000 kg of sodium hydroxide and 300 to 600 kg of characteristic lab waste may have been lost from the retention basin.

3.1.3.2.3 Evidence of Migration--The warm-waste retention basin and the warm-waste leach pond are in close enough proximity that subsurface contamination in the area could be from either source or from both. However, USGS personnel have stated that the elevation of the perched water table described earlier varies, depending on which of the two tanks within the basin is holding water. This would appear to substantiate that at least one tank contributes to the perched water table through leaks and, more importantly, that migration of contaminants is possible by the same logic applied to the warm-waste pond. (The retention basin discharges to the perched water table which, in turn discharges to the Snake River Plain aquifer).

3.1.3.3 Chemical-Waste Pond (TRA-701).

3.1.3.3.1 Description--The chemical-waste leaching pond was constructed north of the warm-waste leach pond (see Figure 3.1.1) and was first used in 1962. The pond was constructed primarily to lessen the

hydraulic load on the warm-waste leach pond. The chemical-waste pond floor is 51.8 by 51.8 m, has 1:1 side slopes (about 2.44 m high), and contains 5.8×10^6 L when the pond is 2 m deep. However, the rated capacity is 4.4×10^6 L. The pond is unlined and has earthen bottom and sides.

3.1.3.3.2 Wastes Received--The pond was designed to receive chemical wastes from the TRA demineralization plant. The wastes consist of regeneration solutions from the plant's ion exchange units and alternately contain sodium hydroxide and sulfuric acid. Discharges to the pond have decreased over recent years as the ETR operations phased down; 7.9×10^7 L were discharged in 1978, as compared to 2.5×10^7 L in 1983. It is estimated that from 1962 to mid-1984 wastewater discharged to the chemical-waste pond contained 1.8×10^6 kg of sodium hydroxide and 9.9×10^6 kg of sulfuric acid. Since mid-1984 the wastes are neutralized before discharge to the pond.

On occasion, other corrosive wastes have been added to the pond. At one point during the past several years, bags containing waste sulfuric acid and sodium hydroxide were dumped down the pond banks. The chemical wastes originated from cleaning out the acid and caustic trenches in the TRA utility area. Records of that incident were not maintained, but it is estimated that three or four 55-gal drums were dumped. Also, a supporting structure was built into the west bank of the pond to brace tanks to be drained into the pond. In August 1982, a 1,900-L tank containing battery acid from the vehicle service facility at the Central Facilities Area (CFA) was drained into the pond.

3.1.3.3.3 Evidence of Migration--Specific conductance, a good measure of dissolved chemicals, has been monitored in both the perched water table under the wastewater disposal area of TRA and in the Snake River Plain Aquifer further down. Recent contours for specific conductance in the perched water table are shown in Figure 3.1.6. As indicated by the contours, the source of the elevated specific conductance definitely appears to be the chemical-waste pond. This figure presents good evidence that migration has occurred.

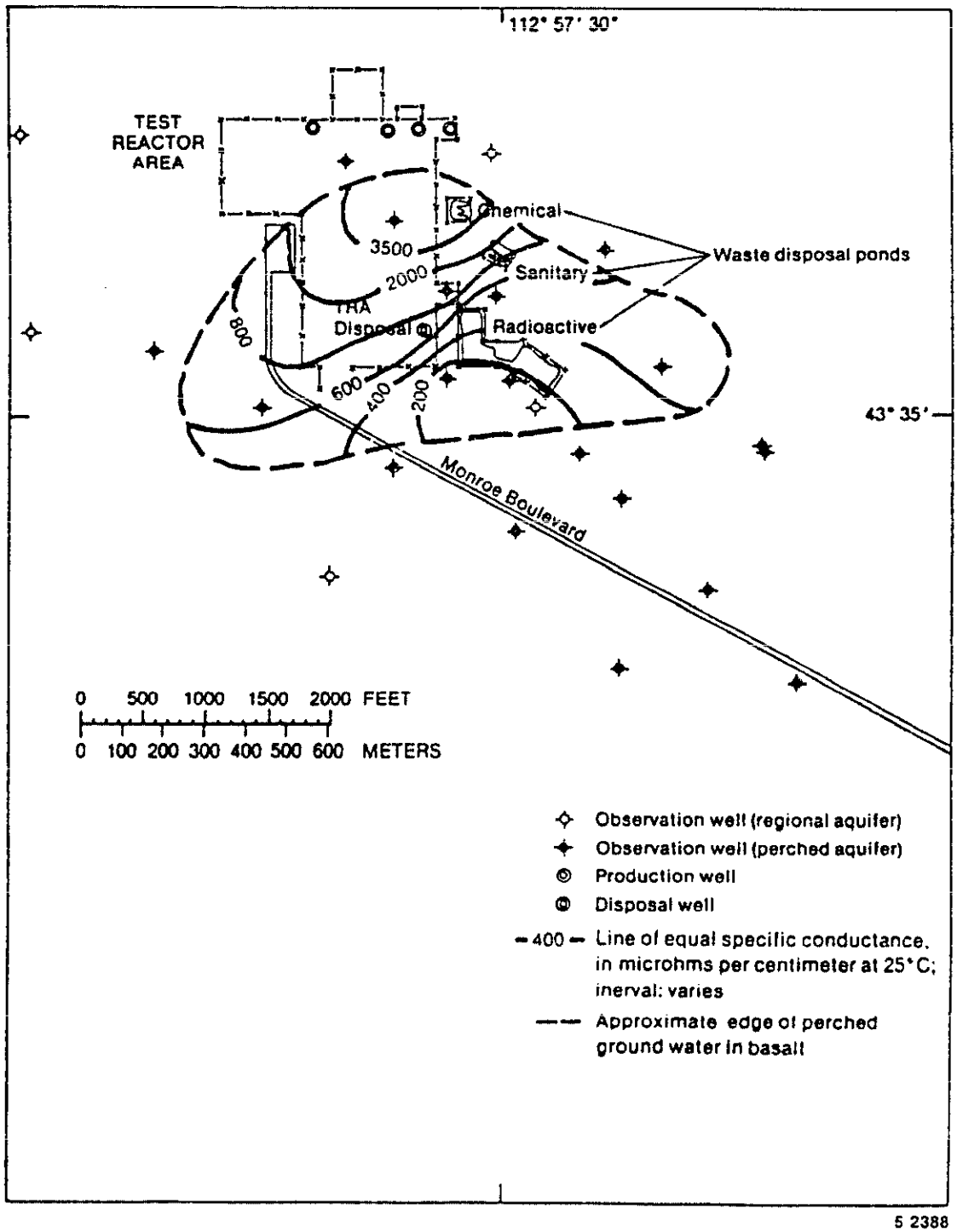


Figure 3.1.6. Specific conductance of perched groundwater in the basalt at TRA, October 1981.

Figure 3.1.7 shows specific-conductance contours for the underlying Snake River Plain aquifer. Again, there appears to be a definite connection between surface operations and elevated specific-conductance levels. The most obvious possible connection is from the chemical waste pond via the perched water table.

3.1.3.4 Waste Disposal Well.

3.1.3.4.1 Description--The TRA waste disposal well (see Figure 3.1.1) was drilled during 1962 and 1963 for disposal of nonradioactive liquid wastes. The well is 387.4 m deep and is cased to the bottom, with casing ranging in diameter from 15.2 to 45.7 cm. The well is perforated at several intervals between 156 and 386 m below land surface. Disposal began in 1964, and yearly discharges have ranged from 19 million liters in 1964 to over 1,100 million liters in 1974. The well has been capable of accepting rates equal to almost 2,000 million liters per year, with no detectable head buildup. The well was used until March 1982, when effluents disposed of in the well were diverted to the new cold-waste ponds. A locked metal cap has been placed on the well opening.

3.1.3.4.2 Wastes Received--Cooling tower blowdown furnishes the bulk of the nonradioactive or cold wastes that went to the disposal well, but water from air conditioning units, secondary system drains, and other nonradioactive drains at the reactors and supporting facilities was included. The hydraulic test facility, a metallurgy laboratory, hot cells, a steam plant, and the ETR compressor building were connected to this system. Small quantities of chemicals were added to the water for pH corrosion and quality control. These chemicals included sulfuric acid, chlorine, phosphates, corrosion inhibitors, and algae inhibitors. The wastes from these sources contained about 500 ppm dissolved solids, primarily water "hardness" salts of calcium and magnesium. On rare occasions the wastes may have been diverted to the warm-waste retention basin. Diversion to the retention basin generally occurred only when detectable radioactive contamination was found in the wastes.

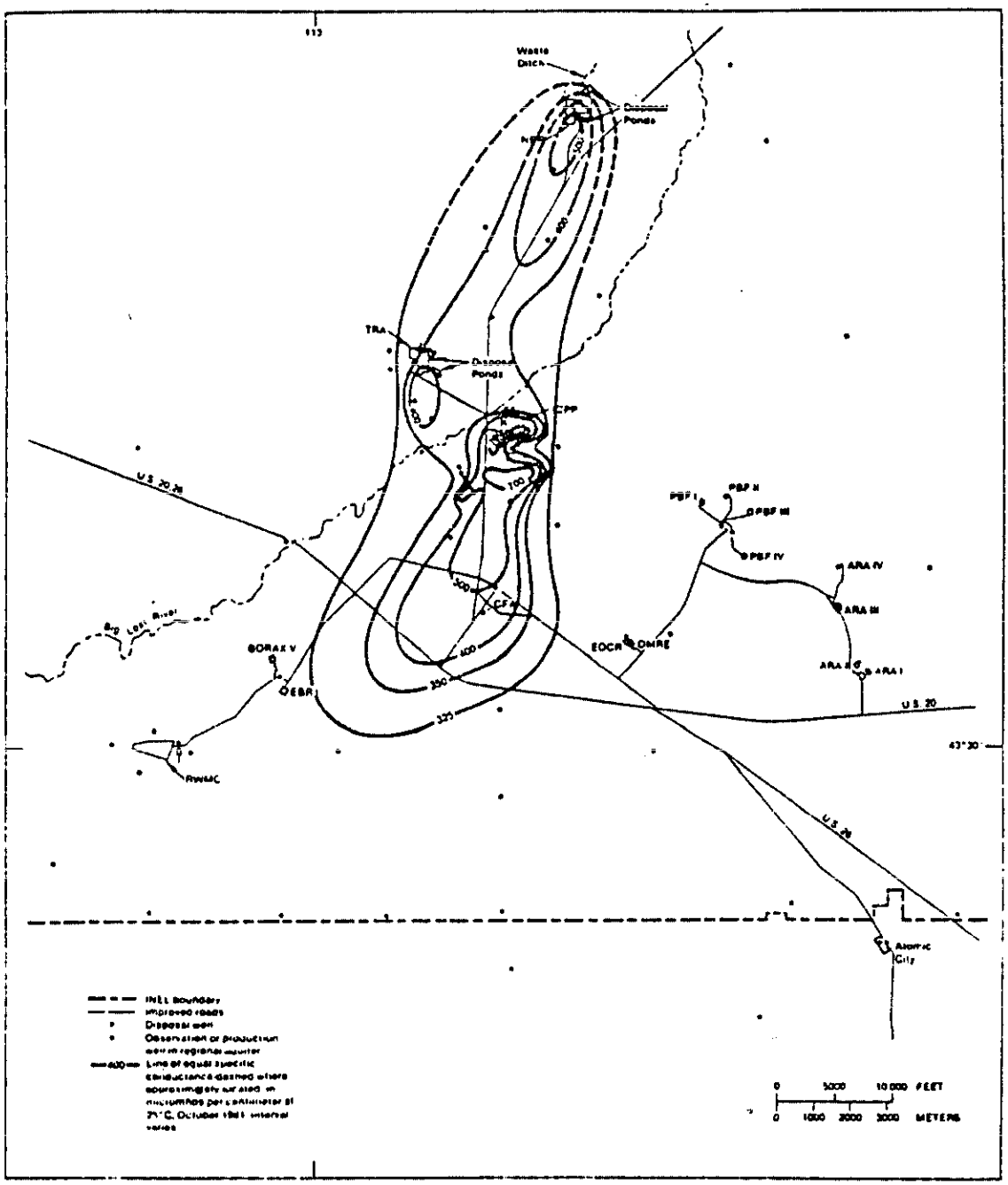


Figure 3.1.7. Specific conductance of water samples from the Snake River Plain aquifer, south-central INEL vicinity, October 1981.

Of the wastes going to the disposal well, the one of primary concern is the cooling tower blowdown that was discharged prior to September 1972. That was the date that the chromate-based corrosion inhibitor was replaced with an organic-silicate-phosphate inhibitor. From 1964, when the well was first used, until September 1972, it is estimated that 13,400 kg of chromium were discharged to the disposal well.

3.1.3.4.3 Evidence of Migration--The USGS monitoring of groundwater in the area of TRA has shown detectable levels of chromium in both the perched water table and the Snake River Plain aquifer. Chromium levels in the perched water were shown in Figure 3.1.5. Past monitoring of the acquifer indicated a chromium plume when chromium was being discharged to the disposal well. For about the past ten years, USGS Well 65, located approximately 1,500 feet south of TRA and shown in Figure 3.1.4, has also shown chromium levels ranging from about 0.3 to 0.4 mg/L. It is unknown whether these levels are due to past disposal operations or are naturally occurring.

3.1.3.5 Paint Shop Ditch (TRA-606)

3.1.3.5.1 Description--This shallow storm water collection ditch is located just east of the paint shop. The ditch is unlined, has natural earthen sides and bottom, and was designed simply to channel small flows of precipitation out of the immediate area.

3.1.3.5.2 Wastes Received--The only wastes suspected of reaching this ditch were those generated by the TRA-606 paint shop. Prior to 1983 small quantities of paint thinners and solvents were dumped here as they were generated. The data in Table 3.1.3 is based on the estimate that 420 liters (55 gallons) of waste were disposed of each year and that they consisted of 50% mineral spirits, 20% xylene, 20% toluene, 5% acetone, and 5% water. This estimate is felt to be conservative and does not take into account any evaporation which was undoubtedly significant, particularly during winter months.

3.2 TAN/TSF Past Activity Review

3.2.1 TAN/TSF Description

The mission of the Test Area North/Technical Support Facility (TAN/TSF) is to provide unique facilities for the support of energy research and defense programs, and to maintain specialized facilities for technical engineering and radioactive materials handling programs, as well as for other INEL programs. The TAN/TSF area is located in the north central portion of the INEL, as was shown in Figure 2.3. TAN is approximately 27 miles northeast of the Central Facilities Area (CFA). Development of TAN/TSF began in the early 1950s to support the Aircraft Nuclear Propulsion (ANP) Program. TAN reactor and hot shop operations began in 1955. The TSF facilities have been modified over the past 30 years to fit the changing needs of the INEL.

The TSF facilities can be broken into several functional categories that correspond to general sections of the area. They are:

1. The Administrative and Technical Support Section: Looking at the plot plan of Figure 3.2.1, this section lies between the guardhouse area on the east (TAN 601/602) and the earth berm on the west. It contains administrative and office buildings, a guardhouse, service and maintenance shops, a small machine shop, and a newly constructed multicraft shop.

2. The Manufacturing and Radioactive Materials Handling Section: This section centers around Building TAN-607 (see Figure 3.2.1). It consists of a complex of buildings which includes: A manufacturing, assembly and hot shop building; a pump station; a fuel assembly and storage facility; and a hot liquid waste pump building. Located immediately west of the TAN-607 complex are: A carpentry shop, a gas cylinder storage area, a liquid waste transfer and storage facility, and a four-rail railroad system with a turntable.

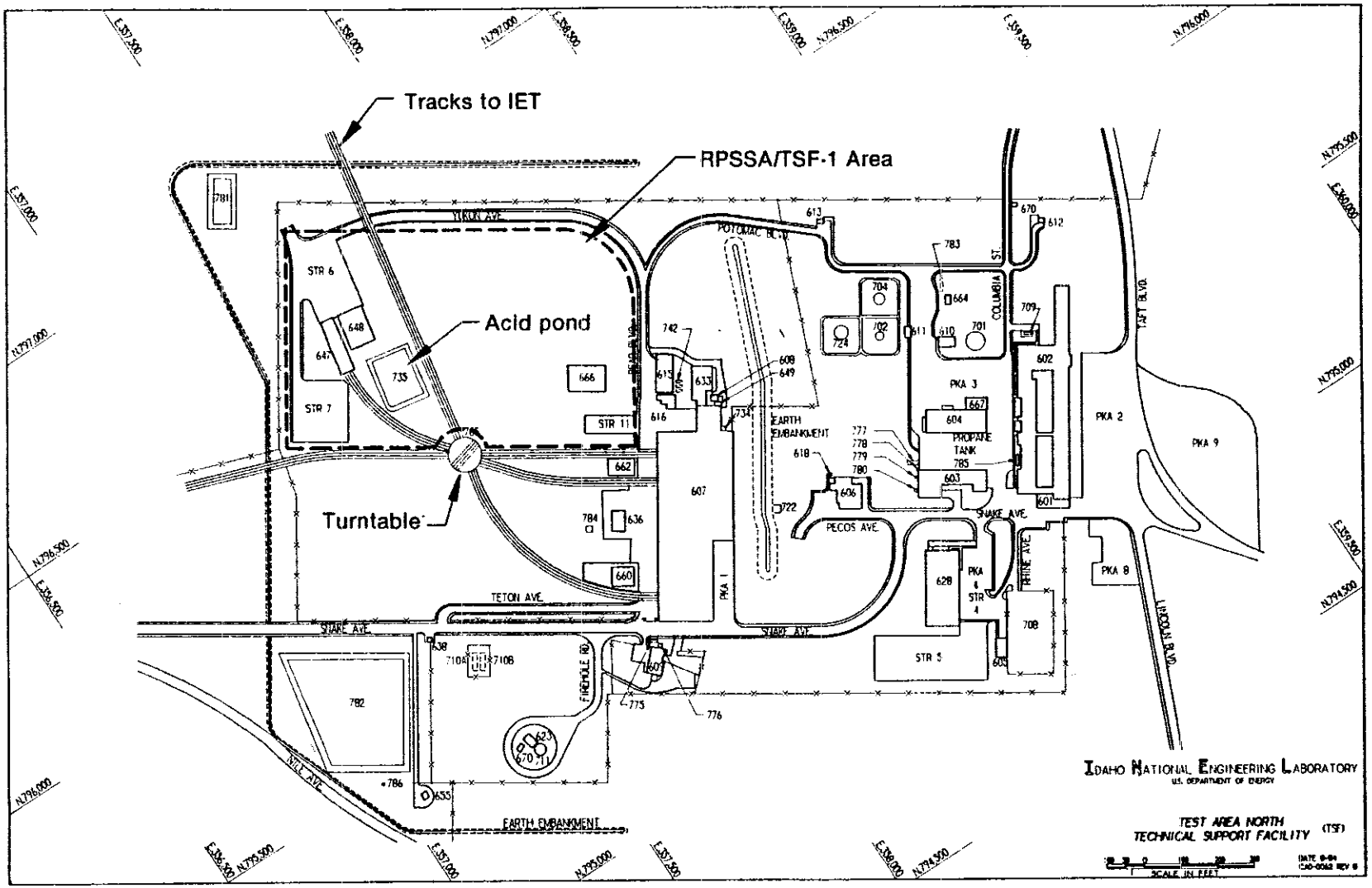


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Figure 3.2.1. Test Area North/Technical Support Facility (TAN/TSF) plot plan.

3. The Radioactive Materials Storage Section: This section is located west of the TAN-607 complex and consists of the dolly storage building (with access by the four-rail track), the Radioactive Parts Security Storage Area (RPSSA) and an outside pond (TAN-735 on Figure 4.2.1). The RPSSA includes the presently used open storage areas (str 6 and 7) and the field area to the east where radioactively contaminated materials have been stored and even buried in the past.

4. Utility Sections: The utility functions can actually be divided into north and south areas. One is on the north side of the Administrative and Technical Support Section and contains a water tank, a No. 2 fuel oil tank, two No. 5 boiler fuel oil tanks, two water wells and associated pumping facilities, an electric substation, and a vehicle service station. The other utility section runs along the south border of TSF and includes the main electric substation, two liquid-waste storage holding tanks, a sewage treatment plant, a liquid-waste lift station, a sanitary-waste settling pond, and a surface run-off water-retention basin.

3.2.2 TAN/TSF Wastes Generated by Specific Activity

3.2.2.1 TAN/TSF Maintenance, Manufacturing, and Utility Operations.

The facility wage within TAN/TSF was screened further to produce a list of TAN/TSF shops, labs, and processes which were considered to pose a potential for contamination. Table 3.2.1 provides the refined list of facilities and also provides the hazardous waste constituents involved, the timeframes in which the hazardous wastes were produced, and the disposal methods. The facilities in Table 3.2.1 are further discussed in the following paragraphs.

TABLE 3.2.1. TAN/TECHNICAL SUPPORT FACILITY--WASTE GENERATION

Shop Location	Function	Waste Stream	Timeframe	Estimated Quantities (if known)	Treatment/Storage/Disposal
TAN-604	Maintenance shop	Paint thinner and solvent	1956-1972	19 L/yr	TSF injection well via sewage plant
			1972-1984	19 L/yr	TSF disposal pond via sewage plant
			1984-Present	19 L/yr	Off-site T/S/D
TAN-607	Chemical cleaning room (pipe laundry)	Corrosive liquids (acids and caustics, but drained separately)	1955-1972	17,000 L/yr	TSF injection well
			1972-1974	17,000 L/yr	TSF disposal pond
	Decontamination room	Corrosive liquids (acids and caustics, but drained separately)	1955-1975	12,200 L/yr	TSF intermediate-level waste disposal system
			1975-1984	12,200 L/yr	ICPP
		Oxalic acid solution	1955-1975	4,200 L/yr	TSF intermediate-level waste disposal system
			1975-1984	4,200 L/yr	ICPP
	Sandblast room	Potentially radioactive and EP Toxic spent sandblast media	1955-1984	--	RWMC
	TAN hot cell (THC)	Decontamination solutions			
		Corrosive wastewater	1955-1969	8,000 L/yr	TSF intermediate-level waste disposal system
		Corrosive chemicals	1970-1974	715 kg/yr	TSF intermediate-level waste disposal system
		Potassium hydroxide	1970-1974	540 kg/yr	TSF intermediate-level waste disposal system
		Potassium chromate	1970-1974	35 kg/yr	TSF intermediate-level waste disposal system
		Potassium permanganate	1970-1974	140 kg/yr	TSF intermediate-level waste disposal system
		Oxalic acid	1970-1974	110 kg/yr	TSF intermediate-level waste disposal system
		Ammonium oxalate	1970-1974	570 kg/yr	TSF intermediate-level waste disposal system

TABLE 3.2.1. (continued)

Shop Location	Function	Waste Stream	Timeframe	Estimated Quantities (if known)	Treatment/Storage/Disposal
TAN-607	Photo lab and cold preparation lab	Corrosive photo developing solution	1955-1972	Small	TSF injection well
			1972-1982	Small	TSF disposal pond
TAN-609 (previously 604)	Auto mechanics shop	Oil with small quantities of hydraulic fluid and stoddard solvent	1956-1967	950 L/yr	Applied to dirt roads in TAN area for dust suppression or burned
			1967-1977	950/L/yr	Applied to dirt roads
			1977-1982	950 L/yr	Part for dust suppression part to oil recycler
			1982-present	950 L/yr	Collected by oil recycler
TAN-633	Hot Cell annex	Decontamination solutions and etching acid	1958-1972	Small	TSF intermediate-level waste disposal system
TAN-649	Water filtration building	Radioactively contaminated ion-exchange resins	1960-present	--	RWMC for burial

TAN-603. The boiler plant in TAN-603 provides steam for TSF. Plant operators add phosphate- and sulphate-based treatment chemicals to the boiler makeup water to prevent scaling and corrosion. It is estimated that about 45,000 liters (12,000 gallons) of blowdown water is sent annually to the sanitary sewer from this facility. However, these chemicals, particularly in the concentrations in which they are found in the blowdown water, are not considered hazardous. The boiler plant also operates water softeners for the makeup water. The brine solutions from regeneration of these softeners likewise goes to the sanitary sewer.

TAN-604. TAN-604 has traditionally been used as a maintenance shop and includes parts and equipment storage, paint storage and mixing area. Paint mixing and cleaning operations have produced hazardous wastes. Painting operations are relatively small, and paint thinners and solvents are generally reused until they are no longer effective or until the odor becomes bothersome. During their use and reuse the materials are kept in 5-gal drums. It is estimated that only about 19 liters (5 gallons) of waste are generated each year. These ignitable wastes are now put into drums and shipped off site as hazardous waste; however, until mid-1984, they were probably poured down the shop drains or sinks which are connected to the sanitary sewer system. Although significant quantities of each waste would undoubtedly be evaporated or biologically destroyed by the time it passed through the TAN/TSF sewage treatment plant, the most conservative estimate would be to assume that the hazardous waste passed through the plant and was discharged to either the TSF injection well or the disposal pond (TAN-736). The receiving site would depend upon the timeframe of the discharge. (It should be noted that TAN-636 is also identified as containing a paint shop. However, mixing and cleaning of paint materials used in TAN-636 is accomplished in the TAN-604 facility.)

TAN-607. The TAN-607 facility is the heart of the TSF Manufacturing and Radioactive Materials Handling Section. It contains a hot shop, a hot cell, a water pit, a warm shop, and multiple crane and manipulator services. Until recent (1985) modifications, the facility also contained

craft shops, a machine shop, a high-bay assembly shop, and cleaning rooms. Those areas suspected of generating hazardous and/or radioactive wastes are discussed in the following paragraphs.

Three cleaning rooms were located in TAN-607. These were the sandblast room, the chemical cleaning room, and the decontamination room. Normally, generation of radioactive waste was limited to the decontamination room. Although each of the three cleaning rooms was designed for a distinct function, together they provided an integrated cleaning capability.

The chemical cleaning room, often referred to as the pipe laundry, was normally used for the industrial cleaning of nonradioactively contaminated components and piping. It contained six cleaning tanks: One tank was a rinse tank and was drained frequently; the other five varied in content from caustic to acidic and were changed out about once a year. Each tank contained about 3400 liters (900 gallons), so it can be assumed that about 17,000 liters of corrosive liquids were drained each year to the process drains that serviced this room. Again, depending upon the timeframe of the discharge, this waste went to either the TSF injection well or the TSF disposal pond. Beginning about 1975, trisodium phosphate was used as the cleaning solution rather than corrosive liquids. A trichloroethylene vapor degreaser was also located in the chemical cleaning room. It had a 5,680-liter (1500-gallon) solvent capacity. In addition to the steam-heating coils in the bottom, it had a heavy vapor middle section and cooling coils to condense the vapors in the upper cold water section. The vapor degreaser was not used heavily and was operated so that there was no drag-out of solvent on the cleaned parts.

The decontamination room provided capability for using chemical solutions to remove loose radioactive materials from components and piping. These chemical solutions became radioactively contaminated and were discharged to the TSF intermediate-level waste disposal system. The decontamination room also had six solution tanks: Three 1900-liter (500-gallon) tanks on the north side of the room and three 4200-liters

(1100-gallon) tanks on the south side. One 1900-liter tank contained an acid solution, one contained a caustic solution and the third contained an oxalic acid solution. One of the 4200-liter tanks contained rinse water only, while the other two contained acid and caustic solutions respectively. It is estimated that each of these tanks were drained once a year or less.

The sandblast area contained one large Pangborn sandblasting room and an adjacent glove box sandblaster for small items. The used sandblast media has always been considered potentially radioactively contaminated and has been taken to the RWMC for disposal. It is unknown whether or not the sandblast media would be considered hazardous because of any heavy metal contamination.

The TAN Hot Cell (THC) in TAN-607, formerly referred to as the Radioactive Materials Laboratory, consists of a hot cell and control galleries. It is used for study, observation, and analysis of small radioactive objects, as well as for disassembly and examination of fuel rods. Wastes are generated when the interior of the cell is washed out to remove radioactive surface contamination.

Prior to 1975, the cell was washed out frequently (possibly as often as once a month) using 570 to 760 liters (150 to 200 gallons) of cleaning solution. The cleaning solution then drains to the intermediate-level waste disposal system. From 1955 to 1970 the cleaning solutions were simply acidic or caustic. From 1970 to 1975 TURCO products 4502, 4518 or 4521 were used to make up the solutions. These were powder products and were mixed in water at concentrations of 120 to 240 g/L (1 to 2 lb/gal). The active ingredients of TURCO 4502 are 75% potassium hydroxide, 5% potassium chromate and 20% potassium permanganate; ingredients of TURCO 4521 are 15% oxalic acid and 80% ammonium oxalate; specific ingredients of TURCO 4518 are unavailable on site, but the material produces an acidic solution. The three solutions were altered in use, but anytime TURCO 4502 was used a follow-up wash with TURCO 4518 or 4521 was required because of the purple color (due to potassium permanganate) left by the 4502 solution.

For the estimated quantities in Table 3.2.1 it is assumed that the TURCO 4521 and 4518 solutions were each used for six washdowns a year. Since it was used in conjunction with one of the above, it will also be assumed that the TURCO 4502 solution was used six times a year.

The THC has been washed less frequently since 1975 because of a change in the method of handling wastewater that goes to the intermediate-level waste disposal system. (Since 1975 this wastewater has been trucked to the ICPP for treatment.) In order to reduce wastewater volumes, the THC is now washed only about three times a year. Also since 1975 only detergent solutions have been used to wash out the cell.

The Hot Shop facilities within TAN-607 are designed to provide remote servicing and maintenance of nuclear experimental assemblies. The shop is not a normal use area for chemicals but does involve occasional decontamination operations and decontamination solutions. Radiacwash (a brand name detergent) is sometimes applied with rags or wipes and the waste materials thrown into hot-waste receptacles. Occasional washdowns with water and detergents go to drains leading to the intermediate-level waste disposal system. Any solid or liquid waste generated in this facility would be suspected of having radioactive contamination and would be treated accordingly. However, there appears to be no evidence of hazardous (chemical) wastes being generated from normal operations.

In past years, a small photo lab has been operated in TAN-607. Corrosive waste developing solutions have been generated and discharged. It is suspected that rinses were discharged to the process waste collection system while actual solutions were sent to the intermediate-level waste disposal system. From about 1965 to 1970 a cold preparation lab was also operated in the upstairs portion of TAN-607 (area now used as office space). Small quantities of photochemicals were also discharged to the process drain from this operation, as were small quantities of etching acid.

The auto mechanics shop at TSF was located in TAN-604 until 1983 when it was relocated to TAN-609. Work done at this shop is limited primarily to preventive maintenance on government vehicles. Wastes generated are limited to oils, hydraulic fluids, and small amounts of solvents used for cleaning parts. Approximately 950 liters (250 gallons) of waste oil are generated per year from this shop. From 1956 to about 1967, the waste oils were either burned (at the TSF burn pit until 1958, then at the WRRTF burn pit) or were accumulated and occasionally spread on dirt roads in the TAN area for dirt suppression. From 1967 to 1977 the TAN burn pits were closed down, and it is assumed that the waste oil was used solely as a dust suppressant. From 1977 to about 1982 or 1983 when the practice stopped, only portions of the oil were used in this manner.

Beginning in about 1977, some of the oil was collected from drums by a commercial oil recycler. Since the practice of using waste oil for dust suppression stopped, all waste oil is collected for recycling. The small quantity of waste hydraulic fluid generated is mixed with the waste oil. Small parts cleaning is now accomplished in leased "Saf-T-Clean" units which are periodically serviced by the owner, who provides new solvent and takes the old material off site, presumably for recycling. Prior to this arrangement Stoddard Solvent was used for small parts cleaning and was mixed with the waste oil when it was spent.

The Hot Cell Annex in TAN-633, like the THC, is set up for the remote handling and examination of radioactively contaminated materials. The facility has been essentially unused since about 1971 or 1972. Radioactive contamination was the primary concern for any waste generated from this facility so the facility had drains connected to the intermediate-level waste disposal system. Wastes from the site were primarily limited to the decontamination solutions occasionally used. However, one cell was set up for metallography work and did involve small discharges of etching acid.

The Water Filtration Building, TAN-649, is a concrete vault that houses water filtering system equipment and chemistry control equipment. The equipment is used to maintain the quality of the storage pool water in TAN-607. The ion-exchange system used to maintain water quality uses disposable resins; therefore, no acidic or caustic regenerants are present. The depleted resins are radioactively contaminated and are shipped to the RWMC for disposal.

The Service Station, TAN-664, is a small facility, limited in use to dispensing of gasoline, propane, motor oil, windshield washer fluid and antifreeze. There is no vehicle maintenance done there and, with the exception of empty containers, no wastes generated. However, the site is occasionally used for car washing, and, in some instances Stoddard Solvent will be applied by hand to the vehicles to remove stains. Washwater is allowed to drain away from the service station into the surrounding dirt areas. The quantities of possible hazardous wastes involved are felt to be insignificant.

3.2.2.2 TSF Fuels/Petroleum Management. Bulk fuel usage at TSF consists primarily of No. 2 and No. 5 fuel oil which is burned in boilers, gasoline for vehicles, and diesel fuel for buses. There are several other small tanks in the area, mostly associated with standby power generators. The product is delivered to TSF in tank trucks and pumped to the various above and belowground tanks. The largest tanks at TSF are TAN-702, -704, and -724; they hold fuel oil, are aboveground, and are surrounded by earthen berms. This oil is piped to the boiler facility, TAN-603, via the fuel pumphouse, TAN-611. The next largest tanks, TAN-664 and -792, are underground and hold gasoline and diesel fuel respectively. These tanks are located adjacent to their dispensing facilities. Table 3.2.2 provides an inventory of the fuel/petroleum storage tanks at TSF.

There have been no Unusual Occurrence Reports (UORs) on spills from the tanks described in the preceding paragraph. However, according to interviews, there have been unspecified occasions when fuel oil has been

TABLE 3.2.2. TSF-FUEL/PETROLEUM STORAGE TANKS

Location or Tank Number Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMS Number	Responsibility	Comments
TAN-603 (TSF)	Diesel No. 2	1,000	U, O	Dipstick	--	Plant services	--
TAN-603 (TSF)	Diesel No. 2	75	A, I	Automatic gauge on pump line	--	--	Curbing; filled from underground tank
TAN-607 (TSF)	Diesel blend	2,500	U, O	--	OISSW611	Transportation	Abandoned
TAN-607 (TSF) (Room 142)	Diesel blend	300	A, I	Automatic gauge on pump line	--	--	Curbing; filled by line from TAN-722
TAN-610 (TSF)	Diesel No. 2	300	A, I	Outside gauge	--	Plant Services	Curbing
TAN-610 (TSF)	Gasoline	300	U, O	--	--	--	Abandoned
TAN-664 (TSF)	Unleaded gasoline	12,000	U, O	Dipstick	OISSW603	Transportation	--
TAN-702 (TSF)	No. 5 fuel oil	101,464	A, O	Dipstick	OIBFW659	Plant services	--
TAN-704 (TSF)	No. 2 fuel oil	190,343	A, O	Dipstick	OIBFW649	Plant services	--
TAN-724 (TSF)	No. 5 fuel oil	190,343	A, O	Dipstick	PIBFW660	Plant services	--
TSF	Diesel No. 2	2,000	A, O	--	--	Transportation	Temporary; near TAN-722
TAN-792 (TSF)	Diesel fuel	10,000	U, O	--	--	Transportation	Bus fuel station tank

spilled inside the bermed area around Tanks 702, 704 and 724. Since there were no UORs on such incidents, it is assumed they were minor, if in fact, they did occur. Other spills and UORs are addressed in the next section.

Oils, lubricants, and small amounts of solvents are most often delivered to TSF in 55-gallon drums which are generally held at their place of use. Empties that are not used to collect the used materials are sent back to CFA for salvage.

3.2.2.3 Spills Within the TSF. Personnel interviews, site observations and review of UORs provided information on the spills identified in this section.

In 1959 or 1960, three drums of sulfuric acid being stored at TSF apparently went bad as there were obvious signs of pressurization (bulging drums). The three drums were taken to a gravel pit approximately 1.6 to 2.4 kilometers (1 to 1.5 miles) northwest of TSF to be dumped. One drum was opened with a long-handled bung wrench, but the pressure released was so great that it was decided it would be unsafe to open the other two in this manner. The drums were then taken to the Liquid Corrosive Chemical Disposal Area (LCCDA) near the RWMC and drained into the pit by having security police shoot them from a safe distance.

In the early 1970s, the TSF intermediate-level waste disposal system included an evaporator that concentrated radioactively contaminated wastewater. Basically the condensate was discharged to the process waste system and the concentrate, being too contaminated for discharge, was held in tanks. In this time frame a leak occurred (corrosion was the suspected cause) in the steam jacket that provided heat to the evaporator. Radioactive contamination migrated to the steam system and caused higher-than-allowed levels of radioactivity to be discharged to the process waste system and ultimately be the TSF injection well. This disposal system is described further in Section 3.2.3.3.

In the 1980-81 timeframe it was discovered that the V-2 tank (part of TAN-742) in the intermediate-level waste disposal system was contaminated with oil containing PCBs. The cause of this contamination (or when it occurred) is unknown, but it is suspected that a ruptured hydraulic fluid line on a piece of equipment inside the TAN-607 hot shop was the source. During the summer of 1981 the contents of the V-2 tank were cycled through an oil separator to remove the PCBs. By the end of the effort, approximately 225 liters (60 gallons) of oil contaminated with 680 ppm of PCBs were collected. This waste is being stored at TSF pending determination of an appropriate treatment/disposal method. This determination is complicated by radioactive contamination that is also in the waste.

Minor fuel spillage around a gas station is to be expected, but one spill incident at the TSF service station, TAN-664, is worthy of note. In 1981 or 1982 a vehicle entering or leaving the station hooked the pump hose with its bumper and ripped the hose. A calculated 821 liters (217 gallons) of gasoline was spilled around the pump. The fuel was hosed off with water to prevent a fire hazard.

A more serious fuel spill was discovered in 1982 when an underground diesel fuel tank, was found to be leaking. The tank, located just west of the central portion of TAN-607, provided fuel to a standby power generator and to a dispenser. Apparently there was an excavated hole around a portion of the tank in 1982, and water from a heavy rain accumulated in the hole. Perforations in the tank allowed the water to enter and caused about 1900 liters (500 gallons) of diesel fuel to be pushed out the top. The diesel fuel was washed into a storm drainage channel, but more importantly, the tank appeared to have been leaking before the incident. The tank is now abandoned but it is unknown at what rate and for how long it may have been leaking.

There are several general areas of potential contamination at TSF that warrant discussion. The areas include the use of mercury, portable sandblasting that has been accomplished outdoors, and spillage around the V-1, V-2, and V-3 tanks (TAN-742).

Mercury was used extensively at TSF from the early 1950s to the early 1960s. The Heat Transfer Reactor Experiment-3 (HTRE-3), part of the Aircraft Nuclear Propulsion (ANP) Program, used mercury as shielding for its reactor. At one time during the program, a significant portion of the world's supply of mercury was located at TAN. As might be expected, mercury contamination in waste streams occurred often and spills were referenced in several interviews. One spill of about 4 liters (1 gallon) happened just outside the high bay door of TAN-607. An attempt was made to clean up the spill but there were most likely significant quantities left on the ground. Spills inside the hot shop area were also noted.

Sandblasting has also taken place on the west side of TAN-607. A portable sandblast unit was sometimes taken outside for pieces of equipment too large to take in the sandblast booth. These occasional operations may have produced minimal amounts of waste, but generally the spent media was uncontrolled and it is unknown if any contained toxic metals. However, it should be noted that most sandblasting done in this manner was on structural steel where corrosion was being removed rather than paint. Potentially toxic materials are often of concern when paints are being sandblasted.

3.2.3 TAN/TSF Waste Disposal Sites

Areas or sites within the TSF at which hazardous and/or radioactive wastes may have been deposited at some time are discussed in the following paragraphs. A tabular summary of the findings is presented in Table 3.2.3.

TABLE 3.2.3. TAN/TSF HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Area Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Waste	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
TAN-736	TSF Disposal Pond	1972 - present	142,000	Corrosive wastewater Ignitable wastes Chromium Lead	105,000 L 230 L 22 kg Unknown	Discharge to common sump, then to open, unlined seepage pond	Active--Discharge of hazardous, nonradioactive chemicals has been eliminated	Snake River Plain Aquifer is about 63 m from surface which is generally level. Subsurface consists of alternating layers of basalt and silt	Pond is bermed against surface water intrusion	--
TAN-330	TSF Injection Well	1955-1972	N/A	Corrosive wastewater Ignitable wastes Chromium Lead Mercury	725,000 L 320 L 25 kg Unknown Unknown	Discharged with other wastewater directly to deep disposal well with casing reaching to groundwater	Closed--Well capped and sealed	Snake River Plain Aquifer is about 63 m from surface which is generally level. Subsurface consits of alternating layers of basalt and silt	Well head is sealed against surface water intrusion	--
TAN-710A and TAN-710B	Tanks T-709 and T-710 (PM-2A Tanks)	1955-1975	240	Barium Chromium Lead	32.3 kg 27.8 kg 2.4 kg	Discharge to underground tanks located within a concrete cradle	Closed--Free water has been removed from tanks and diatomaceous earth has been blown into remaining sludge	Snake River Plain Aquifer is about 63 m from surface which is generally level. Subsurface consists of alternating layers of basalt and silt	Hatch and pipe entrances are sealed against surface or subsurface drainage intrusion	--
--	TSF Burn Pit	1953-1958	Unknown	Garbage and burnable debris Petroleum products (oil, hydraulic fluid, Stoddard Solvent)	Unknown 5,700 L	Materials where dumped in a pit and burned the same day	Closed, covered and graded	Snake River Plain Aquifer is about 63 m from surface which is generally level. Subsurface consists of alternating layers of basalt and silt	Area is now flat, no special effort has been made to keep out surface drainage	--

TABLE 3.2.3. (Continued)

Site	Site Name	Period of Operation	Area Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Waste	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
--	TSF Gravel Pit	1950s-present	Unknown	Construction rubble Sulfuric acid	Unknown 210 L	Materials where dumped and periodically covered	Active--still receives construction rubble	Snake River Plain Aquifer is about 63 m from surface which is generally level. Subsurface consits of alternating layers of basalt and silt	No special surface drainage diversion structures	--

3.2.3.1 TSF Disposal Pond (TAN-736).

3.2.3.1.1 Description--Construction of the TSF disposal pond (TAN-736) and common sump in TAN-655 was started in 1971 and completed in late 1972. The pond replaced an injection well (TAN-330) which was used until September 1972.

Low-level radioactive waste, cold process water, and treated sewage effluent are mixed in the common sump and lifted to the disposal pond. The sump pump has a capacity of about 3.0×10^3 L/min (800 gal/min) and is activated when the sump fills up to the float level. The effluent is then pumped to the pond.

The disposal pond is an unlined diked area encompassing approximately 14.2 hectares (35 acres). Taking into consideration volume losses from evaporation and infiltration, the pond's capacity is estimated at 1.25×10^5 m^3/yr (33×10^6 gal/yr). Three trenches were excavated to construct 1.5-m-high earthen dikes around the pond. A 30.5-cm-diameter galvanized steel pipe is the inlet to the pond from the common sump. The inlet pipe extends into the pond about 40 m from the east corner of the pond. A plot plan showing the location of the pond is provided in Figure 3.2.2.

3.2.3.1.2 Wastes Received--The TSF disposal pond receives effluent from the TSF trickling filter sewage treatment plant, boiler blowdown from the Service Building (TAN-603), process wastes from the regeneration of water softeners, and lightly radioactive drain waste from the Actuator Building (TAN-615), Hot Cell Annex (TAN-633), and Assembly and Maintenance Building (TAN-607). In addition, lightly radioactive borated wastewater is transported from the LOFT facility to a manhole in the process waste line just upstream of the TAN-655 sump.

The TSF sewage plant (TAN-623) provides primary and secondary treatment for all TSF sanitary wastes and is designed to accommodate a flow of 2.2×10^5 L/d. The plant's influent and effluent are routinely

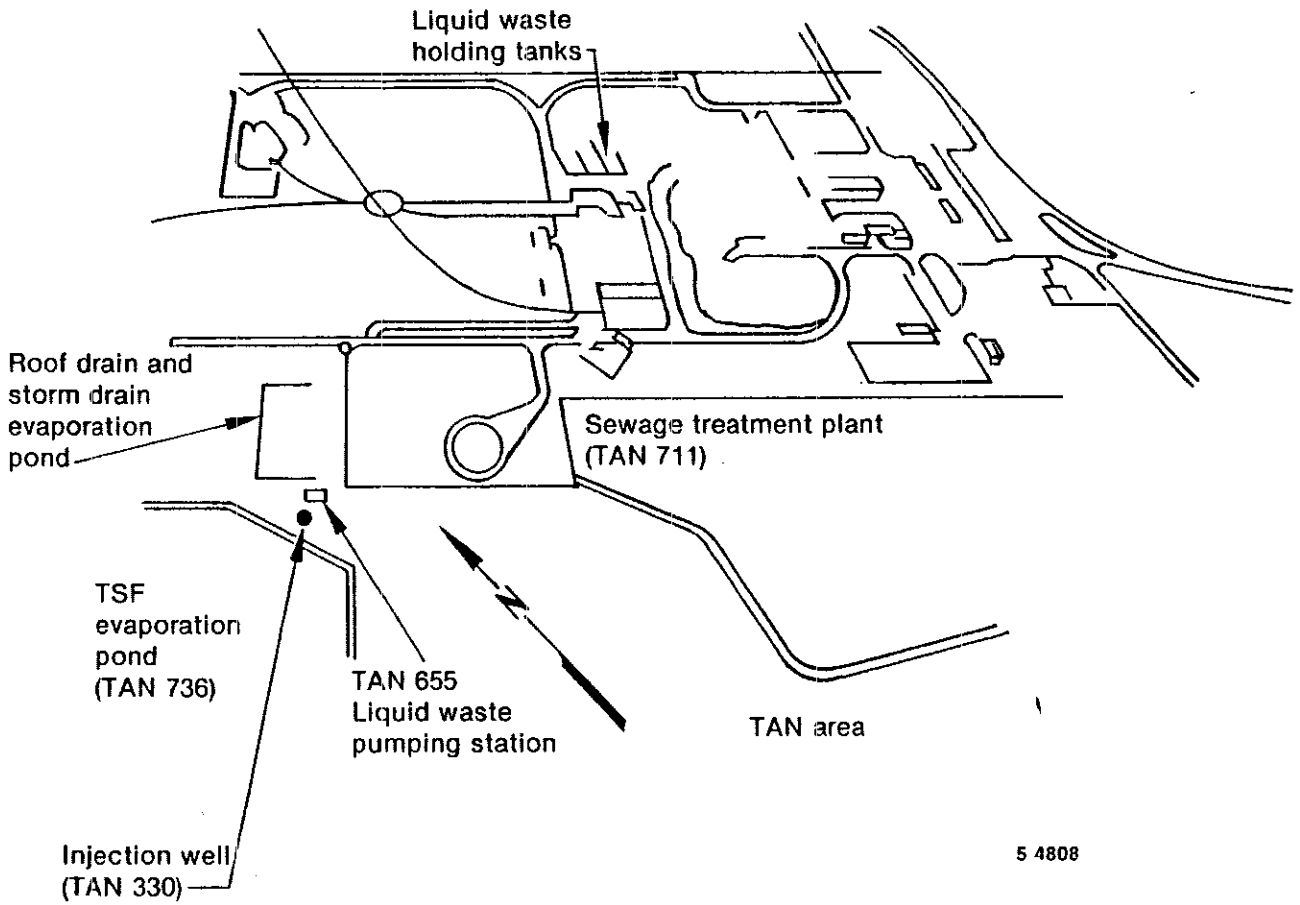

Figure 3.2.2. TAN/TSF Disposal Pond (TAN-736).

monitored for biochemical oxygen demand, dissolved oxygen, and settleable solids. The effluent is also monitored for pH. The results of these analyses are recorded in the Industrial Waste Management Information System (IWMIS).

The specific hazardous wastes suspected to have reached the TAN-736 disposal pond include corrosive liquids (acidic and basic solutions) from the TAN-607 pipe laundry and photo lab, and small amounts of ignitable waste (paint thinner and solvent) from the maintenance shop. Sampling of the pond influent has shown the wastewater to be noncorrosive according to EPA hazardous waste definitions.

The TSF disposal pond also receives radioactive liquid effluents in which radioactivity is low enough that the liquid can be discharged to a controlled surface pond per DOE Order 5480.1A. Concentrations of these effluents are published monthly in the Radioactive Waste Management Information System (RWMIS) reports.

The TSF disposal pond also received condensate from the evaporator process in the intermediate-level waste disposal system when there was such a process. This system is described further in Section 3.2.3.3. There is no specific information on the chemical characteristics of the evaporator condensate, but if it was similar to the condensate produced at the existing ICPP evaporator, then it can be assumed that it was corrosive (low pH). Table 3.2.1 shows about 24,000 L/yr of corrosive solutions going to the intermediate-level waste disposal system; however, it is unknown how much rinse water was used in addition to this. The TSF Disposal Pond information in Table 4.2.3 assumes 24,000 L/yr of corrosive waste as condensate from the evaporator (through May 1975) and 17,000 L/yr of corrosive waste from the pipe laundry. It is also known that the intermediate-level waste disposal system received an estimated 35 kg/yr of potassium chromate from 1970 through 1974 (see Table 3.2.1), which represents 9.4 kg/yr of chromium. It is not known how much of the chromium passed through the evaporator in condensate and how much stayed as

bottoms. The worst case would be for all chromium to have been discharged as condensate to the TSF disposal pond. Discharge to the pond from September 1972 through 1974 would then include approximately 22 kg of chromium. The condensate may also have contained unknown quantities of lead originating from corrosive decontamination solutions being applied to lead shielding.

3.2.3.2 TSF Injection Well (TAN-330).

3.2.3.2.1 Description--The TSF injection well at TAN-330 (N795,400, E357,000) was drilled in 1953 to a depth of 94.5 m (310 feet) to dispose of liquid effluents generated at TSF. It is located just south of TAN-655 shown in Figure 3.2.1. The well has a 40.6-cm diameter (16-inch) casing. Depth to groundwater is 62.8 m (206 feet). The well was last used as a primary disposal site in September 1972 when wastewaters were diverted to the TSF disposal pond (TAN-736). Until the early 1980s the well was used for overflow from the sump at TAN-655, in the event power failure, equipment failure, or equipment maintenance precluded discharge to the pond. There are no records as to whether or not such overflows actually occurred; the well is now capped.

3.2.3.2.2 Wastes Received--The TSF injection well received the same wastewaters which were later received by the TSF disposal pond. The discharges included treated sanitary sewage, process wastewaters, and low-level radioactive waste streams. As with the disposal pond, the hazardous wastes include corrosive and ignitable wastes from shop operations and potentially corrosive and EP Toxic condensate from the intermediate-level waste disposal system evaporator. The EP Toxic heavy metals are suspect because of early (late 1950s and early 1960s) mercury contamination, the use of a potassium chromate solution in decontamination activities after 1970, and the abundance of lead used for shielding materials that were decontaminated with corrosive solutions. The corrosive solutions from the intermediate-level waste disposal system and pipe laundry are estimated at about 24,000 and 17,000 L/yr respectively, but

quantities of diluting rinse waters are unknown. The amounts of mercury and lead that may have passed into the evaporator condensate (and to the well) are also unknown. The quantities of chromium can be estimated using the same logic as was presented in the Section 3.2.3.1.2 discussion on wastes received by the TSF disposal pond. As a worst case, the well may have received 9.4 kg/yr of chromium from 1970 through August 1972. This represents approximately 25 kg of chromium.

3.2.3.3 TSF Intermediate-Level Waste Disposal System.

3.2.3.3.1 Description--This radioactive liquid waste system collects, processes, and has interim storage capacity for all intermediate-level radioactive liquid waste generated at the TSF. Drains and sumps, located in areas with a high potential for contamination are piped to a waste transfer facility (TAN-616). Here the radioactive liquid waste is collected in one of three underground 10,000-gallon stainless steel collection tanks (V-1, V-2, or V-3). These tanks are located immediately northeast of TAN-616, between TAN-615 and TAN-633 (see Figure 3.2.1). From this point on, the process for handling these intermediate-level wastes has changed over time. Figure 3.2.3 depicts flow charts for the three different systems that have been used to process this waste.

Originally, liquid waste from the 10,000-gallon collection tanks was concentrated by an evaporator, and the concentrate was transferred to tanks T-709 and T-710 for long-term storage. (T-709 and T-710 are both 50,000-gallon underground tanks, located south of the railroad track turntable and Snake Avenue as shown in Figure 3.2.1.) The condensate from the evaporator was then sent to the TSF injection well (TAN-330).

In 1972, the process was modified so that the original evaporator downstream of the V-1, V-2 and V-3 tanks was removed and a new evaporator installed in the T-709 and T-710 tank area. The intermediate-level waste was then collected in the V-1, V-2, and V-3 tanks and pumped directly to

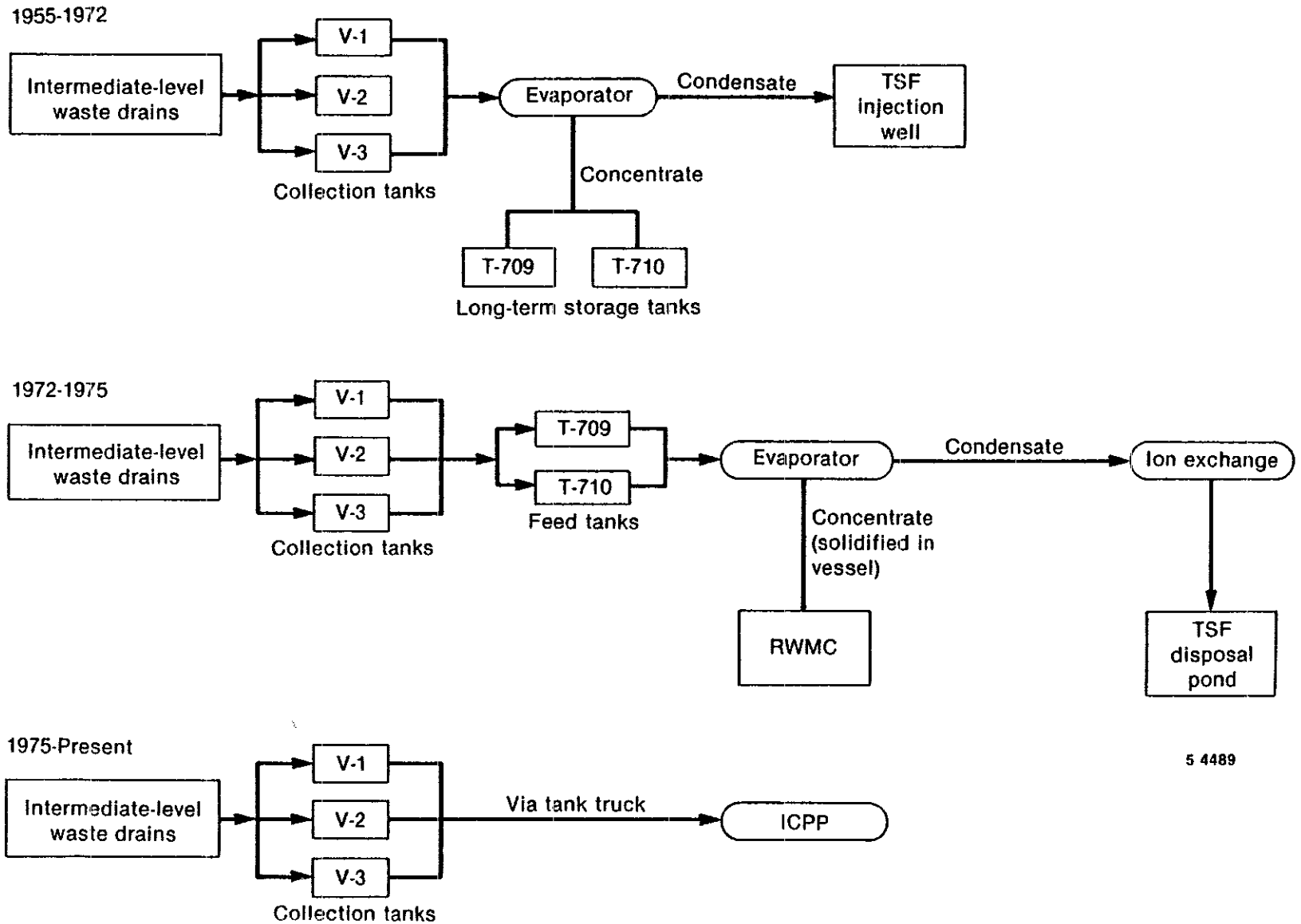

Figure 3.2.3. TSF intermediate-level liquid waste system flow charts.

T-709 and T-710, which served as feed tanks for a subsequent stainless steel evaporator. The liquids and entrained radioactive solids were separated in the evaporator; the solids remained in the evaporator vessel which provided interim storage during processing and also served as the long-term storage container. When filled to capacity (about 20 tons), the semisolid radioactive waste was solidified by evaporation, and the container was transferred to the INEL Radioactive Waste Management Complex for disposal. Distillate from the evaporator flowed to the condenser and then to a condensate storage tank. The condensate was passed through a cation ion-exchange column for further removal of radioactive ions. Effluent from the ion exchanger was combined with other TSF low-level radioactive liquid waste prior to discharge into the disposal pond located southwest of the TSF.

The newer evaporator system was shut down in 1975. Because of operational difficulties and spillage, the system was never put into full operation. Since 1975, the TSF intermediate-level waste has been collected in the V-1, V-2, and V-3 tanks and then transferred to tank trucks for shipment to the Idaho Chemical Processing Plant (ICPP).

Tanks T-709 and T-710 rest in separate concrete cradles. These cradles, filled with coarse aggregate and sand, have sufficient void volume to contain leakage even if the tanks were full. An alarm system has been installed in each cradle that allows immediate detection of any leakage.

3.2.3.3.2 Wastes Received--The TSF intermediate-level waste disposal system was designed to receive and treat radioactive waste too warm (radioactively contaminated) to be discharged to a controlled surface pond (TSF-736). Any hazardous chemicals reaching this system were incidental to the processing of radioactive materials. There is definitely the potential that the system received corrosive materials from decontamination activities and, in some instances, heavy metals, particularly mercury during its extensive usage in the late 50s and early 60s. Also, it is known that small quantities of potassium chromate were used in decontamination solutions from 1970 to 1974.

Records are unavailable to show what hazardous chemicals may have passed through the evaporator (when it was in use) and into the condensate stream. However, estimates were made in the preceding discussions of disposal sites receiving the condensate. It can also be assumed that the concentrate from the evaporator system may have contained small quantities of hazardous chemicals but these concentrates were eventually solidified before disposal at the RWMC. The chemicals with the hazardous characteristics identified should pose little problem in a solidified form.

3.2.3.3.3 Current Status--There has been significant radioactive contamination around the major components of the intermediate-level waste disposal system. The V-1, V-2, and V-3 tanks are still in use but have surface contamination in the area above them. The evaporator equipment has been removed and buried at the RWMC, and the T-709 and T-710 tank area has gone through the decontamination and decommissioning (D&D) process. However, the tanks themselves are still in place.

At different times the T-709 and T-710 tanks received concentrate from the evaporator and unprocessed wastewater. Since the tanks were last used in 1975, their contents have been pumped twice, both times with the waste being solidified and taken to the RWMC for burial. Leaking occurred during the first solidification action and resulted in significant surface contamination around the tank area. The second solidification action in 1981 was part of the D&D process which later included removal of soil from the highly contaminated areas for burial at the RWMC. After backfilling the area with radiologically clean soil, surface activity is negligible.

During the D&D process it was decided to leave the T-709 and T-710 tanks in place, at least until the entire TAN area is decommission. This decision was due partly to the concern that the 30-year-old tanks may no longer be strong enough to with stand the strain of being lifted out of place. Also the tanks still contained contamination sludge which could not be pumped out but which could leak out in the event of a tank rupture. It was also decided to dry the sludge out by adding diatomaceous earth, another precaution against leakage from the tanks.

The sludges in both tanks have been sampled and characterized. The results of 1981 chemical analyses are provided in Table 4.2.6. These results are based on a single grab sample and the sludge may not be homogeneous. However the sample does give an idea of the contents of the sludge and shows that barium, chromium, and lead (all toxic metals) are present. If homogeneity is assumed, Tank 709 could contain about 0.7 kg of barium, 2.5 kg of chromium, and 0.2 kg of lead; Tank 710 could contain about 31.6 kg of barium, 25.3 kg of chromium, and 2.2 kg of lead.

3.2.3.4 TSF Burn Pit.

3.2.3.4.1 Description--The TSF burn pit was used for open burning of combustible waste from about 1953 to 1958. It was located north of the TAN/TSF water tank (TAN-701) just outside the TSF fence, as shown in Figure 3.2.4. The site is now covered-in and natural vegetation has been reestablished. The use of this pit was discontinued when a similar operation was started at WRRTF, a little more than a mile to the southeast.

3.2.3.4.2 Wastes Received--The pit took all garbage and burnable debris from the TAN area. It is suspected that the pit also received some oils and solvent (Stoddard Solvent) from the limited auto maintenance activities at TSF. From Table 3.2.1, the volume of these petroleum products could have been as high as 950 L/yr. The normal operating practice at the pit was to burn every time materials were dumped. Therefore, it is also suspected that a significant portion of petroleum products deposited there were destroyed. It is possible that small quantities of other hazardous materials may have reached this pit, but there are no records and it is likely that they would also have been destroyed.

3.2.3.5 TAN Gravel Pit.

3.2.3.5.1 Description--Since the early 1950s when construction began at the TAN area, gravel/fill material has been brought in from nearby areas. One such excavation site is located approximately 1-1/2 miles

TABLE 3.2.6. CHEMICAL ANALYSIS OF SLUDGE IN TSF TANKS T-709 AND T-710

Parameter	Results	
	T-709 Sludge	T-710 Sludge
Volume (L)	1374	7033
Undissolved solids conc. (g/L)	262	448
Al (g/L)	5.2	3.6
Ba (g/L)	0.5	4.5
Ca (g/L)	5.2	9.0
Cr (g/L)	1.8	3.6
Cu (g/L)	0.005	0.013
Fe (g/L)	15.7	17.9
Mg (g/L)	2.6	4.5
Mn (g/L)	1.8	2.2
Ni (g/L)	0.03	0.09
Pb (g/L)	0.16	0.31
Si (g/L)	86.5	85.1
Sn (g/L)	0.13	0.04
Ti (g/L)	0.08	0.13
Zn (g/L)	0.79	0.90
Zr (g/L)	0.03	0.04
P (g/L)	7.9	49.3

Figure 3.2.4. TAN/TSF burn pit.

northwest of the TAN/TSF area. Over the years it has also been the practice to dump construction rubble (i.e., concrete, asphalt, etc) in this area. The rubble is periodically covered. The last cover was put on about 4 or 5 years ago but more rubble has accumulated since then.

3.2.3.5.2 Wastes Received--There have been at least two relatively minor incidents where waste other than construction rubble was deposited at this site. Section 4.2.2.3 described an event where a 55-gallon drum (208 liters) of sulfuric acid was drained into this pit. Section 4.3.2.3 describes a spill from which an unspecified quantity of soil contaminated with sulfuric acid was also taken. There was no other evidence found that would indicate the presence of additional hazardous materials.

3.3 TAN/LOFT Past Activity Review

3.3.1 TAN/LOFT Description

The Test Area North (TAN)/Loss of Fluid Test (LOFT) area is located in the north central portion of INEL, as was shown in Figure 2.3. The area includes the LOFT Containment and Service Building (reactor facility), an aircraft hangar from the defunct ANP Program, the LOFT reactor Control and Equipment Building, and numerous support facilities. A four-rail railroad track connects the area to the TSF 2.4 km to the east. Figure 3.3.1 is a plot plan of the LOFT area.

The LOFT reactor is part of the Mobile Test Assembly (MTA), mounted on a specially designed railroad flatcar located inside the domed Containment Vessel. Systems for operating and monitoring the reactor are located inside structures immediately adjacent to the Containment Vessel.

Construction of the LOFT facility was basically completed by the end of 1973, and the experimental program began the latter part of 1974. The LOFT facility is used to perform loss-of-coolant experiments (LOCE) as part of the nation's power water reactor safety program.

3.3.2 TAN/LOFT Wastes Generated by Activity

3.3.2.1 LOFT Reactor/Utility Operations (Shops, Labs, and Processes). The various LOFT facilities were investigated for possible production of hazardous wastes. Those pertinent to this report are identified in Table 3.3.1 and are discussed in the following paragraphs.

The Craft Workshop in TAN-624 used small quantities of hazardous materials, but, according to the best recollection of workers at LOFT, there were no hazardous wastes generated. The shop was used for parts/component fabrication. The small quantities of materials, such as solvents (specifically acetone) used for parts cleaning and acid fluxes used in welding, were consumed in the operation. The building has no floor drains.

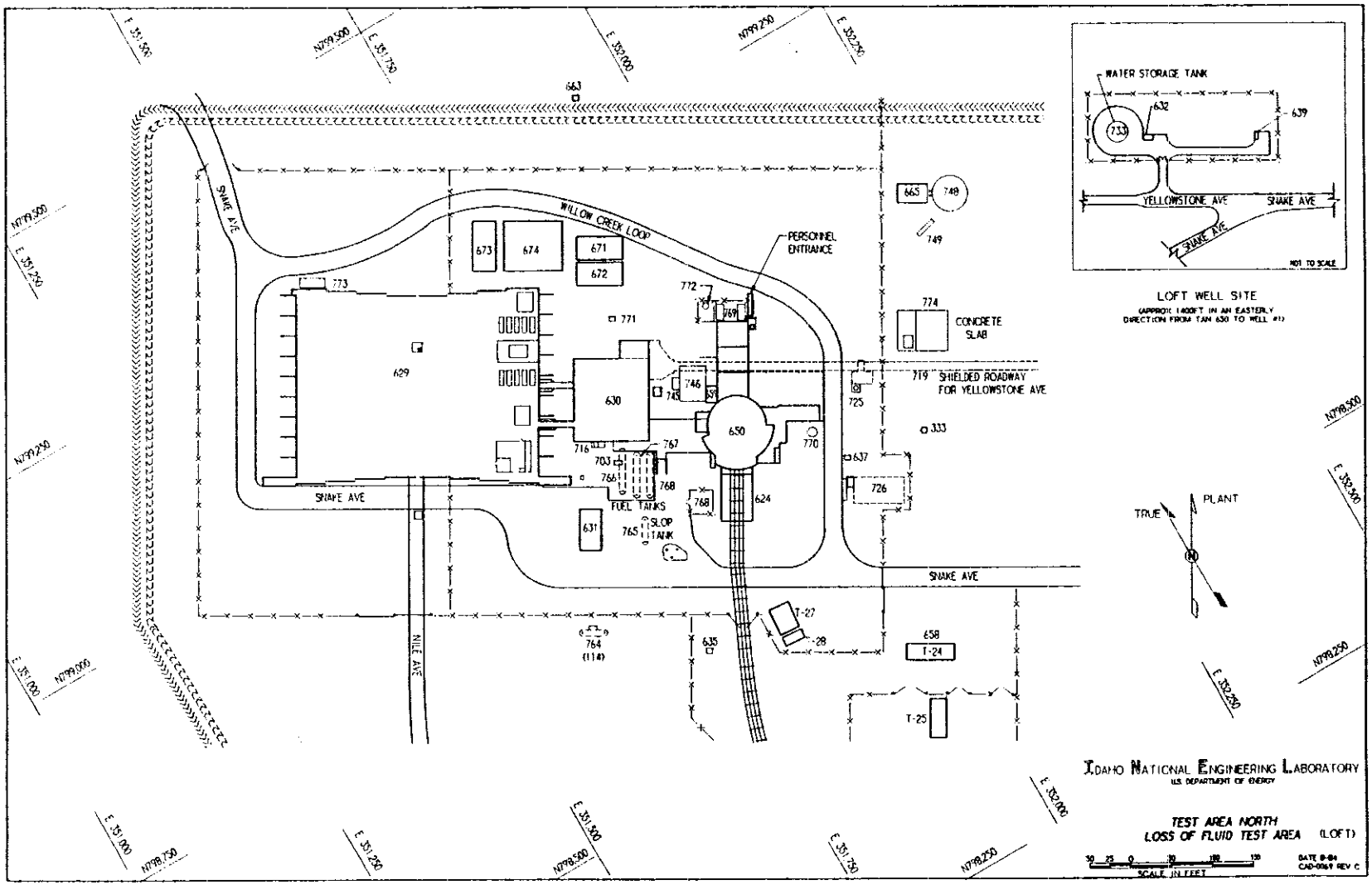

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Figure 3.3.1. Test Area North/Loss-Of-Fluid Test (TAN/LOFT plot plan).

TABLE 3.3.1. LOFT WASTE GENERATION

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
TAN-630	Chemical laboratory	Toluene (mixed with fuel oil)	1973-present	1 Liter/yr	Burned in area boilers
		Carbon tetrachloride	1973-present	200 mL/yr	LOFT pond (TAN-750)
		Acid	1973-present	Minimal	LOFT pond (TAN-750)
TAN-630	Demineralization plant	Sulfuric acid (ion exchange regenerant)	1973-1984	2,350 kg/yr	LOFT pond (at least partially neutralized)
		Sodium hydroxide (ion exchange regenerant)	1973-1984	5,930 kg/yr	LOFT pond (at least partially neutralized)
Various Locations	Waste oils/solvent management	Mixture of lubricating oil, hydraulic fluid, stoddard solvent and methylene chloride	1973-1984	38 Liter/yr	Burned in boilers
			1984-Present	35 Liters/yr	Oil recycling or off-site disposal as hazardous waste

The Craft Shop in TAN-25 was also used for the fabrication of such items as pipings and fittings. Again, the facility may have used small quantities of hazardous materials, but there is no evidence that significant hazardous wastes were generated. The building has no water service or floor drains.

The small chemical laboratory in TAN-630 produced minor quantities of toluene, carbon tetrachloride, and acid. Toluene is used in routine fuel oil analyses which generates a waste mixture that consists of about 50 mL of toluene per liter of fuel oil. It is estimated that a maximum of one liter of toluene per year is used in this manner. The toluene/fuel oil mixture is put back into the feedstock for the area boilers. Carbon tetrachloride is discarded by pouring it down drains that lead to the LOFT pond. About 200 mL/yr are discarded in this manner. Waste acid, also generated in extremely small quantities, goes through these same drains to the LOFT pond.

The demineralization plant pumps acidic and basic regenerant solutions to the LOFT pond. It is estimated that 2350 kg of sulfuric acid and 5930 kg of sodium hydroxide are used each year and eventually make their way to the pond. However, the operation at LOFT is arranged so that both cation- and anion-column regenerants are drained to the same 700-gallon sump prior to discharge to the pond. In 1984 a series of samples of the sump discharge were taken for a short period of time. The timeframe of sampling was felt to represent normal operating conditions during regeneration. Although the discharge was alkaline, the pH never rose above 11.2. This sampling cannot be considered conclusive, but it is likely that much of the ion-exchange regeneration solutions did not meet the definition of corrosive hazardous wastes as they were discharged to the LOFT pond. Also the LOFT pond receives significant amounts of water from other sources and should have always provided neutralization of these regenerates through dilution. Current operations have been modified so that increased quantities of sulfuric acid are used during regeneration to ensure that discharges from the 700-gallon sump are always nonhazardous.

3.3.2.2 LOFT Fuels/Petroleum Management. Bulk fuels used at LOFT are limited to No. 2 fuel oil and diesel oil. Two 35,000-gallon underground storage tanks provide working supplies for the fuel oil used in boilers and one 50,000-gallon tank provides storage for the diesel oil used for standby power generators. Both the materials are delivered to the underground tanks by tank truck. Table 3.3.2 provides an inventory of the fuel/petroleum storage tanks at LOFT.

Various activities at LOFT occasionally generate small quantities of waste lubricating oil, hydraulic fluid and solvent (specifically Stoddard Solvent and methylene chloride). In the past, these materials were accumulated in a single drum which was periodically pumped by the Site fire department. The pumped material was then blended with fuel oil and burned in boilers. It is estimated that as much as 38 liters (10 gallons) of these materials were collected and treated in this manner each year. This information was included in Table 3.3.1. The current practice is to collect the liquids in separate containers for ultimate recycling or disposal as hazardous waste.

3.3.2.3 Spills Within the LOFT Area. Personnel interviews, site observations, and review of UORs, were used to obtain information on the spills identified in this section.

In the February-March timeframe of 1982, an estimated 5,000 gallons of diesel fuel was spilled outside the large hangar building, TAN-629. The spill was caused by overflowing the diesel generator day tank. The diesel fuel, which was lost over at least a one-week period, was discharged through a drain pipe to an outside ditch. The ditch is located on the northeast side of TAN-629 and extends in a northeasterly direction to a culvert that carries it beneath Willow Creek Loop as shown in Figure 3.3.1. The fuel had nowhere to go but into the soil along the small ditch.

Another spill occurred in May of 1983 on the northeast side of TAN-629 at the sulfuric acid tank. This aboveground storage tank and its concrete containment pad are identified as Building TAN-771 on the plot plan in

TABLE 3.3.2. LOFT-FUEL/PETROLEUM STORAGE TANKS

TAN-630 (LOFT) (Room 133)	Diesel No. 2	400	U, I	Automatic gauge on pump line	--	LOFT facility	Filled by line from underground tank
TAN-630 (LOFT)	No. 2 fuel oil	35,000	U, 0	Dipstick	OIBFW650	LOFT facility	2 tanks
TAN-630 (LOFT)	Diesel No. 2	50,000	U, 0	Dipstick	OIBFW618	LOFT facility	--
TAN-665 (LOFT)	Diesel No. 2	300	A, I	Dipstick	--	LOFT facility	No curbing
LOFT	Diesel No. 2	500	U, 0	Automatic guage on pump line	--	LOFT facility	On east side of hangar filled by line from underground tank
LOFT	Diesel waste	--	U, 0	--	--	--	Abandoned; under parking lot

Figure 3.3.1. An estimated 260 gallons of sulfuric acid spilled into the concrete basin from a leaking piping connection. Most of the acid, 240 gallons, was pumped into drums. The drums were then taken to the LOFT pond and drained. The 20 gallons remaining in the pit were neutralized with sodium hydroxide and sodium carbonate. Once the containment basin had been cleaned, soil samples were taken around the basin to see if any acid had escaped. A low pH was detected in an area just outside the west side of the basin. The acidic soil was excavated and taken to a pit north of the LOFT area. Further checks revealed no other contamination in the surrounding soil.

In October of 1984 the diesel generator day tank overflowed again. An estimated 400 to 530 gallons of diesel fuel were lost to the same drain and ditch as described in the 1982 spill. A visual inspection of the outside ditch in April of 1985 showed an oily stain in the ditch but no other obvious sign of spills.

3.3.3 TAN/LOFT Waste Disposal Sites

Figure 3.3.2 provides a schematic of the liquid-waste systems at LOFT; the waste trucked to the TSF pond was discussed in Section 3.2.3.1. Areas or sites within the LOFT facility at which hazardous or radioactive wastes may have been deposited at some time are discussed in the following paragraphs and are summarized in Table 3.3.3.

3.3.3.1 LOFT Disposal Pond (TAN-750).

3.3.3.1.1 Description--The LOFT pond was constructed in 1971 and was designed as a seepage pond. Figure 3.3.3 shows the relative location of the pond. It was excavated by enlarging the natural contour of an inactive borrow pit. The thickness of surface sedimentary material of the pond area is approximately 7.6 to 10.7 m (25 to 35 ft). The pond floor dimensions are approximately 152 m (500 ft) long by 76 m (250 ft) wide by 5.5 m (18 ft) deep; the sides are on a 2:1 slope. The regional groundwater level is about 61 m (200 ft) below the surface. A 0.6-m (2-ft) high and

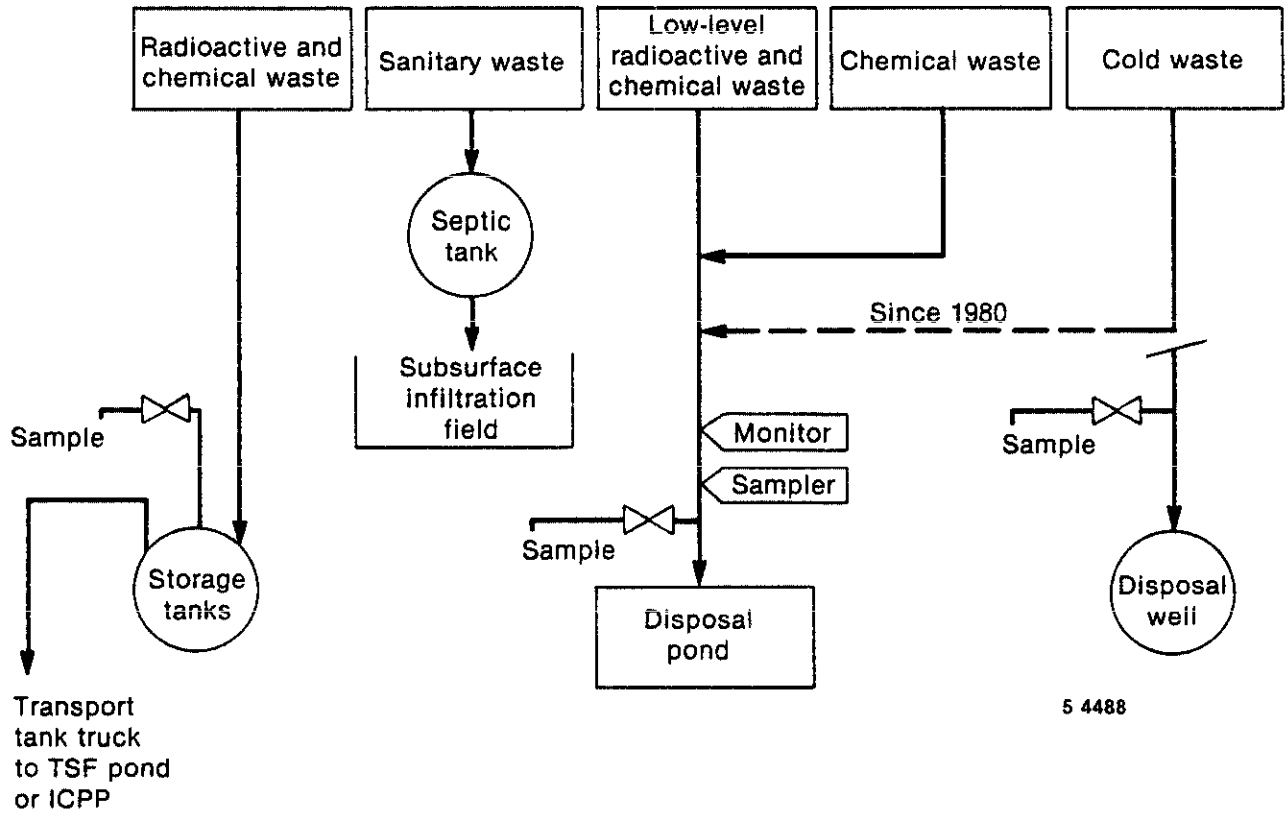

Figure 3.3.2. Schematic of the LOFT liquid waste systems.

TABLE 3.3.3. TAN/LOFT HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Area Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Waste	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
TAN-750	LOFT Disposal Pond	1971 - present	11,500	Carbon tetrachloride Sulfuric acid[a] Sodium hydorxide[a]	2.6 L 28,200 Kg 71,200 Kg	Discharged with other wastewater to the open unlined seepage pond. Sulfuric acid and sodium hydroxide from the demineralization plant were discharged to a common sump before going to the pond.	Active--discharge of hazardous, non-radioactive chemicals has been eliminated.	Snake River Plain Aquifer underlines the site at a depth of about 61 M. Surface is generally level. Subsurface consists of alternating layers of basalt and silt.	The pond is surrounded by an earthern berm which prevents surface runoff from entering.	None
TAN-333	LOFT Injection Well	1971 - 1980	NA	NO hazardous materials are suspected.	NA	Cooling water drained to a common sump which drained to the well.	Closed--well capped and sealed.	Same	Well head is sealed against surface water intrusion.	None

a. These materials (acids and bases) were at least partially neutralized before being discharged to the pond.

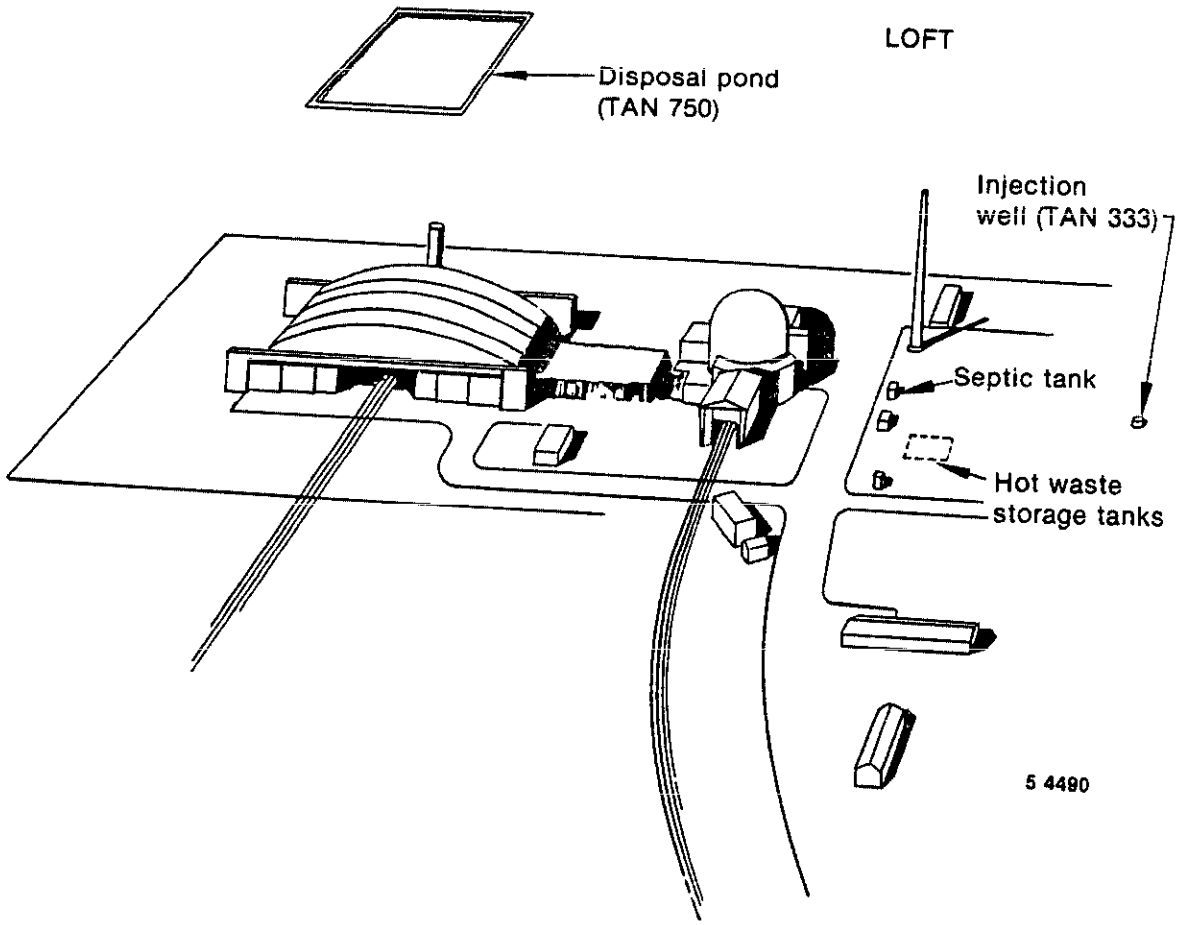

Figure 3.3.3. Location of LOFT disposal pond and injection well.

3.7-m (12-ft) wide (top width) earthen berm encloses the pond to prevent surface runoff from entering. The usable capacity of the pond is estimated at 68 x 10^6 L (18 x 10^6 gal).

3.3.3.1.2 Wastes Received--The LOFT seepage pond was designed to dispose of low-level radioactive and chemical liquid wastes which do not exceed concentration limits for uncontrolled surface pond disposal per DOE Order 5480.1A. The major sources of low-level radioactive wastes include:

- Primary component heat exchanger cooling water
- Low-pressure injection system pump cooling water
- Personnel change room showers
- Miscellaneous floor drains and cooling water from small heat exchangers.

The quantities of low-level radioactive wastewater sent to the LOFT disposal pond have been measured and recorded in the RWMIS reports.

Nonradioactive process water wastes include boiler blowdown, and wastes from regeneration of demineralizer beds and water softeners. The major sources and contents of liquid chemical wastes are:

- NaCl from water softening
- NaOH and H_2SO_4 from demineralization
- Na_2SO_3, Na_3HPO_4 and Na_2PO_4 from corrosion and scaling control.

Small quantities of laboratory chemicals have also found their way to the LOFT disposal pond. Estimates of the minor quantities from this source as well as from the major sources identified above are provided in Table 3.3.3.

3.3.3.2 LOFT Injection Well (TAN-333).

3.3.3.2.1 Description--The 25.4-cm (10-in.) diameter, 91.4-m (300-ft) deep injection well was drilled at LOFT in 1957. The well is located south east of the LOFT site, as depicted in Figure 3.3.3. The well sump is 1.2 m (4 ft) in diameter and 2.1 m (7 ft) deep, sloping to a 0.6-m (2-ft) diameter manhole. Maximum capacity of the well is about 5700 L/min (1500 gal/min). Since 1980, piping to the well has been removed and the well itself has been sealed with a welded cap.

3.3.3.2.2 Wastes Received--During LOFT operations the well was used for disposal of cooling water to which no chemicals were added. Wastewater sources included plant air compressors, refrigeration condensers, diesel jacket water coolers, and water chillers. The average temperature of water from the LOFT production well is 11.1°C, while the cooling water was discharged down the injection well at an average temperature of 25.6°C. Average water flow to the well was 1500 m^3/d (400,000 gal/d). The injection well was used until May 1980, by which time changes were made to the cooling system for partial recycling of the cooling water with ultimate disposal in the LOFT pond.

Since the injection well's construction significantly predates that of the LOFT facility (1957 versus 1973), it can be assumed that the well was constructed for purposes other than to receive LOFT wastewater. The well was probably constructed in conjunction with the ANP Program. The quantities or types of wastewater that may have been injected during the ANP days are unknown. However, considering the limited ANP activities that occurred at the current LOFT area, it is unlikely that significant quantities of hazardous or radioactive wastes were involved.

3.4 TAN/IET Past Activity Review

3.4.1 TAN/IET Description

The Test Area North (TAN)/Initial Engine Test (IET) facility is located in the northern part of the INEL, about one mile north of the TSF complex, as was shown in Figure 2.3. It is part of the TAN facilities and was originally constructed as the initial engine test area for the ANP Program. Figure 3.4.1 provides a plot plant of the IET area. The facility consists of an underground control and equipment building and various other small service buildings. Although constructed as part of the ANP program, the IET facility has been used for two subsequent programs. A description of the three programs that utilized the facility are described in the following paragraphs.

3.4.1.1 Aircraft Nuclear Propulsion (ANP) Program. The ANP Program, for which the IET was initially constructed, began in 1951 and ended in 1961. The experiments were called Heat Transfer Reactor Experiments (HTRE).

The HTRE power plants or test assemblies, stored in the TAN/TSF area, consist of the Core Test Facility and the nuclear reactor. The core components are mounted on a structural steel platform called a dolly. The platform units were rolled over a four-rail railroad track so the assembly could be moved between TAN/TSF and TAN/IET, where the tests were conducted.

The HTRE experiments included the following:

- HTRE-1. The HTRE-1 reactor operated a modified J47 turbojet engine exclusively on nuclear power in January 1956. It accumulated a total of 150.8 hours of operation at high nuclear power levels.

- HTRE-2. The HTRE-2 reactor was a modification of HTRE-1. Testing began in July 1957. The reactor accumulated 1299 hours of high-power nuclear operation.

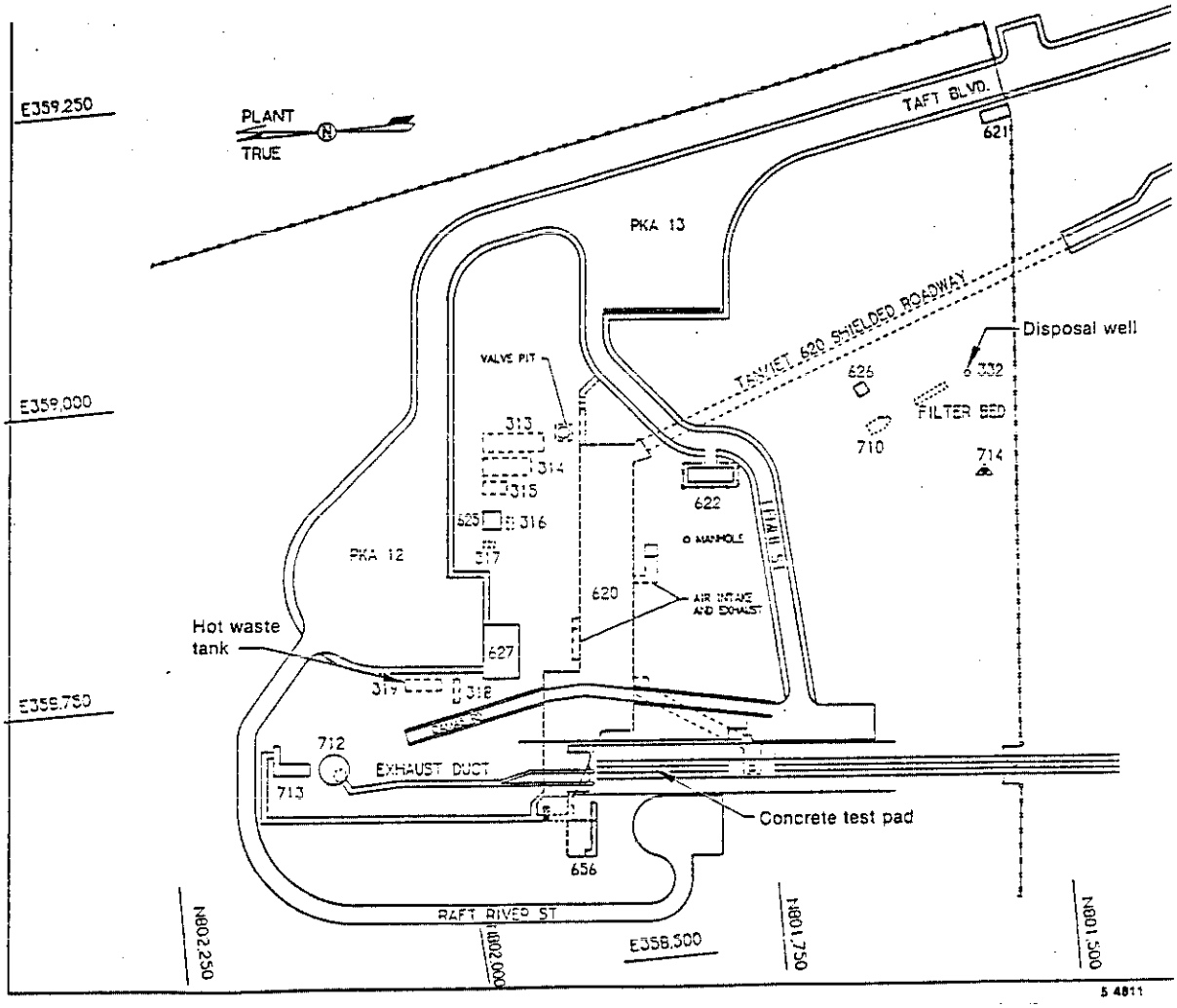

Figure 3.4.1. Test Area North/Initial Engine Test (TAN/IET) facility plot plan.

- HTRE-3. The HTRE-3 reactor was built in a full-scale aircraft reactor configuration. Two modified J47 turbojet engines were operated by this reactor. Full nuclear power was achieved in 1959 and the system operated for a total of 126 hours.

The HTRE-2 and -3 core components are currently being stored within TAN/TSF Radioactive Parts Security and Storage Area (RPSSA). Decontamination and decommissioning of these test assemblies are scheduled for the near future.

3.4.1.2 Space Nuclear Auxiliary Power Transient (SNAPTRAN) Program. The SNAPTRAN Program ran from 1961 through 1967. It involved the following tests.

- A series of test aimed at providing information about beryllium-reflected reactor performance under atmospheric conditions and assessing hazards during reactor assembly and launch,

- Nuclear excursions resulting from immersion of the reactor in water or wet earth,

- Nondestructive tests including static tests and those kinetic tests in which minor damage to the reactor occurred, and

- Destructive tests in which the reactor was destroyed.

3.4.1.3 Hallam Decontamination and Decommissioning (D&D) Project. The Hallam D&D Project was conducted in 1977 and 1978. It included the following:

- Storing, in the hangar at TAN/LOFT, various components shipped to the INEL in 1968 from the dismantled Hallam Nuclear Power Facility near Lincoln, Nebraska;

- Moving the components to the IET for removal of the sodium from the components;

- Decontaminating the components, when feasible, for use in research and development, and for disposal as surplus materials; and

- Sending materials that could not be decontaminated to the Radioactive Waste Management Complex for disposal.

3.4.2 TAN/IET Wastes Generated by Specific Activity

Waste generations are addressed in the following paragraphs according to the program involved. A summation of the hazardous waste generations is found in Table 4.4.1.

3.4.2.1 ANP Program. The IET facility was designed for this program; it is the only program for which all of the IET facility was used. During this program, IET was the site where the HTRE reactors and associated jet engines were actually run-up. Any significant maintenance or repair was accomplished at TSF. The main sources of chemical or radioactive contamination were the concrete test pad where the reactors/engines were tested, and the tank building (TAN-627) where ion exchange columns were operated for cooling water.

The concrete test pad, on the west side of TAN-620, was the place of generation of radioactively contaminated wastewater at the IET facility. The contamination may have been caused by spills, leaks or minor maintenance work. Runoff from the pad was channelled into a cistern which gravity fed the hot waste tank shown in Figure 3.4.1 as TAN-319. Although radiation was the main source of contamination, it is possible the mercury spills may have occurred here during HTRE-3 testing. HTRE-3 used a shield augmentation system to provide additional gamma shielding for the reactor after shutdown by replacing the water in the primary shield outer tank with mercury. During augmentation the primary shield contained 48,000 kg

TABLE 3.4.1. TAN/IET HAZARDOUS WASTE GENERATION

Location	Function	Waste Stream	Timeframe	Estimated Quantities (if known)	Treatment/ Storage/ Disposal
Concrete Test Pad	Operating location for HTRE-reactors during ANP program	Mercury	1959	Unknown	Hot waste collection system
TAN-627	Tank building--maintain cooling water quality during ANP program	Ion exchange column regenerants o Sodium hydorixde o Sulfuric acid	1956-1959	 750 kg 860 kg	IET injection well after at least partial neutralization
Concrete test pad	Location for Hallam D&D project--sodium processing	Corrosive wastewater--pH 13.5	1978	51,000 L	Neutralized on-site, then dump at TAN-735

(106,000 pounds) of mercury which provided the necessary mass around the reactor to allow contact maintenance to be performed. Since mercury has been found in hot waste collection lines (to be discussed further in Section 3.4.2.5), it can be assumed that spillage on the concrete pad is the source.

The tank building (TAN-627) was the location for ion exchange columns used to maintain the cooling water quality for the HTRE tests. Sodium hydroxide and sulfuric acid were used to regenerate the demineralizers and the regenerant solutions were discharged to the IET disposal well (TAN-332). The demineralizers were generated about every 24 hours of full use, that is after about 24 hours of HTRE test being run. Since the HTRE reactors accumulated a total of 1578.8 hours of operation, it can be assumed that the demineralizers were regenerated approximately 66 times. Each regeneration used about 11 kg (25 pounds) of sodium hydroxide and 13 kg (29 pounds) of sulfuric acid, for a total chemical usage of about 750 kg (1650 pounds) of sodium hydroxide and 860 kg (1910 pounds) of sulfuric acid. The regenerant solutions went to a common tank before discharge to the injection well, so they were at least partially neutralized.

It should be noted that the IET was designed such that exhaust from the HTRE reactor/engine assemblies were discharged to a large exhaust duct and stack system. There is significant radioactive contamination inside this exhaust system. It has already been characterized and is scheduled for future decontamination and decommissioning (D&D) work. Therefore, it will not be addressed further in this document.

3.4.2.2 SNAPTRAN Program. As part of the SNAPTRAN Program, IET was again used as the site for testing the operation of small mobile reactors. The concrete pad on the west side of TAN-620 was the primary test location. Any contaminated wastewater was drained to the hot waste collection system. There are no records of the SNAPTRAN program having generated hazardous waste at the IET facility.

Again, it should be noted that the last phase of the SNAPTRAN program involved the destruction of a small reactor. Debris and component parts have all been removed but some radioactive contamination remains in the area. The D&D effort has already characterized the contamination and, if necessary, additional cleanup of the area will be addressed in the scheduled D&D effort.

3.4.2.3 Hallam D&D Project. As mentioned earlier, the portion of the Hallam D&D effort that was accomplished at IET consisted primarily of removing reactive sodium metal from various reactor components. Simplified, the process consisted of injecting wetted nitrogen gas into the components. The wetted nitrogen gas reacts with the sodium producing gaseous hydrogen and sodium hydroxide. After the vessels had been processed in this manner, they were filled with water and allowed to stand for three days. The purpose for the water was to react any sodium remaining in the component. After the three days were over, the components were left containing a wastewater that was highly corrosive (pH greater than 13.5) and radioactively contaminated and which also required disposal.

It was decided to neutralize the wastewater before any disposal took place. The caustic wastewater was drained to a rinse tank in batches and slowly neutralized with concentrated sulfuric acid. The neutralized wastewater was then taken to TAN/TSF by tank truck where it was dumped in the acid pond (TAN-735) which is part of the RPSSA. After each of the Hallam components were drained, they were refilled with fresh water and retested to ensure pH was 7.0. This refill water was also pumped to the tank truck and hauled to the acid pond. Approximately 51,000 L (13,400 gallons) of corrosive wastewater was neutralized in this manner.

After the Hallam D&D operations at IET were completed, all components were removed from the facility for salvage or burial at the RWMC if still radioactively contaminated. The Hallam D&D project involved no disposal activities at the IET facility.

3.4.2.4 IET Fuels/Petroleum Management. During the ANP program days, bulk fuel management included engine fuel, diesel fuel, heating fuel and gasoline in underground tanks TAN-313 (50,000 gallons), TAN-314 (30,000 gallons), TAN-315 (20,000 gallons), and TAN-318 (5,000 gallons) respectively. Engine fuel, diesel fuel, and gasoline were all utilized in jet engine testing. One three inch fuel line from TAN/TSF provided the supply for at least engine fuel. Fuel not received by way of this line was delivered in tank trucks. The fuel transfer pumping building (TAN-625) housed the pumps that moved the fuel to and from the concrete pad test area. Since the ANP days, the gasoline tank (TAN-318) has been abandoned and the three remaining tanks have been used periodically to store No. 2 fuel oil. These three tanks (TAN-313, -314, and -315) are all shown on Figure 3.4.1.

There are no records of significant fuel leaks from these tanks and no obvious signs of environmental stress due to spillage or leaks.

3.4.2.5 Spills Within IET. Review of UOR's personnel interviews, observations and operation records provided information on the spills identified in this section.

During the original construction of the IET facility, it was envisioned that radioactive wastewater would be generated, either by spillage or draining, on the concrete test pad west of TAN-620. Water collected on this pad drained to the hot waste collection system. However, during a September 1985 D&D project on the underground line connecting the concrete pad to the Hot Waste Tank (TAN-319 in Figure 3.4.1) contamination in addition to radioactivity was found. When one section of pipe was removed from the excavation trench, a sludge material drained from one end and was found to contain mercury. As mentioned previously, the HTRE-3 reactor utilized great quantities of mercury as shielding and apparently some was lost while the reactor was sitting on the concrete test pad. It is felt that the piece of pipe removed was a low section where the mercury

had accumulated and had never been flushed out. However, the rest of the pipe will be suspect of containing mercury as will the sludge that sits in the bottom of the Hot Waste Tank.

During the Hallam D&D project, there were numerous small spills of caustics and acids mentioned in operation reports, but they were limited to small spills caused by corrosion of pipe and pump fittings. In all cases the reports indicated the spills were neutralized and cleaned up.

3.4.3 TAN/IET Waste Disposal Sites

Areas of sites within the IET facility at which hazardous wastes may have been deposited are discussed in the following paragraphs. A summary of the hazardous waste findings is presented in Table 3.4.2.

3.4.3.1 IET Hot Waste Collection System.

3.4.3.1.1 Description--Radioactive liquid wastes generated at the IET Facility were moved by gravity to a 56,800 L (15,000 gallon) underground waste holding tank (TAN-319 on Figure 3.4.1). Depending upon the quantity and level of activity, the waste was transported either to the ICPP for processing or pumped to the TSF Intermediate-Level Waste Disposal System (see Section 3.2.3.3). The radioactive liquid wastes were generated from tests performed at the concrete test pad.

4.4.3.1.2 Wastes Received--D&D operations have already been completed on the hot waste line that connected the IET Hot Waste Tank (TAN-319) with the TSF disposal system and D&D operations are currently underway on the line that fed the Hot Waste Tank. Because of the mercury found in the later section of pipe (see Section 3.4.2.5), it is estimated that the current D&D operation will generate 15 drums of radioactive and hazardous mixed waste.

TABLE 3.4.2 TAN/IET HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Area Size (km^2)	Suspected Types of Wastes	Estimated Quantity of Waste	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
TAN-319	IET hot waste tank	1956 - 1978	NA	Mercury contaminated sludge	6,000 L of sludge (extent of mecury contamination, if any, is unknown)	Radioactively contaminated wastewater from the concrete test pad is collected in this tank before being pumped to ISF or trucked to ICPP. Over the years sludge has accummulated in the tank.	Closed - piping to tank has just recently been capped - until then test pad runoff was reaching the tank and overflowing it.	Snake River Plain Aquifer underlies the site at a depth of about 64 m. Surface is generally level. Subsurface consists of alternating layers of basalt and silt.	The underground tank is now closed from runoff sources.	Presence of mercury is unknown, only suspect.
TAN-332	IET injection well	1956 and 1978	N/A	Ion exchange column regenerants - Sodium hydroxide - Surfuric acid	 750 kg 860 kg	Regenerant solutions were mixed in a tank and at least partially neutralized prior to discharge to the injection well.	Closed	Some	Well heat is closed to surface drainage.	None

a. These materials (acids and bases) were at least partially neutralized before being discharged to the pond.

The Hot Waste Tank itself contains liquid and sludge that has been radiologically characterized. The sludge is considered contaminated waste but the liquid is not. (The liquid has accumulated from precipitation falling on the concrete test pad and draining to the hot waste collection system.) The sludge in the tank is estimated to be about 6,000 L (about 10% of the tank's volume). Although radiologically characterized, the tank contents have not been analyzed for hazardous chemical constituents and because of the mercury found in pipes upstream from the tank, mercury contamination of the sludge is suspect. It is possible that all the mercury that found its way to the collection system stayed in low spots in the line before reaching the tank, but depending on the quantities spilled, this appears unlikely. There is a better chance, however, that any mercury reaching the Hot Waste Tank would have stayed in the tank bottom rather than being pumped to a tank truck or to the TSF disposal system. Again, it would all depend on the amount of mercury spilled, but because of mercury's density and relative insolubility in water, if any reached the tank it would be in the sludge. The Hot Waste Tank sludge is scheduled to be addressed in future D&D efforts at IET. Before these D&D efforts can be started, the sludge will have to be resampled for hazardous chemical constituents, particularly mercury.

3.4.3.2 IET Injection Well (TAN-332).

3.4.3.2.1 Description--The IET injection well is located southwest of the main control facility (TAN-620) as shown in Figure 3.4.1. The well is 98.9 meters (324 ft) deep and information is unavailable on its casing size. Depth to groundwater in this area is approximately 64 meters (210 ft).

3.4.3.2.2. Wastes Received--Regeneration backwash from the cooling water treatment equipment and other nonradioactive liquid wastes were discharged to the IET injection well. It is suspected that

wastewaters from these sources only occurred during the time that the ANP program was active at IET (1956-1961). As mentioned in Section 3.4.2.1, the regeneration backwash contained a total of about 750 kg of sodium hydroxide and 860 kg of sulfuric acid. However, operations were such that the regenerant solutions were mixed and, at least, partially neutralized prior to discharge to the injection well.

The IET injection well also received septic tank overflow from the facility's sanitary sewer collection/disposal system. Sanitary sewer would flow from the facility to a septic tank system south of the area. The septic tank itself is shown as TAN-710 in Figure 3.4.1. Effluent from the septic tank was chlorinated, passed through a sand filter, and discharged to the well. The sanitary sewer system is not a suspected source of hazardous chemicals to the injection well.

3.5 TAN/WRRTF Past Activity Review

3.5.1 TAN/WRRTF Description

The Test Area North (TAN)/Water Reactor Research Test Facility (WRRTF) is located in the northern part of the INEL, about 1-1/4 miles south-southeast of the TSF complex, as shown in Figure 2.3. Like IET it is part of the TAN facilities and was originally constructed as part of the ANP program. Figure 3.5.1 provides a plot plan of the WRRTF area. As can be seen in Figure 3.5.1, with the exception of some small support/utility type buildings, the WRRTF area consists primarily of two building complexes: one identified as TAN-640/641 and the other as TAN-645/646. These two building complexes have gone through several modifications and usages since the time of the ANP program. The following paragraphs provide a brief description of the work/research that has been done in these two complexes.

3.5.1.1 TAN-645/646. This complex was originally constructed in 1958 as the Shield Test Pool Facility (STPF). It was composed of two adjacent buildings; one housed administrative offices, utility areas, and a reactor control room, and the other was a large high bay building with an overhead crane and two deep pools. During the ANP program one pool contained a "swimming pool" type reactor designated as "SUSIE" and the other pool was used as a storage space for fuel elements and radioactive experimental equipment.

In 1961, after termination of the ANP program, SUSIE was modified such that the pool water was forced through the reactor and then through a heat exchanger. The reactor was still used as a radiation source for experiments but at a higher power (2 MW versus 10 kW before modifications). The reactor was operated in this mode for approximately one year and was then dismantled and shipped to the Sandia Corporation at Albuquerque, New Mexico.

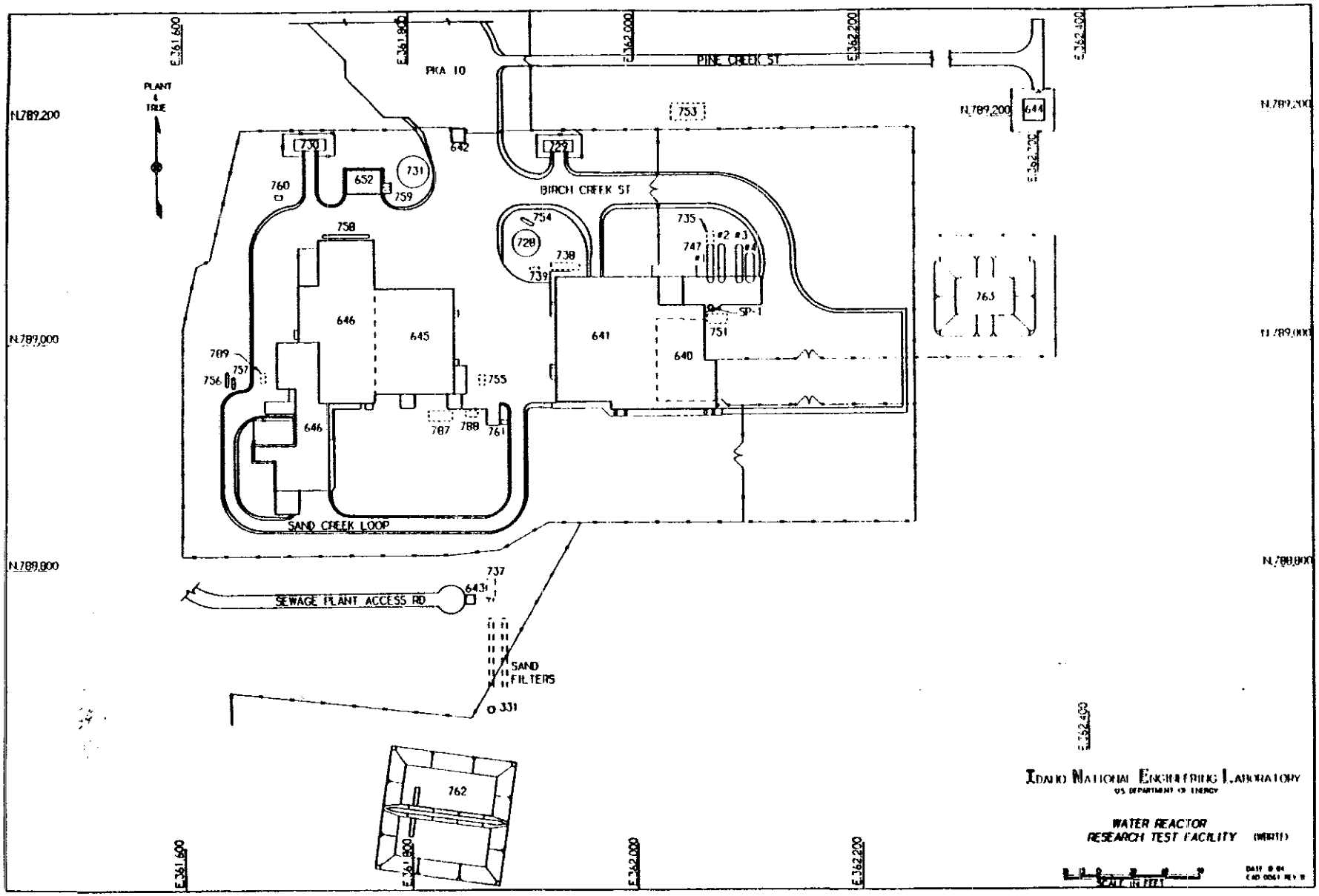

Figure 3.5.1. Test Area North/Water Reactor Research Test Facility (TAN/WRRTF) Plot Plan.

Modifications began again on the facility in 1963 to house the Experimental Beryllium Oxide Reactor (EBOR). However, the EBOR program was terminated in 1966 before fuel was inserted into the reactor, and the facility subsequently has been used for nonnuclear testing programs.

Since EBOR, the TAN-645/646 complex has housed the Semiscale program. Semiscale in a nonnuclear program that simulates the principal thermal-hydraulic features of a commercial nuclear reactor on a much smaller scale in order to predict what occurs in a nuclear system during a loss-of-coolant accident and other transients. Testing is performed in the Semiscale Facility as research for the Nuclear Regulatory Commission and to assist the LOFT program.

3.5.1.2 TAN-640/641. This complex was constructed in 1958 and historically has most often been referred to as the Low Power Test (LPT) facility. It comprises two large concrete shielded cells (which have housed test reactors) and an associated building with control rooms, office space and utilities.

The facility was designed to conduct tests on engineering "mockups" of real or proposed reactor systems. These tests, conducted at low or near zero power, required no heat removal systems. During the ANP program, the facility was used for pretesting reactor cores in a specifically designed tank before those cores were transported to the IET facility for high-power testing. The LPT facility has been utilized subsequently for a number of specialized low-power tests.

After several years of being used primarily as office space for activities in the adjacent facility (TAN-645/646), this building has more recently been remodeled to support tests for the LOFT program. Until the recent completion of the LOFT program, TAN-640/641 has housed the Blowdown and Two-Phase-Flow Loop facilities. The Blowdown test loop has been used to assess and calibrate LOFT external fuel cladding thermocouples under transient conditions, to test the performance of LOFT flow instrumentation,

to study basic blowdown heat transfer, to qualify the Power Burst Facility blowdown valves, and to test the performance of the Semiscale scaled high-speed pump. The Two-Phase-Flow-Loop is a large, high-temperature steam-water test system designed and installed to test LOFT flow instrumentation over the full range of two-phase-flow conditions expected to occur during a LOFT blowdown.

3.5.2 TAN/WRRTF Wastes Generated by Specific Activity

Waste generations are addressed in the following paragraphs according to the buildings and operations involved. A summation of the hazardous waste generations is found in Table 3.5.1.

3.5.2.1 TAN-640. During the ANP program and for some time subsequently, the shielded cells of this building were used to perform low power reactor tests. The tests were done at such low power that cooling water was never needed, thus eliminating a major source of waste for most reactor operations. However, because reactor fuel was handled in the facility, often unclad uranium, provisions were made in the facility's design to handle any wash or other wastewater as radioactively contaminated. It drained to the facility's radioactive liquid waste disposal system. No other hazardous wasted were generated at the facility while it was used for low power testing.

The most current use of this facility has been to house the Blowdown Test Loop and the Two-Phase-Flow Loop. Wastes from these non-nuclear tests are limited to wastewater, some of which is pretreated to maintain a desired water chemistry. Water for the Two-Phase-Flow Loop testing has hydrazine added to act as an oxygen scavenger. Although hydrazine itself is highly hazardous, the make-up waste for the test contains only about 0.27 mL of hydrazine per L of water and is not considered hazardous.

3.5.2.2 TAN-641. This facility provides office and utility support to the tests accomplished in the adjoining TAN-640. The only industrial-type waste streams associated with this building are

TABLE 3.5.1. TAN/WRRTF HAZARDOUS WASTE GENERATION

Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
TAN-640	Two-phase-flow-loop	Wastewater (from testing) containing hydrazine in very small quantities	1981-Present	0.27 mL/L	Discharge to two-phase pond
TAN-641/646	Demineralizers	Regeneration solutions (acidic and basic)	1958-1984	Unknown	Neutralized and discharged to disposal well
			1984-Present	Unknown	Neutralized and discharged to seepage pond

regeneration solutions from a demineralizer unit and blowdown of boiler condensate return water. The regenerants are alternately acidic or caustic through use of sulfuric acid or sodium hydroxide, respectively. However, it is reported that the regenerants are always neutralized or diluted by the time they are discharged such that they are nonhazardous. Make-up water to the steam boilers is treated with sulfites and phosphates to control corrosion and scaling. The blowdown from the system also contains these chemicals but is not considered hazardous. Process water is also softened in this facility, resulting in the discharge of brine.

3.5.2.3 TAN-645. Traditionally this facility has provided administrative and control space for the operations accomplished in TAN-646. There is no record of hazardous waste streams from this facility.

3.5.2.4 TAN-646. During its days as part of the Shield Test Pool Facility (STPF) this building not only housed the pools; but it contained water softeners and demineralizers that preconditioned the water. Brine from the water softening operation as-well as acidic and caustic regeneration solutions from the demineralizer all flowed to a neutralizing pit prior to discharge to the area's disposal well. Blowdown from the steam heating system was also discharged to the well but contained only small quantities of sulfites and phosphates as water conditioners.

The pools of the STPF produced no liquid radioactive wastes. They were equipped with a clean up system filter which removed radioactive material from the pool water, and the filters where shipped to the RWMC. There are no records of any other hazardous waste streams from this facility.

3.5.2.5 WRRTF Fuels/Petroleum Management. Bulk fuels used at WRRTF have included No. 2 and No. 5 fuel oils, diesel fuel and gasoline. The single gasoline tank is now abandoned. All fuel tanks are supplied fuel from tank trucks. There are no records of any significant fuel spills

occurring at the WRRTF area. Table 3.5.2 provides an inventory of the fuel/petroleum storage tanks at WRRTF. The locations are shown by facility number in Figure 3.5.1.

3.5.3 TAN/WRRTF Disposal Sites

Areas or sites within the WRRTF facility at which hazardous and/or radioactive wastes may have been deposited are discussed in the following paragraphs. A summary of the hazardous waste findings is presented in Table 4.5.3.

3.5.3.1 WRRTF Injection Well (TAN-331).

3.5.3.1.1 Description. The WRRTF injection well at TAN-331 (see Figure 3.5.1) was first used in 1957. The well is 95.4 m (313 feet) deep and has a 20.3 cm (8 inch) diameter casing to a depth of 8.8 m (29 feet) and a 10.2 cm (4 inch) casing to a depth of 9.1 m (30 feet). Depth to groundwater is approximately 64 m (210 feet). The injection well was last used in August of 1984. Beginning in September of 1984 the water which was flowing to the injection well was diverted to a newly constructed evaporation pond which is contiguous to the WRRTF sewage lagoon. The disposal well was then plugged with concrete and capped on September 11, 1984.

3.5.3.1.2 Wastes Received--The injection well received boiler blowdown, non-radioactive process waters, and cooling water. The major known sources of liquid chemical wastes were NaCl from water softening, NaOH and H_2SO_4 from demineralization, and Na_2SO_3, Na_2HPO_4, and Na_3PO_4 from corrosion and scaling control. The brine (NaCl), sulfite, and phosphate solutions are considered non hazardous. The basic (NaOH) and acidic (H_2SO_4) wastewaters can be hazardous but were reported to be neutralized before any discharge to the injection well. The volume and calculated concentrations of expected ions in the waste streams are

TABLE 3.5.2. WRRTF FUEL/PETROLEUM STORAGE TANKS

Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMX No.	Responsibility	Comments
TAN-751 (WRRTF)	Diesel No. 2	12,000	U, O	Dipstick	01BFW619	Plant Services	--
TAN-753 (WRRTF)	No. 5 fuel oil	55,000	U, O	Dipstick	01BFW661	WRRTF	--
TAN-787 (WRRTF)	No. 2 fuel oil	10,240	U, O	Aboveground gauge	01BFW656	Plant Services	Coated; outside fence on north side
TAN-652 (WRRTF)	Diesel No. 2	300	A, I	Dipstick	--	Plant Services	--
TAN-738 (WRRTF)	No. 2 fuel oil	10,240	U, O	Aboveground gauge	01BFW655	Plant Services	--
TAN-739 (WRRTF)	Diesel No. 2	1,000	U, O	Aboveground gauge	--	WRRTF	--
TAN-788 (WRRTF)	No. 2 fuel oil	2,500	U, O	Aboveground gauge	--	--	Abandoned
TAN-789	Diesel	?	U, O	Aboveground gauge	--	--	Abandoned
TAN-755 (WRRTF)	No. 2 fuel oil	5,000	U, O	Aboveground gauge	--	--	Abandoned; next to TAN-645
TAN-644 (WRRTF)	Gasoline	550	U, O	--	--	--	Abandoned; outside fence on northeast side

TABLE 3.6.3. TAN/WRRTF HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Wastes	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
TAN-331	WRRTF Injection well	1957-1984	NA	Ion exchange column regenerants	Unknown	Corrosive waste was neutralized or diluted with other wastewater prior to the discharge to well. Other industrial wastewaters discharged directly.	Closed-well capped and sealed as of September 1984.	Snake River Plain Aquifer is about 64 m below the surface which is generally level. Subsurface consists of alternating layers of basalt and silt.	Well head is sealed against surface water intrusion.	
				Cobalt-60	50 mCi					
TAN-762	WRRTF sewage lagoon/ evaporation pond	1984-present	16,400	Ion exchange column regenerants	Unknown	Neutralized or diluted with other wastewater prior to discharge.	Active grab samples have shown pH value of discharge to pond to be non-hazardous.	Same	Lagoon/pond has earthen berms to prevent surface water intrusion.	
TAN-763	WRRTF two-phase pond	1981-present	450	Water conditioned with small concentration of hydrazine.	708,000 L of water with 5 ppm hydrazine (i.e., 3.5 L of hydrazine).	Discharged directly to pond with earthern berms and bottom.	Active but used only periodically, when two-phase-flow testing is being done.	Same	Pond has earthen berms to prevent surface water intrusion.	
TAN-736 and adjacent discharge area	WRRTF radioactive liquid waste disposal system.	1957-1977	Unknown	Radioactive contaminated wash water from reactor test cell areas of TAN-640.	Unknown-below release criteria of DOE Order 5480.1A.	Each tank fully analyzed and found to be below release criteria - tank discharged to surface.	Surface discharge area no longer used survey has shown no activity above background.	Same	Surface discharge area has no surface discharge protection.	
		1977-Present	NA		Unknown-expected to be minimal, if any.	Collected wastewater is routinely taken to TSF disposal pond independent of activity, if any.	Tank collection system still in operation.		Tank is located underground and has no problems with surface drainage intrusion.	
	WRRTF Burn Pit	1958-1967	3,000	Garbage and burnable debris Fuel oil Lubrication oil Zinc-bromide oil Stoddard Solvent	Unknown-Lube oil and Stoddard Solvent probably amount to at least 9,5000 L over the 10 year period.	Waste dumped into pits and ignited. As a pit began to fill with rubble, it was covered and another pit was opened.	Closed-all pits filled in and surface is graded level.	Same	No provisions were made to prevent surface drainage run-on.	

a. These materials (acids and bases) were at least partially neutralized prior to release.

determined monthly and published in the Industrial Waste Management Information System (IWMIS) yearly report. These yearly reports, however, do not take into consideration any neutralization.

Prior to 1981, the injection well also received treated domestic wastewater from WRRTF operations. Domestic waste generated at the facility first goes to a septic tank and overflow from the septic tank flows into a sand filter with an aerator. Until the WRRTF sewer lagoon was constructed in 1981, the effluent from the sand filter was pumped to the injection well.

3.5.3.2 WRRTF Sewage Lagoon/Evaporation Pond (TAN-762).

3.5.3.2.1 Description--In 1981 a two-cell sewage lagoon was constructed to receive WRRTF sewage as it leaves the septic tank/sand filter treatment system. In 1984 the south cell of the lagoon was expanded and converted into an evaporation pond for those process and industrial wastewaters that were going to the injection well. As now used, the sewage lagoon is one cell with a capacity of about 1.1×10^6 L (2.9×10^5 gallons) and the evaporation pond is a large extension of the second cell achieved by removing the southern berm shown in Figure 3.5.1. The large spreading area now joined with the second cell is approximately 128 m square. The two cells are still separated by a berm and it is anticipated that the domestic wastewater flow from WRRTF will not overflow the one-cell sewage lagoon.

3.5.3.2.2 Wastes Received--From 1981 through August 1984 the two-cell sewage lagoon received nothing but domestic wastewater after it had passed through the septic tank/sand filter treatment system. Since September 1984 only the first cell has been used to receive the domestic wastewater and the enlarged second cell (now called the evaporation pond) has received process and industrial wastewaters. The water going to the second cell has contained diluted solutions of brine, sulfite, phosphates, acids, and bases. Only the corrosive acids and bases are considered hazardous and they are neutralized prior to discharge to the evaporation pond.

3.5.3.3 WRRTF Two-Phase Pond (TAN-763).

3.5.3.3.1 Description--The two-phase pond was constructed in 1981 to handle the wastewater discharge from the Two-Phase-Flow Loop test system operated in the TAN-640/641 structure. The pond is located on the east side of the WRRTF facility as shown in Figure 4.5.1. Its approximate dimensions are 30 m (98 feet) long by 15 m (50 feet) wide by 3 m (10 feet) deep and its capacity is about 1.4×10^6 L (3.7×10^5 gallons). The pond was constructed with earthen berms and an earthen bottom.

3.5.3.3.2 Wastes Received--The two-phase pond is used only during the two-phase loop experiments. It receives process wastewater approximately once a month with small amounts of hydrazine which is used as an oxygen scavenger. The original concentration added to the process water is 80 mL per 300 liters of water or 0.27 mL/L. The pond received 511,000 L of wastewater in 1981 and 197,000 L in 1984; no wastewater was generated from two-phase-flow testing in 1982 or 1983 and none has been generated thus far in 1985. Assuming that the hydrazine make-up concentration of 0.27ml/L is also true for the wastewater, the 708,000 L of wastewater would contain about 191 L of hydrazine. However, as the hydrazine scavenges oxygen from the test loop it is oxidized and the wastewater resulting is expected to have lower hydrazine concentrations. Limited analytical results have shown hydrazine concentrations in the wastewater to be as high as about 5 ppm. At this level, only about 3.5 L of hydrazine has been discharged to the pond. No other hazardous or radioactive constituents are expected to be present in the discharge to the two-phase pond.

3.5.3.3 WRRTF Radioactive Liquid Waste Disposal System.

3.5.3.4.1 Description--As described in Section 3.5.2.1, the reactor test cell areas in TAN-640 were provided "hot" waste floor drains in case any wash or other wastewater might contain radioactive contamination. These drainlines exit the building to the north and discharge to a 3,000-gallon underground tank identified as TAN-735 in Figure 3.5.1. Prior to the 1976/1977 timeframe, normal procedure called

for pumping the contents of the tank, if they were above the limits for discharge to the environment, into a tanker truck for transport to the TSF or ICPP radioactive liquid waste process systems; otherwise, the waste was pumped directly to a surface area just north (across Birch Creek St) of the tank. Since the 1976/1977 time frame all wastewater collected in the tank has been pumped and trucked to the TSF disposal pond independent of whether or not there is any radioactive contamination.

3.5.3.4.2 Wastes Received--This collection/disposal system was installed because of the possibility of radioactive contamination occurring in certain areas of the building; there was never a routinely contaminated liquid waste stream generated and there are no hazardous wastes suspected.

3.5.3.5 WRRTF Burn Pit.

3.5.3.5.1 Description.--The WRRTF burn pit area was utilized from 1958 to the 1966/67 time frame. It was located on the east side of a small dirt road (now blocked) that ran north and south between WRRTF and State Highway 33 as shown in Figure 3.5.2. The area consisted of three pits for garbage and burnable debris and in 1961 or 1962 a fourth, smaller, pit was dug for liquid petroleum product wastes. The dimensions of the three larger pits, (all side-by-side) were approximately 6 m (20 feet) wide by 61 m (200 feet) long, 12 m (40 feet) wide by 61 m (200 feet) long, and 15 m (50 feet) wide by 76 m (250 feet) long. The smaller "waste oil" pit was about 0.5 m (18 inches) deep and 9 m (30 feet) wide by 15 m (50 feet) long.

The large pits were operated essentially as a cut-and-fill landfill; as a pit began to fill with rubble, it was covered and another pit was opened. However, the waste was burned every time something was put in the pit. The entire area has now been filled-in and graded. The only evidence of the burn pit area is a surface scar and a mound of unused fill material.

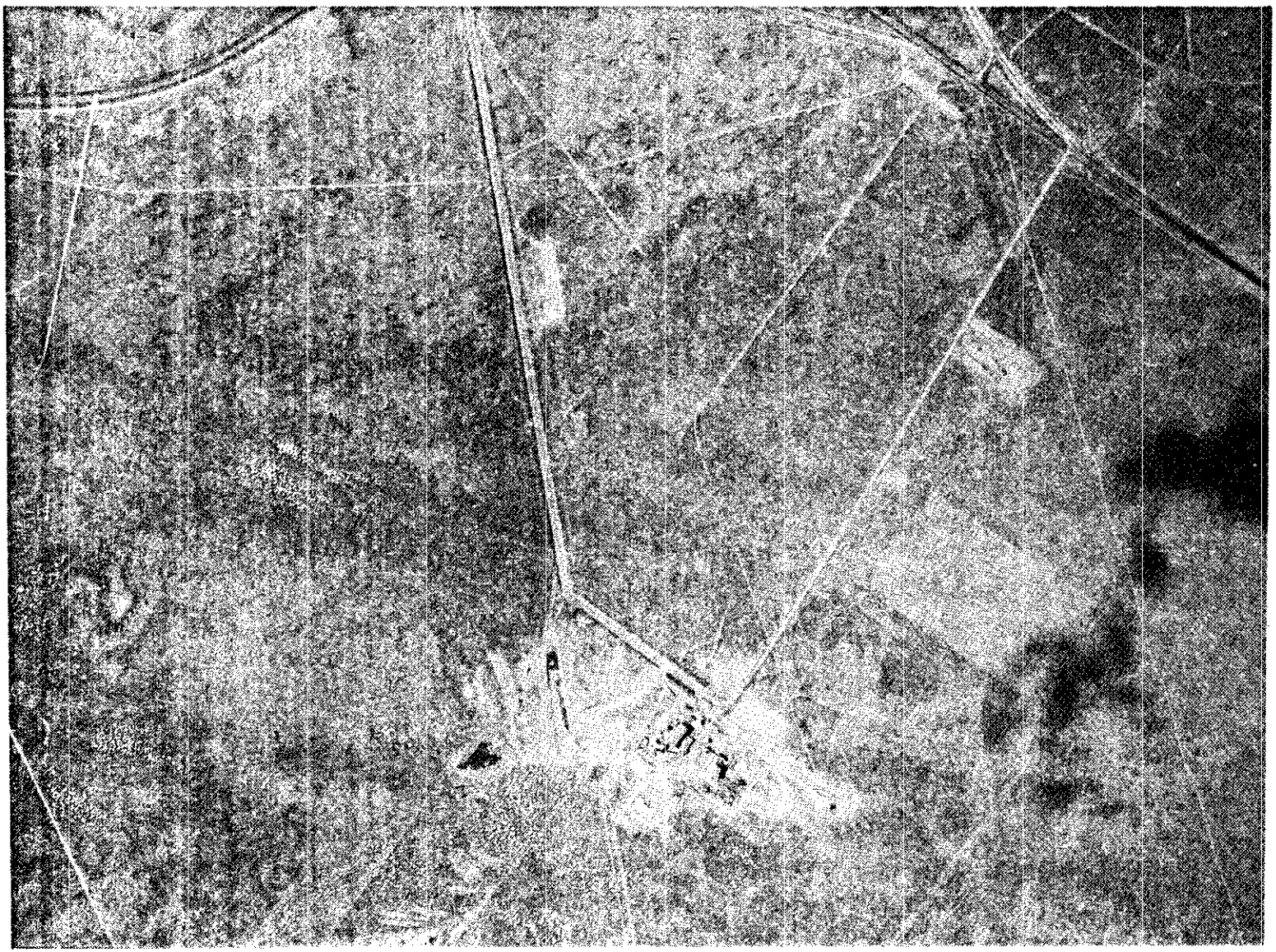

Figure 3.5.2. TAN/WRRTF Burn Pit (1958 to 1966/67) location.

3.5.3.5.2 Wastes Received--This burn pit took all garbage and burnable debris from the TAN area from 1958 to the 1966/67 time frame. From 1958 to about 1961 or 1962, the same pit that was receiving garbage also received waste petroleum products that were generated at TAN. After experiencing some incidents where drums were accidentally lost down the pit embankment while dumping, the shallow pit for liquids was excavated. As with the larger pits, the material was set afire each time it was dumped there.

No records were kept of the solids or liquids that received disposal at this site. It is suspected that the petroleum products burned at the pit(s) included such things as:

- Waste fuel oil from boiler operations
- Waste oil from equipment maintenance
- Zinc-bromide oil from the hot shop windows and the alcohol used to clean it out
- Waste Stoddard Solvent from parts cleaning

The quantities of solid and liquid waste that went to these pits are unknown. However, it is estimated that about 950 L (250 gallons) of waste oil and Stoddard Solvent has been generated each year from the Auto Mechanics Shop at TSF. It is also unknown how much of the solid or liquid waste remained after burning, but it is assumed that the burning has decreased the wastes' potential to cause migration problems.

The hazardous constituents that went to the WRRTF burn pits appear to be limited to those liquids described above. It is possible that small quantities of janitorial cleaning materials may have gone to the pits but there is no evidence that any significant streams of chemical wastes were involved.

3.6 ARA Past Activity Review

3.6.1 ARA Description

The Auxiliary Reactor Area (ARA)[a] is broken into four main areas where various activities have been performed from 1955 to present. The four areas are ARA-I, ARA-II, ARA-III, and ARA-IV.

The ARA is located in the south-central part of the INEL. Originally, access to the ARA was from U.S. Highway 20, and approximately one mile north on Fillmore Blvd. During 1984, this direct access road was closed and barracaded, so that present access is through the INEL South Guard Facility.

3.6.1.1 ARA-I Description. ARA-I is the furthest south of the four ARA areas. It has two main buildings, initially constructed about 1957 to support the Stationary Low Power Reactor No. 1 (SL-1) which was located at what is now called ARA-II. Figure 3.6.1 presents the plot plans for ARA-I.

Building ARA 626 is a hot cell building, presently used to support materials research. It also contains a small laboratory area for sample preparation and inspection; this laboratory is presently not used.

Building ARA 627 was a print shop from about 1955 to 1971. During 1971, this building was expanded and modified to serve as a research laboratory for materials development and testing. In 1980 the building was further modified to incorporate a radiochemistry laboratory. During 1984, this building became unoccupied, with the exception of the radiochemistry laboratory, which is still being used.

Other facilities located at ARA-I are ARA 629, a pump house which provides potable water and fire water, stored in Tank 727; the guard house, ARA 628; a fuel storage tank, Tank 728; and a hot-waste storage tank, Tank 729.

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a. This area was originally called the ARMY Reactor Area, which became the Auxiliary Reactor Area in 1965 when the ARMY's program was phased out.

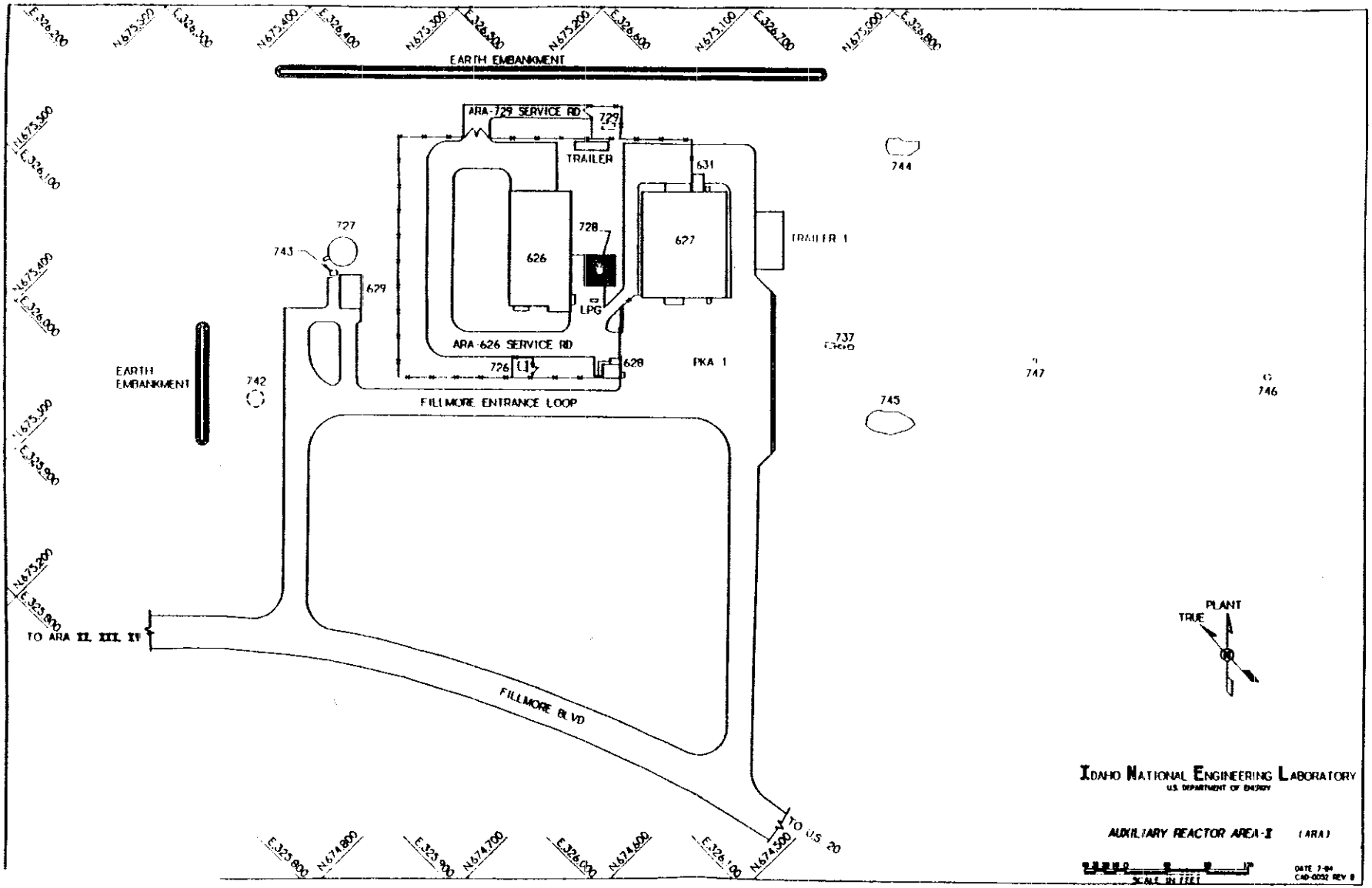


Figure 3.6.1. ARA-I plot plan.

3.6.1.2 ARA-II Description. ARA-II was originally the site of the Stationary Low Power Reactor No. 1 (SL-1) which was a prototype 300 kw (thermal) electrical power (200 kw) and heat source intended for use at remote military bases. The reactor was operated from August 1958 until December 23, 1960. During completion of maintenance operations on January 3, 1961, a nuclear excursion and explosion occurred. Cleanup operations were completed 18 months later during which time a fenced 4.6-acre burial ground was established about 1600 feet northeast of ARA-II; more than 3000 yd^3 of radioactive waste, including the reactor, were buried there. Blacktop was placed over the entire 350-ft by 375-ft ARA-II area within the perimeter fence to stabilize the area. Following the cleanup, the three main buildings were converted to offices and welding shops.

The buildings and structures that make up ARA-II are: The guardhouse, ARA 604; the administration building ARA 613; two 3900-ft^2 buildings, ARA 602 and 606; the power extrapolation building, ARA 615; the decontamination and layout building, ARA 614; and numerous utility buildings and components including the electrical power substation, 701; the wellhouse ARA 601; water storage tank, 702; chlorinator building, ARA 605; fuel oil tanks (an aboveground 1400-gal tank and an underground 1000-gal tank); underground waste storage and drainage components (a 1500-gal septic tank, 738; two 500 gallon septic tanks, and a 1000 gallon radioactive waste detention tank), telephone and light poles and lines, and a mobile home trailer that was brought in after the SL-1 accident. Figure 3.6.2 presents the plot plan for ARA-II.

3.6.1.3 ARA-III Description. ARA-III was originally built to house the ARMY Gas Cooled Reactor Experiment (GCRE) which was designed, fabricated, and tested at the INEL. Construction was completed in 1959 and test work was continued until April 1, 1961, when the plant was deactivated (1962). The major test equipment consisted of a gas circulation system (blowers, heaters, heat exchangers, and a water cooling loop) to release

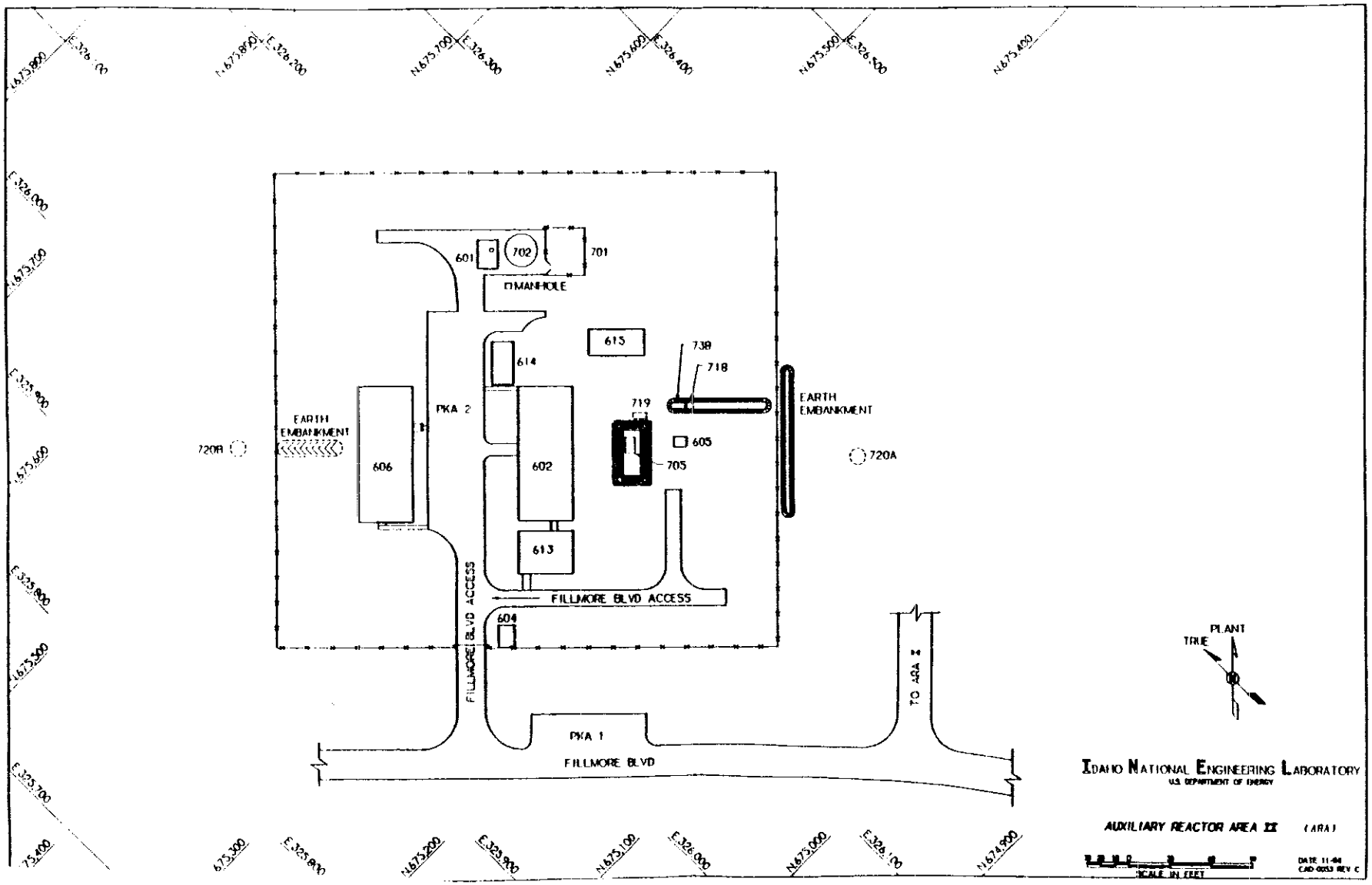


Figure 3.6.2. ARA-II plot plan.

reactor heat (2.2 MW) to the atmosphere through a cooling tower. The GCRE was a water-moderated, nitrogen-cooled, direct-and-closed-cycle reactor that generated heat, but no electricity.

During 1963, the reactor building and control room were modified for testing of the ML- reactor. In late 1965, the ARMY Reactor Program was phased out.

Originally, the buildings consisted of: ARA 608, the reactor building; ARA 607, the reactor control building: ARA 610 and 622, shop and storage buildings; ARA 612, nuclear materials storage bunker; and ARA 609, the guardhouse. In 1969, ARA 630 and ARA 621 were built to provide additional laboratory and office space. There is a small mobile trailer, T-1, which is used for electronic equipment storage.

In addition, the site has several storage tanks, as shown in Figure 3.6.3 (ARA-III plot plan); presently, only 709 (the water storage tank) and 710 (the fuel oil storage tank) are being used.

3.6.1.4 ARA-IV Description. The ARA-IV facility was designed to accommodate the Mobile Low Power Plant No. 1 reactor, a portable, gas-cooled, water moderated power reactor. This project was in operation from 1957 through May 29, 1964. From mid-1967 to June 1970 a small Nuclear Effects Reactor (FRAN) was operated on the site before its removal to Lawrence Livermore Laboratory. The area was closed down until 1975 at which time it was used temporarily for some welding qualification work. In 1984 and 1985 the facility underwent D&D. Presently, the facility (due to its remoteness) is being used to perform some explosive-initiated powdered-metal manufacture experiments. Only two buildings remain, ARA 617 and a part of ARA 616. There are three leach pits at ARA-IV. Leach Pit 1 was used for radioactive wastes, and Leach Pits 2 and 3 were used for sanitary wastes for ARA-616 and ARA-617, respectively. Figure 3.6.4 presents the ARA-IV plot plan.

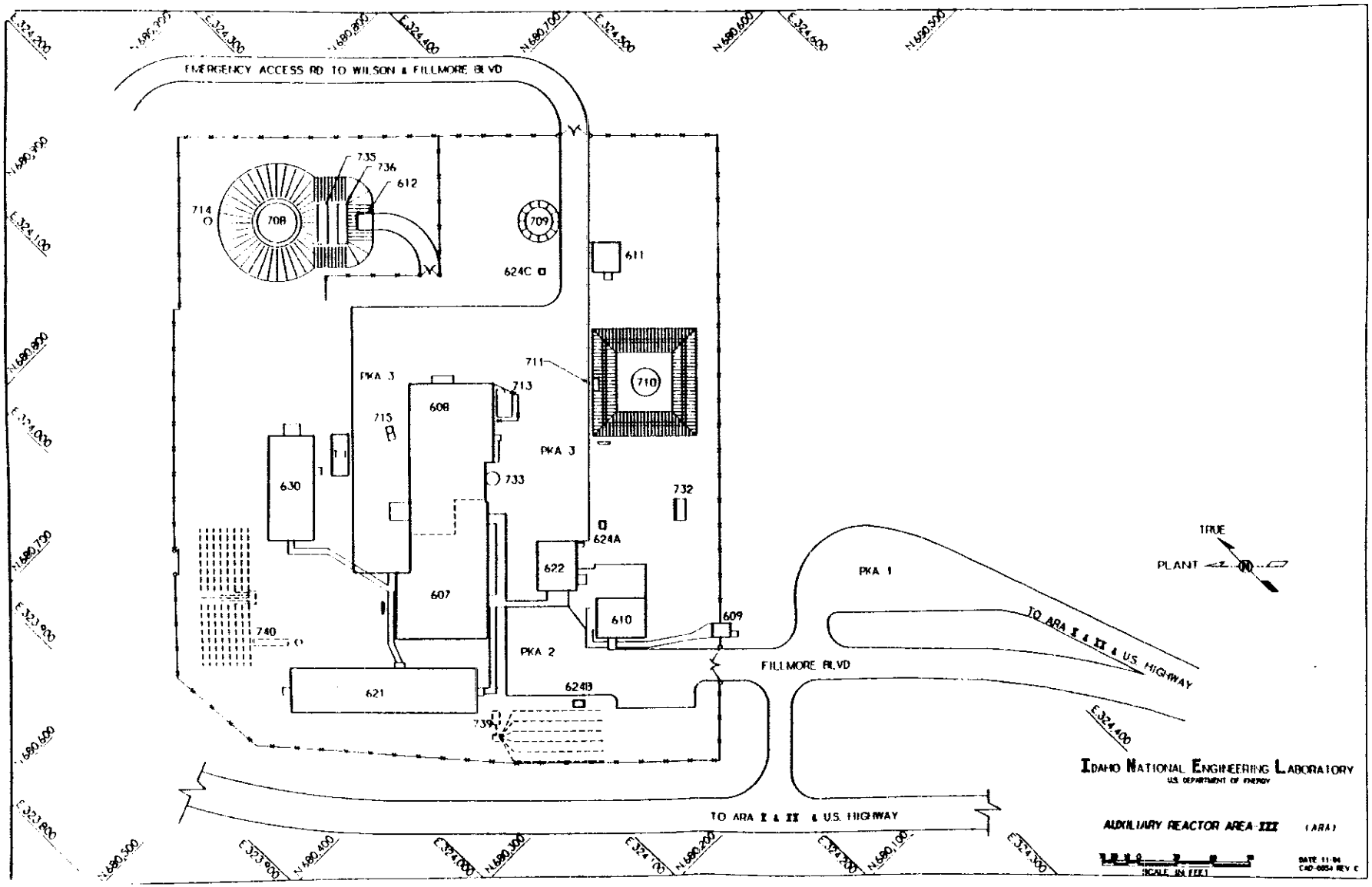


Figure 3.6.3. ARA-III plot plan.

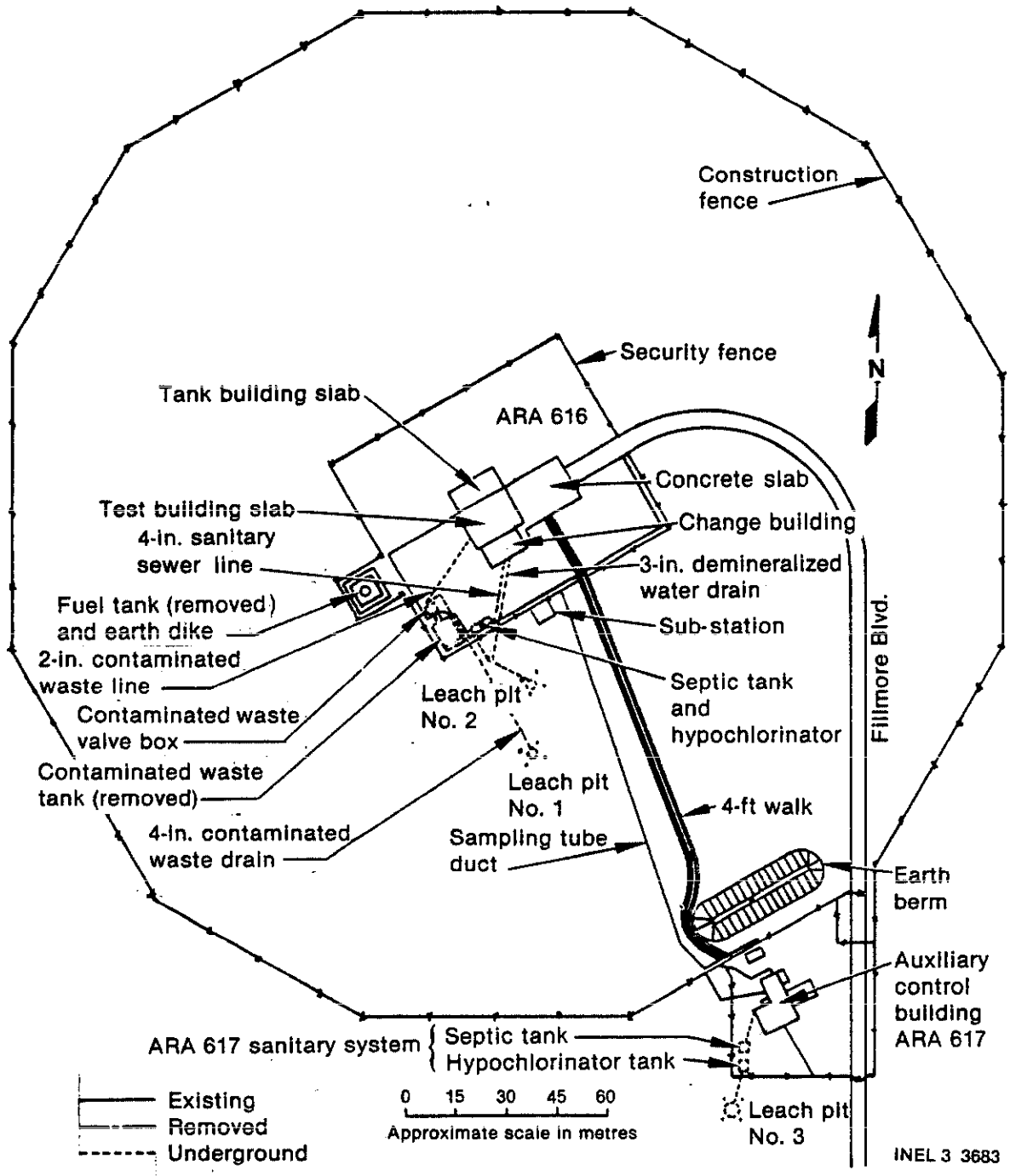


Figure 3.6.4. ARA-IV plot plan.

3.6.2 ARA Wastes Generated by Specific Activity

Through the investigation of reports on past activities, interviews with past and present personnel assigned to ARA, and through site tours, a list of hazardous waste constituents and approximate quantities has been drawn up for the ARA. This list is presented in Table 3.6.1. Those facilities which are not now, nor have in the past, generated any significant quantities of hazardous waste are omitted from this table. The facilities identified in Table 3.6.1 are discussed in the following paragraphs.

3.6.2.1 ARA-I. The hot cells, ARA 626 (ARA-I), have been in operation since 1957. They were originally used to support operations for the ARMY's Nuclear Reactor Program conducted at ARA. In 1965, all activities in support of the ARMY's program were curtailed at ARA, and activities in the hot cell were dedicated to other programs at the INEL. In 1970, the operation of the hot cell became dedicated to Fuels and Material research, but this had no significant impact on the quantity or type of work at the hot cell. The hazardous chemicals used at the hot cell were limited to small quantities of solvents and acids.

Typically, because of the personnel hazards associated with these chemicals in a hot cell environment, soap and water were the cleaning agents of choice. When organic solvents were used, either methanol or acetone was used because of their high vapor pressures. Occasionally, nitric acid was used in the hot cell laboratory. The effluents generated during these operations were passed through a hot sewer to a radioactive holding tank. Periodically, this tank was emptied and the contents shipped to ICPP for processing and disposal. Contaminated radiation worker clothing and rags, either contaminated or moistened with cleaning fluids, were originally sent to the RWMC. More recently, these articles, if not contaminated with TRU waste, have been sent to WERF prior to disposal at the RWMC.

TABLE 3.6.1. AUXILIARY REACTOR AREA FACILITIES WASTE GENERATION

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
ARA-626 (ARA I)	Hot Cells	Degreasing waste	1957-present		Idaho Chemical Processing Plant (ICPP)
		Mixed radioactive			
		Soap/water		100 l/yr	
		Acetone		5 l/yr	
		Methanol		5 l/yr	
		Chlorinated/parafine		5 l/yr	
		Metal etching wastes	1957-present		
		Mixed acids		~5 l/yr	ICPP
		Rags/Radiation clothing	1957-present	300 lb/yr	RWMC & WERF
ARA-627 (ARA I)	Print Shop	Rags/cleaning	1957-1970	300 lb/yr	Landfill
		Acetone/printing fluids		20 lb/yr	Landfill
	Materials Development & Testing	Metal etching fluids			
		Mixed radioctive (HNO_3)	1970-1984	20 l/yr	ICPP
		Non-radioactive (HNO_3)	1976-1984	20 l/yr	Chemical Leach Field
		Solvents			
		Acetone, Methanol	1970-1984	20 l/yr	Chemical Leach Field
	Radiochemistry Lab	Lightly contaminated solvents (~1 x 10^{-12} Ci/ml) Xylene, Heptane, 2-ethyl hexanol, Methanol	1980-present	12 l/yr (total)	Chemical Leach Field

TABLE 3.6.1. (continued)

Facility Location	Function	Waste Stream	Time Frame	Estimated Quantities	Treatment/Storage/Disposal
ARA 606 (ARA II)	Welding qualification	Rags/cleaning acetone/MeOH	1962-present	20 l/yr	Landfill
ARA 602 (ARA II)	Welding qualification	Rags/cleaning acetone/MeOH	1962-1984	20 l/yr	Landfill
ARA 621 (ARA III)	Chemical research	Mineral acids	1980-1983		Septic Tank
		HNO_3	1980-1983	5 l/yr	ARA-740
		H_2SO_4	1980-1983	5 l/yr	ARA-740
		HCl	1980-1983	5 l/yr	ARA-740
		Solvents	1980-1983		ARA-740
		di-methyl sulfoxide	1980-1983	.25 l/yr	ARA-740
		methanol	1980-1983	10 l/yr	ARA-740
		ethanol	1980-1983	1 l/yr	ARA-740
		2-propanol	1980-1983	1 l/yr	ARA-740
		acetone	1980-1983	1 l/yr	ARA-740
		methylene chloride	1980-1983	1 l/yr	ARA-740
		3-chloroethane	1980-1983	1 l/yr	ARA-740
		toluene	1980-1983	100 ml/y	ARA-740
		chlorobenzene	1980-1983	100 ml/y	ARA-740
		Metals (dissolved salts)			
		chromium	1980-1983	50 g/y	ARA-740
		boron	1980-1983	50 g/y	ARA-740
		strontium	1980-1983	50 g/y	ARA-740
		zirconium	1980-1983	50 g/y	ARA-740
ARA 630 (ARA III)	Geochemical Research	Mineral Acids	1980-1982		Septic Tank
		H_2SO_4	1980-1982	1 l/yr	ARA-740
		HNO_3	1980-1982	1 l/yr	ARA-740
		Potassium chromate	1980-1982	1 l/yr	ARA-740
		acetone	1980-1982	1 l/yr	ARA-740

Building 627 (ARA-I) was originally a print shop which generated small amounts (approximately 300 lb/yr) of rags which were occasionally wetted with acetone/printing fluids. These rags were disposed of in a land-fill.

During 1970, Building 627 was modified and expanded and subsequently used for materials research and testing. From 1970 to 1984, small amounts of organic solvents and mineral acids were used in operations in Building 627. Typically, but infrequently, when large amounts of acids or solvents were used on a specific project, they were retained and sent to TRA or ICPP for disposal. The small amounts of acids and solvents which were used on a more routine basis (metal etching, cleaning, etc.) were disposed of in the following manner. Acids which were radioactively contaminated (from metal etching operations) were put into the radioactive waste sewer and retained in the radioactive waste tank (the same tank used by Building 626). These wastes were subsequently treated and disposed of at ICPP when the tank was periodically emptied. Nonradioactively contaminated acids and solvents were disposed of in a chemical leach field located south of Building 627.

In 1980, minor modifications were again made to this building to provide space for a radiochemistry laboratory. This laboratory performs extractions to determine potential leaching of radionuclides from waste forms and other inorganic media. By the nature of the work performed, approximately 95 to 99% of the low-level radioactivity contained in the analytical samples is retained on filter paper, and periodically sent to the RWMC. The organic solvents used in the extraction process (xylene, heptane, 2-ethyl hexanol, and methanol) are sent to the chemical leach field.

In 1984, the materials research and testing operations were moved from Building 627, and presently the only work being performed in the building is in the radiochemistry laboratory.

3.6.2.2 ARA-II. ARA-II originally housed the Argonne Low Power Reactor (ALPR) PLant, which was later renamed as the Stationary Low Power Reactor No. 1 (SL-1). This reactor operated from March 1958 to December 1960. On January 3, 1961, near the completion of routine maintenance and minor modifications to this reactor, a nuclear excursion occurred. Cleanup operations began in April 1961 and were completed in November 1962. Following cleanup, the three main buildings (ARA 602, 606, and 613) were used as office and welding shop space.

Building 606 has housed the INEL welding qualification program since that time. Building 602 was used for welding research until 1984, when the research was moved into the Idaho Laboratory Facility (ILF). Presently Building 602 is used to warehouse some welding equipment. Building 613 was used to supply office space to the welding program and some PBF personnel; Building 613 was also vacated in 1984.

Due to the nature of the work performed (nonradioactive welding), very few hazardous materials were employed. The only materials used were small amounts of solvents, methanol, acetone, chlorinated hydrocarbons, etc., which were used for cleaning metal parts prior to welding. These solvents were used with rags and the rags were subsequently sent to a landfill. A conservative estimate of the quantity of solvents used is 20 L/yr (total of all solvents). There is no evidence of any significant spill of these solvents.

3.6.2.3 ARA-III. The ARA-III facility was initially constructed (1958-1959) for development and experimental testing of the ARMY Gas-Cooled Reactor (AGCR). The reactor was subsequently operated from February 1960 through April 1961. During normal operation of this reactor, a small amount of low-level radioactive material was released into a portion of the closed loop water cooling system. This small amount of contamination was diluted by significant amounts of cooling water. This water was collected in ARA-708, a 75,000-gallon low-level wastewater storage tank, sampled, and then drained into a leach field located across Fillmore Blvd., due west of

ARA-III. Analysis of the leach field indicates an above-anticipated chromium content in the soil, which was probably due to drainage of water from a cooling tower (removed in 1966); dichromate solutions were typically used to prevent algal growth in cooling tower waters. This pond will be discussed in Section 3.6.3.

In 1962, the AGCR project was terminated. In 1963, the reactor was modified for testing of the ML- reactor. This reactor was intermittently operated from April 1964 to September 1965. During this period, several leaks were encountered, which resulted in radioactive silver (108) being released into the leach field. In late 1965, the ARMY Reactor Program was phased out. Since that time, no radioactive research has been performed at ARA-III.

Since 1966, the ARA-III facility has been used primarily as a component and instrumentation laboratory for testing and evaluation of items to be used later in nuclear reactor experiments. No known chemically hazardous or radioactively contaminated materials were used in these experiments.

In 1969, two new buildings, ARA-621 and ARA-630, were built to provide additional office and laboratory space. The laboratory, ARA-630, was used primarily for instrumentation development, fabrication, and testing. There is no evidence of hazardous materials being used for this work.

During the period from 1980 through 1983, some chemical research was performed in ARA-621, and some geochemical research performed in ARA-630. Table 3.6.1. lists the hazardous materials used or generated at ARA-III, the disposition of these materials, and the approximate quantities of these materials.

During 1984, essentially all the previous activities were moved from ARA-III. There is one experiment (instrumentation) still being performed at ARA-III. For a period from 1984 through early 1985, ARA-610 was used

to evaluate some components from Three Mile Island (TMI). There is no evidence that any contaminated materials from these evaluations escaped from ARA-610 or were disposed of at ARA-III.

3.6.2.4 ARA-IV. The ARA-IV facility originally was used to test the Mobile Low Power Plant No. 1 (ML-) reactor. This was a portable gas-cooled, water-moderated power reactor. The reactor operated from March 1961 to late 1963. During late 1963 and early 1964, the ML- was moved to ARA-III for continuation of the testing program.

In mid-1967, a new program was started at ARA-IV to test a small, pulsed reactor capable of providing bursts of high intensity fast neutrons and gamma radiation. This reactor was operated from August 1968 to June 1970. At that time, ARA-IV was closed down. All utilities were terminated, and tanks, machinery, and electrical equipment were either abandoned or moved to other facilities.

In 1984 and 1985, decontamination and decommissioning (D&D) activities were performed at ARA-IV. Presently, ARA-IV is being used to perform explosive sintered metal forming tests. There are no effluents from these tests. The D&D activities have been completed with the exception of clean-up of Leach Pit No. 1. This leach pit is a 9-ft. diameter, concrete-lined pit with a 20-in. gravel bed for drainage. Soil samples have been collected from the bottom of this leach pit and analyzed for radioactive constituents.

3.6.2.5 ARA Fuels/Petroleum Management. Fuel storage at ARA-I is limited to No. 2 Fuel Oil which is used to heat Bldgs. 626 and 627. This fuel oil is stored in Tank 728, located between the two buildings. There is no evidence of a significant spill from this tank.

Fuel storage at ARA-II is limited to No. 2 Fuel Oil which is used to heat buildings within the area. Building 606 is supplied oil from a buried 1000-gal tank located just northwest of the building. Buildings 602 and 613 are supplied fuel oil from Tank 705, a 1400-gal aboveground tank

located southeast of Bldg. 692. There is also a buried 1000-gal detention tank located just off the northeast edge of the berm surrounding Tank 705. This tank contains radioactively contaminated fuel oil which was intentionally drained into the tank during the SL-1 cleanup operation.

Fuel storage at ARA-III is provided by a 42,000-gal tank which stores No. 2 Fuel Oil. This tank provides fuel for the buildings within the ARA-III area, and also serves as bulk storage for the other ARA areas. There is no evidence of any significant spill from this tank.

ARA-IV's fuel storage tank was removed when the facility was shut down in 1966.

4.6.2.6 Spills within the ARA. Review of Unusual Occurrence Reports, personnel interviews, Health Physics records, and site observations provided information on the spills identified in this section.

On January 3, 1961, a nuclear excursion and explosion occurred at SL-1, ARA-II. Cleanup operations took approximately 18 months. During these operations, a burial ground was established about 1600 feet northeast of ARA-II. This burial site is fenced and encompasses about 4.6 acres. More than 3000 yd^3 of highly contaminated materials, including the SL-1 reactor vessel, are buried in this site. No significant quantities of hazardous wastes are suspected of being present.

There is no evidence to indicate any hazardous chemical spills occurring at the ARA areas.

3.6.3 ARA Waste Disposal Sites

Areas or sites within the ARA at which hazardous wastes may have been deposited at some time are discussed in the following paragraphs.

3.6.3.1 Chemical Waste Pond (ARA-745). The chemical waste pond for ARA-627, ARA-I, is designated ARA-745. This pond was installed in 1971 when ARA-627 was expanded. Table 3.6.1 identifies the waste streams introduced into this pond. During the period from September 1981 to May 1984, the flow into this pond was routinely sampled and analyzed for trace metals and radioactivity. Unfortunately, the samples were collected from liquid entering the pond and not from the pond itself. Therefore, unless a sample coincidentally was taken while a chemical was being introduced into the pond, the type and level of contamination would go undetected. The water analyses indicate no unusual chemical species when compared with the water analysis of the well water entering the building, with the exception of chlorine, which would be anticipated. Due to the sampling procedures used for this pond, it is doubtful that the available analytical data accurately represents the pond's condition.

3.6.3.2 Sanitary Waste Leach Field (ARA-I). The sanitary leach field for ARA-I is located east of ARA-627; the area maps do not designate a number for this leach field. Although there are no recorded spills or incidents which would have contaminated this leach field, Health Physics surveys have indicated that it is radioactively contaminated. It is possible that this contamination is a remnant of the SL-1 cleanup operations.

3.6.3.3 ARA-III Pond. The ARA-III Pond was built to receive low-level radioactively contaminated water generated during operation of the GCRE and ML- reactors. Although this pond has not been used for waste materials since the conclusion of the ML- program (1965), a small amount of water still flows into this pond. Attempts to turn off this flow have been unsuccessful without turning off all water to ARA-III.

Soil samples have been collected from the pond; soil samples were limited to the edge of the pond and were not collected from the drainage portion of the pond, which was under water at the time of sampling. Soil samples were analyzed for radionuclides and trace metals. Table 3.6.3 presents a composite of these samples.

TABLE 3.6.3. ANALYSIS OF ARA-III POND SOIL

Species	Concentration mg/kg	Activity pCi/g
Antimony	<10.0	--
Arsenic	2.4	--
Beryllium	1.0	--
Cadmium	0.6	--
Chromium	7.0	--
Copper	19.0	--
Lead	3.4	--
Mercury	<0.005	--
Nickel	14.0	--
Selenium	<0.2	--
Silver	<2.0	
Silver (108)		1.9 - 6.8
Thallium	<2.0	--
Zinc	76.0	--
Boron	<30.0	--
Chloride	<20.0	--
Cyanide	<0.2	--
Nitrogen (Nitrate)	5.0	--
Sulfate	<50.0	--
Phenol	<0.5	--
Cobalt (60)	--	3.1 - 36.9
Cesium (137)	--	0.84 - 4.1

Inspection of these data indicates that the only chemical species which is higher than might be anticipated is chromium. This is probably from the dichromate solutions used to inhibit algal growth in the cooling tower used for GCRE and ML-. The low-level radioactive contamination is also from the GCRE and ML- reactor; the radioactive silver, which was used in the moderators and in various seals for these reactors, was the results of gas leaks in the reactors.

3.6.3.4 SL-1 Burial Ground. This burial ground is discussed in Section 4.6.2.6.

3.6.3.5 Evidence of Migration. There are insufficient numbers of aquifer sampling wells located at the ARA areas to determine whether there has been any significant migration of contamination to the aquifer as a result of operations at ARA. Due to the limited use of the ponds at ARA, and the semi-arid environment, it can be assumed that a significant migration has not occurred.

3.7 PBF Area Past Activity Review

3.7.1 PBF Area Description

The Power Burst Facility (PBF) area is located in the south central portion of the INEL, about six miles northeast of CFA, in an area originally constructed for the Special Power Excursion Reactor Tests (SPERT). The four SPERT reactors were built beginning in the late 1950's as part of an early investigation involving reactor transient behavior tests and safety studies on water-moderated, enriched-fuel reactor systems. All of the reactors have been removed and most of the SPERT facilities have since undergone partial or complete decontamination and decommissioning (D&D).

The last of the SPERT reactors was placed on standby status in 1970 and the PBF began operation just to the north of the SPERT-I reactor around 1972. The PBF was built to support the Thermal Fuel Behavior Program's testing on pressurized-water reactor fuel rods under normal and off-normal operating conditions and hypothetical reactor accidents. The PBF testing program was completed in 1985. The SPERT-III facility now houses the Waste Experimental Reduction Facility (WERF), and the SPERT-IV facility is being modified to become a storage facility for radioactive mixed waste.

As shown in Figure 3.7.1, the PBF area consists of five sites: PBF Control Area, PBF Reactor Area (includes SPERT-I), SPERT-II, SPERT-III, and SPERT-IV. The four reactor areas are arranged in a semicircle around the PBF Control Area with a radius and nominal distance between reactors of one-half of a mile. More detailed descriptions of each of the five sites within the overall PBF area are provided below, along with current facility maps.

3.7.1.1 PBF Control Area Description. A plot plan of the current PBF Control Area is shown in Figure 3.7.2. Though it has been greatly expanded for the PBF program, its main functions have not changed since serving as the SPERT control center. The facility provided for remote operation of

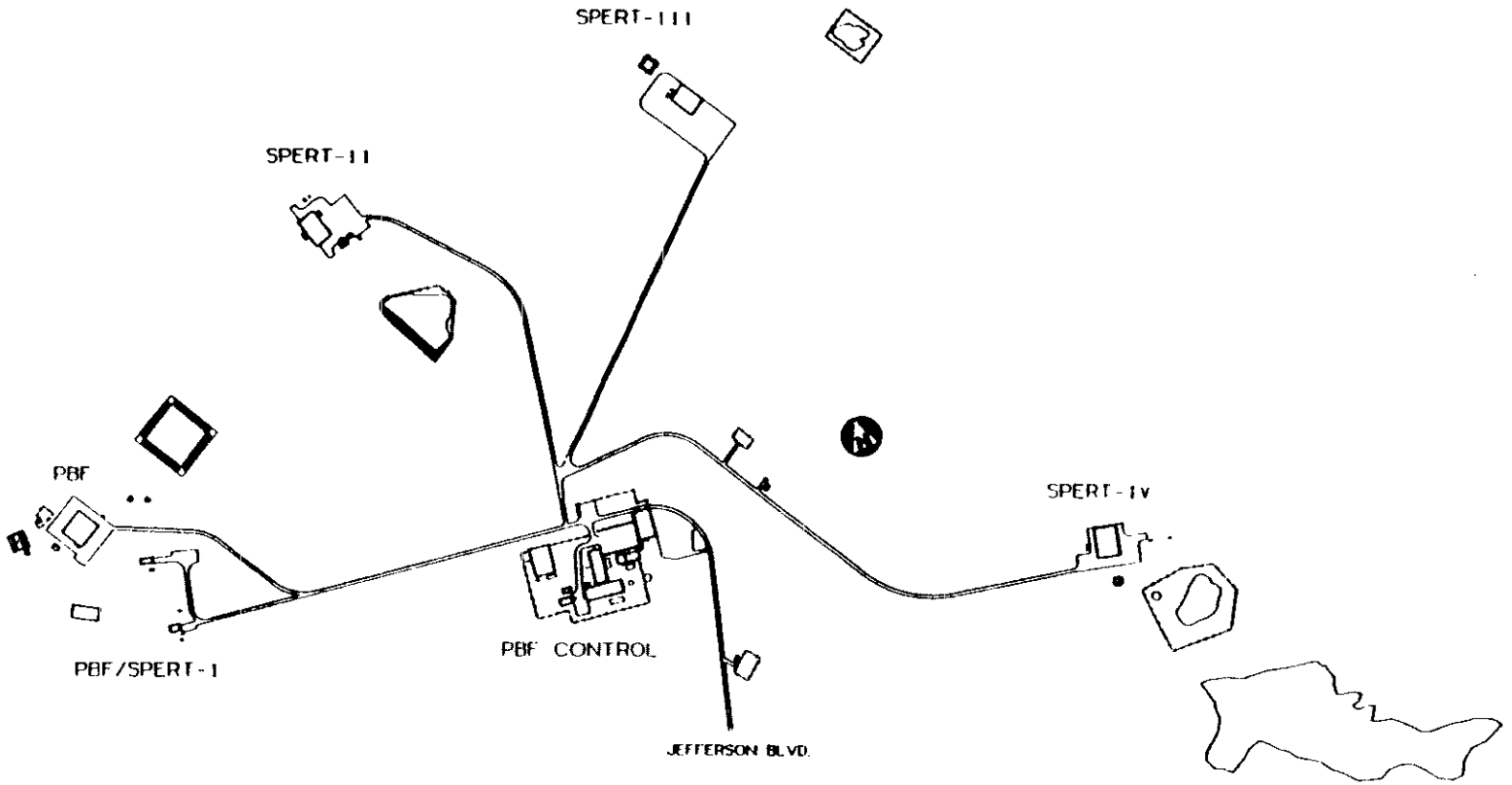


Figure 3.7.1. PBF overall area.

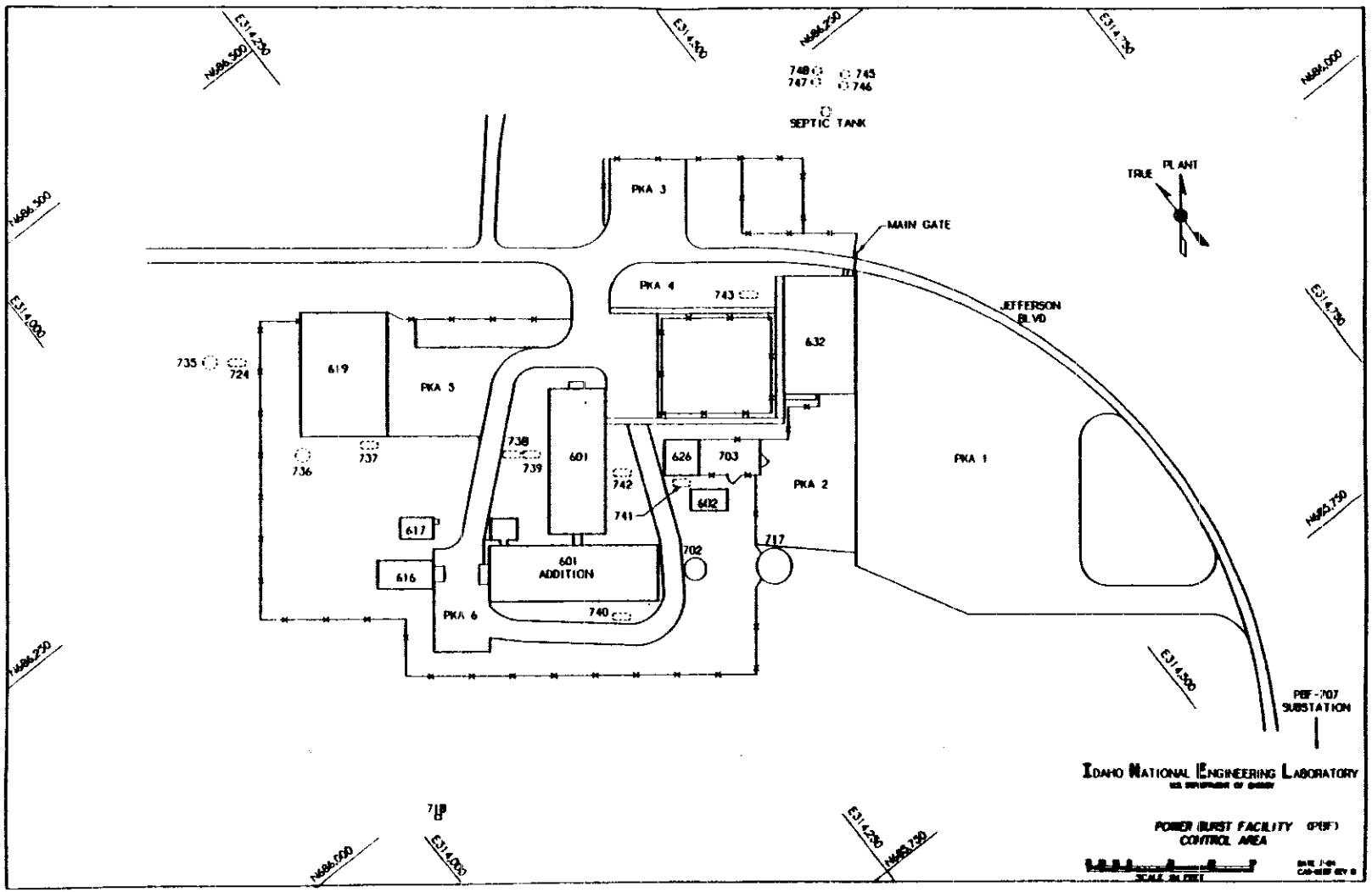


Figure 3.7.2. PBF control area.

all reactors, raw water storage and distribution, administrative offices, instrument and mechanical work areas, and data acquisition. Due to the nature of these functional duties, no hazardous and/or radioactive wastes have been generated here.

3.7.1.2 PBF Reactor Area Description. The PBF Reactor Area, shown in Figure 3.7.3, includes the reactor areas for both the SPERT-I and the PBF facilities. The structures utilized for SPERT-I are located in the lower right corner of the plot plan and include the reactor pit building (PBF-605), the instrument bunker (PBF-606), the terminal building (PBF-604), and a seepage pit (PBF-750). Another seepage pit, not shown in Figure 3.7.3, was located about 40 ft north of PBF-605 and was D&D'd by EG&G in September 1984.

The SPERT-I reactor was an open, pool-type reactor located below grade in a steel-lined pit in PBF-605, which had no provisions for heat removal or coolant circulation through the core. During the period 1955 to 1964, as many as five tests per day were run to measure the extent and effect of reactor excursions to high power over short periods. The early tests were conducted in a 3,600 L (950 gal) capacity reactor vessel that was placed inside the pit tank. However, beginning in 1962, a series of destructive tests were conducted on various cores using the pit tank as the reactor vessel, which had a capacity of 36,000 L (9,400 gal).

The PBF reactor, housed in PBF-620, achieved criticality in 1972 and was used to study the behavior of fuel rods under a variety of conditions until February 1985. Major components of the PBF reactor system include a 120,000 L (32,000 gal) open tank reactor, an 83,000 L (22,000 gal) canal for temporary storage of reactor fuel and test fuel assemblies, a central flux region containing a cylindrical in-pile tube in which the test fuel is isolated, and various coolant systems. In addition to PBF-620, the other structures in Figure 3.7.3 that are pertinent to this report are the cooling towers (PBF-720), the auxiliary building (PBF-624) where the

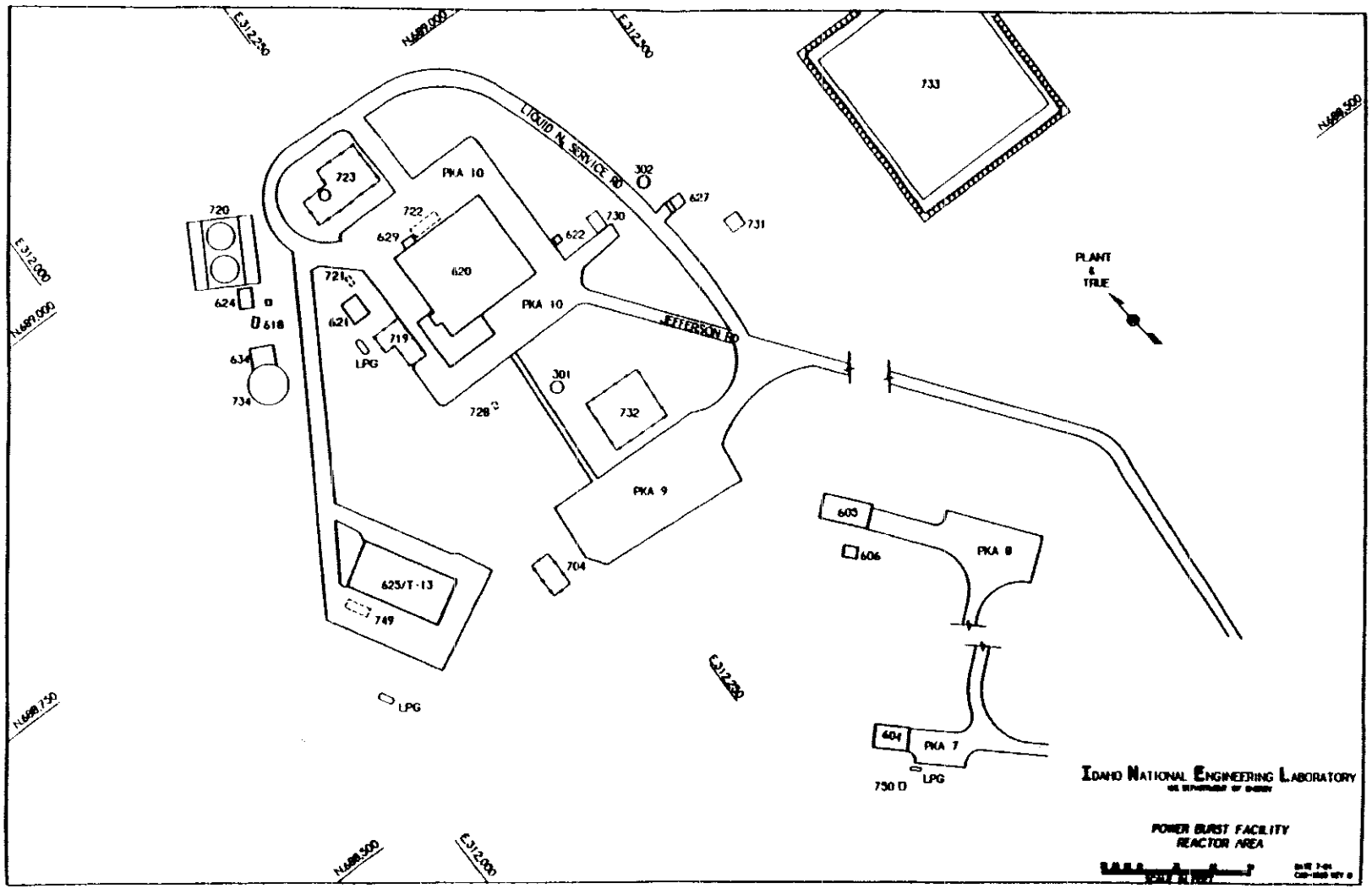


Figure 3.7.3. PBF reactor area.

secondary cooling water is chemically treated, the hot waste storage tank (PBF-732), the warm waste injection well (PBF-301), the corrosive waste injection well (PBF-302), the corrosive waste disposal sump (PBF-731), and the corrosive waste evaporation pond (PBF-733).

3.7.1.3 SPERT-II Area Description. The present-day SPERT-II facility, shown in Figure 3.7.4, has not changed much since the period from 1960 to 1964, when the SPERT-II pressurized-water reactor was operational. The original facility did, however, include a 45,000 L (12,000 gal) demineralized water storage tank just to the east of the reactor building (PBF-612) that has since been removed. Also, a 190,000 L (50,000 gal) hot waste storage tank (PBF-751) was installed, ca. 1982, to supplement PBF's hot waste storage capability.

The SPERT-II reactor was designed to operate with either light or heavy water as moderator and coolant, and was utilized to determine the transient characteristics of heavy water-moderated reactors, the parameters that affected these characteristics, and the differences between light and heavy water-moderated reactors. Power operation was not an objective in the design of the facility since the tests were conducted from low initial reactor powers and involved relatively small total energy releases. As a result, no provision was made for heat removal other than an outdoor, forced-air heat exchanger for cooling the heavy water coolant after shutdown. Due to its expense, an extensive heavy water cleanup and recovery system was housed in PBF-612 so that the heavy water could be saved and reused.

3.7.1.4 SPERT-III Area Description. A current plot plan of SPERT-III is provided in Figure 3.7.5, which shows the modifications that have been incorporated to accommodate the WERF project. these modifications include expansion of the SPERT-III reactor building (PBF-609) and addition of the sizing and decontamination building (PBF-635). The original SPERT-III facility also used to include the following structures that are not shown in Figure 3.7.5: an underground, 30,000 L (8,000 gal) hot waste storage

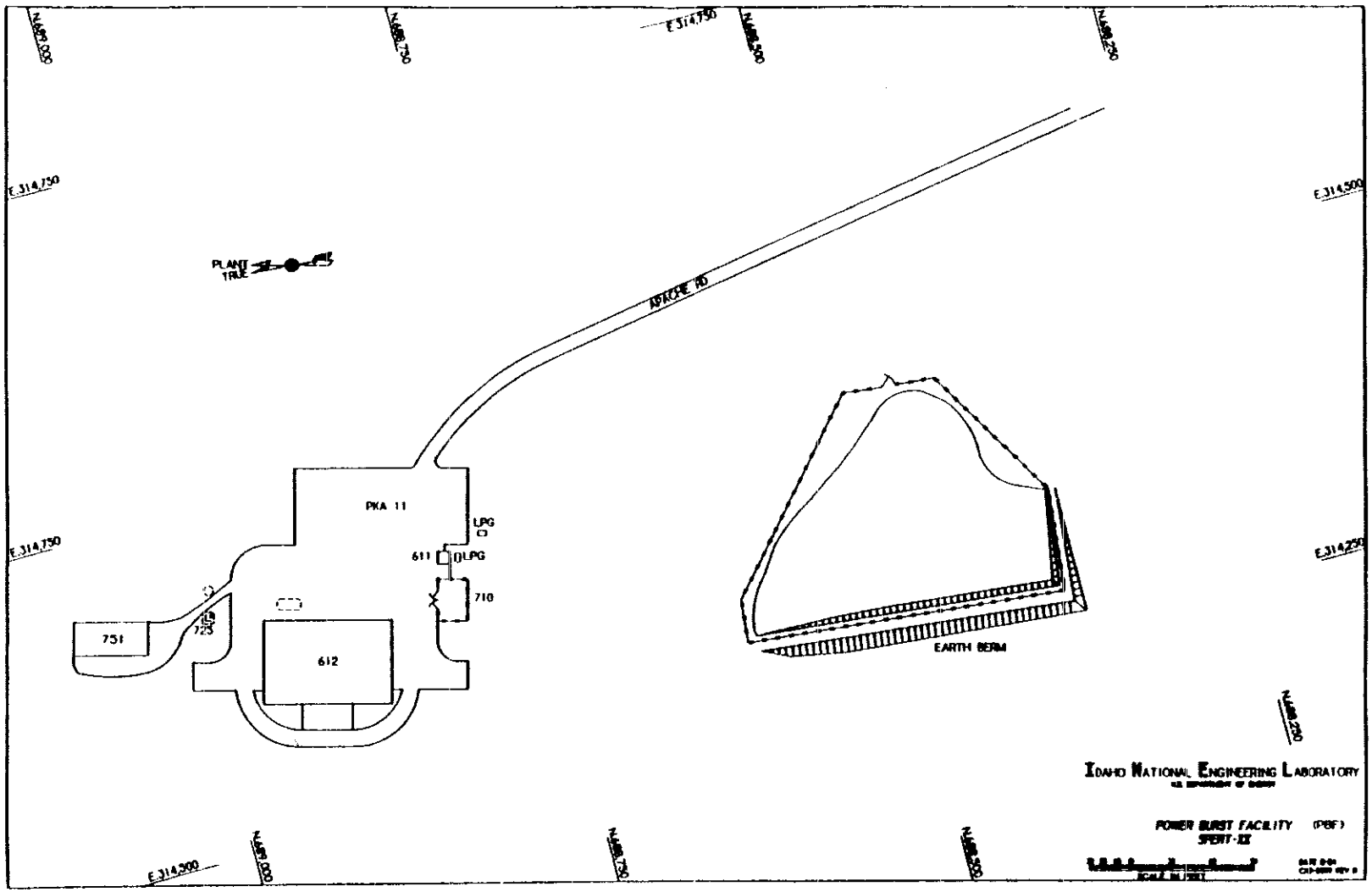


Figure 3.7.4. SPERT-II area.

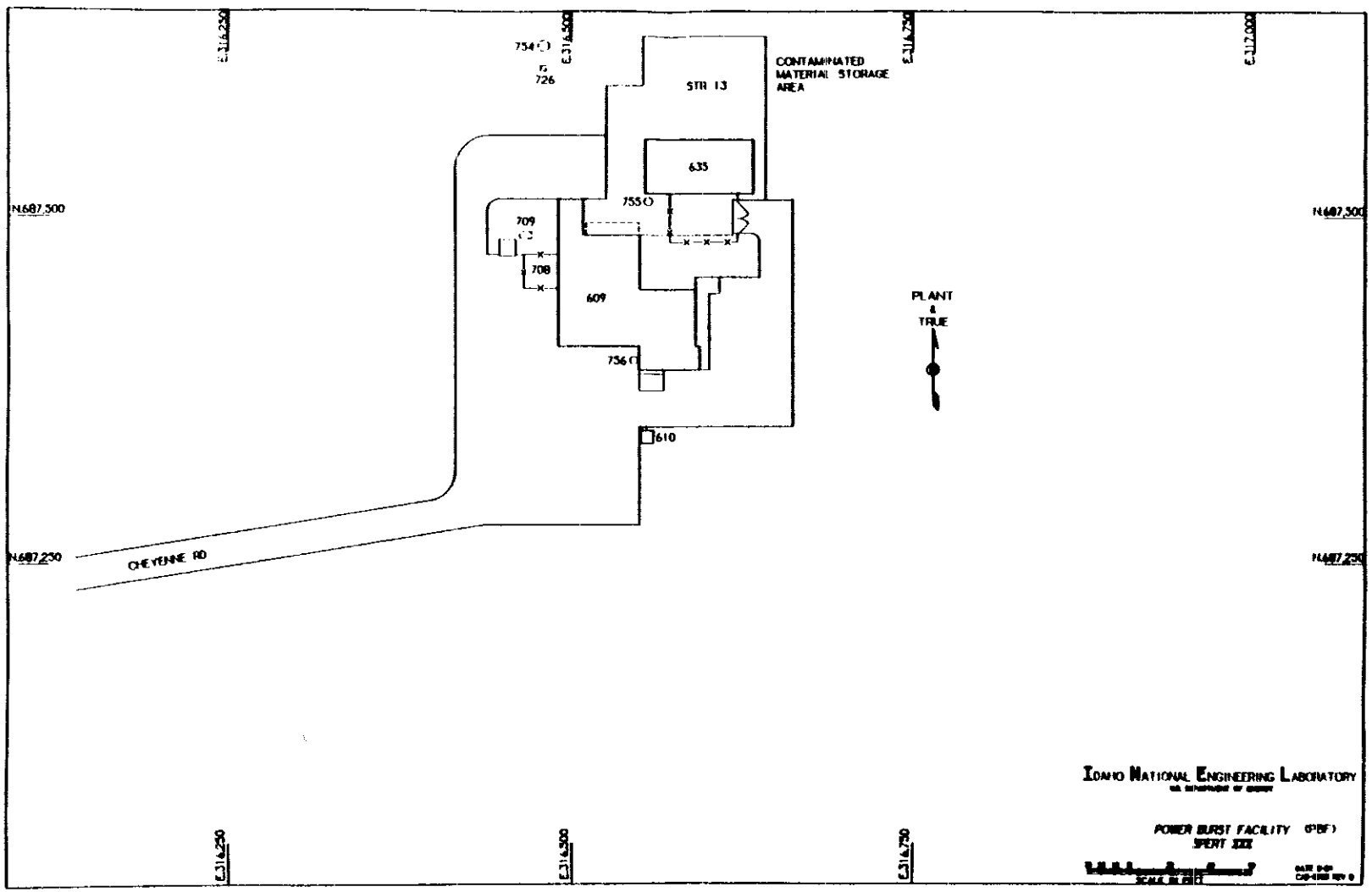


Figure 3.7.5. SPERT-III area.

tank just to the west of PBF-609, a 45,000 L (12,000 gal) demineralized water storage tank north of PBF-609, a small leach pond just to the east of the septic tank (PBF-726), and a larger leach pond 122 m (400 ft) southeast of PBF-609. The former locations of the ponds can be seen in Figure 4.7.1.

The SPERT-III pressurized-water reactor operated from 1958 to 1968 and was used to determine the effect of water flow, pressure, and temperature on transient reactor characteristics. Most of the tests were conducted from low initial reactor powers and involved small total energy releases. However, power operation for a limited time (about 30 min) was also provided for by circulating the primary coolant through heat exchangers, where the heat was rejected to the secondary coolant.

Following D&D of the reactor building in 1980, construction was started on the WERF project. WERF began operation in 1982 and is involved in the volume reduction of low-level radioactive wastes. This is accomplished by using a controlled-air incinerator and a 680-kg (1500-lb) capacity melter located in PBF-609, and the metal-sizing and decontamination facilities housed in PBF-635.

3.7.1.5 SPERT-IV Area Description. The SPERT-IV area, shown in Figure 3.7.6, is essentially the same as it was during the period from 1961 to 1970, when the reactor was operational. The major structures within the area are the reactor building (PBF-613), the 231,000 L (61,000 gal) capacity hot waste holdup tank (PBF-714), and the leach pond (PBF-758). In addition, the larger leach pond, called the "SPERT-IV Lake," was located south of PBF-758 and had a capacity of about 23 million L, or 6 million gal (see Figure 3.7.1), and was used to dispose of nonradioactive, untreated cooling water.

The SPERT-IV reactor building housed two 190,000 L (50,000 gal) reactor pool tanks; one for nuclear testing and one for hot fuel storage. Studies conducted here included the effect of power excursions and instability tests at conditions typically found in large, open-pool type

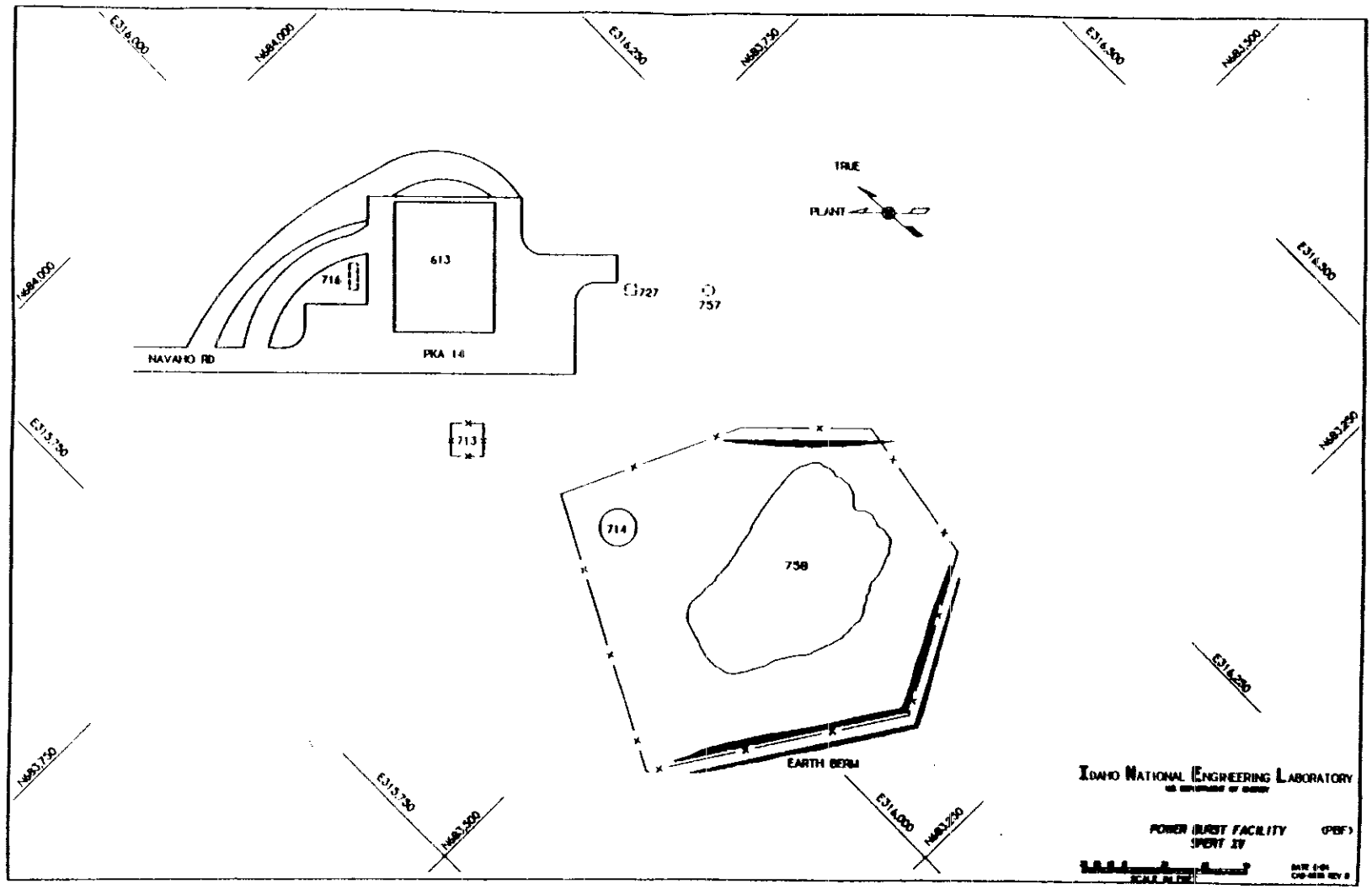


Figure 3.7.6. SPERT-IV area.

reactors. Power operation for a limited time was provided for by circulating the demineralized primary coolant water through a heat exchanger, where the heat generated in the reactor core could be rejected to the waste secondary coolant water.

3.7.2 PBF Area Wastes Generated by Activity

The wastes generated from past activities conducted at the individual sites within the overall PBF area are discussed in this section. Since no hazardous materials were used and no hazardous wastes were produced at the PBF Control Area, it is not addressed further. A summary of the findings obtained from past reports, interviews, and site visits is given in Table 3.7.1. This table provides the pertinent information, where known, on the composition, quantity, period of generation, and disposal method for the potentially hazardous wastes generated at the PBF area.

Also included in this section are the management of fuels/petroleum and the spills of significance that have occurred since 1976 within the overall PBF area.

3.7.2.1 PBF Reactor Area.

3.7.2.1.1 SPERT-I--The terminal building, PBF-604, housed the service facilities for SPERT-I including a zeolite softener and a mixed-bed demineralizer. This water treatment system produced the only significant quantities of chemical wastes at SPERT-I during regeneration of the ion exchange resins. Regeneration of the the demineralizer was necessary after treating 25,000 L (6,700 gal) of water and required about 15 kg of sulfuric acid and 25 kg of sodium hydroxide. The corrosive solutions produced during regeneration were discharged without neutralization to the seepage pit (PBF-750) south of PBF-604. Due to the lack of information on the frequency of regenerating the demineralizer, a rough estimate of ten times per year was assumed after conferring with former operators.

3.7.1. PBF AREA WASTE GENERATION

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
PBF-604 (SPERT-I)	Demineralization Plant	Sulfuric acid (ion exchange regenerant)	1955-1964	150 kg/yr	SPERT-I corrosive waste seepage pit
		Sodium hydroxide (ion exchange regenerant)	1955-1964	250 kg/yr	SPERT-I corrosive waste seepage pit
PBF-605 (SPERT-I)	Reactor Building cleanup	Rags with trichloroethane, trichloroethylene, ethanol, carbon tetrachloride	1955-1964	Small	RWMC
PBF-620 (PBF)	Demineralization Plant	Sulfuric acid (ion exchange regenerant)	1972-1978	1,300 kg/yr	PBF corrosive waste injection well (PBF-302)
			1979-1984	1,200 kg/yr	PBF evaporation pond (PBF-733)
			1984-present	--	Neutralized prior to release
		Sodium hydroxide (ion exchange regenerant)	1972-1978	1,500 kg/yr	PBF corrosive waste injection well (PBF-302)
			1979-1984	1,300 kg/yr	PBF evaporation pond (PBF-733)
			1984-present	--	Neutralized prior to release
	Cleanup of water in reactor vessel, canal, and loop	Spent ion exchange, resins--no regeneration	1972-present		RWMC
	Decontamination of sampling system	TURCO 4502 (caustic plus potassium permanganate)	1984-present	8 kg/yr	ICPP
		TURCO 4521 (oxalic acid)	1984-present	4 kg/yr	ICPP
	Equipment maintenance	Waste hydraulic oil	1972-present	750 L/yr	CFA

TABLE 3.7.1. (continued)

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities (if known)	Treatment/Storage/Disposal
PBF-624 (PBF)	Pretreatment of secondary coolant	Trivalent chromium	1972-1978	17 kg/yr	PBF corrosive waste injection well (PBF-302)
		Trivalent chromium	1979-1984	15 kg/yr	PBF evaporation pond (PBF-733)
PBF-612 (SPERT-II)	Demineralization Plant	Sulfuric acid (ion exchange regenerant)	1960-1964	40 kg/yr	SPERT-II leaching pond
		Sodium hydroxide (ion exchange regenerant)	1960-1964	70 kg/yr	SPERT-II leaching pond
PBF-609 (SPERT-III)	Demineralization Plant	Sulfuric acid (ion exchange regenerant)	1958-1968	400 kg/yr	SPERT-III small leaching pond
		Sodium hydroxide (ion exchange regenerant)	1958-1968	700 kg/yr	SPERT-III small leaching pond
PBF-609 (WERF)	WERF off-gas treatment	Flyash containing Cd, Cr, Pb	1984-present	6 55-gal drums	Stored outside of PBF-635
PBF-613 (SPERT-IV)	Demineralization Plant	Sulfuric acid (ion exchange regenerant)	1961-1970	800 kg/yr	SPERT-IV leaching pond (PBF-758)
		Sodium hydroxide (ion exchange regenerant)	1961-1970	1,000 kg/yr	SPERT-IV leaching pond (PBF-758)

Cleanup operations were occasionally required in the reactor building (PBF-605) that involved organic solvents such as trichloroethane, trichloroethylene, and smaller amounts of ethanol and carbon tetrachloride. However, according to former operators, these materials were not released to the warm waste seepage pit, but applied by hand with rags which were sent to the RWMC for burial.

3.7.2.1.2 PBF--The demineralization plant in PBF-620 consists of two mixed-bed demineralizers that were regenerated after treating about 57,000 L (15,000 gal) each. Regeneration involved successive flushes with sulfuric acid, sodium hydroxide, and about 3,000 gal of rinse water. These corrosive solutions were drained to a common 12,000 gal sump (PBF-731) where they were neutralized by mixing. From 1972 to 1978, wastes containing an average of 1,500 kg/yr of sodium hydroxide and 1,300 kg/yr of sulfuric acid were pumped from the sump and discharged into the corrosive waste injection well (PBF-302). Since 1979, these wastes have been sent to the corrosive waste evaporation pond (PBF-733) and have contained an average of 1,300 kg/yr of sodium hydroxide and 1,200 kg/yr of sulfuric acid. The pH of the sump effluent has been monitored prior to release since late 1984 and has usually been between 6.5 and 7.0. Prior to that the pH was not checked. However, since the method of disposal has not been changed, it is likely that previous releases were also nonhazardous.

Other wastes generated in PBF-620 include disposable ion-exchange resins that are used to maintain water purity in the reactor vessel, canal, and experimental loop. These resins are sent to the RWMC for burial when depleted. Also, waste TURCO solutions (TURCO 4521 and TURCO 4502) are generated about once a year since 1984 during decontamination of the sampling system. These wastes are sent to ICPP for treatment, along with the other hot wastes generated at PBF. Lastly, about 750 L (200 gal/yr) of waste hydraulic oil have been generated during the maintenance of mechanical equipment in PBF-620 and other buildings. This waste oil was stored in 55-gal drums on a concrete pad just north of PBF-625 (see Figure 3.7.3) and then transferred to CFA.

The raw water used in the secondary coolant system is pretreated in the auxiliary building (PBF-624). In addition to the relatively minor amounts of sulfuric acid used here to maintain the pH of the secondary coolant between 7.0 and 8.0, corrosion inhibitors were also added that contained hexavalent chromium. The chromate concentration was maintained at about 15 to 20 ppm. The secondary coolant system was drained periodically (2 to 4 times per year) and the amount of chromates disposed at the PBF were recorded in the Industrial Waste Management Information Service (IWMIS) reports. As with the discharge from the regeneration of the demineralizers, the waste secondary coolant was released to the corrosive waste injection well from 1972 to 1978 and then rerouted to the evaporation pond until 1984, when PBF switched to a nonhazardous phosphate-based corrosion inhibitor. The IWMIS reports indicate that, on the average, 38 kg/yr of chromate ions (17 kg/yr trivalent chromium) were discharged to the injection well and 33 kg/yr (15 kg/yr trivalent chromium) to the evaporation pond. It should be noted that the chromium in the coolant was reduced to trivalent chromium by bubbling sulfur dioxide through it before being released.

The secondary coolant is passed through cooling towers (PBF-720) to reject heat transferred from the primary coolant. There is no blowdown stream from PBF-720, but the water vapor released to the atmosphere from the towers may contain low concentrations of chromium. Since 1979, cooling tower evaporation losses have averaged about 3.4×10^6 L/yr from PBF-720. However, since most of the chemical additives are expected to remain in the water and since any releases are dissipated over an unconfined area, no estimate has been made on the chemical loss via cooling tower evaporation.

3.7.2.2 SPERT-II. A demineralization plant that consisted of a zeolite softener and a mixed bed demineralizer was located in the SPERT-II reactor building (PBF-612). Regeneration of the demineralizer was necessary after processing 38,000 L (10,000 gal) of soft water and required 20 kg of sulfuric acid and 35 kg of sodium hydroxide. The resulting corrosive solutions were piped directly to the SPERT-II leach pond located about 91 m (300 ft) south of the reactor building.

Because the SPERT-II reactor primarily used heavy water as coolant, a rough estimate of only two demineralizer regenerations per year has been assumed. This number was confirmed by former operators at the SPERT-II facility.

3.7.2.3 SPERT-III. As with the other SPERT facilities, the SPERT-III facility also had a demineralization plant to supply deionized water to the reactor. The water treatment system was housed in PBF-609 and included a zeolite softener and a mixed-bed demineralizer. The demineralizer had a treatment capacity of 75,000 L (20,000 gal) between regenerations, which required 40 kg of sulfuric acid and 70 kg of sodium hydroxide. The successive acidic and caustic rinses were piped directly (no neutralization) to the small corrosive waste leach pond 30 m (100 ft) north of PBF-609.

According to former operators, the demineralizer was regenerated about ten times a year. However, it should be noted that this and, therefore, the quantities given in Table 3.7.1 are only rough estimates.

Since about 1982, the SPERT-III facility has been used to house the WERF project. The principal wastes generated at WERF (bottom ash and slag) are nonhazardous and sent to the RWMC for burial. However, the flyash and particulate matter removed from the baghouse filter are handled as hazardous waste because of their heavy metal content. Six 55-gal drums of flyash have been generated to date and are being stored in a metal dumpster within a restricted area north of PBF-635 until the radioactive mixed waste storage facility is available at SPERT-IV. Liquid wastes are not generated by WERF and both SPERT-III leach ponds have been backfilled and seeded.

3.7.2.4 SPERT-IV. The SPERT-IV demineralization plant, located in PBF-613, consisted of a zeolite softener and two mixed-bed demineralizers. Corrosive wastes produced during regeneration of the demineralizers were directed to the SPERT-IV leach pond (PBF-758) located about 270 ft south of the reactor building (PBF-613). No attempt was made to neutralize these solutions prior to release.

The two demineralizers had a combined capacity of 114,000 L (30,000 gal) per regeneration. A total of 80 kg of sulfuric acid and 100 kg of sodium hydroxide was required to regenerate the ion exchange resins in both units. Assuming that regeneration was done, on the average, ten times a year the quantities given in Table 3.7.1 were obtained. Once again, it should be noted that these numbers are only rough estimates.

3.7.2.5 PBF Area Fuels/Petroleum Management. Table 3.7.2 provides an inventory of the fuel/petroleum storage tanks within the overall PBF area. Bulk fuels used at PBF are limited to No. 2 diesel fuel for generators, No. 2 fuel oil for boilers, and one currently used tank for gasoline. All tanks are buried outside and are refilled by tank truck.

The maintenance of mechanical equipment within the PBF area generates relatively small quantities of waste hydraulic oil. This waste oil is accumulated in drums which are stored on a concrete pad just north of PBF-625. From there they are transferred to the CFA for ultimate recycling by an off-site vendor.

3.7.2.6 Spills Within the PBF Area. Review of UOR's, personnel interviews, and site visits were used to obtain information on any significant spills occurring within the overall PBF area. The findings are summarized below.

In January 1983, 10 square inches of cadmium-plated metal was processed along with 1,300 lb of stainless steel in the WERF melter in PBF-609. Exposure to cadmium vapor and dust was found to be minimal and new procedures were instituted to screen out similar metals from feeds going to the melter in future operations.

3.7.3 PBF Area Waste Disposal Sites

Areas or sites within the overall PBF area at which hazardous and/or radioactive wastes may have been released are discussed in this section. Those sites which were found to be connected with hazardous waste disposal are summarized in Table 3.7.3.

3.7.2. PBF AREA FUEL/PETROLEUM STORAGE TANKS

Location	Oil Type	Maximum Capacity (g)	Underground (U), Outside (O), Inside (I)	Level Check	IMMS #	Responsibility	Comments
Control Area:							
PBF-742	No. 2 fuel oil	4,000	U, O	Automatic refill	--	Plant Services	--
PBF-740	No. 2 fuel oil	2,000	U, O	Automatic refill	--	Plant Services	--
PBF-737	No. 2 fuel oil	2,000	U, O	Automatic refill	--	Plant Services	--
PBF-741	Diesel No. 2	500	U, O	Automatic refill	--	Plant Services	--
PBF-743	No. 2 fuel oil	2,000	U, O	Automatic refill	--	Plant Services	--
Reactor Area:							
--	--	--	U, O	Dipstick	--	--	Abandoned-east side of PBF-605; pumped dry
PBF-722	No. 2 fuel oil	10,000	U, O	Automatic refill	--	Plant Services	--
PBF-721	Gasoline	265	U, O	--	--	--	--
PBF-749	Diesel No. 2	5,000	U, O	Automatic refill	--	Plant Services	--
SPERT-II:							
PBF-752	No. 2 fuel oil	6,000	U, O	Dipstick	--	Plant Services	--
--	Gasoline	--	U, O	--	--	--	Abandoned; pumped dry
SPERT-III:							
PBF-709	No. 2 fuel oil	3,000	U, O	Dipstick	--	--	--
SPERT-IV:							
PBF-716	No. 2 fuel oil	2,000	U, O	Automatic refill	--	Plant Services	--

TABLE 3.7.3. PBF AREA HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Wastes	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
PBF-750	SPERT-I corrosive waste seepage pit	1955-1964	64	Sulfuric acid Sodium hydroxide	1,350 kg 2,250 kg	Discharge to open, unlined seepage pit	Has not been used since 1964	Snake River Plain Aquifer is about 139 m below surface which is generally level. Subsurface consists of alternating layers of basalt and silt.	No specific action taken to exclude surface drainage from reaching pit	None
PBF-302	PBF corrosive waste injection well	1972-1978	N/A	Sulfuric acid[a] Sodium hydroxide[a] Trivalent chromium	9,100 kg 10,500 kg 119 kg	Discharged to common sump then to shallow injection well	Closed--well plugged	Same	Well head is beneath paved road excluding surface drainage	None
PBF-733	PBF evaporation pond	1979-present	2,400	Sulfuric acid[a] Sodium hydroxide[a] Trivalent chromium	7,200 kg 7,800 kg 90 kg	Discharged to common sump then to hypalon-lined pond	Active--Discharge of hazardous chemicals eliminated in late 1984	Same	Pond has bermed sides that exclude surface drainage	None
--	SPERT-II leach pond	1960-1964 1977-present	2,500	Sulfuric acid Sodium hydroxide	200 kg 350 kg	Discharged to open, unlined pond	Active--Has received only nonradioactive, raw cooling water since 1977	Same	Pond is slightly bermed but may not exclude surface drainage	None
--	SPERT-III small leach pond	1958-1968	81	Sulfuric acid Sodium hydroxide	4,400 kg 7,700 kg	Discharged to open, unlined pond	Closed-backfilled and seeded	Same	Area is now flat with no provision to exclude surface drainage.	None
PBF-758	SPERT-IV leach pond	1961-1970	1,750	Sulfuric acid Sodium hydroxide	8,000 kg 10,000 kg	Discharged to open, unlined pond	Active--Has received only "clean" water and minor amounts of radioactive water since 1979	Same	Pond is bermed along 1/2 of its perimeter and may not exclude all surface drainage	None

a. These materials (acids and bases) were at least partially neutralized prior to release.

The groundwater beneath the PBF area has been periodically analyzed by the USGS. Samples have been taken from the production well near the PBF Control Area since 1956. To date, there has been no evidence of any contaminants, chemical or radioactive, reaching the Snake River Plain Aquifer.

3.7.3.1 SPERT-I Corrosive Waste Seepage Pit (PBF-750).

3.7.3.1.1 Description--The SPERT-I corrosive waste seepage pit is located about 15 m (50 ft) south of the terminal building (PBF-604). It is roughly circular in shape with a 9 m (30 ft) diameter at the top and a depth of about 5 m (15 ft). The regional groundwater level is about 139 m (455 ft) below the surface.

3.7.3.1.2 Wastes Received--The SPERT-I corrosive waste seepage pit was used to dispose of nonradioactive, chemical liquid wastes from the water treatment equipment in PBF-604. These wastes included salt solutions produced during the regeneration of a zeolite softener and acidic and caustic solutions produced during the regeneration of a mixed-bed demineralizer. The quantities of sulfuric acid and sodium hydroxide discharged to the pit in Table 3.7.3 were determined by assuming that an average of ten demineralizer regenerations were required per year during the nine-year SPERT-I operating period.

3.7.3.2 SPERT-I Warm-Waste Seepage Pit.

3.7.3.2.1 Description--The SPERT-I warm-waste seepage pit was located about 12 m (40 ft) north of the pit building (PBF-605). The pit basin was approximately 14 m (45 ft) by 5 m (15 ft) and was surrounded by an earthen dike varying from 0.6 (2 ft) to 2 m (6 ft) in height. It was D&D'd by EG&G in September 1984, at which time the top 0.8 m (2.5 ft) of contaminated soil from the pit was removed, along with the underground waste line, and sent to the RWMC. This was followed by backfilling of the seepage pit with radiologically clean soil and seeding with grass.

3.7.3.2.2 Wastes Received--The SPERT-I warm waste seepage pit was designed to receive the low-level waste water pumped from the sump pit in PBF-605. Under normal operating conditions the activity of this waste cooling water was well below the upper limit for direct, surface disposal. Past reports indicate that even during the SPERT-I destructive test series, the activity was low enough to be discharged directly to the seepage pit. However, a detailed characterization of the pit in 1982 revealed that minor releases of fission products had occurred. The D&D radiological survey showed a maximum surface activity of 196 cpm, compared to a background reading of 72 cpm. The principal contaminants were Cs-137, U-234, and U-238. Upon completion of the D&D operations, described briefly in the preceding section, a maximum surface activity of 76 cpm was obtained.

3.7.3.3 PBF Warm-Waste Injection Well (PBF-301).

3.7.3.3.1 Description--The PBF warm-waste injection well, located 25 m (83 ft) south of the PBF reactor building (PBF-620), was drilled in 1969. It is a dry well with a 25.4 cm (10 in.) diameter and a depth of 34 m (110 ft), ending in a natural sump of rock, gravel, and sand. Steel casing extends to the bottom of the well and is perforated between the 22 m (72 ft) and 32 m (105 ft) levels. The depth to the ground-water is 139 m (455 ft). In the summer of 1984 the well was sealed and capped.

3.7.3.3.2 Wastes Received--The warm-waste injection well received low-level radioactive liquid waste from the 5,700 L (1,500 gal) warm-waste sump in PBF-620 from 1973 to 1980. When the radioactivity level in the sump was above the specified level for disposal to the well, the liquid was transferred to the hot-waste storage tanks and ultimately to the ICPP. In addition to the low-activity fluids collected from various floor and equipment drains throughout PBF-620, the injection well was also used to dispose of uncontaminated, raw water used by the utility cooling system for cooling plant equipment.

3.7.3.4 PBF Corrosive-Waste Injection Well (PBF-302).

3.7.3.4.1 Description--The PBF corrosive-waste injection well was drilled in 1969 in an area 34 m (110 ft) east of the reactor building and about 55 m (180 ft) northeast of the warm-waste injection well (PBF-301). It is 10.2 cm (4 in.) in diameter and 35 m (115 ft) deep. Discharge to the well ceased in mid-1979, and the well was subsequently plugged.

3.7.3.4.2 Wastes Received--The PBF corrosive-waste injection well was used from about 1972 through December 1978 to dispose of uncontaminated chemical wastes. Liquid wastes disposed of here originated from the regeneration of demineralizers and the draining of the secondary coolant system. Beginning in January 1979, these wastes were rerouted to the PBF evaporation pond.

During the seven years that the corrosive-waste injection well was used, an average of 1.1×10^6 L/y of chemical wastewater were discharged to it. The hazardous constituents which were contained in this waste stream are given in Table 3.7.3. It should be noted that the sulfuric acid and sodium hydroxide solutions released to PBF-302 were probably nonhazardous. This is due largely to the fact that the acidic and caustic streams were drained to a common sump and largely neutralized prior to discharge into the well. The wastewater from the secondary coolant system was also shunted through this sump and would have further diluted the corrosive solutions from demineralizer regeneration. However, since the pH of the sump effluent pumped to the well was not measured, the regenerant solutions have been included as hazardous wastes.

3.7.3.5 PBF Evaporation Pond (PBF-733).

3.7.3.5.1 Description--The PBF evaporation pond was constructed in 1978 about 85 m (280 ft) east of the reactor building. The pond was formed from dirt bermed to 1.4 m (4.5 ft) in height with dimensions of 43 x 43 m (140 x 140 ft) at the bottom and 52 x 52 m (170 x 170 ft) at the

top. The bottom and sides are layered with 22.9 cm (9 in.) and 7.6 cm (3 in.) of sand, respectively. A 0.08 cm (0.03 in.) thick Hypalon lining is in place over the sand. Depth to the Snake River Plain Aquifer is about 139 m (455 ft).

3.7.3.5.2 Wastes Received--The PBF evaporation pond has been receiving the plant's corrosive and chemical wastes, formerly sent to the injection well (PBF-302), since January of 1979. These include the chromium-containing water drained from the secondary coolant system and the sulfuric acid and sodium hydroxide solutions produced during the regeneration of the demineralizers. As discussed in Section 3.7.3.4, the two streams are routed to the corrosive waste sump and then to the evaporation pond. The combined regenerant solution has once again been listed as a hazardous waste, even though its pH was probably close to neutral.

By the latter part of 1984, the discharge of hazardous chemical wastes to the evaporation pond had been eliminated, as shown in Table 3.7.3. This was accomplished by switching from the chromate-based corrosion inhibitor to a phosphate-based system in the secondary coolant system. Procedures were also instituted to monitor the pH of the sump effluent, which was found to vary between 6.5 and 7.0. Prior to these changes (1979 to 1984), the average annual discharge of hazardous waste water to the PBF evaporation pond was 1.4×10^6 L/yr.

3.7.3.6 SPERT-II Leach Pond.

3.7.3.6.1 Description--The SPERT-II leach pond is located about 91 m (300 ft) south of the reactor building (PBF-612). It is roughly 61 m (200 ft) by 46 m (150 ft) and about 1 m (3 ft) below the surrounding area. The depth to the Snake River Plain Aquifer is about 139 m (455 ft).

3.7.3.6.2 Wastes Received--The SPERT-II leach pond was designed to receive both the chemical wastes from the demineralization plant and the low-level radioactive waste drained from the reactor. The hazardous

chemical wastes discharged to the pond consisted of sulfuric acid and sodium hydroxide solutions produced during the regeneration of the mixed-bed demineralizer. However, since the SPERT-II reactor primarily used heavy water as coolant, which was purified and reused, its demineralized (light) water requirements were assumed to be much smaller than those of the other SPERT reactors.

Under normal operating conditions the only radioactive waste disposed to the pond was the primary coolant water drained from the reactor to maintain water purity. As previously mentioned, this occurred only when light water was used and, therefore, the discharge of contaminated liquid waste to the pond should also have been fairly small.

This has been verified by D&D characterizations of the pond in 1982 and 1985. In both radiological surveys the pond was found to be uncontaminated with a surface activity comparable to background.

The only waste currently being released to the pond is clean cooling water used for the air compressor in the PBF maintenance shop, now located in the SPERT-II reactor building. There is no evidence that any additional hazardous wastes have been released by the maintenance shop. An analysis for toxic contaminants in a soil sample from the pond was conducted in 1983 and revealed that the soil would not be classified as hazardous on the basis of EP (Extraction Procedure) toxicity. The results of the analysis are presented in Table 3.7.4.

3.7.3.7 SPERT-III Small Leach Pond.

3.7.3.7.1 Description--The SPERT-III small leach pond was located 30 m (100 ft) north of the reactor building (PBF-609) and consisted of a 9 x 9 m (30 x 30 ft) gravel pit about 0.6 m (2 ft) below the surrounding area. An underground vitrified clay pipe was used to drain the effluent from the water treatment system. The pond was 139 m (455 ft) above the ground water level.

TABLE 3.7.4. SUMMARY OF TOXIC CONTAMINANT CONCENTRATIONS IN SPERT-II LEACH POND

Contaminant	Concentration in soil (mg/kg)	Equivalent[1] Concentration (mg/l)	EP Toxicity Maximum Concentration (mg/l)
Arsenic	2.9	0.145	5.0
Cadmium	1.2	0.06	1.0
Chromium	7.0	0.35	5.0
Lead	32	1.6	5.0
Mercury	0.71	0.0355	0.2
Selenium	<0.2	<0.0073	1.0
Silver	<2	<0.1	5.0
Endrin	<0.006	<0.0003	0.02
Lindane	<0.006	<0.003	0.4
Toxaphene	<0.06	<0.003	0.5

Notes

1. Soil concentration times 0.05 gives the maximum concentration (mg/l), if all the contaminant present were to pass into solution during the EP toxicity test.

2. Analysis conducted in October, 1983.

In 1982, a D&D characterization of the pond was performed. The radiological survey revealed the pond to be uncontaminated and it was then backfilled and seeded with native grasses.

3.7.3.7.2 Wastes Received--The SPERT-III small leach pond was used to dispose of nonradioactive, chemical liquid wastes from the demineralization plant in PBF-609. Primarily, these wastes consisted of sulfuric acid and sodium hydroxide solutions produced during the regeneration of a mixed-bed demineralizer. Salt solutions were also discharged here from regeneration of the zeolite softener.

Since the deactivation of the SPERT-III reactor in 1968, there is no evidence of the pond being used for disposal purposes.

3.7.3.8 SPERT-III Large Leach Pond.

3.7.3.8.1 Description--The SPERT-III large leach pond was located about 122 m (400 ft) southeast of the reactor building (PBF-609). The base of the pond was approximately 15 m (50 ft) by 20 m (65 ft) and was about 2.4 m (8 ft) below the surrounding area. An 8-in. carbon steel discharge line ran underground from the sump pit in PBF-609 to the pond.

In 1982, a characterization of the pond revealed it to be lightly contaminated. Soil samples were found to contain 18 pCi/g of Cs-137, compared to 0.94 pCi/g of Cs-137 for INEL background, and 0.075 pCi/g of U-235 (versus 0.05 for background). D&D operations, completed in November 1983, involved backfilling the pond with radiologically clean soil and seeding with grass. This reduced the surface activity from a pre-D&D maximum reading of 112 cpm to a maximum of 68 cpm.

3.7.3.8.2 Wastes Received--Under normal operating conditions the only radioactive waste discharged to the pond was the primary coolant water drained from the system to maintain water purity. The activity of this waste water was primarily due to the presence of corrosion an/or erosion

products in the water and was usually low enough to permit discharge directly to the pond. A 30,000 L (8,000 gal) hot waste storage tank was available for the collection of highly contaminated waste water but, according to former operators, it was seldom used. Since a separate leach pond was used to dispose of chemical wastes, it is unlikely that any hazardous wastes were discharged to the SPERT-III large leach pond.

3.7.3.9 SPERT-IV Leach Pond (PBF-758).

3.7.3.9.1 Description--Located about 82 m (270 ft) south of the reactor building (PBF-613), the SPERT-IV leach pond is approximately 46 m (150 ft) by 38 m (125 ft) and about 1.5 m (5 ft) below the surrounding area. A 0.6 m (2 ft) high berm of rocks is in place along about one-half of the pond perimeter. The regional groundwater level is about 139 m (455 ft) below the surface.

3.7.3.9.2 Waste Received--The SPERT-IV leach pond was designed to receive both the chemical wastes from the demineralization plant and the low-level radioactive waste drained from the reactor. The chemical wastes produced during the regeneration of the demineralizers (sulfuric acid and sodium hydroxide solutions) were directed to the pond by gravity flow. Table 3.7.3 shows the total quantities of acid and caustic entering the pond that were obtained by assuming that each of the two mixed bed demineralizers were regenerated ten times per year.

Contaminated (radioactive) waste water was flushed into the sump pit in PBF-613. The sump pump discharge line was monitored and when the effluent's radioactive isotope content was more than 50 cpm above background, the waste was piped to a 231,000 L (61,000 gal) hot waste hold-up tank. However, according to former operators, the activity of the waste water was usually low enough to permit discharge directly to the pond. A recently completed (August 1985) radiological survey has shown the surface activity of the pond to be comparable to background readings.

Since the reactor building underwent D&D in February of 1979, it has housed various limited-scale research projects such as waste forms research, plate fuel testing, heat treatment furnace studies and the Three Mile Island core drilling tests. Some of these projects discharged minor amounts of warm waste to the SPERT-IV leach pond, but records do not show any releases of significance. However, in 1982 about 59,000 L (16,000 gal) of contaminated water drained from the PBF primary coolant system were disposed of here when the ICPP could not treat it. The soil contaminated by this discharge was removed and sent to the RWMC.

In 1983, a soil sample from the pond was analyzed for toxic contaminants. The results are presented in Table 3.7.5, which shows that the primary contaminants were chromium and lead. The second column of this table gives the maximum possible concentration obtainable during an EP toxicity test of the soil. Comparing these values to the specified limits for EP toxic wastes, given in column three, reveals that the soil would not be classified as hazardous.

TABLE 3.7.5. SUMMARY OF TOXIC CONTAMINANT CONCENTRATIONS IN SPERT-IV POND

Contaminant	Concentration in soil (mg/kg)	Equivalent[1] Concentration (mg/l)	EP Toxicity Maximum Concentration (mg/l)
Arsenic	<0.5	<0.025	5.0
Cadmium	<0.5	<0.025	1.0
Chromium	5.3	0.265	5.0
Lead	13	0.65	5.0
Mercury	<0.05	<0.0025	0.2
Selenium	<0.2	<0.01	1.0
Silver	<2	<0.1	5.0
Endrin	<0.003	<0.0002	0.02
Lindane	<0.003	<0.0002	0.4
Toxaphene	<0.03	<0.0015	0.5

Notes

1. Soil concentration times 0.05 gives the maximum concentration (mg/l), if all the contaminant present were to pass into solution during the EP toxicity test.

2. Analysis conducted in October, 1983.

3.8 Experimental Organic Cooled Reactor (EOCR) Past Activity Review

3.8.1 EOCR Area Description

The Experimental Organic Cooled Reactor (EOCR) Facility is located approximately 2.5 miles east of the Central Facilities Area. The EOCR project was terminated shortly before completion of construction in September 1962. Because the project was terminated before starting the reactor, no radioactive contamination occurred; therefore, most equipment has been removed for use elsewhere.

The EOCR was designed and built to advance the Organic Reactor program, which addressed coolant and fuel element technology for advanced organic concepts. The Site operating contractor at the time was Phillips Petroleum Company. The reactor was designed to operate at power levels up to 70 MW. Complex cooling systems were built to circulate and cool a paraffin-like organic substance, which in turn cooled the reactor.

During the construction period, operating personnel continued to work toward final occupancy and operating of the EOCR by preparing plant operating manuals and by performing plant system tests. Prior to the project termination, work was in progress on the following systems: Pressurized cooling water system, steam systems, plant and instrument air systems, reactor complex cooling systems, reactor instrumentation, health physics, and radiation monitoring instruments and process instruments. The systems listed (and some additional ones) were completed as part of the EOCR decommissioning.

In 1978-1979, the office portions were used during the demolition of the Organic Moderated Reactor Experiment (OMRE) Facility, which was directly to the south. Since 1978, the facility has been used only for material storage, security force practice maneuvers, occasional explosives testing, and for PBF fuel rod drive.

3.8.1.1 Waste Disposal System Description. Waste disposal included sump discharge, process waste, and sanitary waste. Aqueous waste from the reactor area, canal, and all drains (except those in the laboratory floors, boiler room floors, and utility floors) flowed by gravity to a 5,000-gal concrete sump located below the basement, as shown in Figures 3.8.1 through 3.8.3. Two sump pumps, with a capacity of 250 gpm each, pumped the aqueous waste from the building sump to an aqueous leaching well. The aqueous waste system provided for separate disposal for the acids and caustics resulting from demineralizer regeneration.

The sanitary drain system included collection of discharge from restrooms in a percolation pond.

3.8.2 EOCR Wastes Generated by Activity

According to one source, for a period of two years prior to the decommissioning of EOCR, the demineralized beds were regenerated periodically with sulfuric acid and sodium hydroxide. This effluent was discharged to a nearby leaching pond, as shown in Figure 3.8.4. Between the regular regenerations with sulfuric acid, the beds were also regenerated with zeolite. This was done to provide analytical data for OMRE.

Because the steam system was tested as part of the preparations for plant performance, the boilers were used continually. As a result, the boilers were blown down occasionally and the blowdown contained phosphates and sulfates; these waste streams were also discharged to the leaching pond.

3.8.2.1 Waste Generated by EOCR After Shutdown. From 1965 to 1966, PBF conducted some control and transient rod driven tests at EOCR. These tests provided information concerning the engineering performance of the machinery; therefore, no fuels were involved.

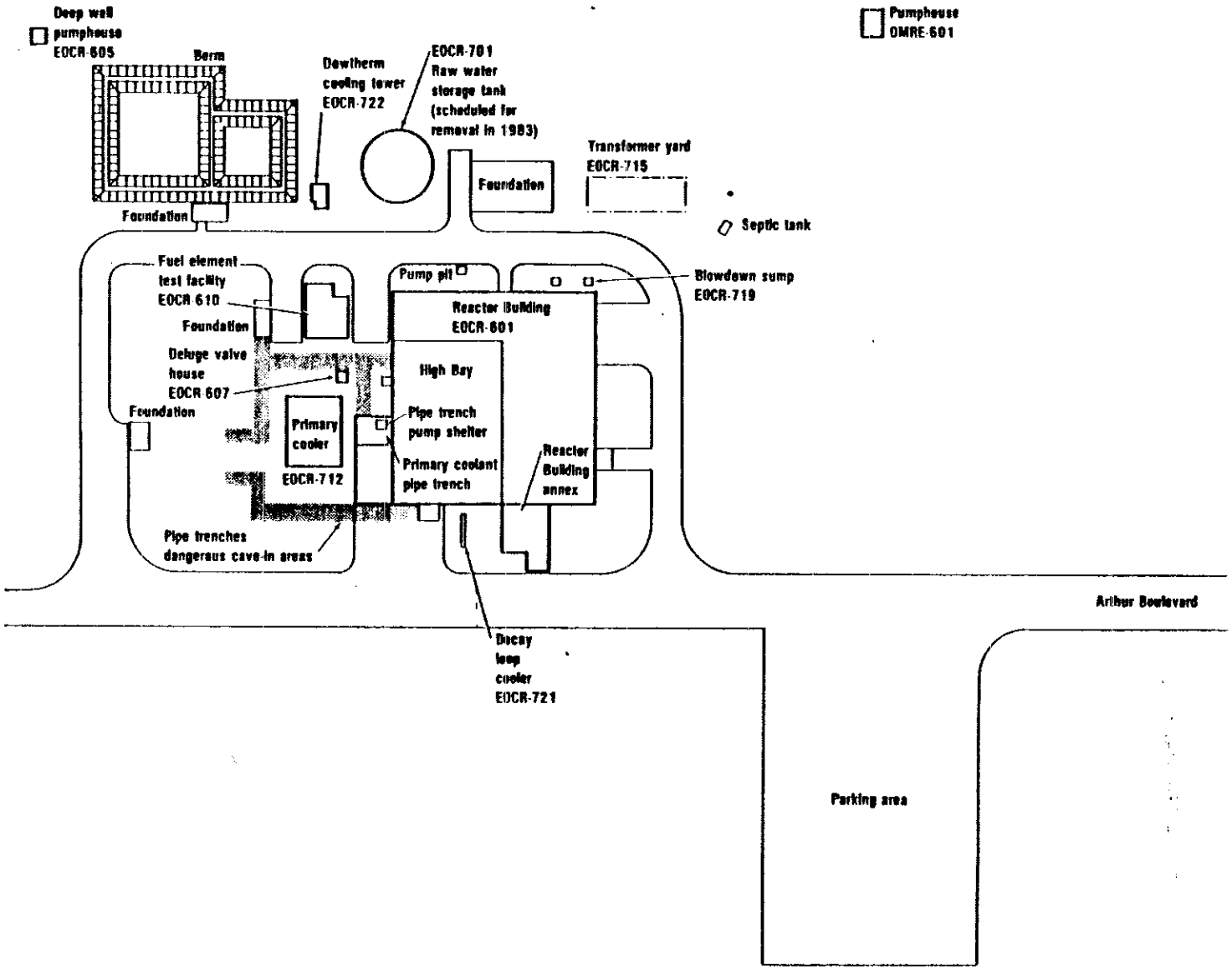


Figure 3.8.1. EOCR plot plan.

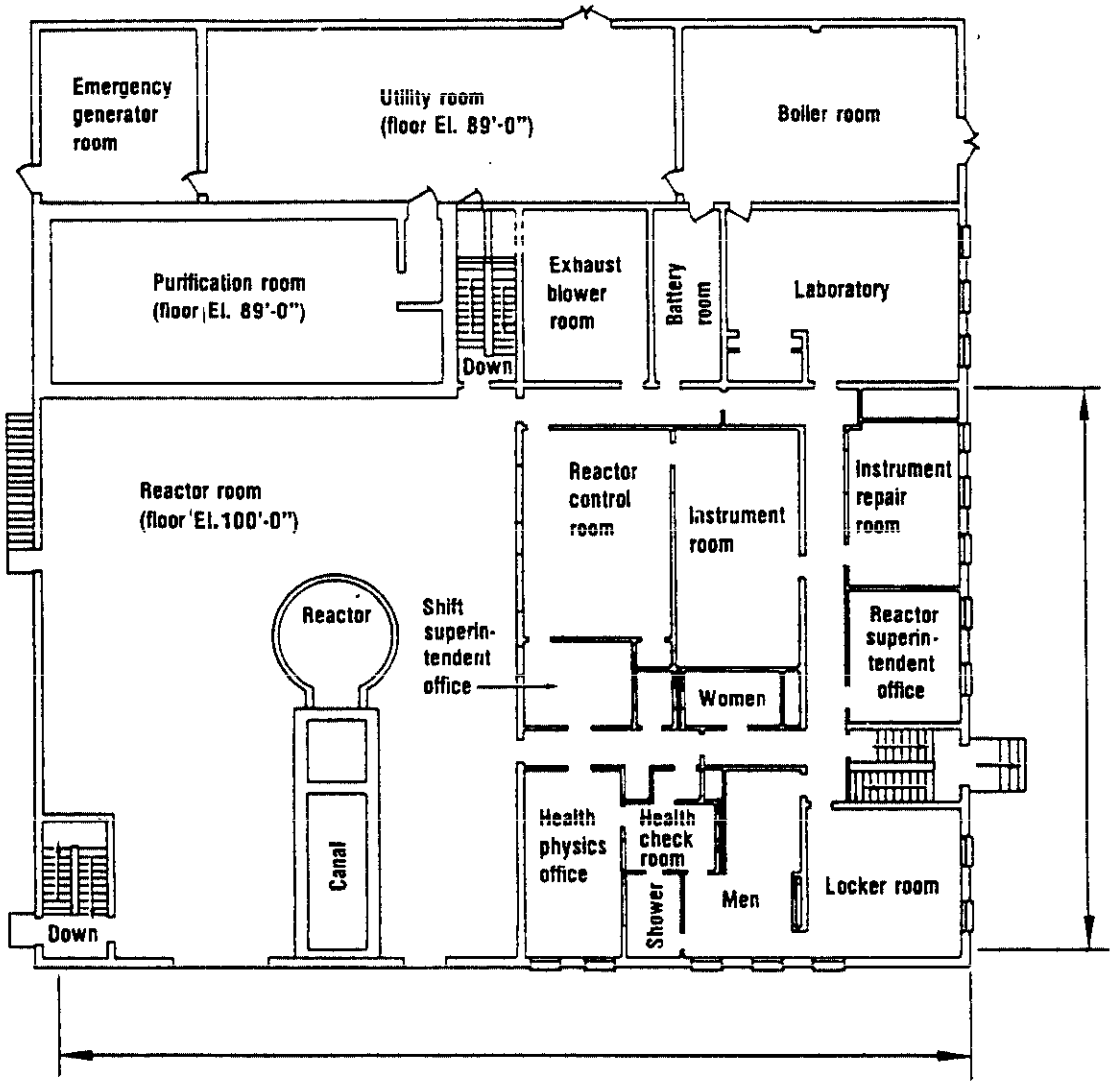


Figure 3.8.2. The main floor of the reactor building, EOCR-601.

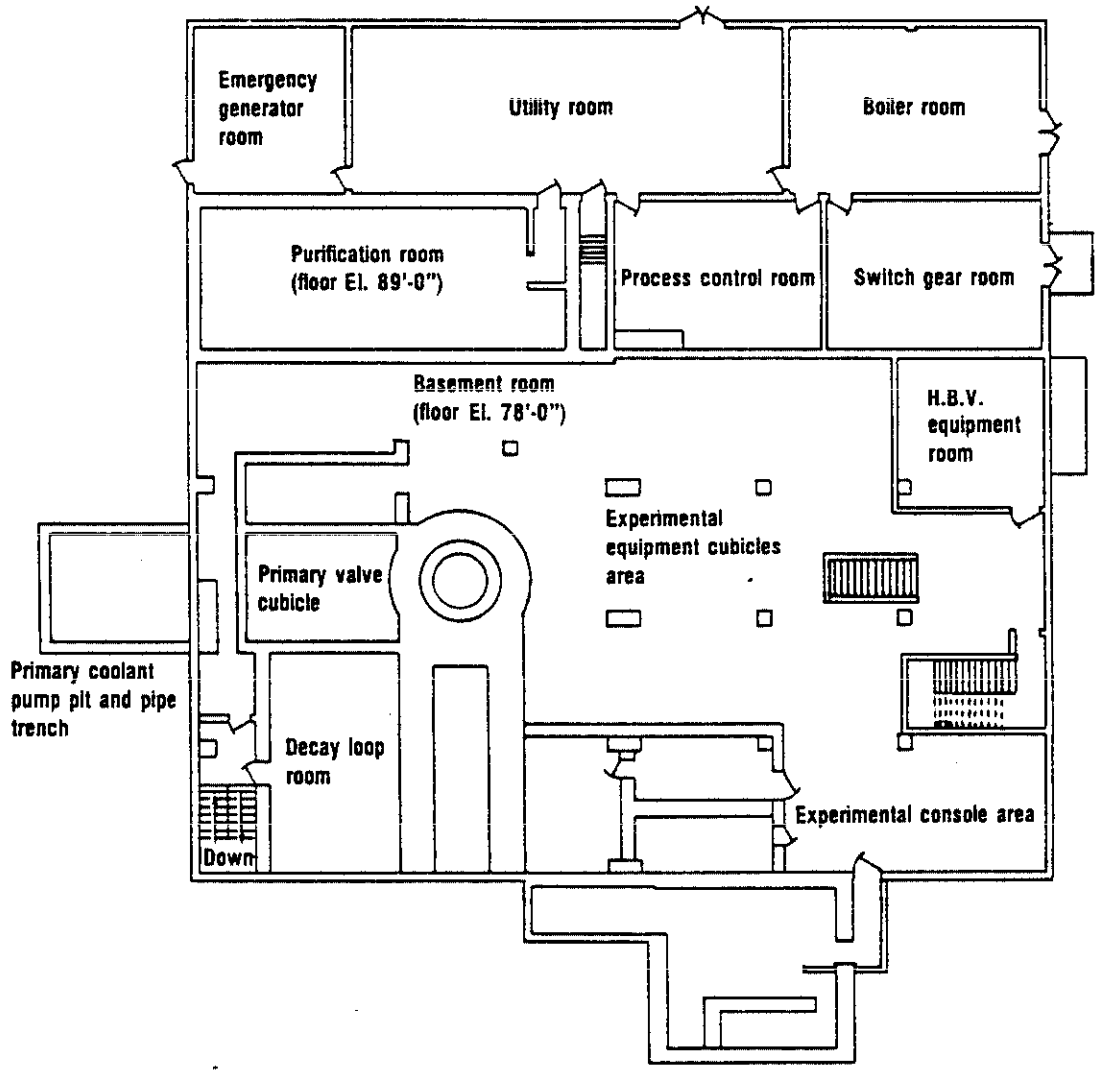


Figure 3.8.3. The basement area of the reactor building, EOCR-601.

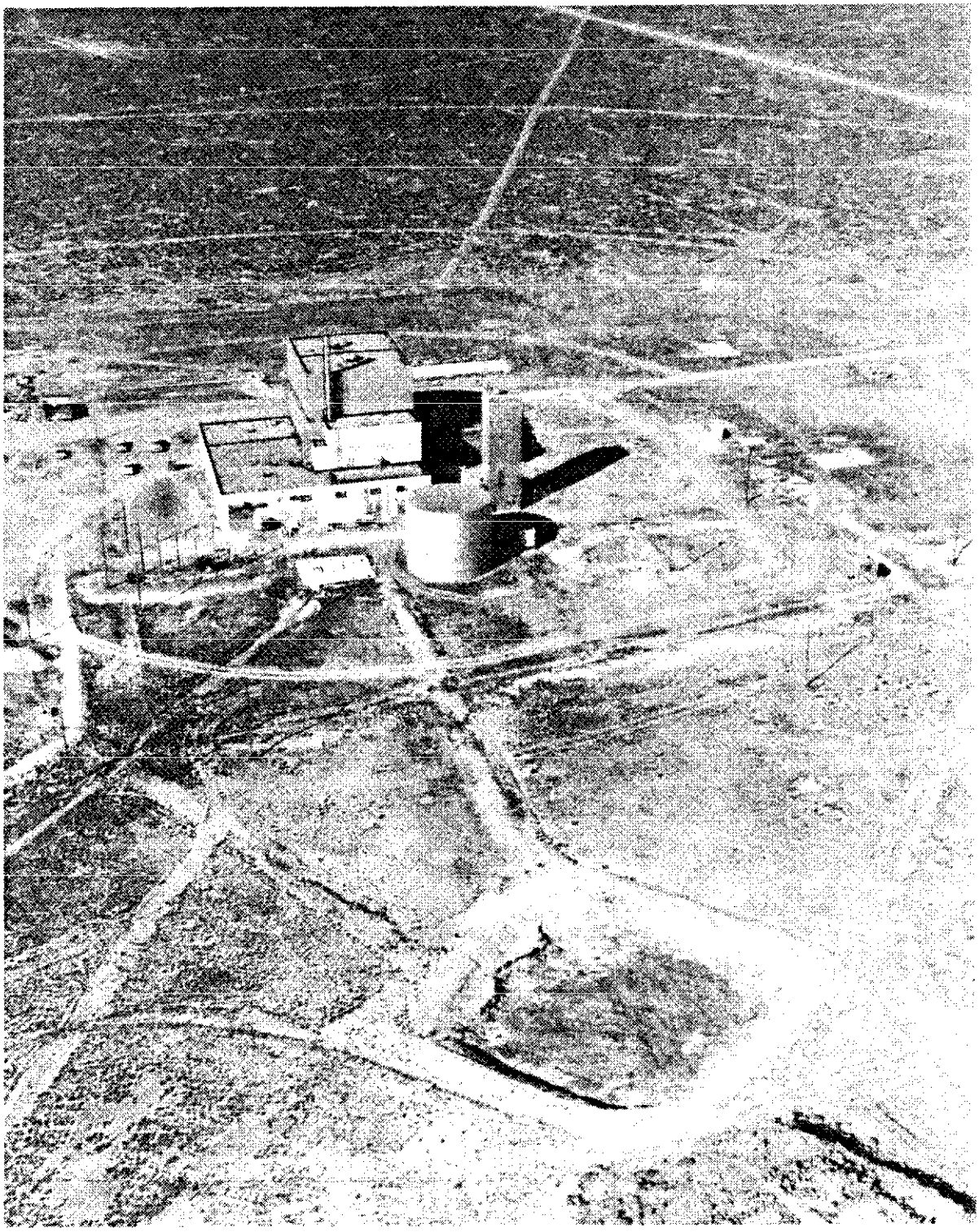


Figure 3.8.4. An aerial view of EOCR, looking toward the southwest.

According to the present Deputy of the National Oceanographic, Atmospheric and Administration (NOAA), that organization used part of the EOCR Building for storage from 1976 to 1984. This inventory included wires, equipment, rubber tires, and air samplers. All these materials were removed prior to occupancy by the current occupant, the Special Response Team.

3.8.2.1.1 Nitrate Resin Reactivity Test--This test was conducted in September of 1983. Its purpose was to determine the explosive characteristics of nitrates in ion-exchange resins. The tests involved the use of 10 gallons of nitric acid and 10 gallons of resins. This test took place approximately 100 yards from the EOCR.

3.8.2.1.2 SWEPP Drum Tests--During the period from July 24 to August 11, 1982, two tests were conducted with simulated sludge and two tests with combustible waste. The purpose of these tests was to provide step-by-step instructions for conducting explosive tests of hydrogen-oxygen-nitrogen mixtures contained within simulated radioactive waste packages. The simulated sludge consisted of diatomaceous earth moistened with water. The combustible waste consisted of miscellaneous dumpster debris. The percentage of hydrogen in the drums ranged from 11 to 30%.

3.8.3 EOCR Disposal Sites

EOCR building 610 is currently used as a storage area for minor amounts of hazardous materials. The materials known to have been stored there as of November 1984 were: two ft^3 of mercury-containing material (i.e. thermometers), 2 lbs of picric acid, 20 grams of Dipicrylamine, magnesium rods and powder, fired zirconium turnings, and resins. As of the date of this report, most of these materials have been removed and no others are scheduled to be stored here.

Table 3.8.1 summarizes the total waste generated at EOCR from the time of construction to present.

TABLE 3.8.1. HAZARDOUS WASTE FROM EOCR

Facility	Waste Stream	Time Frame	Estimated Quantities	Treatment/Storage Disposal
Reactor Building #601	H_2SO_4 NaOH	1960-62	908 L/yr 1363 L/yr	Disposed of in diluted form to leaching pond
Outside EOCR	Nitric Acid Resins	1983	37.8 L/yr 37.8 L/yr	100 yards away from Reactor Building
EOCR-601	Mercury waste	1980-present	0.0464 m^3	Stored in EOCR-610
	Magnesium rods & powder		20 lbs	Stored in EOCR-610

3.9 Organic Moderated Reactor Experiment (OMRE) Past Activity Review

3.9.1 OMRE Facility Description

The Organic Moderated Reactor Experiment (OMRE) was built by Atomics International at the Reactor Testing Station. Construction was completed in May 1957, with fuel loading in September of that same year. It continued in operation until shutdown of the reactor in 1963.

The OMRE facility consisted of the reactor control building, water tank, pump house, leaching pond storage area, and drum tank vault area. Figure 3.9.1 shows specific locations. Within these facilities, three types of circulation were used: The coolant system circulated 9,200 gal/min of coolant from the reactor to an air-blast heat exchanger with a nitrogen blanket; the auxiliary cooling system removed heat from the reactor core during shutdown (a water spray cooler and filtering equipment were part of this system).

The overall objective of the OMRE experiment was to achieve an economical power supply generated by an organic coolant. The experiment provided a basis for the study of three system variables:

1. A study of coolant decomposition rates at various boiler (high boiler) concentrations in the coolant

2. A study of the effect of bulk coolant temperature on coolant decomposition rate

3. A study of heat transfer surface characteristics with increasing fuel plate surface temperature.

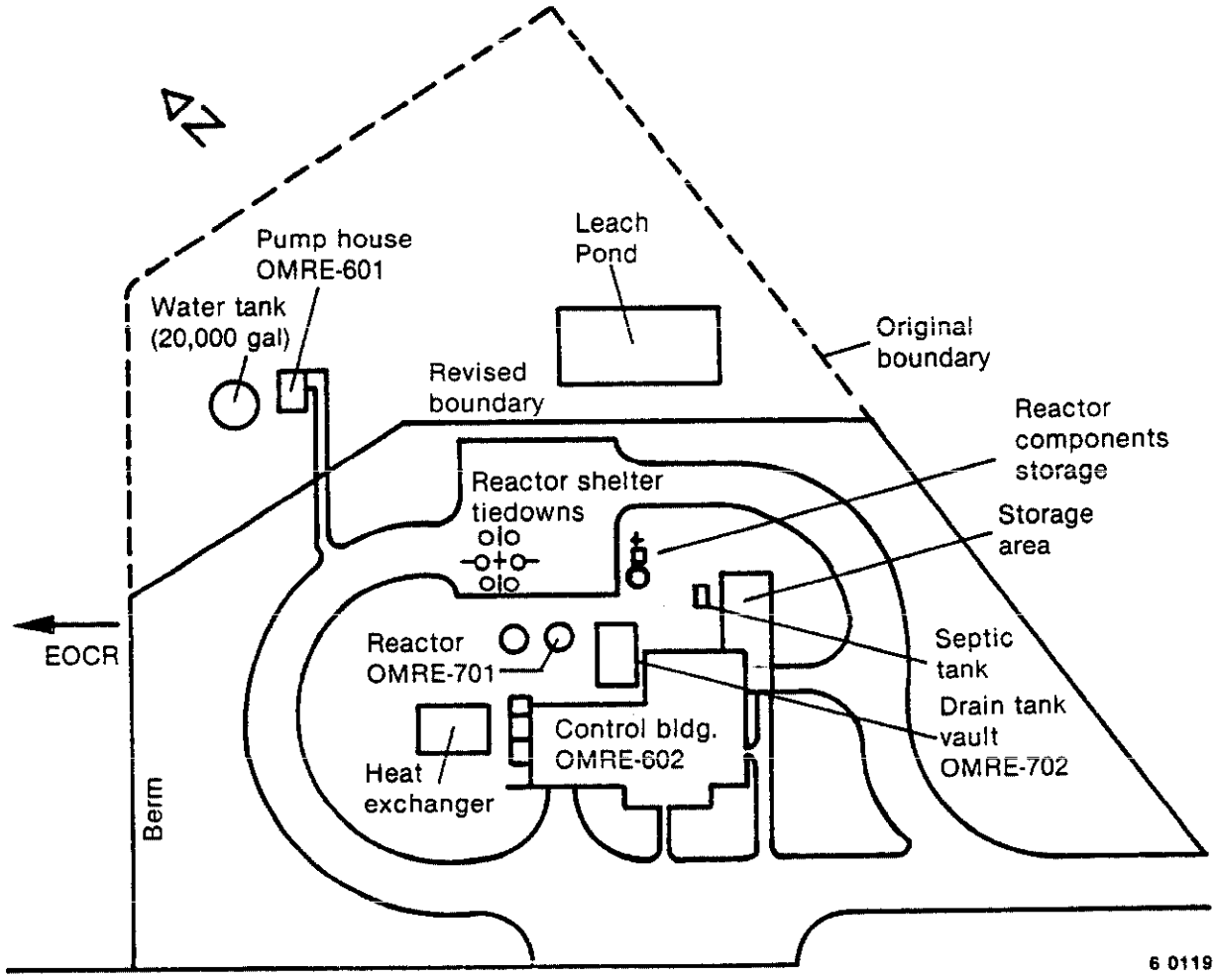


Figure 3.9.1. OMRE site boundaries.

The purification system removed damaged hydrocarbon from the main coolant system and consisted of a distillation unit, adsorption on a bed of Attapulgus clay and a filtration unit, through which impurities were removed from high boiling compounds as waste for storage.

3.9.2 OMRE Wastes Generated by Activity

The organic coolants used were a mixture of organic molecules called polyphenyls, which consisted of diphenyls and terphenyls. The Santowax (OMRE coolant) consisted of a low-melting mixture of diphenyl and three terphenyls.

Polyphenyls, like organic materials in general, tend to decompose when subjected to heat or ionizing radiation. In both instances, most of the decomposition products recombine to form molecules larger than the original polyphenyls. Up to a point, this change in composition improves the coolant properties (lower melting point, lower decomposition rate); hence OMRE reactors were designed to run with Santowax R containing about 30% decomposition products (high boilers).

3.9.2.1 Gaseous Wastes. In the reactor vessel, a continuous purge of nitrogen over the surface of the coolant prevented buildup of hydrogen and light hydrocarbon gases (which are formed during decompositions of the coolant under irradiation) and swept these gases to the exhaust stack.

Table 3.9.1 represents a typical analysis of the gaseous decomposition products formed during reactor operation.

3.9.2.2 Liquids and Solids. Figure 3.9.2 is a schematic flow diagram of OMRE. Note that the waste is generated by the purification system; therefore, this system will be analyzed in more detail.

TABLE 3.9.1. TYPICAL DECOMPOSITION GASES

Compound	Vol %
Hydrogen	62.8
Methane	10.5
Ethane and ethane	18.0
Propane and propane	5.9
Butane and butane	2.1
	99.3%

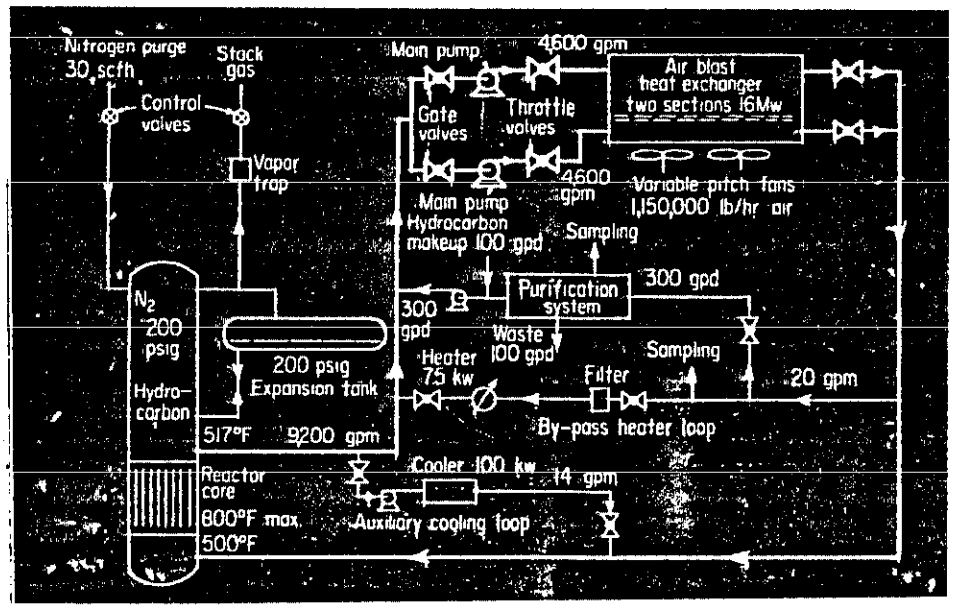


Figure 3.9.2. OMRE flow diagram showing coolant-purification bypass.

The purification system removed a small batch of damaged hydrocarbon from the main coolant stream each day, purified it, and returned the purified material (with additional fresh makeup) to the reactor coolant system. The waste was rejected to storage.

A small number of low boilers (compounds with boiling points in the range of 80-254°C) were isolated and identified. The most important of these were benzene, toluene, ethylbenzene, p-ethyltoluene, m- and p-xylene, n-propylbenzene and indanes. Traces of at least 14 others have been detected. Table 3.9.2 gives a summary of the low-boiler contents of the OMRE coolant.

A minimum of 13 intermediate boilers (compounds with boiling points in the range of 254-383°C) were detected in the OMRE coolant. Four of these compounds have been identified: 3-methyl-biphenyl, flourene, phenanthrene, and 9-fluorenone. The others were of too low concentrations to be of consequence. Table 3.9.3 gives sample contents of the major intermediate boilers in the OMRE coolant from Core II.

The high-boiler fraction of the decomposition product was found to be a very complex chemical system. Clear-cut separation of individual components was extremely difficult. Only 75% of the high-boilers have been identified in the OMRE coolant sample. See Table 3.9.4 for a sample content of high-boilers from OMRE.

Finally, Table 3.9.5 summarizes all four groups of decomposition product in the order of their volatility.

3.9.2.3 Radioactive Waste Generated by OMRE. The radioactivity of the OMRE coolant came mostly from the activation of impurities either originally present in the coolant or from those introduced into the coolant in the form of rust, welding slag, and metal filings from the OMRE piping vessels. A major part of these impurities was in a less volatile form than was the OMRE coolant itself and was therefore removed with the waste from

TABLE 3.9.2. SUMMARY OF LOW-BOILER CONTENT OF OMRE COOLANT

	Concentration (wt %)			
	Core I		Core II	
Low Boilers	Range	Average	Range	Average
Benzene	0.003-0.154	0.089	0.006-0.134	0.056
Toluene	0.004-0.154	0.112	0.006-0.125	0.073
Ethylbenzene	0.005-0.176	0.129	0.007-0.099	0.066
Other low boilers	0.02-0.57	0.41	0.05-0.70	0.32
Total low boilers	0.03-0.98	0.74	0.09-0.95	0.52

TABLE 3.9.3. MAJOR INTERMEDIATE BOILERS IN OMRE CORE II COOLANT SAMPLES

Sample Date	Cumulative Exposure (Mwd)	HB Content (wt %)	Intermediate Boiler (wt %)			
			3-Methyl-biphenyl	Fluorene	Phenan-threne	Total (wt %)
6-1-59	0	0.9	0.26	0.41	1.69	2.36
6-18-59	27	8.6	0.26	0.46	0.84	1.56
11-12-59	496	29.2	0.27	0.47	0.61	1.35
1-7-60	747	31.1	0.30	0.62	0.57	1.49

TABLE 3.9.4. TYPICAL COMPOSITION OF OMRE HIGH BOILERS

Substituted polyphenyls	Wt %	Substituted triphenylenes	Wt %
Alkylterphenyls	0.5	Triphenylene	9.1
Quaterphenyls	8.6	Alkyltriphenylenes	1.3
Alkylquaterphenyls	1.3	Phenyltriphenylenes	0.8
Quinquephenyls	16.8	Alkylphenyltriphenylenes	1.1
Alkylquinquephenyls	1.5	Diphenyltriphenylenes	1.5
Hexaphenyls	25.8	Alkyldiphenyltriphenylenes	1.4
Alkylhexaphenyls	1.1	Triphenyltriphenylenes	2.5
Heptaphenyls	1.6	Alkyltriphenyltriphenylenes	0.8
Alkylheptaphenyls	0.1	Tetraphenyltriphenylenes	0.1
Octaphenyls	0.8		
Totals	58.1		18.6

TABLE 3.9.5. DECOMPOSITION PRODUCTS OF OMRE COOLANT

Group	Boiling Range (°C)	Approximate Yield (wt %)	Types of Compounds
Gases	-259 to 80	1	Hydrogen, alkanes, alkanes, and alkynes to C_6
Low boilers	80 to 254	1-2	Aromatics and alkylaromatics
Intermediate boilers	254 to 383	5-10	Alkylaromatics and alkylpolyphenyls
High boilers	>383	85-90	Aromatics and alkylaromatics, including polyphenyls and fused ring types

the purification system, which acted as a decontaminating unit. The most important of the activities observed were Mn^{54}, Mn^{56}, Fe^{59}, Co^{60}, Se^{75}, S^{35}, and P^{32}. During normal operation, the specific activity of the coolant was approximately $0.1\mu C/cm^3$ at a power level of 6.0 MW.

Cleanup of the OMRE coolant and coolant system proceeded in parallel with removal of the first core. The coolant was distilled in the purification system for reuse with the second core loading. The vessel and piping were flushed with a solvent (xylene) to loosen any particulate matter from the walls and carry this particulate matter to a temporarily installed filtering system.

3.9.3 OMRE Shutdown

The reactor was shut down on April 3, 1963 at the completion of CORE III operations. Deactivation steps were begun shortly thereafter under OMRE Maintenance and Operational Development. By the end of fiscal year 1963, all 32 fuel elements had been removed from the reactor vessel.

3.9.3.1 Organic Coolant. The organic coolant drained from the system was drummed out and stored on site, along with the coolant and high boilers loaded out previously . These contaminated items were shifted to the NRTS burial ground. During that period, 43 drums of Core III-HB were shipped to AECL in Canada, and 50 lb were shipped to the Juenta de Energia Nuclear in Spain. These drums were identified by drum number, color-coded, and grouped by content. A total 696 drums were removed from the site after shutdown.

Following the shipment of the last two fuel elements, the fuel-washing system was deactivated, drained, and secured. All contaminated fluids and surface area decontamination were discarded. The water system and storage tank were drained and all water pumps shutdown. Propane, nitrogen, carbon dioxide, xylene, gasoline, and other industrial liquids and gases were removed from the site.

3.9.3.1 OMRE Leaching Pond Characterization. OMRE was decommissioned during FY-78 and 79. As part of the D&D plan, it was necessary to characterize the OMRE leaching pond.

The OMRE pond is approximately 8 m wide by 22 m long with a slope to the pond base. The base of the pond is approximately 5 m wide by 15 m long. The depth of the soil to basalt in the base varies from 30 cm at the east end to 46 cm at the west end.

The amount of effluent discharged to the pond during the operation of the reactor is listed in Table 3.9.6. The organic effluent which is mentioned in Table 3.9.6, is definitely xylene, with possible dissolved low-boilers and intermediate-boilers from the reactor residue after purification. This table specifies the radioactivity of the pond, along with identified nuclides. There are no records for the initial operation period between 1957 and 1959.

3.9.4 OMRE Spills and Accidents

On December 20, 1960, a fire occurred at the organic coolant makeup tanks located on the north side of the maintenance shop section of the OMRE control building.

There were two tanks, one with a capacity of 500 gallons, the other 1500 gallons. The design pressure of the tanks was listed as 400 psi. Both tanks were heated to a temperature of between 300 and 350°F in order to keep the organic coolant in a liquid state. Normal heating was accomplished by induction heating of coils in the tank shell and related piping. Supplementary heat was occasionally provided by resistance heaters on the bottoms of the tanks.

Due to extensive damage to the wiring and related tank equipment, it was difficult to establish the exact cause or source of ignition. However, it is believed that a short circuit in the induction heating wire was the

TABLE 3.9.6. OMRE LEACH POND RADIOACTIVE INVENTORY

	1959[a]	1960[b]	1961[c]	1962[d]	1963	TOTAL
Activity (mCi)[e]	120.8	79.9	2.52	--	2,150	2,353.22
Volume (liters)	4,012	41,618	23,334	--	52,990	496,518

a. Two radioactive liquid discharges were recorded as being discharged to a "ditch" outside OMRE. These two discharges totalled 0.4 mCi and 2.687 liters. An additional discharge consisting of 0.9 mCi and 22,710 liters was reported as being released to a trench. The "trench" may or may not have been the previously mentioned ditch. The contaminants for the latter discharge were noted as: ^{32}P, ^{35}Sb (?), ^{54}Mn, ^{58}Co, ^{59}Fe, ^{60}Co, ^{131}I, ^{140}Ba, ^{140}La, and xylene particulates. These three releases are <u>not</u> included in the 1959 values of this table.

b. Included in these values are three releases noted as "organic." The activity of these releases was 5.5 mCi, the volume was 1,344 liters.

c. Records reported 5.68×10^5 liters of nonradioactive cooling water was released to the leaching pond in addition to the contaminated water.

d. No releases recorded.

e. The nuclides reported were: ^{54}Mn, ^{59}Fe, ^{95}Zr, ^{95}Nb, ^{103}Ru, $^{141\text{-}144}Ce$, ^{129}I, ^{90}Sr, ^{90}Sm, ^{131}I, ^{106}Rh, ^{89}Sr, ^{137}Cs, and unidentified beta-gamma (normally notes as <10%).

probable cause. There were other factors that would have contributed to the seriousness of this accident had there been an extended delay in controlling the fire or had wind conditions been different.

Equipment damaged by the fire included: Tank instruments and tubing, wiring, thermocouples, insulation, tank coolant circulation pump and motor, and weatherproofing. Water damage was negligible.

No direct radiation or radioactive contamination was involved, and there were no injuries to personnel.

3.9.5 Decontamination and Decommissioning of OMRE

The OMRE Facility was decontaminated and decommissioned in 1980 and was returned to DOE for further use. That project involved the removal and disposal of all contaminated articles, including plant hardware, soil, and some basaltic rock, and salvaging all uncontaminated items. All material was surveyed to segregate the contaminated from the noncontaminated. The noncontaminated, nonhazardous material that was not salvageable was sold as scrap. All contaminated material (>0.1mR/hr) was shipped to the Radioactive Waste Management Complex (RWMC) for disposal.

3.10 BORAX Past Activity Review

3.10.1 BORAX Area Description

The BORAX Program, initiated by Argonne National Laboratory in 1953, was conducted primarily to increase knowledge of the basic reactor physics of boiling water reactors and to investigate the interaction among components of various systems of the reactor/power-generation train. This program involved multiple tests on five separate reactors. Modifications were made to each reactor between tests.

BORAX-I was the first experiment in a series consisting of BORAX-I, -II, -III, -IV, and -V. The experiments were conducted during the summers of 1953 and 1954. In July 1954, the BORAX-I reactor was intentionally destroyed during a power excursion and after cleanup was buried in place. A new site, northeast of BORAX-I, was selected for BORAX-II through -V experiments. Figure 3.10.1 shows this new site, which is the existing but no longer active, BORAX-V Facility.

There is no descriptive data available on the waste generated while BORAX-I was active. However, RWMC records confirm that radioactive waste was disposed of from 1953 to 1968 by Argonne National Laboratory Building No. 601, which includes BORAX-I-V, EBR-I and ZPR-I.

The waste disposal systems at BORAX-I and BORAX-II were based on criteria related to personnel safety, i.e., advantage was taken of the remote location relative to disposal of gaseous and liquid radioactive waste. The waste disposal requirements were concerned mainly with long-lived decay radioactivity. Since the duration of individual runs was kept relatively short, the resulting fission-product build-up inventory was kept at manageable levels, and disposal requirements were satisfied by dilution in water and atmospheric dispersion.

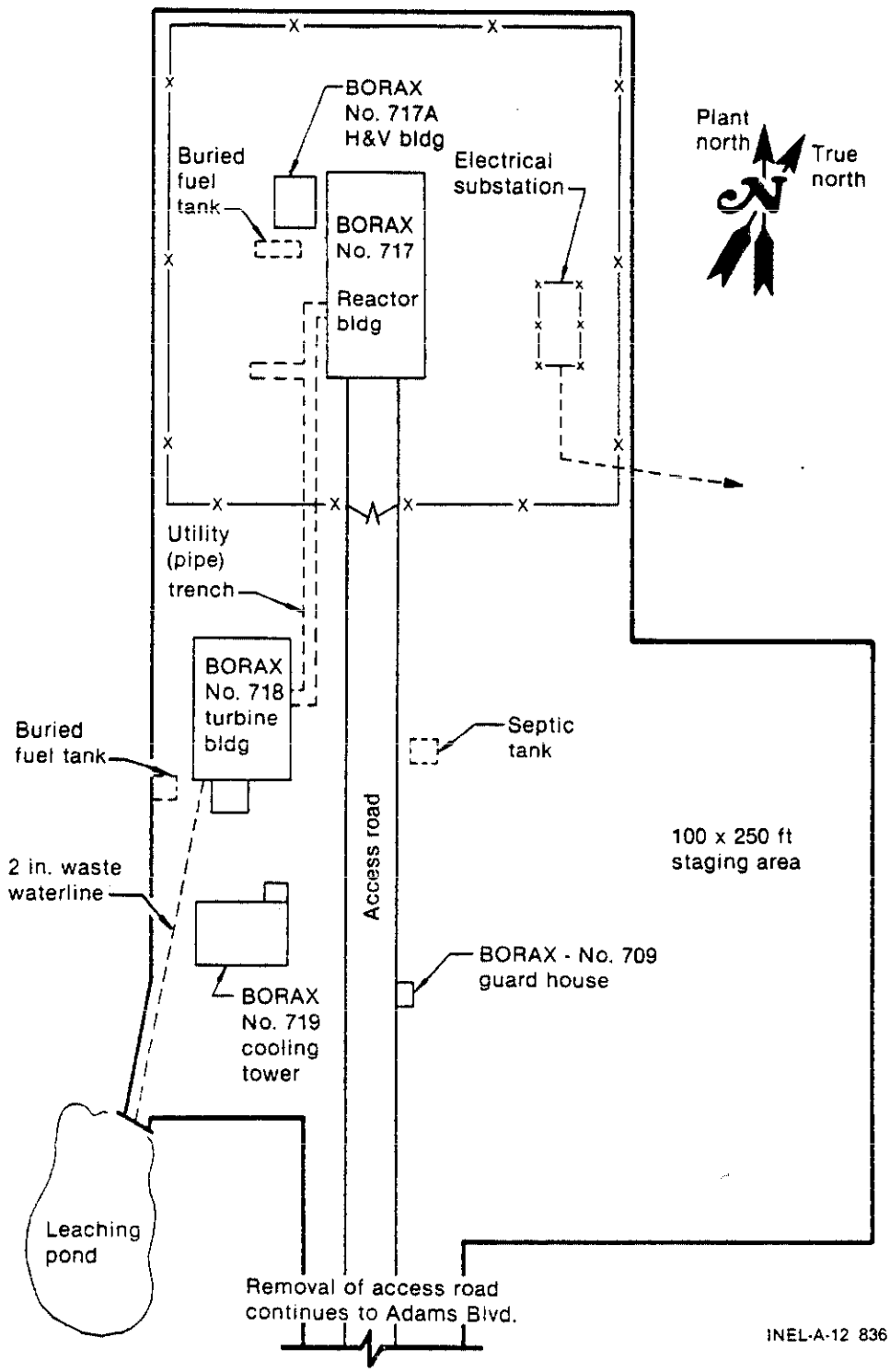


Figure 3.10.1. BORAX-V site boundary.

3.10.2 BORAX Activities

3.10.2.1 BORAX-I. EG&G's radiological characterization of the BORAX-I reactor area was performed as a prelude to the decontamination and decommissioning (D&D) of the area. The present BORAX-I site is shown in Figure 3.10.2; it consists of a radiologically contaminated area and the buried remains of a reactor. No hazardous wastes are expected to be present.

3.10.2.2 BORAX-III. BORAX-III was the first of the BORAX experiments to use steam for the production of electrical power and so was the first to be connected with water quality.

The fuel in BORAX-III was uranium-aluminum alloy clad with 2S aluminum. The use of aluminum meant that the pH should be kept on the acid side of neutrality to minimize corrosion. The problems connected with the reactor water were an important part of the BORAX-III program, the first step being to maintain water purity as high as consistent with the desired pH. Figure 3.10.3 shows this cleanup circuit, which consisted of filters and ion-exchange columns. In operation, these became quite radioactive; consequently, they were installed in the cement fuel-storage pit so that the water provided the necessary shielding.

During normal operation, steam flowed in a closed-cycle mode. However, pressure relief and excess steam were released directly to the atmosphere. The carryover of activity from the reactor water into the steam phase did not reach high levels.

Radioactive liquid wastes were directed through an approximately 2-in. diameter pipe to a leaching pond remotely located on the desert floor. Nonradioactive liquid industrial wastes, comprising primarily cooling tower blowdown, were directed through 1-1/2-in. diameter steel pipe to the same leaching pond.

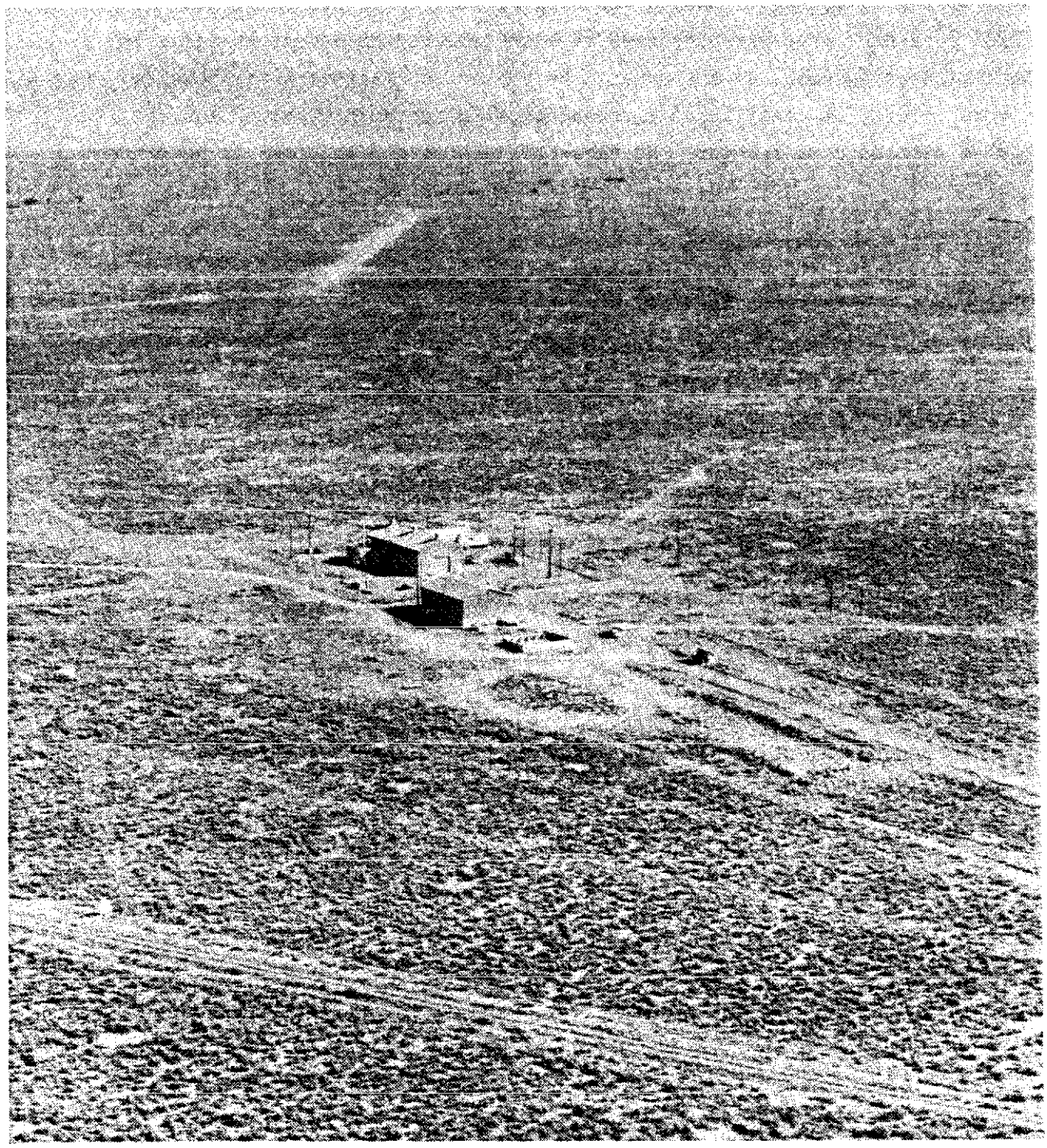


Figure 3.10.2. BORAX-II site looking northeast.

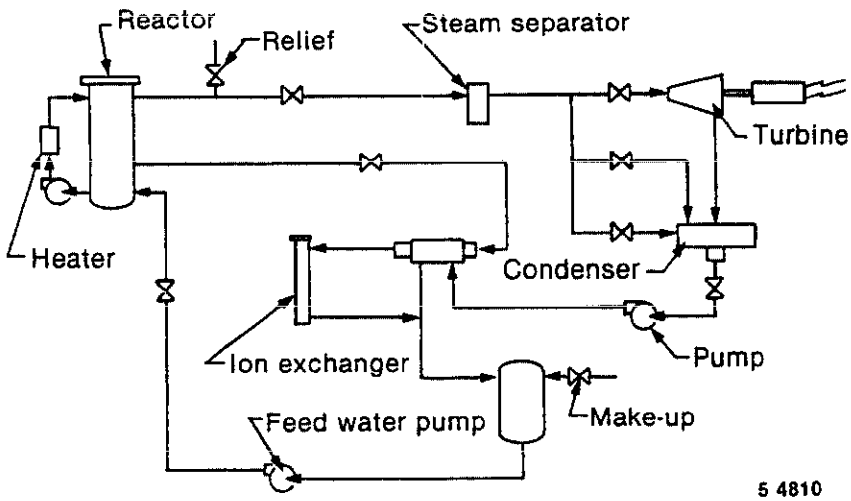


Figure 3.10.3. BORAX-III flow diagram.

3.10.2.3 BORAX-IV. From the standpoint of water chemistry, BORAX-IV was not significantly different from BORAX-III. The combination of mixed-bed and cation exchangers operated with parallel flow, found best in BORAX-III, was continued in BORAX-IV. Instead of operating at low pressure, however, as in BORAX-III, the purification system in BORAX-IV was designed for reactor system pressure (see Figure 3.10.4). Fuel cladding in BORAX-IV was the aluminum alloy 7388 instead of 2S as used in BORAX-III. A pH range of 5 to 6 was maintained in the water in order to reduce corrosion.

With the exception of a new fuel design element, the BORAX-IV system comprised the same components and instrumentation used in BORAX-III. Therefore, the waste-disposal methods were essentially the same.

3.10.2.4 BORAX-V. The primary objective of the BORAX-V program was to test nuclear superheating concepts and to advance the art of boiling water reactor design by performing experiments which improved the understanding of factors limiting the stability of boiling water reactors at high-power densities.

The BORAX-V facility is comprised of the reactor and turbine building, cooling tower, heating and ventilating (H&V) building, and miscellaneous outdoor components. Figure 3.10.1 showed the facility layout and corresponding building numbers. The reactor building houses the BORAX-V reactor vessel, the BORAX-II, -III, and -IV reactor vessels, and the associated reactor support systems. A process flow diagram is shown in Figure 3.10.5.

Nonradioactive liquid industrial waste effluent was disposed of in a manner identical to that of BORAX-III and BORAX-IV.

3.10.3 Waste Activities and Sites

3.10.3.1 Leaching Pond Description. The BORAX-V Leaching Pond is located approximately 60 ft south of the cooling tower (see Figure 3.10.1). The pond basin is approximately 20 ft x 90 ft and is one foot below grade on the west side and three feet below grade on the

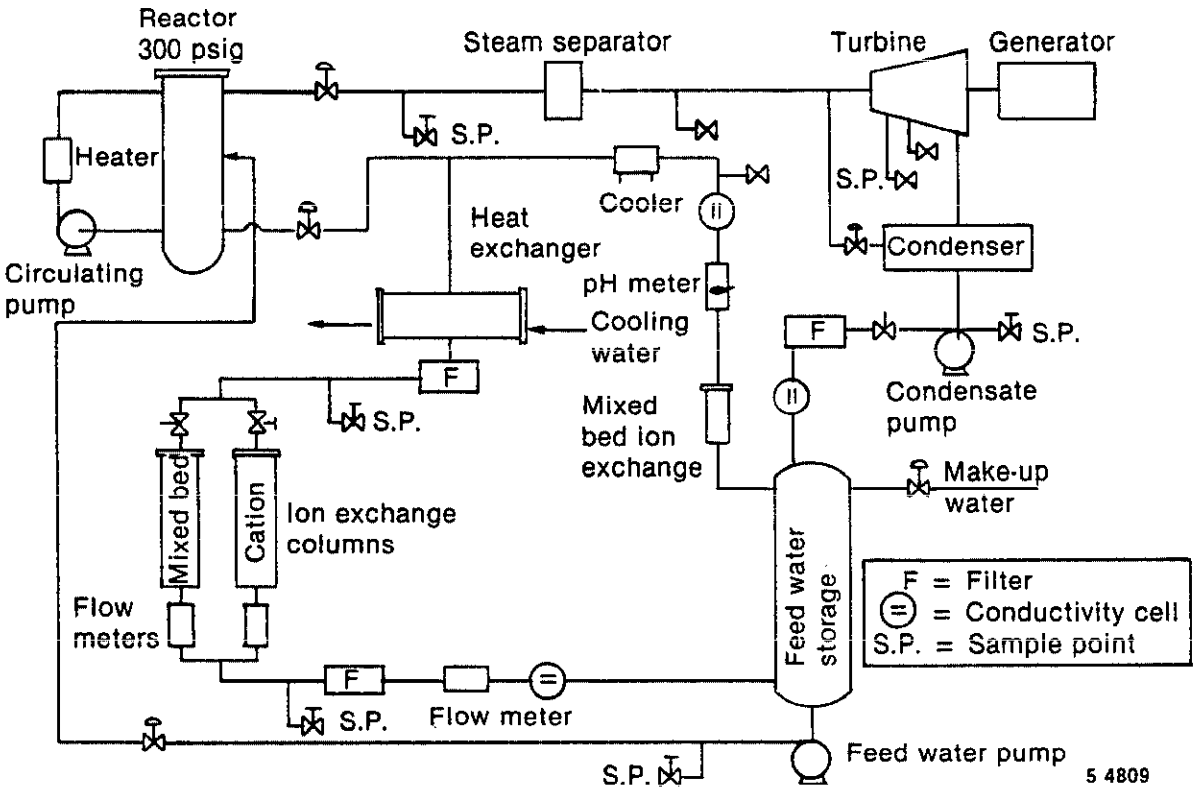


Figure 3.10.4. BORAX-IV flow diagram.

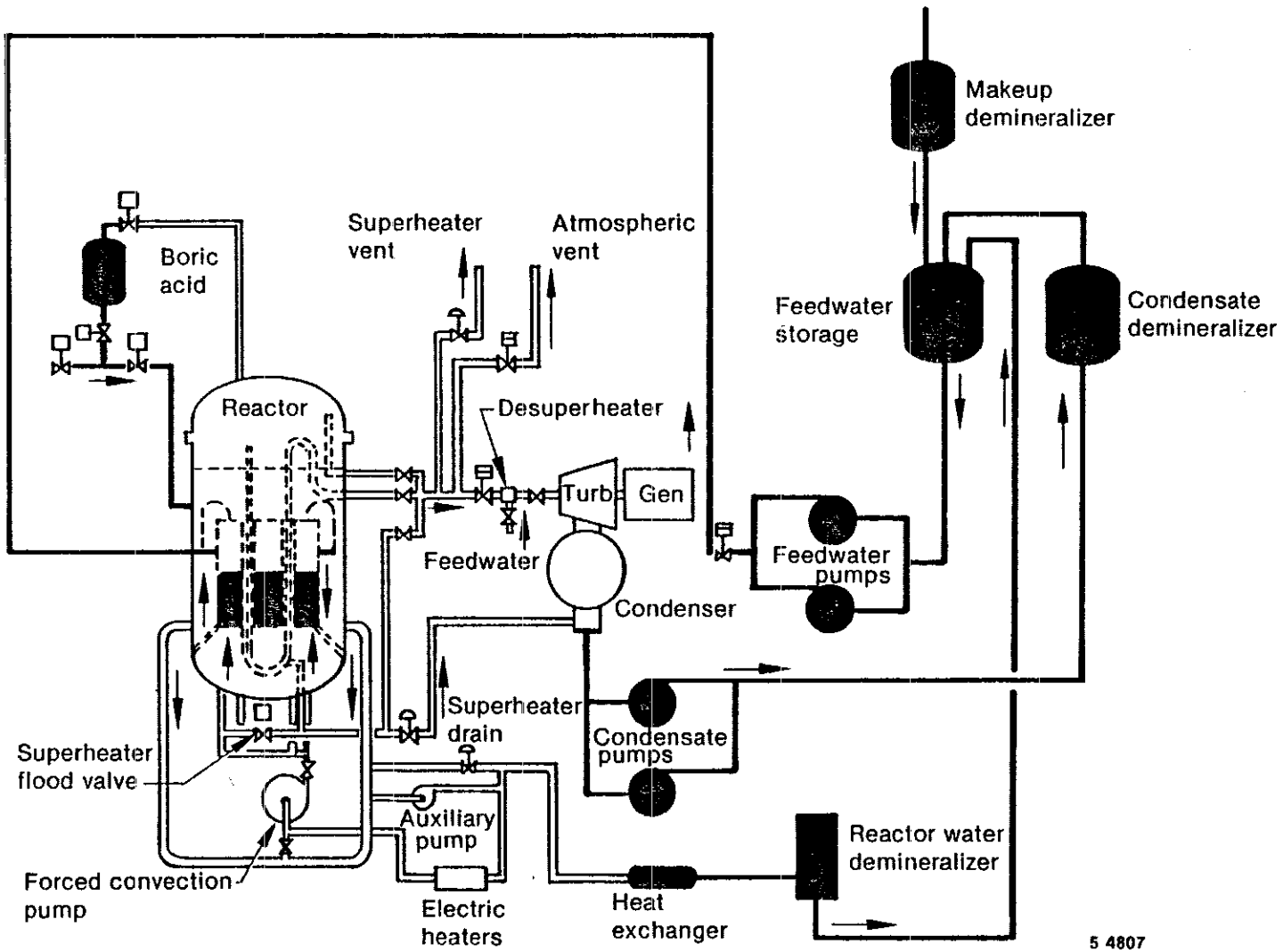


Figure 3.10.5. Flow diagram for BORAX-V.

other three sides. The earth dike that surrounds the pond is level with the surrounding land, except along the southeastern portion where it slopes down about three feet. A sketch of the pond basin, the surrounding dike, and some elevation are shown in Figure 3.10.6. There are presently two underground carbon steel waste lines that release to the pond, as indicated in Figure 3.10.7. Figure 3.10.8 outlines the path of the wastewater line from the facility to the leach pond.

3.10.3.2 Activities Contributing Waste to the BORAX Leach Pond. Due to the experiments conducted during BORAX operations, some hazardous chemicals were used in relatively small quantities. Therefore, a certain percentage of the chemicals used will appear in the wastewater line leading to the leaching pond. This is one way of investigating the probable chemical constituents in the leaching pond.

In the experiments at BORAX-III, the steam was collected and fed directly to a turbine. It therefore lent itself to the study of water decomposition rate as a factor of addition of certain chemicals. The results of this study are given below.

Addition	Rate of Change in Water Decomposition
KCl, 4 gm	Increased 10%
NH_4OH, 4 cc	Increased 10%
N_2, 166 cc/L of condensed steam	No effect
O_2, 26 cc/L of condensed steam	Slight increase
KOH	Decreased as pH increased
H_2	Decreased in proportion to rate of addition

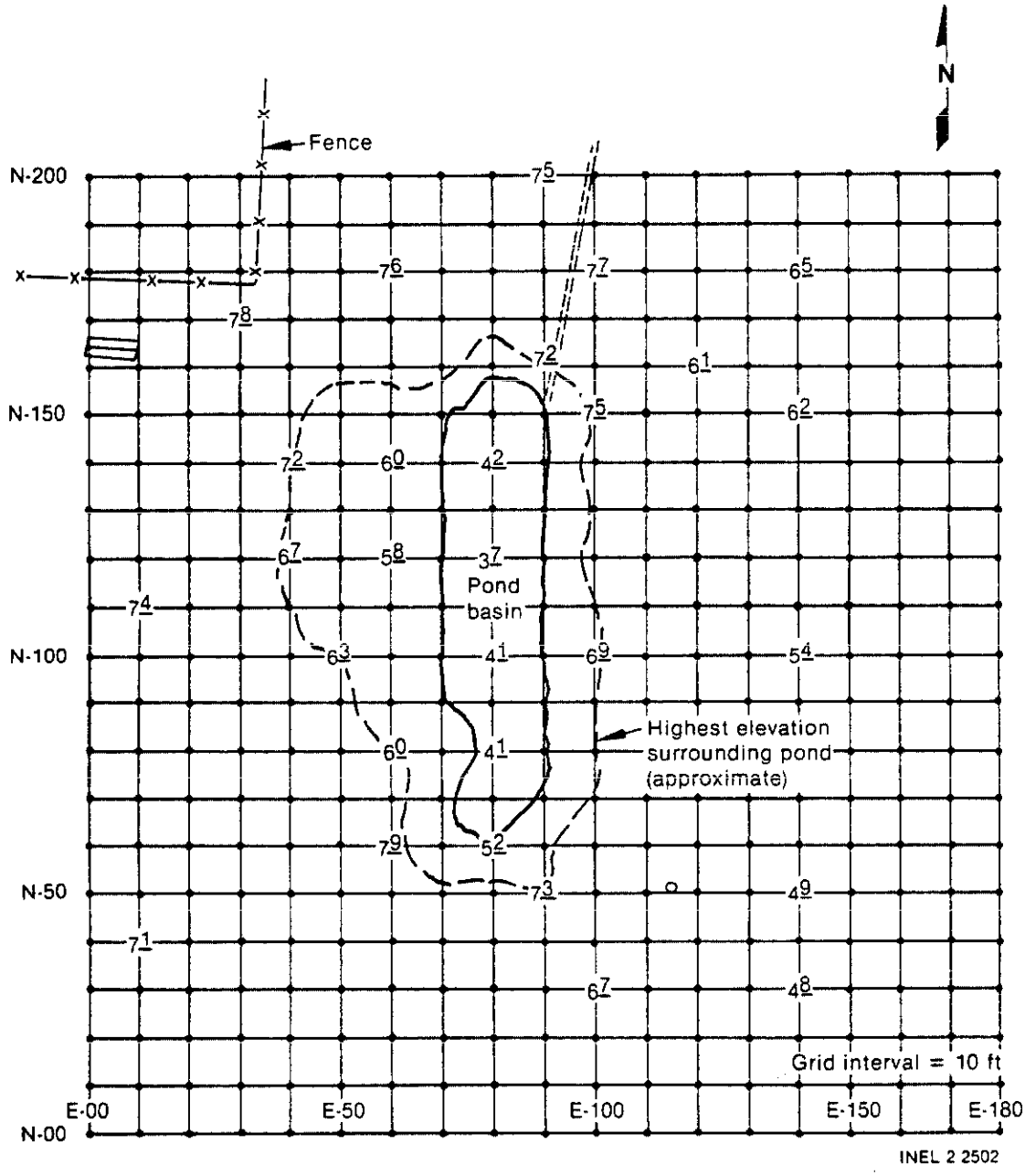


Figure 3.10.6. BORAX-V leach pond perimeter and relative elevation.

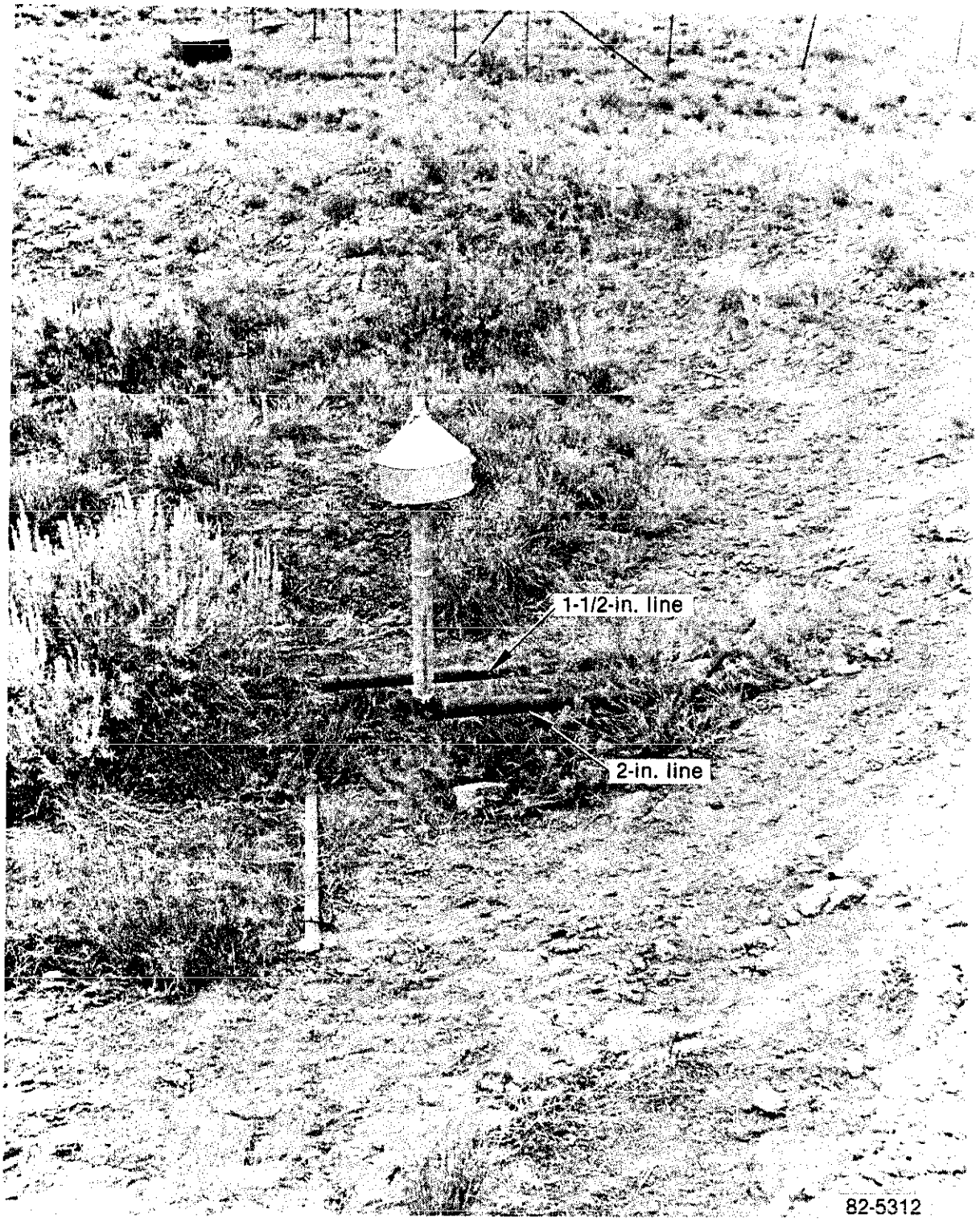


Figure 3.10.7. Wastewater outlets to BORAX-V leach pond.

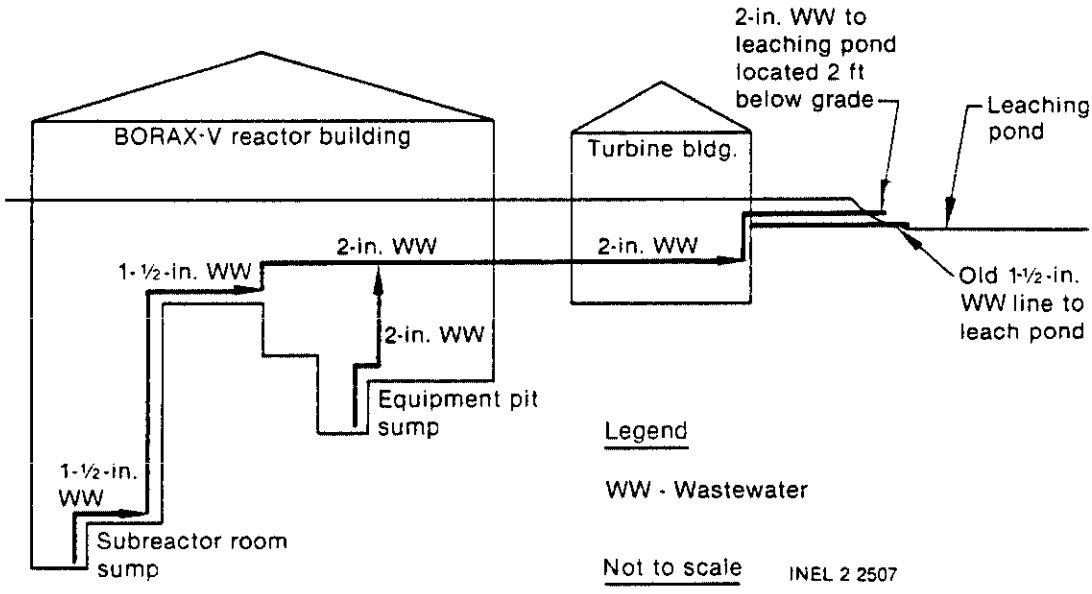


Figure 3.10.8. Wastewater pipelines to BORAX-V leach pond.

Another study was made on BORAX-III in 1956, to observe the changes which occur in Hotwell activity when chemicals are added to the feedwater. The results of this study are given in Table 3.10.1.

Similar studies of water decomposition were made for BORAX-IV by observing the effect of adding chemicals to water.

- o Addition of phosphoric acid: A preliminary two-day test was made in BORAX-IV to study the effect of H_3PO_4 on water decomposition and activity in reactor steam systems. H_3PO_4 was added at intervals in five portions until a total of 201 cc had been added (47.7 ppm PO_4^{-3}).

- o Addition of Morpholine: A total of 5 ppm were used to study water decomposition.

3.10.3.2.1 Suspended and Dissolved Solids from BORAX-V--Corrosion products at the surface of materials are in contact with the primary coolants. Since water-cooled nuclear reactor systems are constructed mainly of an 18-8-type stainless steel, the corrosion products contain the elements found in these steels, i.e., iron, chromium, nickel silicon, and carbon.

Typical suspended insoluble solids measured in boiling core B-2 and in cores PSH-1A and 1B are compared in Table 3.10.2.

Further information on the major corrosion products formed and collected from the boiling zone of the reactor during this operation period was derived from the analysis of a sample of material taken from the cellulose filters upstream of the reactor-water demineralizer after about 30 days of operation. Table 3.10.3 shows the major components present in this material.

TABLE 3.10.1. CHANGES IN HOT WELL ACTIVITY RESULTING FROM ADDITION OF CHEMICALS TO FEEDWATER

Date	Addition	Amount	Activity, mR/hr		Delay Time to Peak Activity (Minutes)
			Before Addition	Peak After Addition	
3-9	KCI	4 gm	70	125	2
3-11	HCI	6.8 cc (conc.)	150	225	15
3-11	NH_4OH	2 cc (conc.)	73	180	1.75
		4	100	240	1.1
		4	65	225	1.25
3-11	HNO_3	1.9 cc (conc.)	62	130	9
		1.9	80	160	8
		6.0	50	290	10
3-16	NH_4NO_3	1.2 gm	95	200	5
3-16	N_2H_4	1 cc (anhydrous)	90	95	
		10	95	310	2
2-16	H_2SO_4	5 cc (conc.)	200	270	8
3-17	H_2O_2	5 gm	No Increase		
		9	No Increase		
3-15	KOH	2 gm	80	60	6
		2	65	55	5
		2	50	50	
		6	50	50	
3-12	N_2 (gas)		No Increase		
3-14	O_2 (gas)	26 cc/L	100	70	5
		50	70	45	
3-13	H_2 (gas)		75	230	20 sec
3-14			80	170	27 sec
3-17		27 cc/L	90	160	15 sec

TABLE 3.10.2. SUSPENDED INSOLUBLE SOLIDS, COMPARISON OF CORE B-2 WITH CORES PSH-1A AND PSH-1B

Sample Period	Concentrated Ignited Solids, ppm	Average Analysis, w/o	Remarks
1963		Core B-2	
Jan 30 to Feb 1 Feb 6 to Feb 8 Feb 8 to Feb 13	0.02 0.08 0.08	Fe: 20.4 Cr: 1.2 Ni: 3.7 Al: 41.0	System hot. Various powers from 0 to 20 MWt. Sampled with midvessel probe.
Date and Time, 1964		Cores PSH-1A and PSH-1B	
June 22 (1000) to June 23 (0830) June 23 (0850) to June 23 (1303) June 23 (1355) to June 23 (1500)	0.09 0.03 0.83		DM-1 off from 1352 to 1418. $Al(NO_3)_3$ injected at 1410.
June 23 (1510) to June 23 (1840)	2.5		
June 24 (0850) to June 24 (1500) June 24 (1509) to June 26 (1100)	0.009 0.008	Fe: 20.0 Cr: 1.9 Ni: 1.3 Al: 32.0	Average suspended solids analysis includes $Al(NO_3)_3$ injection.
June 26 (1115) to June 26 (1600) July 6 (1600) to July 10 (0930) July 10 (1020) to July 10 (1240) July 10 (1245) to July 10 (1545)	0.002 0.006 0.001 0.001		
July 13 (1400) to July 15 (0900) July 15 (0900) to July 16 (0900)	0.080 0.003		

TABLE 3.10.3. ANALYSIS OF SOLIDS FROM CELLULOSE FILTER UPSTREAM OF REACTOR-WATER DEMINERALIZER, CORE PSH-1A

Compounds: (mostly amorphous)	Elements, w/o:			
Major ones identified:	Al:	15	Cu:	0.1
	Fe:	10	Zn:	0.1
Bayerite $-\infty Al(OH)_3$	Ni:	3	V:	0.05
	Cr:	1	Sn:	0.05
Silica $= SiO_2$	Si:	1	Zr:	0.02
	Pb:	1	Ti:	0.02
Iron Oxide - Fe_2O_3 (hydrated)	Mn:	0.5	B:	0.01
	Mg:	0.3	Ag:	0.001

3.10.3.2.2 Boron Addition in BORAX--Boron in the reactor vessel water has the same type of poisoning or neutron-absorbing effect as do the reactor control rods. When introduced into an actively steaming vessel, only a very small amount of boric acid is carried away in the steam; most remains in the vessel water.

A charge of approximately 130 kg (dry wt.) of boric acid was calculated to be adequate for most BORAX core loadings and maximum water load with forced convection piping in place.

3.10.3.2.3 Regeneration of Ion-Exchange Columns--From BORAX-III to BORAX-V, the purification system (which included both an ion-exchange column and a mixed bed) had to be regenerated occasionally. Sulfuric acid and sodium hydroxide were used. The total discharge from this regeneration was approximately 454 kg/y for the acid and for the base.

3.10.3.2.4 Chemical Decontamination--Laboratory studies were made to evaluate decontamination methods that may be useful in boiling water reactor systems. A recommended procedure for the decontamination of metal contamination by using high-pressure steam involves the use of alkaline permanganate; the chemical formula consists of NaOH (100 g/L), $KMMO_4$ (30 g/L), H_2O (870 g/L), and citric acid.

3.10.4 Hazardous Materials Presently Observed from BORAX-V--Asbestos: Steam piping throughout the BORAX-V facility is wrapped in several inches of insulation (see Figure 3.10.9). Samples of this insulation were collected and analyzed at the Hanford Environmental Health Foundation and were found to contain asbestos. The asbestos pieces were located as part of a dump, behind the reactor building. This dump has now been cleaned up and the asbestos has been boxed and buried at the central landfill.

PCB: There is a possibility that the turbine lube oil and the liquid dielectric in the electrical transformer contained the toxic material PCB. According to the Waste Management D&D Program of EG&G, one of the tanks,

Figure 3.10.9. Asbestos piping insulation in BORAX-V waste dump.

V-2 from TAN, which contained dielectic liquid was tested and confirmed the presence of PCB (500 ppm). Since the electrical transformers at the TAN and BORAX facilities were of the same time frame, and same design, we assume the same type of dielectric liquid was used.

Lead: Lead pieces were observed throughout the BORAX-V facility. The largest, shown in Figure 3.10.10, was about 9 ft^3.

Chromium: Chemical analyses on the BORAX-V cooling tower were completed in May of 1979 by D&D. The analyses were conducted in order to determine the presence of wood-preservative chemicals. Each sample was analyzed for hexavalent, and total chromium, arsenic, trichlorophenols and penta-chlorophenol. The results of the analyses indicated that most chemical concentrations were at or below detection limits. See Table 3.10.4.

Tables 3.10.5 summarizes the total waste generated by the BORAX facility. This table characterizes the nonradioactive wastes only, which include sulfuric acid and sodium hydroxide, with their respective quantities in kg or liters per year.

Figure 3.10.10. Lead waste (9 ft^3).

TABLE 3.10.4. CHEMICAL ANALYSIS ON BORAX-V COOLING TOWER WOOD SAMPLE

Field Sample Number	UBTL Lab Number	Sample Type	Results	
			% CHROMIUM	% ARSENIC
A-2	4802	Bulk	29.3 0.0003	<0.001
B-2	4803	Bulk	0.0002	<0.001
C-2	4804	Bulk	0.0001	<0.001
Limit of detection			0.0001	0.001
			ppm	
			2,4,5 TRICHLOROPHENOL 2,4,6	PENTACHLOROPHENOL ppm
A-3	4805	Bulk	<2.5 <1.0	<16
B-3	4806	Bulk	<2.5 <1.0	<16
C-3	4807	Bulk	<2.5 <1.0	<16
	LOD		2.5 1.0	16

TABLE 3.10.5. NON-RADIOACTIVE WASTE AT BORAX FACILITIES

Facility	Waste Streams	Time Frame	Estimated Quantities	Treatment/ Storage/ Disposal
BORAX-I -III -V	H_2SO_4	1955-1964	454 kg/yr	Dispose of in diluted form to leaching pond
	NaOH	1955-1964	454 kg/yr	Same as above
	Boric Acid	1955-1964	90.8 kg/yr	Same as above
BORAX-IV	Morpholine	1957	0.095 kg/yr	Leaching pond
BORAX-V	PCB	1955-1964	--	
	Chromium	1955-1964	--	
	Asbestos	1955-1964	--	Piping insulation in the BORAX facility

3.11 Experimental Breeder Reactor-I (EBR-I) Past Activity Review

3.11.1 EBR-I Description

The Experimental Breeder Reactor-I/Waste Management Office (EBR-I/WMO) area is located on the INEL site, southwest of the Central Facilities Area. Figure 3.11.1 shows the present plot plan of EBR-I/WMO area.

The EBR-I was designed in the period 1948 to 1950. It was designed to prove: (1) The concept of breeding by actual measurement (by making measurements after radiation of fuel by chemically reprocessing it and then arriving at values), and (2) the concept of cooling a reactor with liquid metal and using the heat in the production of steam.

The reactor was built in 1951, went critical that fall, and produced the first useful power in December of 1951. The Mark I-IV series cores were developed and tested over a ten-year period. In 1964 the reactor shut down because of lack of further assignments.

A flow diagram of the heat transfer system is shown in Figure 3.11.2. Primary and secondary coolant circuits are used in series. Both the primary (or reactor) circuit and the secondary (or steam generator) circuit use sodium-potassium alloy (78 wt 90 K). The coolant flow path is as follows:

The alkali metal was pumped from the sump tank to a head tank as shown in Figure 3.11.2. The metal flowed by gravity from this head tank through the reactor then through an intermediate heat exchanger to return to sump tank. The heat produced was then transferred to the steam generator, which in turn, powered a turbine-generator.

The Argonne Fast Source Reactor shielding (AFSR) was developed as a tool to study the physics of fast breeder reactors. It was placed in operation in October 1959, with a design power of one kilowatt. The AFSR was located southeast of ZPR-III building. The original AFSR building had

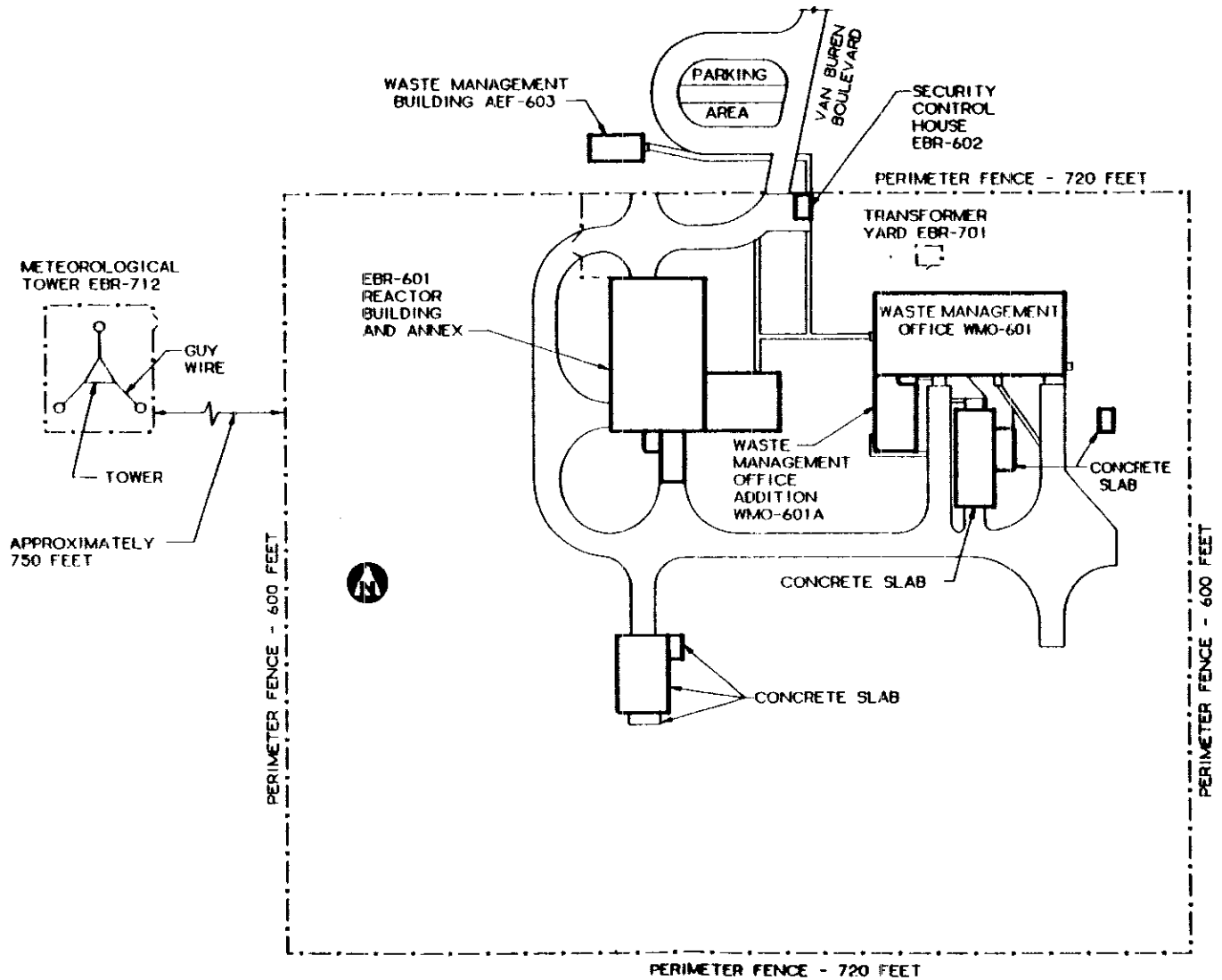


Figure 3.11.1. EBR-I/WMO plot plan.

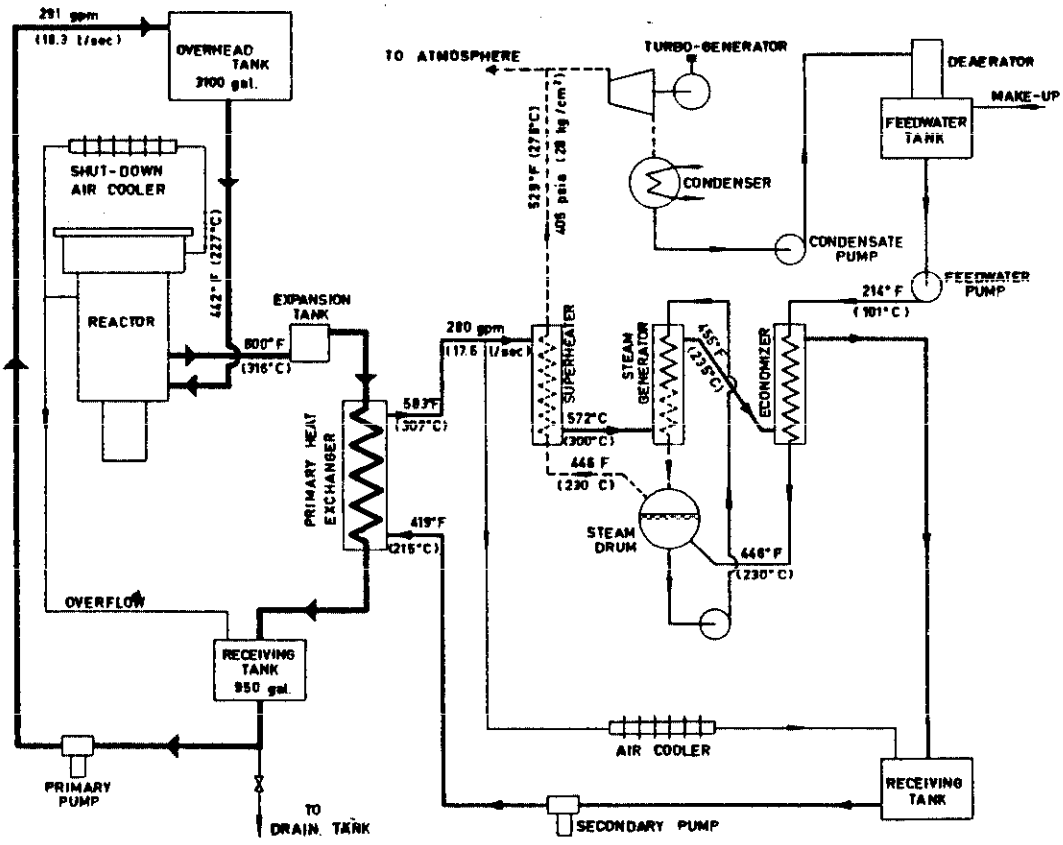


Figure 3.11.2. Flow Diagram, EBR-I Reactor.

been dismantled and the reactor, control instrumentation, and electrical gear had all been removed to EBR-II prior to initiation of the EBR-I D&D program. Remaining were the belowgrade basement, source storage vault and hardware, the abovegrade steel-lined concrete shielding structure with view port and access ports to the centrally located reactor cell shown in Figure 3.11.3.

3.11.2 EBR-I Condition Prior to Decommissioning

The Experimental Breeder Reactor main building is a multilevel structure, which consists of basement, main floor level and the mezzanine. Basic floor plans are shown in Figures 3.11.4, 3.11.5 and 3.11.6 respectively.

In addition to housing the reactor, its associated controls, cooling and power generation system office, heating, utility and maintenance provisions, the building housed facilities and equipment for handling storage and wash-down of nuclear fuel elements. Consequently, even though all nuclear elements were removed from this facility many years ago, some areas of the building remained radioactive. These activated and/or contaminated areas included the reactor core area, the fuel rod farm, fuel handling, storage, and wash-down areas, and the conveyor area below the reactor. In addition, the primary coolant system, containing 4,400 gal of NaK, had been radioactively contaminated by the core meltdown that took place in 1955. At the time that the facility was deactivated, both the primary and secondary NaK systems had been drained into their respective drain tanks, 4,400 gal of radioactively contaminated NaK in the primary drain tank and 1,100 gal of uncontaminated NaK in the secondary drain tank. Observations at the reactor tank showed evidence of oxide residue over the NaK, which might have been caused by air and moisture in the system. (In 1970, analysis showed a total Cs-137 contamination of 16.2 curies and 2.1 mCi of Sr-90.)

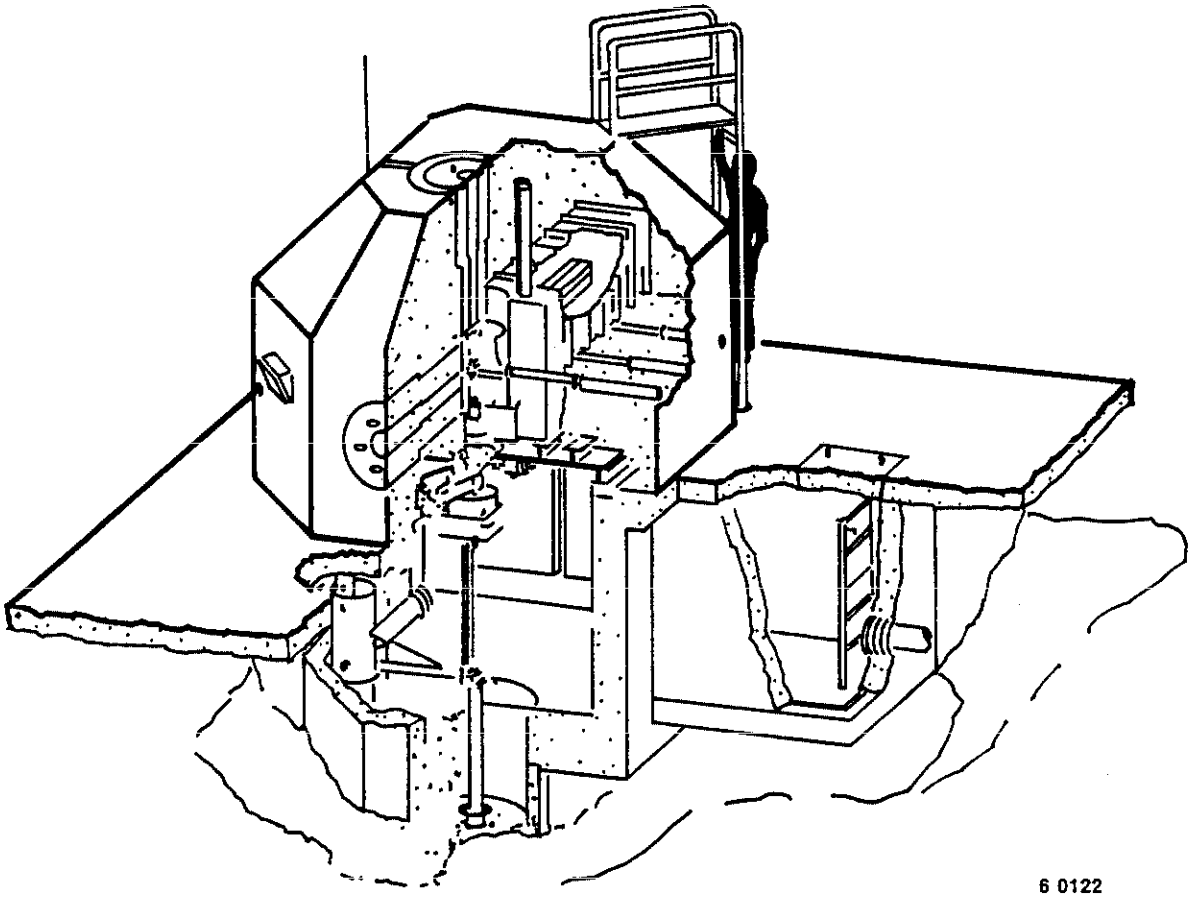


Figure 3.11.3. AFSR shielding.

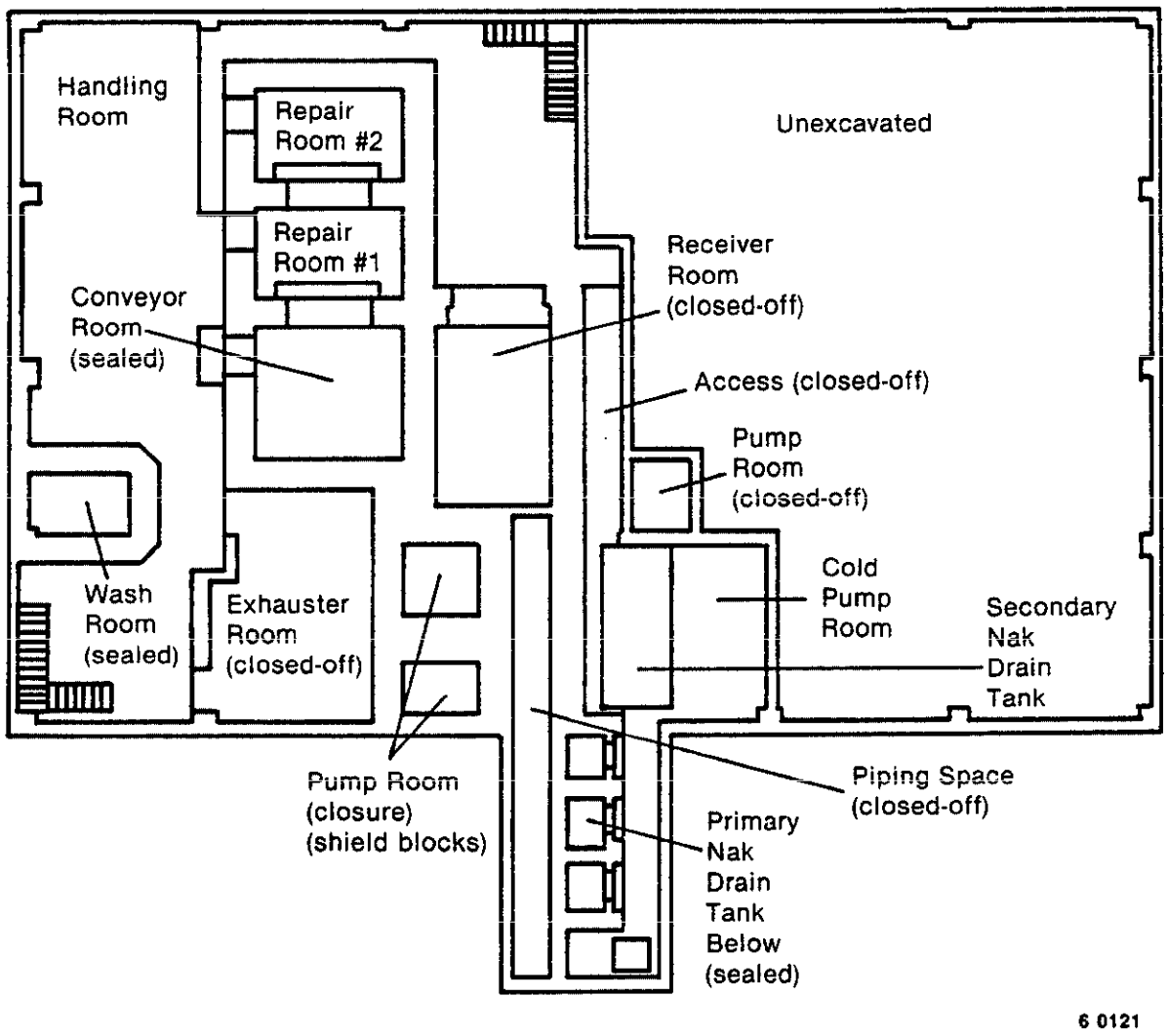


Figure 3.11.4. EBR-I basement plan.

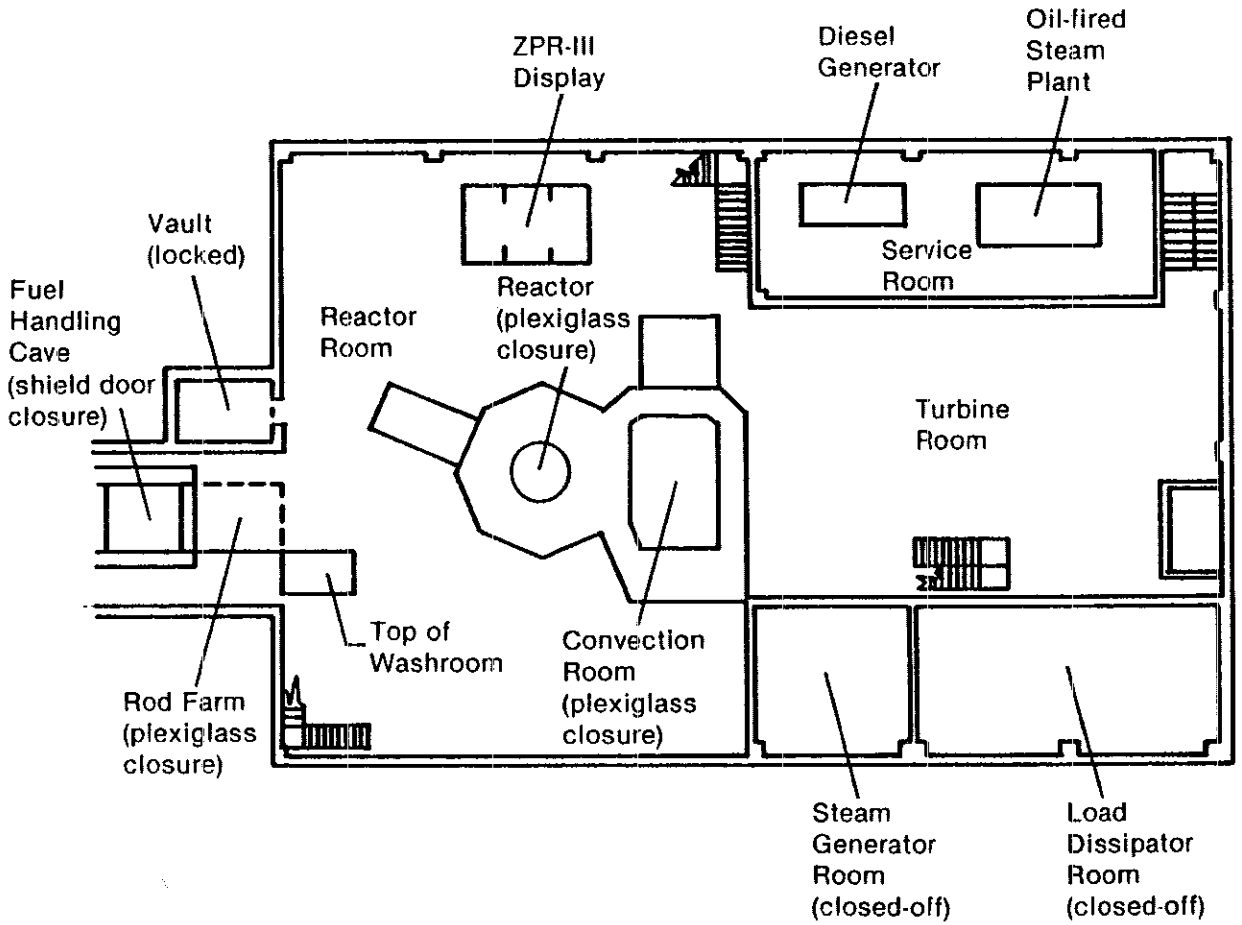


Figure 3.11.5. EBR-I main-floor plan.

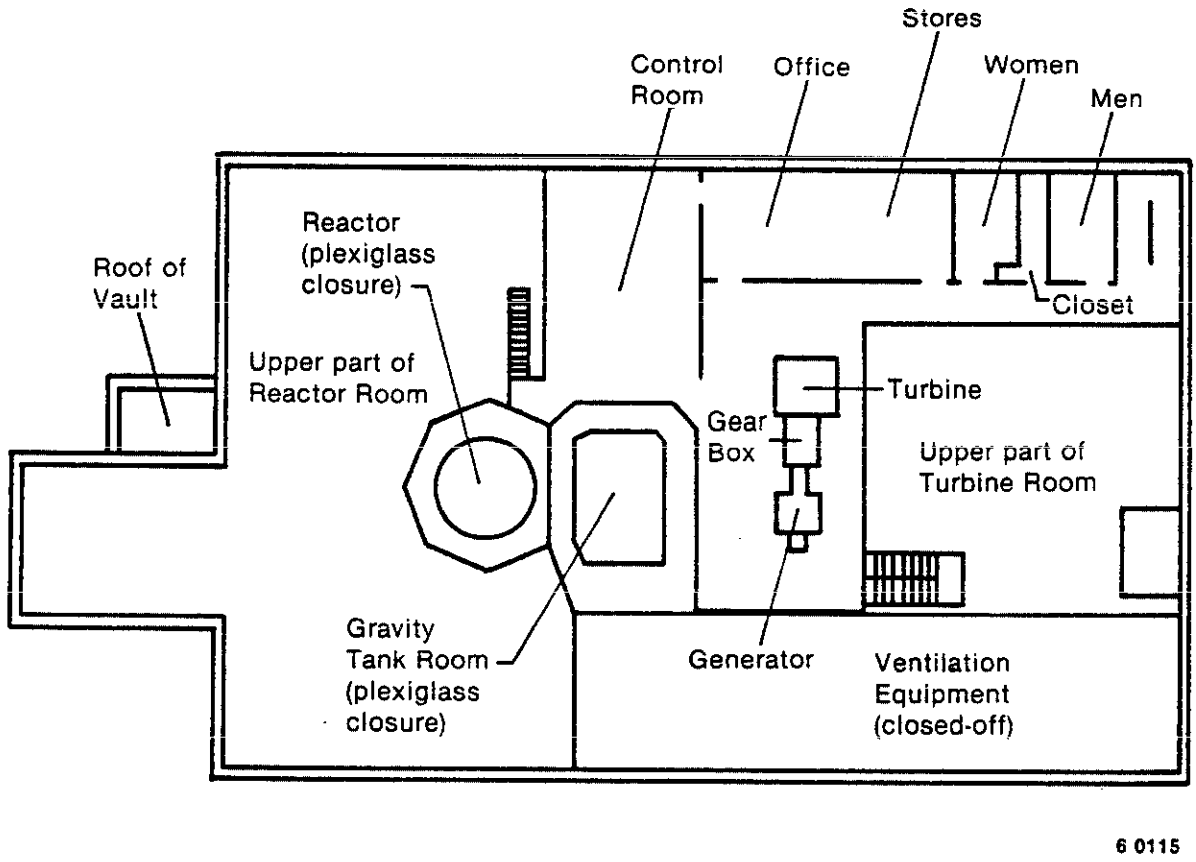


Figure 3.11.6. EBR-I Mezzanine plan.

3.11.3 Decontamination and Decommissioning of the EBR-I Complex

The purpose of the EBR-I Complex Decontamination and Decommissioning (D&D) Program was to make the EBR-I Complex safe for use and enjoyment by the public as a National Historical Monument. The complex consists of the EBR-I Reactor Building, the Zero Power Reactor Building (ZPR-III), the Argonne Fast Source Reactor (AFSR), and the contaminated NaK Storage Pit.

The D&D Program for the EBR-I complex included:

- Extraction of 5,500 gal of NaK coolant which were left in the reactor primary and secondary coolant loops
- Conversion of the NaK to a solid caustic (KOH/NaOH) for drummed waste disposal at the RWMC
- Decontamination of all NaK and/or radioactive contaminated equipment of the complex
- Demolition and removal of the portion which could not be decontaminated to safe levels
- Decontamination and removal of the ZPR-III Reactor
- Demolition of the AFSR shielding
- Removal of contaminated NaK in the NaK storage pit
- Removal of all nonradioactive debris to the INEL Central Facility Area (CFA) sanitary landfill
- Performance of final surveillance and safety inspection to ensure the safe condition of the entire EBR-I complex.

The D&D work was initiated in October 1973, and the U.S. National Park Service was given beneficial occupancy of the building May 27, 1975. All D&D work was completed by June 13, 1975.

3.11.4 Waste Generated by D&D Activity

3.11.4.1 NaK Process Plant. The 5500 gal of NaK were disposed of by reacting it with water in a strongly basic solution (NaOH/KOH), solidifying the solution by evaporation and cooling and disposal of the solid waste at the INEL RWMC.

The NaK process plant is shown in Figure 3.11.7. The NaK was reacted with water in the caustic in the VFE-I vessel to produce additional caustic. Water was injected into the vessel to make up for the water consumed by the NaK and for vaporization of water in the vessel. The off-gas from the vessel was passed through a demister, a scrubber vessel and a knock-out vessel. It then passed through one of two filter limits, each of which contained a glass wool or a steel wool prefilter and a particulate (HEPA) filter. The off-gas was sampled and then passed through a flare stack containing a flame arrester. Condensate, which formed in the off-gas line, was continuously drained and periodically recycled to the VFE-I vessel. The product from the VFE-I vessel was drained into 55-gal drums which, after solidification, were shipped to the RWMC.

To clean up the final traces of NaK, moist gaseous nitrogen (GN_2) was passed through the NaK feed tanks and lines followed by a water rinse. Finally, the residual liquid was evaporated until a 25-M concentration was attained for solidification and disposal.

The flowsheet for the NaK conversion is shown in Table 3.11.2. The conversion apparatus was designed to react 125 L/hr of NaK with the caustic solution to form the mixed NaOH/KOH solution. Water was to be conserved by

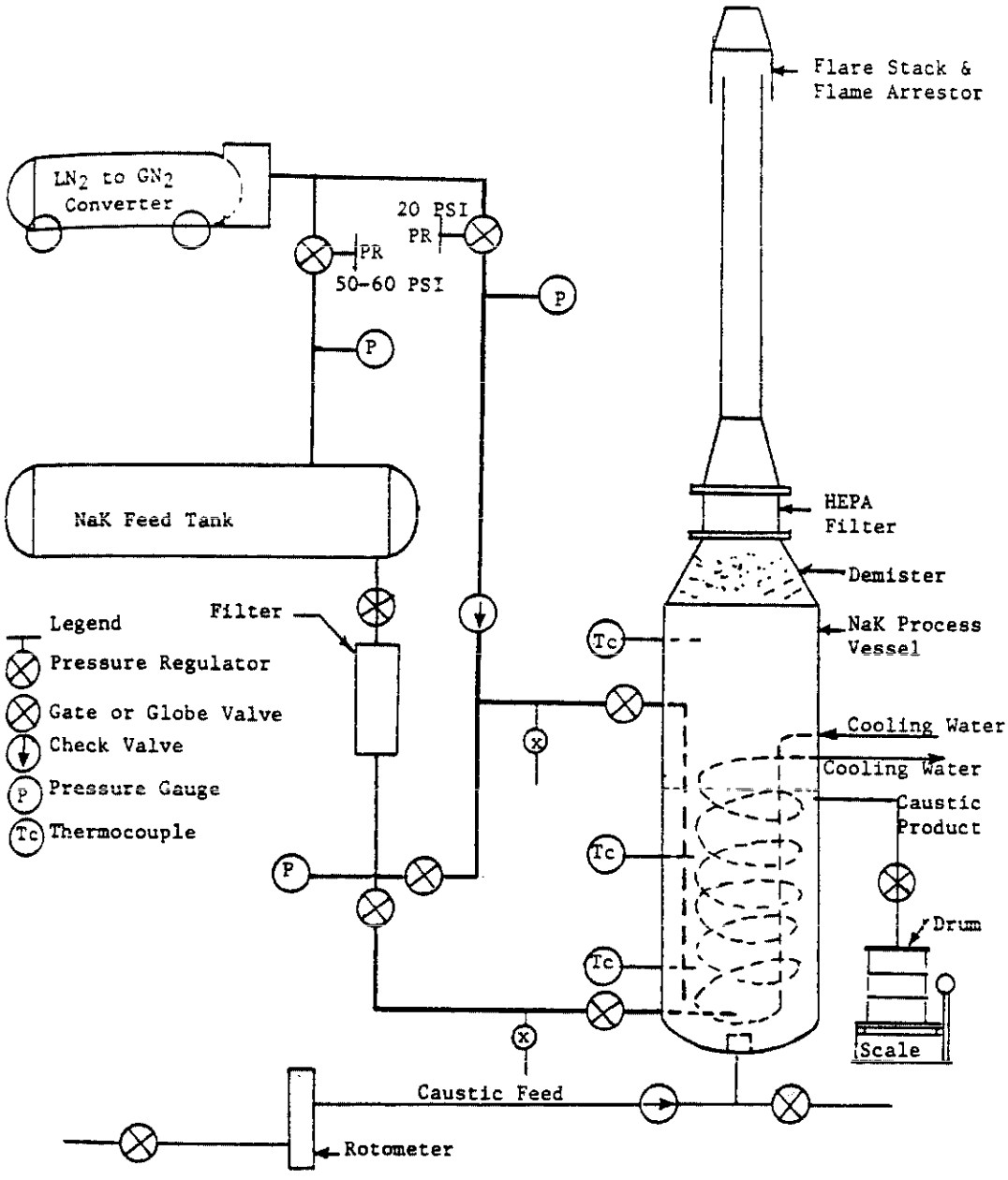


Figure 3.11.7. Process flow diagram of the EBR-I NaK Process Plant.

TABLE 3.11.1. FLOWSHEET FOR NaK REACTION

	NaK Feed	Water Addition	Caustic Produced	Off-Gas
Flowrate	125 P/hr	255 P/hr	128 P/hr	172 scfm
NaK, M	25.6	--	25	--
H_2 Vol. %	--	--	--	12%
H_2O (vapor) Vol. %	--	--	--	83%
GN_2 Vol. %	--	--	--	5%

reaction with NaK and by vaporization at a rate of 252 L/hr. The caustic product at 25 M was to be removed periodically at an average rate of 128 L/hr.

The 93 full or partially full drums filled during disposal of the EBR-I primary system NaK were shipped to the RWMC after solidification of the caustic.

During the last stages of processing of EBR-I, the contents of the scrubber and knock-out vessels were pumped into the VFE-I vessel. Two partially full 58-gal drums containing condensate from the stack were shipped to ICPP for disposal as a liquid waste.

After all NaK processing was completed, all of the processing equipment was dismantled and removed to the RWMC for disposal.

3.11.4.2 Isolation of Unclaimed Area. It was neither possible nor practical to decontaminate some areas in building EBR-60, to safe levels. These areas included the fuel rod farm, fuel wash room, and the areas containing the elevators, the reactor cell, and the primary NaK drain tank. Since these areas could not be satisfactorily decontaminated, isolation walls or barriers were constructed to prevent entry.

After NaK removal and flushing out of the EBR-I NaK systems had been completed, there remained approximately 80 gal of contaminated caustic sludge at the bottom of the primary drain tank. This residual sludge was not readily removable through the normal system fill or drain lines. It was therefore decided to solidify the residue in place in the tanks, seal up the tank, and isolate the area to prevent entry.

3.11.4.3 NaK Storage Pits. The NaK storage pit, the drums of residual NaK stockpiled along the west fence line, and miscellaneous useless equipment had to be disposed of. The four packages of contaminated NaK were located in the NaK storage pit, approximately 100 ft west of EBR-601. They included two 55-gal drums and two specially fabricated

containers which were partially filled with the NaK present in the reactor at the time of the partial core meltdown in November 1955. Radionuclide analysis showed that the NaK was highly radioactive and contained uranium, plutonium, and potassium superoxide. The containers and contents were removed from the NaK storage pit and transported to the Army Re-entry Vehicle Facility Site (ARVFS) bunker for temporary storage. The NaK storage pit was found to be uncontaminated, after removal of the drums and containers. Therefore, after the removal of the packages, the pit walls and concrete pad were demolished and backfilled into the pit. Further backfill to grade level was completed with native soil.

3.12 Zero Power Reactor-III (ZPR-III)

ZPR-III was used for determining the accuracy of predicted critical mass geometries and to determine critical measurements in connection with various loadings for make-up of fast reactor core design. The cores of EBR-II, Fermi, Rapsodie, and SEFOR reactors were originally mocked-up in this facility.

The ZPR-III Building (now WMO-601) is situated approximately 74 feet east of EBR-I. The basic building flow plan is shown in Figure 3.12.1.

3.12.1 Waste Generated by ZPR

Liquids: There were no radioactive liquid wastes or industrial liquid wastes produced in this facility. The sanitary waste effluent was discharged through a cast-iron pipe to a septic tank and leaching bed.

Solids: The major source of radioactive solid waste was from wipe rags, plastic containers, shoe covers, and other industrial solids associated with contact with radioactive materials. These were packaged and transported to the NRTS burial ground for disposal.

Solid nonradioactive waste was segregated into combustibles and noncombustibles. The combustibles were disposed of in the NRTS incinerator, and the noncombustibles were stored for future disposition.

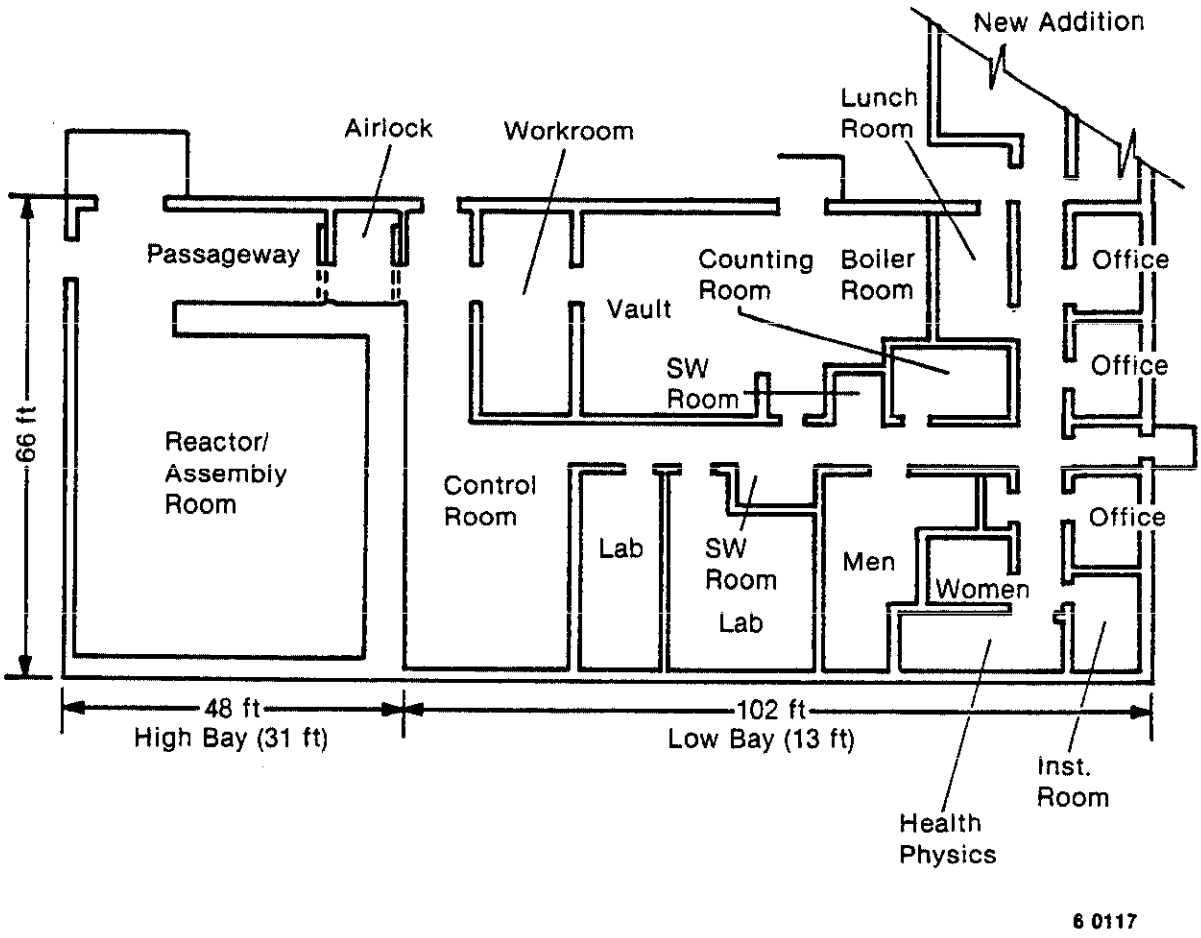


Figure 3.12.1. ZPR-III (Bldg. RTF-60) floor plan.

3.13 Liquid Corrosive Chemical Disposal Area (LCCDA)

3.13.1 LCCDA Description

The Liquid Corrosive Chemical Disposal Area (LCCDA) consisted of two surface impoundments used primarily for the disposal of a limited variety of liquid, nonradioactive, corrosive chemicals. It is located on the INEL near the RWMC as shown in Figure 4.13.1. Although officially closed in 1981, the site is still clearly visible and enclosed by a fence.

The LCCDA was probably first used in about 1961. The two surface impoundments were located at either end of a rectangular fenced area, the newer pit at the east end and the older pit on the west end. There is little information on the older pit except that it had been abandoned by 1974. The older pit was probably never more than a depression and was used little in the late 1960s. When use of the site was needed in the early 1970s, the newer pit was constructed. A plot plan of the LCCDA showing the newer pit is provided in Figure 4.13.2. Also, provided in the figure is an end view of this pit which was about 3 m (10 ft) by 4.6 m (15 ft) and 3 m (10 ft) deep. This newer pit had approximately 1.8 m (6 ft) of limestone covering the bottom to facilitate acid neutralization.

The LCCDA was enclosed by a 1.2-m (4-ft) high fence with one gate on the north side. The newer pit was surrounded by a berm about 1 m (3 feet) high and was accessible by both a ground ramp and a cribbed, elevated ramp. the cribbed ramp was used when a dumpster-mounted tank was drained. The ground ramp was used for all other disposals. The older pit probably did not have a set up (berms, ramps, limestone, etc.) as formal as that of the newer pit.

Use of the LCCDA was officially halted in 1981, and there are no records indicating that any waste was received that year. The last recorded incident of waste going to the LCCDA occurred in April 1980. The decision to stop using the site was based at least partially on the fact that its use had been decreasing and did not warrant the cost of upgrading the facility to meet new regulations.

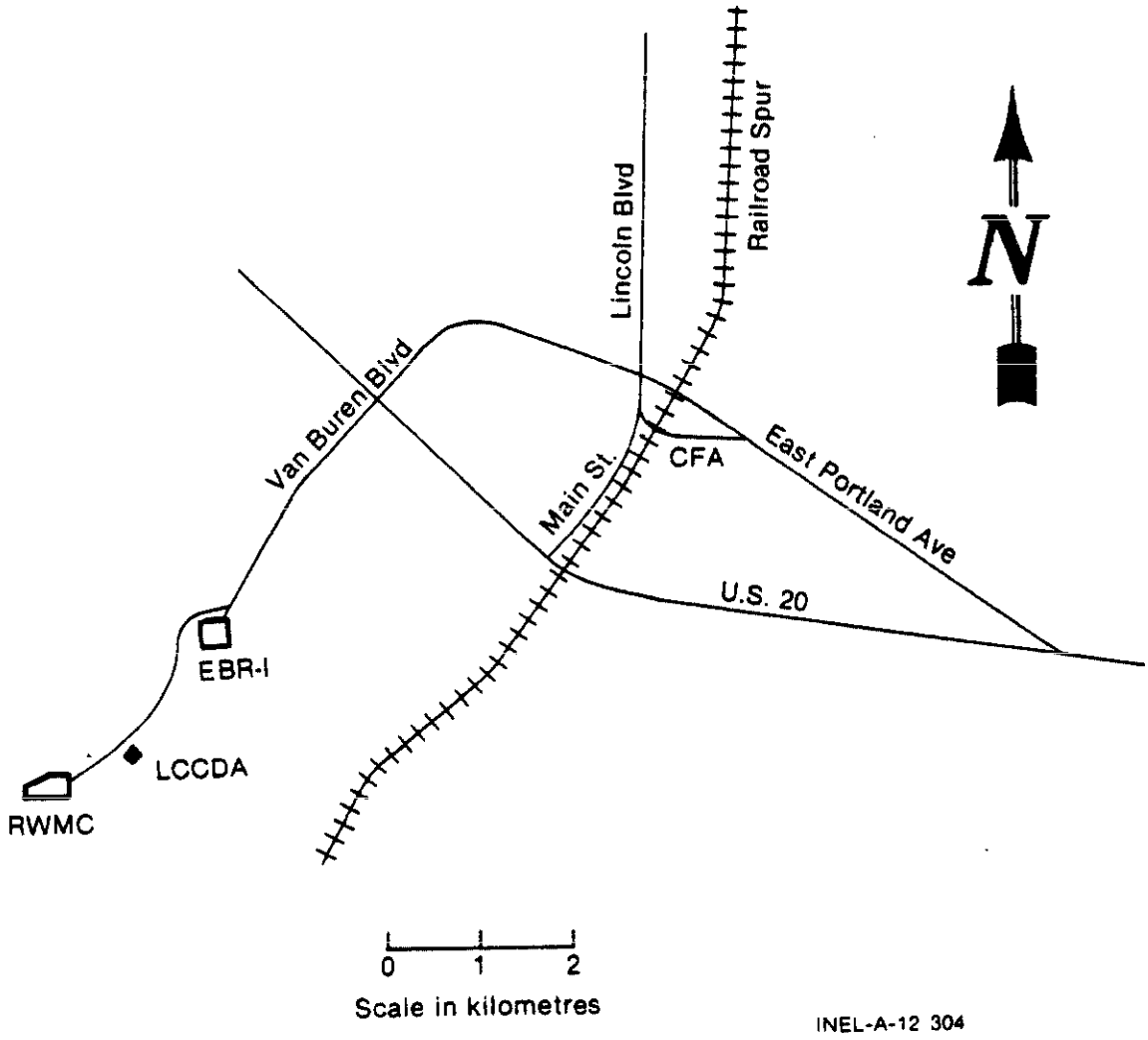
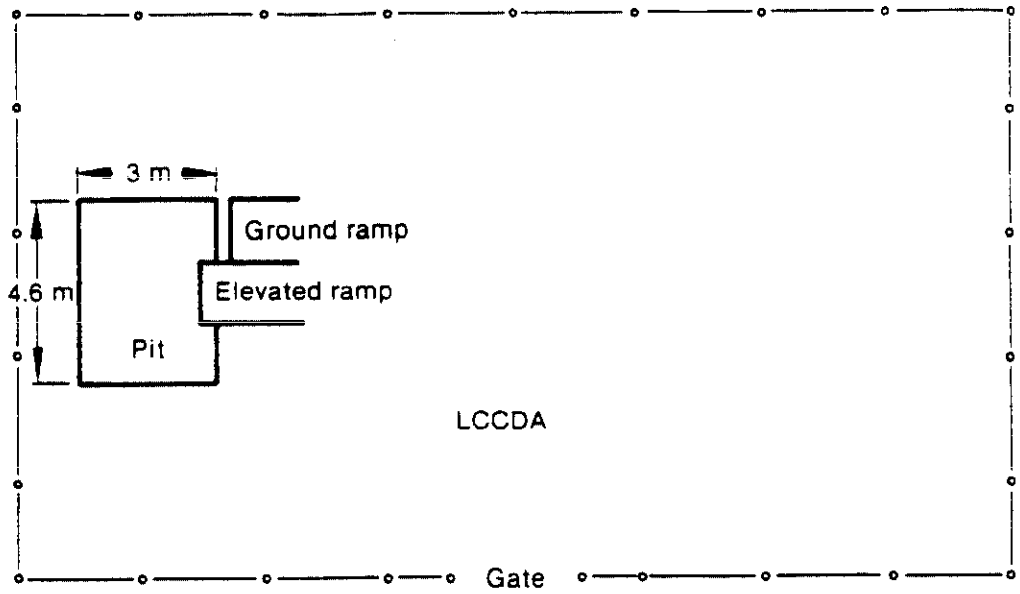
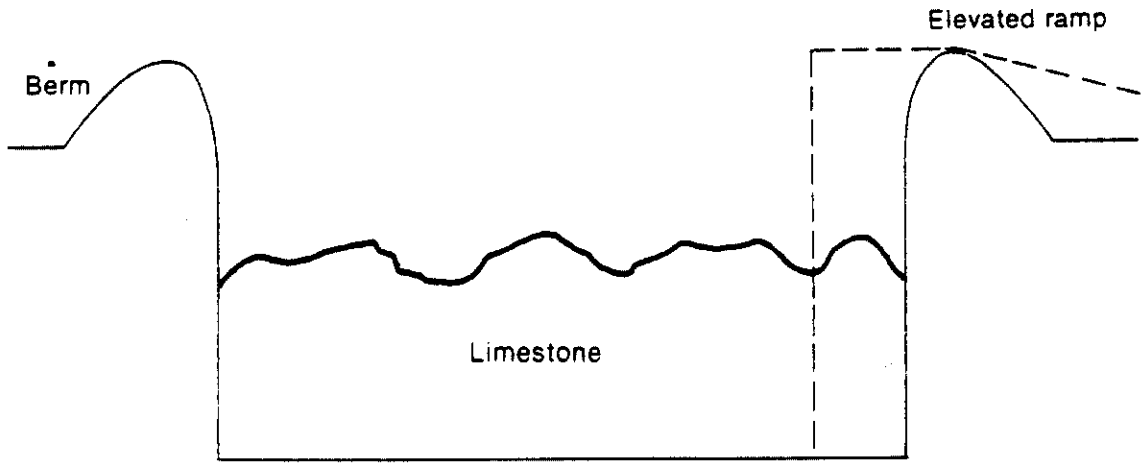


Figure 3.13.1. Vicinity map of LCCDA.



View a. Plot plan



View b. Pit end view

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Figure 3.13.2. Plot plan and pit end view of LCCDA.

3.13.2 Wastes Received at the LCCDA

Records indicate that some of the corrosive chemicals taken to the LCCDA were in solid form. The items most often handled were common acidic and basic mineral-based chemicals. Organic-based acids (except acetic acid) and other materials that might present a significant toxicity or hazard potential were normally handled on a case-by-case basis.

Records of wastes going to the LCCDA were not maintained before 1972. Since then, records have been kept as part of the Industrial Waste Management Information System (IWMIS). The IWMIS records correspond with the approximate date that the newer pit within LCCDA was opened; therefore, it is assumed that the recorded information pertains to the newer pit only. For site evaluation purposes, it is estimated that similar volumes of corrosive materials went to the old pit prior to 1972. Table 3.13.1 provides a summary of the materials identified in the IWMIS as going to the LCCDA. It should be noted that the IWMIS has entries for the CFA acid pit, RWMC acid pit, and the CCD Area. From the timeframe involved, it is quite certain that these disposal designations all refer to the site herein identified as the LCCDA.

TABLE 3.13.1. LCCDA HAZARDOUS WASTE DISPOSAL

Site	Site Name	Period of Operation	Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Wastes	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
LCCDA	New pit	1972-1980	13.8	Corrosive materials (S) = Solid, (L) = Liquid		Corrosive materials were dumped in a limestone bottomed pit.	Inactive-pit still remains, but behind locked gate	Snake River Plain Aquifer is about 177 m (580 ft) below the surface which is relatively level. Subsurface consists of alternating layers of basalt and silt	Pit is surrounded by a berm that prevents surface water intrusion	
				Potassium hydroxide (S)	569 gm					
				Sodium hydroxide (S)	786 gm					
				Sodium hydroxide (L)	17,158 L					
				Sodium bicarbonate (S)	136 gm					
				Sodium carbonate (S)	2,041 gm					
				Ammonium hydroxide (L)	1,666 L					
				Sulfuric acid (L)	8,873 L					
				Sulfuric acid sludge (L)	227 L					
				Nitric acid (L)	45 L					
				Phosphoric acid (L)	8 L					
				Hydrochloric acid (L)	95 L					
				Acid tank rinse water (L)	757 L					
				Nitric acid, sodium hydroxide (L)	95 L					
				Hydrobromic acid	5 L					
				Zinc bromide	15 L					
LCCDA	Old pit	1961-1970	10	Assume same materials and quantities as above		Corrosive materials were dumped into an unlined, informal pit	Inactive-pit remnants inside a locked fence	Same	There are no formal structures or grading around pit that would prevent surface water intrusion	

3.14 Munitions/Ordnance Areas

As described in Section 2.1, the U.S. Navy and the U.S. Army Air Corps have in the past used portions of what is now the INEL for gunnery and bombing ranges. As a result, there are numerous sites within the INEL where unexploded ordnance and munitions have been found. This section attempts to document these sites and the potentially hazardous materials which may be present. In cases where DOE-generated hazardous materials may also be present, discussions of such materials are included. (Only those sites involving DOE-generated hazardous materials are considered during the ranking process addressed later in this document.) The general sites of concern are located on the INEL map shown in Figure 3.14.1. The following paragraphs provide discussions on the sites and are presented in the order in which they are identified in Figure 3.14.1.

3.14.1 Naval Proving Grounds Aerial Bombing Range

3.14.1.1 General Location. The location, as shown in Figure 4.14.1, is northwest of the RWMC. The extent of this bombing range is believed to be several miles in diameter.

3.14.1.2 Description of Past Activities. This area was allegedly a bombing range for B24 Liberator bombing aircraft flying out of the Army Air Force base at Pocatello during WWII. Evidence of these activities includes verbal statements by knowledgeable personnel, explosive ordnance finds of practice bombs with spotting charges, and concentric rings spotted from high altitudes. The practice bombs found to date have been disposed of.

3.14.2 Firing Site for Naval Guns

3.14.2.1 General Location. The firing site is east of the RWMC and north of the Big Southern Butte.

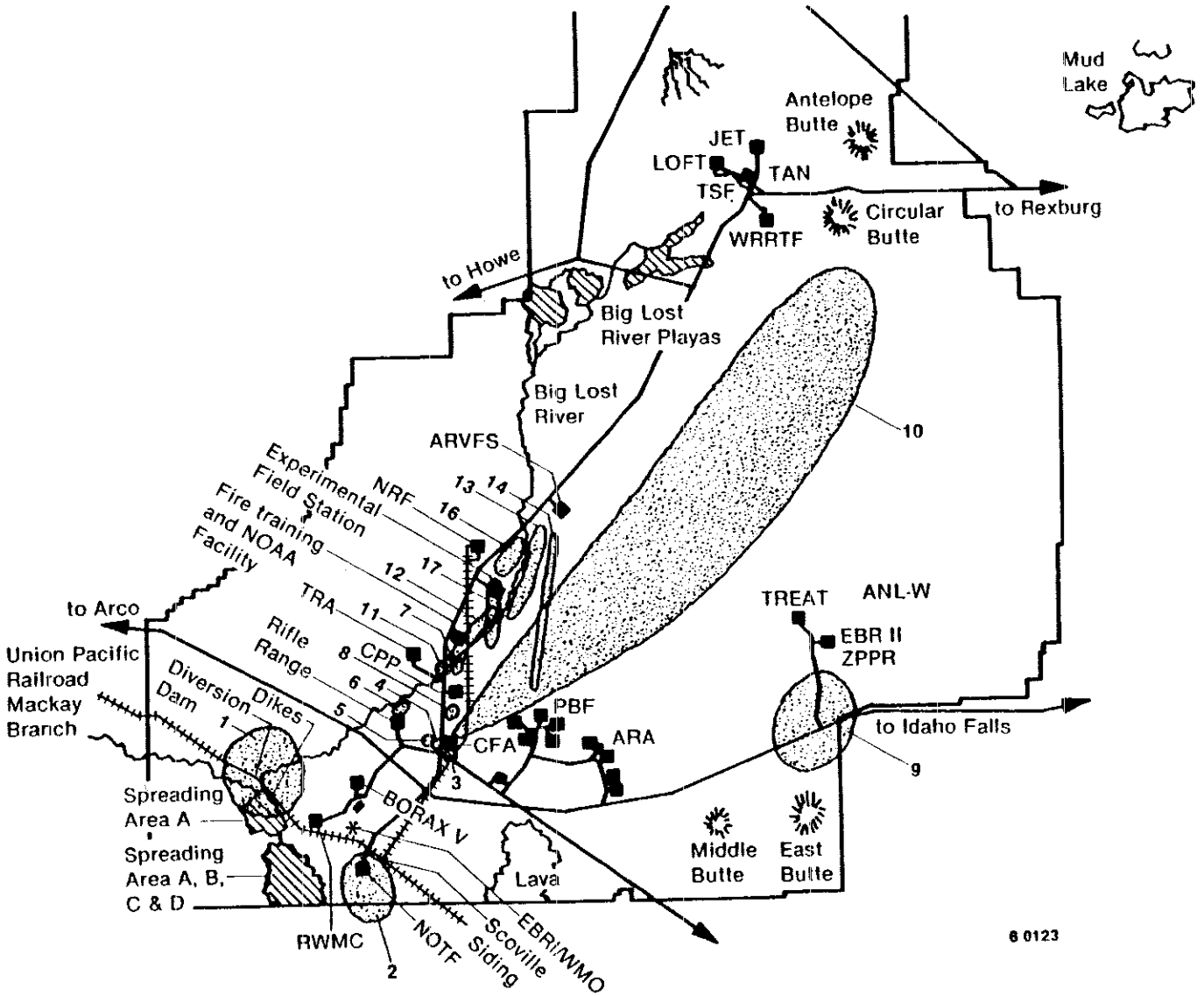


Figure 3.14.1. Map showing munitions/ordnance areas at the INEL.

3.14.2.2 Description of Past Activities. This was the firing site for 16- and possibly 8-inch naval guns. The site contains several 16-ton reusable concrete blocks that constituted a firing berm. From the information available, this site was used during the Vietnam War to test guns from the Battleship New Jersey which were refurbished at the Naval Ordnance Plant in Pocatello. Downrange azimuths for this firing range were toward the Big Southern Butte. To date there are large numbers of 16-inch shells distributed over the land, most of which are suspected to be mono-block shot rounds. These do not contain main explosive charges, but may contain spotting charges. It should be noted that one 14-inch naval artillery shell has also been found downrange and the New Jersey did not fire 14-inch shells.

3.14.3 CF-633 Naval Firing Site

3.14.3.1 General Location. The location is within the northern portion of the existing Central Facilities Area (CFA), next to the Scoville Power Station.

3.14.3.2 Description of Past Activities. The CF 633 area was a firing site for naval guns during WWII. Shells were fired at both close and far ranges. Close-range firings were made into 16-ton concrete blocks that were transported by the 200-ton gantry crane. Long-range firings were made toward the northeast for distances of up to twenty-nine miles. To date many shells have been found in the CF 633 area and disposed of. Pieces of torpedoes and large quantities of smokeless powder (50-100 pounds) have also been found in the area. A 5-inch artillery shell is known to have been buried 50 feet deep in a French drain located between CF 633 and Scoville station.

3.14.4 Central Facilities Gravel Pit

3.14.4.1 General Location. The gravel pit is just north of the Scoville Power Station at CFA.

3.14.4.2 Description of Plant Activities. A 5-inch naval artillery shell was buried in this gravel pit. The area is now danger signed. The area in front of the gravel pit was downrange of the CF 633 firing site. During the period when the Navy was using this area, it had extensive lighting and underground cables. Ordnance has also been found in this area.

3.14.5 Central Facilities Sanitary Landfill Area

3.14.5.1 General Location. The sanitary landfill is north-northwest of Central Facilities.

3.14.5.2 Description of Past Activities. Explosive ordnance (primarily 5-inch artillery shells) has been found in this area. The points of origin appear to be the Naval Ordnance Disposal Area.

3.14.6 Naval Ordnance Disposal Area (NODA)

3.14.6.1 General Location. The NODA is north-northwest of CFA and nine-tenths of a mile north of the APS small arms/automatic weapons firing range.

3.14.6.2 Description of Past Activities. This site was used by the Navy as a disposal and experimental site. Large concentrations of many kinds of ordnance have been found and disposed of. It is known that ordnance is buried under crater ejecta.

More recently, until 1982, the NODA was used as a storage area for hazardous wastes generated at the INEL. The site was then referred to as the Hazardous Materials Depot Area. It was used to store all types of hazardous wastes generated at the INEL: solvents, corrosives, ignitibles, heavy-metal contaminated solutions, formaldehyde, PCB materials, waste laboratory chemicals, reactives, and others. As of October 1985, all these materials had been removed for off-site disposal as hazardous waste or treated on site by open burning as defined by RCRA regulations. In the

future the site will be used only for the open burning of reactive/explosive materials, and these materials will be taken there only when they can be burned immediately (i.e., no storage).

In August 1983 four soil samples were taken in the NODA. Analyses were performed by an independent laboratory for priority pollutants, metals, boron, chloride, cyanide, nitrate nitrogen, sulfate, and phenol. Results from the four samples show evidence of toluene and methylene chloride. Several of the inorganics were shown to be present at levels in excess of drinking water standards (used as a frame of reference), but they have not been compared to background levels. Also, EP toxicity tests, as defined under RCRA regulations, have not been performed on the soils.

3.14.7 Explosives Storage Bunkers North of ICPP

3.14.7.1 General Location. The bunkers are one-fourth to one mile north of the Idaho Chemical Processing Plant (ICPP).

3.14.7.2 Description of Past Activities. There are at least two explosive storage magazines, which were demolished in Navy tests, in this general location. Five-inch shells and anti-tank mines have been found and disposed of.

3.14.8 National Oceanic and Atmospheric Administration (NOAA) Grid

3.14.8.1 General Location. The NOAA grid is east of the Test Reactor Area (TRA).

3.14.8.2 Description of Past Activities. The NOAA grid is used for atmospheric testing by releasing chemical agents from the center (note the 200-foot tower used for these releases) and monitoring their transport off site. There are numerous bomb or artillery craters on the grid, from which have been extracted a considerable number of 5-inch artillery shells and chunks of high explosive, mainly TNT.

3.14.9 Aerial Bombing Range Near ANL-W

3.14.9.1 General Location. The center of the range is near the junction of Highway 20 and the access road to Argonne National Laboratory-West (ANL-W).

3.14.9.2 Description of Past Activities. This area was also a bombing range for Army Air Corps bombers flying practice missions out of Pocatello, Idaho during the 1940's. At the time this range was active there were no ANL-W roads or Highway 20. Practice bombs with spotting charges have been found in the zone, which is greater than a mile in diameter.

3.14.10 CF 633 Area and Downrange Zones

3.14.10.1 General Location. The zone begins at CF 633 with CFA and extends approximately 30 miles downrange to the northeast.

3.14.10.2 Description of Past Activities. When the Navy was using the area, the Scoville substation did not exist. The CF 633 building and the structures in the foreground constituted a firing station for large-caliber naval guns testing the internal and external ballistics of weapons refurbished at the Naval munitions plant in Pocatello. The range extended to the northeast for approximately 30 miles. Many of the roads seen in the photographs were originally naval roads. The structures to the left of CF 633 were rail foundations to support the 200-ton gantry crane while moving and storing 15-45-ton concrete blocks that were positioned northeast of CF 633 as targets. Fuses, chunks of explosive, parts of torpedoes, smokeless powder and many artillery shells have been cleaned out of this zone. There is one known 5-inch artillery shell that was inadvertently buried in a deep French drain west of CF 633. Downrange are remnants of naval structures and shells that have been fired from this zone. The shells found to date are primarily of the 5- and 14-inch varieties.

3.14.11 Fire Station II Zone, West of Lincoln Boulevard

3.14.11.1 General Location. The location is across the road from Fire Station II.

3.14.11.2 Description of Past Activities. This area west of Lincoln Blvd. is infested with remnants of explosive tests involving anti-tank mines. It is not certain whether this area was a point of explosive origin or whether the materials were launched from some other area. Most of the debris is harmless, but live anti-tank mine fuses have been found, as has one anti-tank mine.

3.14.12 Range-Fire Burn Area, East-Northeast of Fire Station II

3.14.12.1 General Location. This area is adjacent to Fire Station II and extends in an east-northeasterly direction in excess of one mile.

3.14.12.2 Description of Past Activities. In the early 1970s, a range fire was accidently started during fire training exercises at Fire Station II. The fire burned approximately 800 acres and "cooked-off" (thermally initiated) a large number of pieces of explosive ordnance. This fire was a key occurrence in emphasizing the problem of unexploded ordnance within the INEL.

3.14.13 Zone East of the Big Lost River

3.14.13.1 General Location. As shown in Figure 3.14.1, this site is an area just east of the Big Lost River, which extends from north of the ICPP to the Naval Reactor Facility (NRF).

3.14.13.2 Description of Past Activities. Many single pieces of explosive ordnance have been found in this large area. To date no large concentrations have been found, but some surveyors claim to have seen large

assortments of ordnance; searches conducted with these people did not result in finds. Much of the ordnance found were 3- and 5-inch artillery shells, primarily mono-block shot rounds.

3.14.14 Anaconda Power Line

3.14.14.1 General Location. These power lines run generally north and south several miles east of Lincoln Boulevard.

3.14.14.2 Description of Past Activities. This section of power line has been the site of a number of explosive ordnance finds. Probably 25 pieces of ordnance have been found to date, mostly 5-inch artillery shells, of mono-block shot round design. Most shells have been fired through gun tubes, as evidenced by lands and groove marks on the gas check band. Two 5-inch shells which had not been fired have been found. Both had mechanical time fuses which were subsequently destroyed.

3.14.15 Old Military Structures or Remnants

3.14.15.1 General Location. This area is not shown on Figure 3.14.1, but it consists of numerous old facilities located between CFA and the bomb craters east of NRF.

3.14.15.2 Description of Past Activities. There are several demolished structures, or the remnants thereof, that were originally built to serve as protective areas in which witnesses (i.e., gauges and cameras) to explosives testing could stand. In this capacity, they were to stand within the shock flowfield and respond to the pressure and impulse that resulted from the large explosives tests being conducted. Ordnance has been found at some of these sites.

3.14.16 Large-Scale Naval Magazine Test Area

3.14.16.1 General Location. This test area is east of NRF and adjacent to the Big Lost River.

3.14.16.2 Description of Past Activities. This is an area where the Navy conducted large explosive magazine sympathetic detonation tests. Some of the detonations involved three explosive magazines, each with 500,000 pounds of explosive ordnance. There have been many kinds of ordnance found, most of which have been partially exploded: 500- and 1000-lb bombs and fuses, anti-tank mines and fuses, and artillery shells of various calibers. There are many burned-out containers for smokeless powder. This site is the point of origin for ordnance that traveled four miles.

3.14.17 Dairy Farm Revetments

3.14.17.1 General Location. The revetments are southeast of NRF, northeast of ICPP, and bounded on the east by the Big Lost River.

3.14.17.2 Description of Past Activities. Many concrete revetment walls, approximately 1 ft thick by 10 feet high by 12 feet long are in this area. There are bomb craters near some walls, while others are free of any evidence of explosive loading. It is most likely these revetments served as protectors of sensitive munitions tested during the large detonation tests. Ordnance has been found near some of the adjacent craters.

3.15 CFA Past Activity

3.15.1 CFA Description

The Central Facilities Area (CFA) is located in the south-central portion of the INEL, as was shown in Figure 2. The facilities now in use at CFA were, for the most part, built in the 1940's and 1950's. These facilities were initially used to house Naval Gunnery Range personnel and, later, National Reactor Testing Station personnel. These facilities have been modified over the past 30 years to fit the changing needs of the Idaho National Engineering Laboratory (INEL). They now provide four major types of functional space: craft, office, services, and laboratory.

The purpose of CFA is to ensure efficient, centralized support for programmatic and nonprogrammatic efforts of all INEL contractors and DOE. Accomplishing this mission involves the efforts of several government offices as well as contractors. The scope of this report includes only those CFA facilities operated by EG&G Idaho, Inc.

Because CFA covers a large area and includes some 80 buildings and structures, it is divided into eight sections for planning purposes. These sections, shown in Figure 3.15.1, are described as follows:

3.15.1.1 The Handling and Open Storage Section. This section is located between the service shops and East Portland Avenue. It contains a large stockpile of processed manganese ore.

3.15.1.2 The Remote Service Facilities Section. This section is located on the northeast end of CFA and includes light laboratories, the Scoville Power substation and control house, the sewage treatment plant, laundry, and the fuel storage area.

3.15.1.3 The Administrative Offices and Support Section. This section is bounded by Main Street on the east, Ogden Avenue on the north,

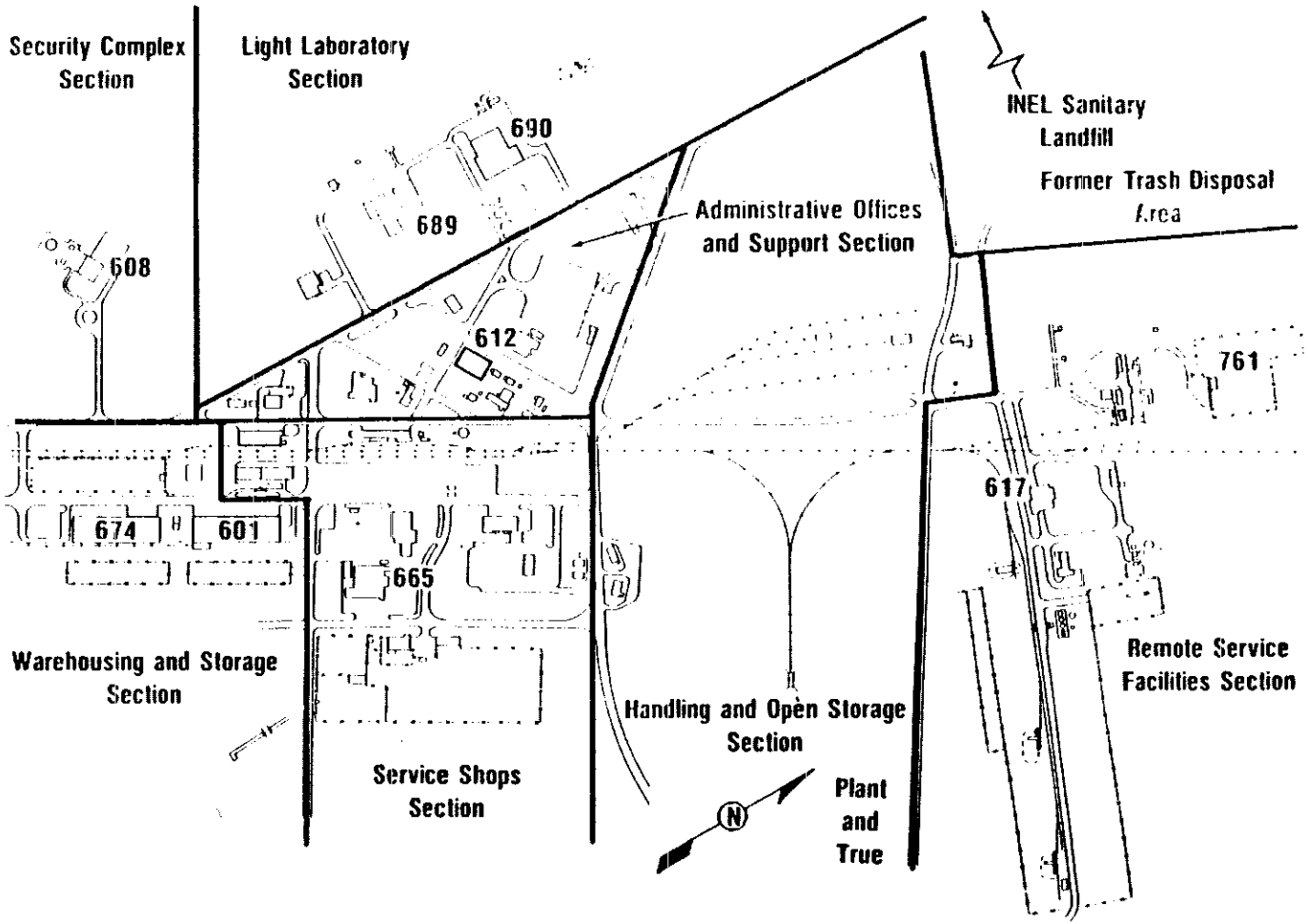


Figure 3.15.1. Central Facilities Area (CFA) layout map.

and Lincoln Boulevard on the west. Within this triangle are the central security headquarters, medical dispensary, communications center, bus depot, cafeteria, craft shops, and other offices.

3.15.1.4 The Service Shops Section. This section, located east of the Administration Office and Support Section, is the site of vehicle maintenance shops, main INEL fire station, Morrison-Knudsen office building, bus dispatch, motor pool, and multicraft shop complex.

3.15.1.5 The Light Laboratory Section. This section is located on the west side of Lincoln Boulevard. It includes two large laboratory buildings, the Technical Center, and the Radiological Environmental Sciences Laboratory (RESL); the latter is operated by the Department of Energy.

3.15.1.6 The INEL Sanitary Landfill. The landfill is now located 1/4 mile west of the Lincoln Boulevard and West Portland Avenue intersection. The area, formerly used for trash disposal (shown in Figure 3.15.1), has been reclaimed for future use pending Department of Energy, Idaho Operations (DOE-ID) evaluation of the Site.

3.15.1.7 The Warehousing and Storage Section. This section, located in the southeast portion of CFA, contains two large warehouses used for storage and material receiving.

3.15.1.8 The Security Complex Section. This section is located on the extreme west side of CFA and currently contains the Helicopter Storage and Maintenance Facility.

3.15.2 CFA Waste Generated by Activity

Waste generations are addressed in the following paragraphs according to the buildings and operations involved. A summation of the hazardous waste generation is found in Table 3.15.1. It should be noted that two areas of possible concern at CFA are not included in this report because

TABLE 3.15.1. CFA HAZARDOUS WASTE GENERATION

Location	Function	Waste Stream	Time-Frame	Estimated Quantities (If Known)	Treatment/Storage/Disposal
CF-633	Laboratory Facility	Laboratory wastewater with small quantities of corrosives, radionuclides and possibly solvents	1950-1984	Unknown	CF-633 French Drain
CF-654	Paint Shop	Waste paint and paint thinners	1950-1983	190 L/yr	CFA Landfill
			1984-Present	190 L/yr	Off-site as Hazardous Waste
CF-664	Service Station	Oils and grease from steam cleaning of equipment	1951-1983	Unknown	Motor Pool Pond
			1983-Present	Unknown	CFA Sewage Treatment Plant after oil and sand trap
CF-665	Equipment Repair Building	Waste petroleum products	1951-Present	Unknown	Waste oil tank
		Trichloroethane vapor degreaser bottoms	1970-1984	10 drums/yr	CFA Landfill
		Battery acid (sulfuric)	1951-1982	1700 L/yr	Motor Pool Pond
		Waste paints and thinners from paint and body work	1951-1985	500 L/yr	CFA Landfill
CF-674	Fuel Processing Prototype Experiments	Extraction/Dissolution Materials - Corrosives - Mercury - Natural uranium	1954-1956	2,500 L/yr	CF-674 Pond
		Calciner Wastes - Mercury - Natural uranium	1956-1965	Unknown	CF-674 Pond

they are not controlled by EG&G Idaho, Inc. The two sites are the Radiological and Environmental Sciences Laboratory (RESL) and the DOE Fire Department Training Facility.

3.15.2.1 CF-617/669. The Central Laundry Facility has been located at CF-617 since 1981. Prior to that time the laundry operation was in CF-669. Both facilities are at the north end of CFA, as shown in Figure 3.15.2. The "hot" laundry section of the facility involves the acceptance, washing, and drying of radioactively contaminated clothing and items which can be laundered. The laundry uses normal detergents which are not considered hazardous. However, as a result of the operation, the wastewater leaving the facility is lightly contaminated with radioactivity. Wastewater from the facility flows to the CFA Sewage Treatment Plant. Influent to the treatment plant is sampled weekly for radioactivity, and the results are reported in the Radioactive Waste Management Information System (RWMIS).

3.15.2.2 CF 633. Through the years, the CF 633 building has housed laboratory facilities. In 1985, EG&G set up a lab operation there; from 1976 through 1984 WINCO operated an environmental analysis group laboratory in this building; and prior to that the RESL (then called the Health Services Laboratory) was located there. Other than the sanitary sewer, the wastewater (including laboratory sink waste) from this building flows to a French drain located just outside the east end of the building. EG&G's recent operations have included packaging and off-site disposal of hazardous waste whenever possible. WINCO's operation routinely generated small quantities of acids and bases that were washed down sinks along with small quantities of radionuclides. The RESL operation probably included similar materials and may have included small quantities of solvents such as xylene or toluene in scintillation cocktails. The maximum allowable discharge of radionuclides from WINCO operations (1976 to 1984) was 10 nanoCuries per day. Using this as a conservative estimate of the actual discharge to the French drain, as much as 2.3×10^{-5} curies were sent to this drain. (This assumes 260 operating days per year over a nine-year period). For scoring purposes, this figure will be doubled to include the RESL activities and will be assumed to be beta activity.

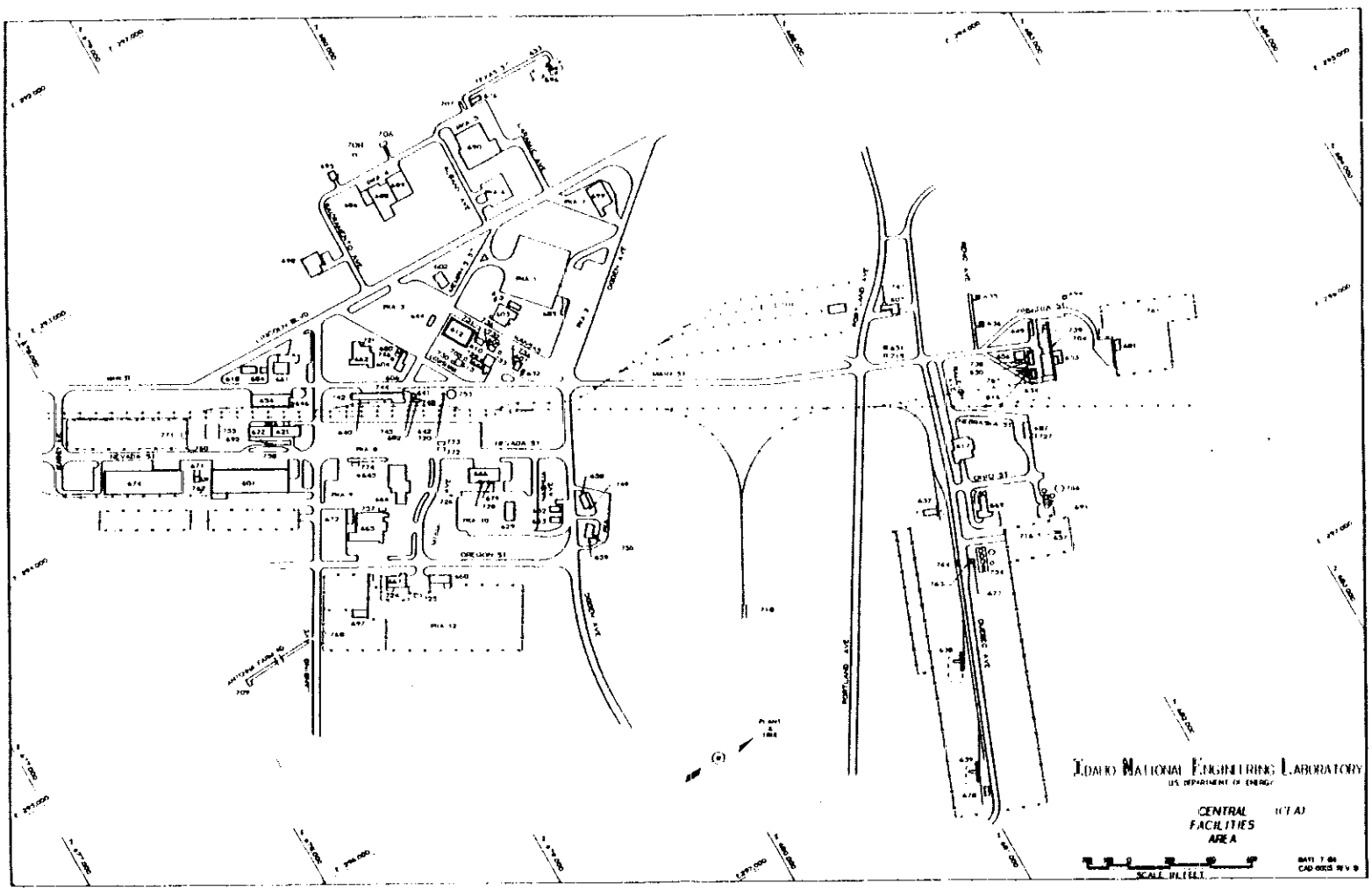


Figure 3.15.2. Central Facilities Area plot plan.

3.15.2.3 CF-654. The Maintenance Shop facility at CF-654 includes a paint shop that routinely produces hazardous wastes. These wastes consist primarily of flammable thinners but occasionally include paint and paint residues. Various types of thinners are used at the shop and may find their way to the waste; paints used include acrylics, epoxies, enamels and latex. It is estimated that 95 to 190 L (25 to 50 gallons) of waste thinners are generated yearly at this shop. For the past two years the waste has been turned in for disposal as hazardous waste. Prior to that, it was thrown out as garbage and was probably buried or burned at the CFA landfill. It is also likely that paint is occasionally dumped at the various work sites when small quantities of materials are left over. These small individual sites are not addressed further as they are not specifically identified and should not pose a significant threat of migration.

3.15.2.4 CF-664. The service station facility at CF-664 houses a steam cleaning operation. Prior to about mid-1983, the water from this operation, along with the grease and grime it generated, was discharged to the Motor Pool Pond. The amount of oils and grease discharged is unknown, but two or three pieces of equipment are cleaned every day. Past cleaning operations have, at times, included washing radioactively contaminated equipment. When this occurred the wash area was roped off and the ground (asphalt-covered) was monitored after the operation to check for any remaining activity. The wash area was kept clean, but it is known that some minor amounts of radioactivity were discharged to the catch basin and thence to the Motor Pool Pond. In about mid-1983, discharge from the steam cleaning operation was rerouted to a grease trap and sand trap. Effluent from these traps then went to the CFA Sewage Treatment Plant.

3.15.2.5 CF-665. The Equipment Repair Building at CF-665 was constructed in 1951 and houses the repair facilities for the INEL bus and passenger car fleet. Other motorized equipment is also repaired there. Individual activities within the building which produce wastes of concern are addressed below.

Waste oil generated at the facility is put in an "oil dump" receptacle, the contents of which are pumped to an underground tank outside the building. Various fluids (i.e., lubricating oil, transmission fluid, brake fluid, Stoddard Solvent, etc.) have been disposed of in this manner. The waste oil tanks are currently pumped by an oil recycling contractor, but past operations very likely included spreading on dirt roads for dust suppression and burning by the Fire Department as part of fire training exercises.

For the last 10 to 15 years the facility has operated a trichloroethane vapor degreaser. For the purposes of this report, it is assumed that it has been used since 1970. Bottoms in the degreaser are cleaned out and drumed about once every three months. It is estimated that 10 drums of waste are generated each year in this manner. Prior to mid-1984 this waste was sent to the CFA landfill; since that time it has received disposal off site as hazardous waste.

The facility changes up to 300 batteries per year. Prior to about 1982, the acid from the old batteries (1 to 2 gallons from each battery) was dumped down the drain in the battery room which led to the Motor Pool Pond. Under present operations, the batteries are taken wet (i.e., acid included) by a recycling contractor. Any batteries that cannot be handled by this contractor are sent to salvage where they are handled on a case-by-case basis.

Painting and body work are routinely done in this facility. Empty paint cans are regularly thrown in the trash, but waste paint and thinner are also generated. It is estimated that two liters of waste acrylic enamel paint and acrylic thinner mixtures are generated each work day. Until this year, these wastes were put into gallon cans and thrown in the trash that goes to the CFA landfill.

Asbestos-lined brake shoes generated at the facility are also buried at the CFA landfill.

3.15.2.6 CF-674. This building is currently a warehouse, but in the past it housed proto-type or pilot-plant experiments for the fuel-processingoperations that are now done at the ICPP. The processes that were tested at CF-674 from about 1953/54 to about 1965 included the following:

- Dissolution of simulated fuel elements. This tested processes to dissolve primarily aluminum cladding.

- Extraction of uranium from dissolution mixture. Dissolution mixtures were spiked with natural uranium to test the capability of extraction columns to recover uranium.

- Concentration of uranium recovered during extraction process. The aqueous solutions from the extraction columns were run through an evaporator to further concentrate the uranium. The concentrated uranium solution was normally reused to spike the feed solutions for the other extraction process tests.

- Calciner for converting liquid radioactive waste to solid form. Solutions of varying chemical compositions were formulated and processed through a small calciner to determine the effectiveness of the operation as related to the composition of the feed stock.

There are no records on the types or quantities of hazardous wastes that were generated from the fuel processing pilot plant operations. However, personnel that worked on the operations are aware of the types of chemicals that were used and it can be assumed that these chemicals reached the waste stream. The chemicals that could be found in the dissolving and extracting process included:

Aluminum
Nitric acid
Mercuric nitrate

Zirconium fluoride
Hydrofluoric acid
Natural uranium

The chemicals associated with the calcining operation included:

Aluminum
Zirconium
Aluminum nitrate
Aluminum oxide
Mercury
Sodium
Sodium nitrate
Boric acid
Natural uranium

Through discussions with personnel involved with the pilot plant operations, it is estimated that the extraction/dissolution processes may have generated about 2,500 L (660 gal) per year. The plant was operational from 1954 through 1956.

Waste from the calciner operation was limited to the calcine itself and wastewater generated from the venturi scrubber on the calciner's off-gas system. The scrubber water likely included small amounts of the chemicals identified previously as being associated with the calciner.

Liquid wastes generated during the pilot-plant operations were probably drained to the small pond-like depression southeast of the building. It is possible that the calcine material may have been dumped there also.

3.15.2.7 CFA Fuels/Petroleum Management. Bulk fuels and oils used or stored at CFA included unleaded gasoline, diesel fuel, No. 2 fuel oil and waste oil. All tanks are supplied by tank truck. There are no records of

any significant fuel spills occurring in CFA. Table 3.15.2 provides an inventory of the fuel/petroleum storage tanks at CFA. The locations are shown by facility number in Figure 3.15.2.

3.15.3 CFA Disposal Sites

Areas or sites at CFA at which hazardous and/or radioactive wastes may have been deposited are discussed in the following paragraphs. A summary of the hazardous waste findings is presented in Table 3.15.3.

3.15.3.1 Motor Pool Pond.

3.15.3.1.1 Description--The Motor Pool Pond is an excavated pond area located east of parking area 12 in Figure 3.15.2. Historically, it has taken waste from the Equipment Repair Building (CF-665) and the Service Station (CF-664). In mid-1983, flow to the pond was diverted to the CFA Sewage Treatment Plant after passing through grease and sand traps.

3.15.3.1.2 Wastes Received--The wastewater discharged to the Motor Pool Pond contained oils, greases, and battery acids. The quantities of waste received are shown in Table 3.15.3. Water and sediment samples were taken from the pond in 1982. A summary of the results from this sampling is provided in Table 3.15.4. Several constituents of concern were identified in the pond sediment, but these were generally below action levels. Of particular interest are the quantities of bis (2-ethylhexyl) phthalate or dioctyl phthalate (DOP) found in the sediment. It is unknown how the DOP got to the pond but it is suspected that it may have been used in some of the motor pool solvent cleaning tanks, the contents of which may have found their way to the pond.

At times the Motor Pool Pond also received washwater from the wash-down of radioactively contaminated equipment. There have been instances in which contaminated vehicles/equipment were cleaned at the

TABLE 3.15.2. CFA FUEL/PETROLEUM STORAGE TANKS

Location or Tank Number Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMS Number	Responsibility	Comments
CFA	Unleaded gasoline	7	A, O	7	--	M-K	West of M-K building
CFA	Diesel	7	A, O	7	--	M-K	West of M-K building
CFA-604	No. 2 fuel oil	300	U, I	Automatic refill	--	Plant services	--
CFA-605	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-607	No. 2 fuel oil	500	U, O	Automatic refill	--	Plant services	--
CFA-608	No. 2 fuel oil	500	U, O	Automatic refill	--	Plant services	--
CFA-609	No. 2 fuel oil	500	U, O	Automatic refill	--	Plant services	--
CFA-610	No. 2 fuel oil	500	U, O	Automatic refill	--	Plant services	--
CFA-613	No. 2 fuel oil	500	U, O	Automatic refill	--	Plant services	--
CFA-614	No. 2 fuel oil	500	U, O	--	--	--	Abandoned
CFA-615	No. 2 fuel oil	500	U, O	--	--	--	Abandoned
CFA-633	No. 2 fuel oil	5,000	U, O	Automatic refill	--	Plant services	2 tanks
CFA-641	No. 2 fuel oil	--	U, O	--	--	--	Abandoned
CFA-645	Diesel blend	10,000	U, O	Dipstick	01SSW211 01SSW212	Transportation	2 tanks
CFA-658	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-659	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-662	No. 2 fuel oil	5,000	U, O	Automatic refill	--	Plant services	--
CFA-664	Unleaded gasoline	10,000	U, O	Dipstick	01SSW203	Transportation	--
CFA-664	Unleaded gasoline	8,000	U, O	Dipstick	01SSW204	Transportation	--
CFA-665	No. 2 fuel oil	12,000	U, O	Dipstick	01TMP252	Transportation	--
CFA-665	Waste oil	5,000	U, O	Dipstick	--	Transportation	--

TABLE 3.15.2. (continued)

Location or Tank Number Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMS Number	Responsibility	Comments
CFA-665	Waste oil	2,000	U, O	Dipstick	--	Transportation	--
CFA-667	No. 2 fuel oil	6,000	U, O	Automatic refill	--	Plant services	--
CFA-668	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-669	No. 2 fuel oil	18,000	U, O	--	--	Plant services	Abandoned
CFA-671	No. 2 fuel oil	17,000	U, O	Dipstick	01TMP250	Plant services	--
CFA-675	Diesel No. 2	500	U, O	Automatic refill	--	Plant services	--
CFA-680	Gasoline	7	U, O	--	--	Plant services	Abandoned
CFA-682	Diesel storage tank	~500	U, O	Automatic refill	--	Plant services	Next to RR
CFA-683	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-687	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--
CFA-699	Unleaded gasoline	500	U, O	Dipstick	01SSW200	Plant services	--
CFA-708	No. 2 fuel oil	42,420	A, I	Gauge on outside of tank	01TMP251	Plant services	--
CFA-755	Diesel blend	60,060	U, O	Dipstick	01BFW214	Site services	Abandoned
CFA-755	Diesel blend	11,200	U, O	Dipstick	01BFW213	Site services	Abandoned
CFA-754	No. 2 fuel oil	29,988	U, O	Gauge on outside of tank	01BFW249	Site services	--
CFA-754	Diesel blend	20,580	U, O	Gauge on outside of tank	01BFW215	Site services	--
CFA-754	Unleaded gasoline	20,580	U, O	Gauge on outside of tank	01BFW205	Site services	--
CFA-754	Diesel No. 1	5,040	U, O	Gauge on outside of tank	01BFW245	Site services	--
CFA-754	Diesel No. 1	5,040	U, O	Gauge on outside of tank	01BFW246	Site services	--
CFA-754	Unleaded gasoline	15,750	U, O	Gauge on outside of tank	01BFW206	Site services	--
CFA-754	Diesel blend	46,200	A, O	Gauge on outside of tank	01BFW216	Site services	--

TABLE 3.15.2. (continued)

Location or Tank Number Location	Oil Type	Maximum Capacity (g)	Above (A), Underground (U), Outside (O), Inside (I)	Level Check	IMMS Number	Responsibility	Comments
CFA-764	Waste oil	7	U, O	Dipstick	--	Site services	--
Fire Station No. 2	No. 2 fuel oil	1,000	U, O	Automatic refill	--	Plant services	--

TABLE 5.15.3. CFA HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Wastes	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
	Motor Pool Pond	1951-1983	5,000	Oils and grease Battery acid (sulfuric) Dioctylphthalate	Unknown 56,100 L Unknown	Discharge lines from Equipment Repair Building (CF-665) discharged directly to the pond	Inactive--waste lines rerouted through grease and sand traps to the CFA Sewage Treatment Plant	Snake River Plain Aquifer is about 148 m (485 feet) below the surface which is generally level. Subsurface consists of alternating layers of basalt and silt	Surface run-on is not excluded from the excavated pond area	
	Old CFA Sanitary Landfill	1951-1981	150,000	Miscellaneous/ Unknown hazardous materials[a]	30 M^3	Cut and fill landfill operation-no liners or impermable covers	Inactive	Same	Surface run-on is not excluded from the excavated pond area	
				Asbestos[a]	590 M^3					
				Chrome/chromates[a]	205 M^3					
				Mercury[a]	1 g					
				Methyl Dithiocyrate[a]	23 g					
				Beryllium[a]	1 g					
				Zirconium chips[a]	1 M^3					
				Trichloroethane sludge bottoms	120 drums					
				Waste paint and thinners	24,000 L					
				Assumed total hazardous materials reaching landfill	Total 100-150 drums/ yr					

TABLE 3.15.3. (continued)

Site	Site Name	Period of Operation	Size (m^2)	Suspected Types of Wastes	Estimated Quantity of Wastes	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
CF-633	French drain or seepage pit.	1950-Present	NA	Lab wastewater with small quantities of corrosives, radionuclides and possible solvents.	Unknown	Lab sinks drain to this French drain.	Inactive--since 1984 no hazardous wastes discharged.	Same	Discharge area is subsurface, but there has been no action taken to preclude surface infiltration.	
CF-674	CF-674 Pond	1954-1965	3,000	Chemical and natural uranium contaminated wastewater from fuel processing prototype operations. Mercury is also suspect.	Unknown	Floor drains led to this pond.	Inactive	Same	Pond depression area is open to surface drainage.	

a. From IWMIS Reports.

TABLE 3.15.4. WATER AND SEDIMENT ANALYSIS FOR CFA MOTOR POOL POND SEPTEMBER 1982

Element	Water (mg/L, ppb)	Sediment (mg/g, ppm)
Aluminum	BDL[a]	192.0
Chromium	BDL	8.2
Barium	BDL	72.5
Cadmium	BDL	1.2
Cobalt	BDL	2.0
Copper	BDL	21.7
Iron	875	3416.7
Lead	BDL	7.5
Nickel	BDL	8.3
Manganese	115	70.0
Zinc	BDL	83.3
Boron	450	37.5
Ions	**(mg/L, ppm)**	
Chlorides	330	NA[b]
Nitrate-N	0.2	NA
Sulfate	30	NA
Organics	**(mg/L, ppb)**	**(mg/kg, ppb)**
bis (2-ethylhexyl) phthalate	6	4000
PCB-1016	BDL	170

a. BDL--below detection limit.

b. NA--not analyzed.

steam cleaning facility at CF-664 which drains to the pond. Past radiological surveys of the pond have at times indicated contamination, but more recent surveys have shown nothing of concern.

3.15.3.2 CFA Landfill.

3.15.3.2.1 Description--As mentioned in Section 3.15.1.6, the sanitary landfill at CFA is designated the INEL landfill, and historically was located first on the west then the east of Lincoln Boulevard, but was recently moved back to the west side. The landfill is a cut and fill operation; that is, trenches are dug and waste is deposited. The trenches are then backfilled to cover the waste and new trenches are dug as necessary. Solid waste is brought from all over the site to this location. The aerial photograph in Figure 3.15.3 shows the approximate location of the CFA landfill.

3.15.3.2.2 Wastes Received--The sanitary landfill has always had tight controls on receiving radioactive materials, but up until about 1980 there was probably little concern over other potentially hazardous materials being sent there. To some extent, records have been kept of materials going to the landfill since 1971. However, these records are often nonspecific and do not include all the hazardous chemicals or materials that went to the landfill, particularly those that went in small quantities combined with other solid wastes. Table 3.15.3 provides a list of known or recorded hazardous materials that have been buried at the landfill. It includes items identified in records (Industrial Waste Management Information System--IWMIS) and the trichloroethane vapor degreaser bottoms and the paint/paint thinner residues described in Section 3.15.2. Materials shown in the IWMIS date back only to 1971; it can be assumed that similar materials were buried from 1951 to 1971. Reviewing the types and quantities of wastes now generated within the INEL, certain assumptions can be made on which waste streams may have gone to the landfill in the past. These waste streams currently amount to about 100 drums per year. It is further assumed that similar or larger waste

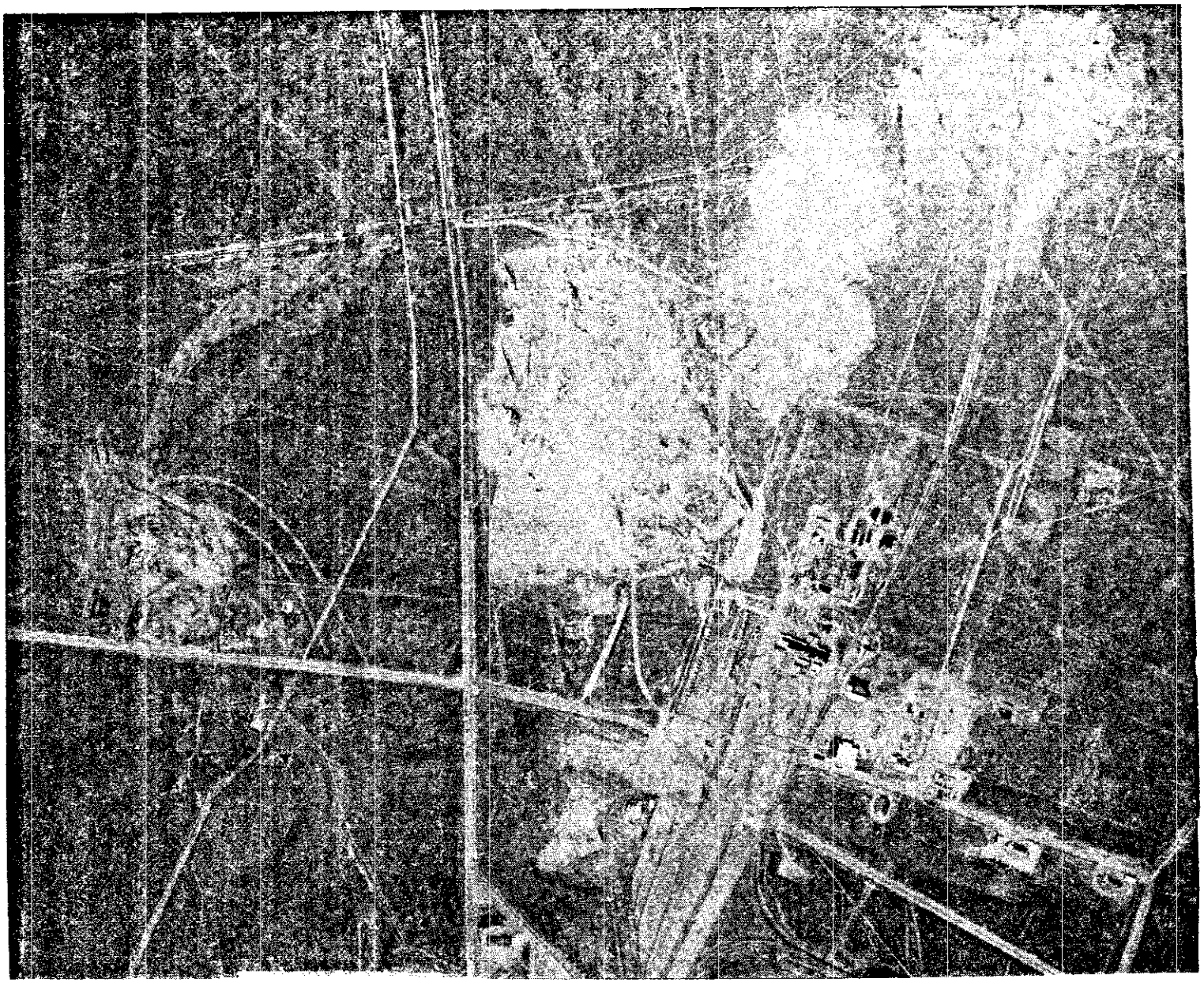


Figure 3.15.3. Aerial view of CFA landfill vicinity.

streams existed in the past since there have at times been larger numbers of operations going on at the site than there are at present. For ranking purposes the figure of 100 to 150 drums per year will be used.

3.15.3.3 CF-633 French Drain.

3.15.3.3.1 Description--CF-633 was constructed so that drains with the potential to receive contamination (radioactive contamination was of primary concern) were plumbed to a French drain or seepage pit located just outside the east end of the building. A seepage pit is generally an excavated area which is backfilled with a permeable material such as gravel and into which the wastewater is piped.

3.15.3.3.2 Wastes Received--The CF-633 facility has housed several laboratory facilities as described in Section 3.15.2.2. It is suspected that the wastewater created from these laboratories contained small quantities of corrosives, radionuclides and possibly solvents such as xylene and toluene which are commonly used in scintillation cocktails. There is no record of the quantities of waste that went to the seepage pit, but the hazardous constituents were probably relatively small.

3.15.3.4 CF-674 Pond.

3.15.3.4.1 Description--This abandoned pond is a low area just southeast of CF-674 (see Figure 3.15.2). It is connected by underground pipe to the south end of CF-674. Wastewater is no longer being discharged to the pond, but there have been no attempts to fill in the depression or to grade the area to prevent surface runoff.

3.15.3.4.2 Wastes Received--The only identified wastes of concern entering this pond are those associated with the fuel processing pilot plant operations. There is no record of the wastes that went to this pond, but it is likely that hazardous constituents such as mercury, acids, zirconium, and natural uranium were included. Although quantities are

unknown, the processes involved were small, pilot-plant operations that were run only intermittently. For purposes of applying the Hazard Ranking System (HRS), it is assumed that fewer than 500 drums of hazardous constituents went to the CF-674 pond. This should be a conservatively high estimate since most waste associated with the calciner operation was water and estimated quantities of wastes from the other operations are about 12 drums per year.

It should be noted that there was radioactive contamination reported due to a spill adjacent to the CF-674 facility and to the wastewater discharged to the CF-674 Pond. According to people who worked on the pilot plant operations, any radioactivity was due solely to the natural uranium that was used to make up the test solutions. Contaminated soil next to the building was removed and taken to the RWMC at the time of the spill. Past radiological surveys of the pond have shown minor activity but more recent surveys have detected none.

3.16 Radioactive Waste Management Complex (RWMC) Review

3.16.1 RWMC Description

The Radioactive Waste Management Complex (RWMC) was established at the INEL in 1952 to accommodate the radioactive wastes generated by laboratory operations. It is located in the southwest corner of the INEL. In addition to receiving wastes generated by the INEL, the RWMC has received wastes from Rocky Flats since 1954, and smaller quantities from other DOE facilities, including Argonne National Laboratory--East, Bettis Atomic Power Laboratory, Battelle Columbus Laboratory, and Mound Laboratory.

The original area involved 13 acres. This was expanded to over 88 acres in 1957 and enclosed a pit previously used for the disposal of laboratory acid. Currently, the RWMC encompasses approximately 144 acres.

The RWMC may be divided into two major sections. The first is the Subsurface Disposal Area (SDA); the second is the Transuranic Storage Area (TSA). Each of these sections contains several smaller storage areas, as can be seen in Figure 3.16.1.

3.16.1.1 Subsurface Disposal Area. The SDA contains low-level waste which has been segregated based on radioactivity and container size. Wastes go into either a large pit, trenches, or soil vaults and are covered with earth. This is considered permanent disposal.

The Transuranic Disposal Area (TDA) is an asphalt pad within the SDA that is used for permanent disposal of uranic and transuranic wastes containing fewer than ten nanocuries (nCi) of transuranic activity per gram of waste. The waste containers are stacked on the asphalt pad and then covered with earth. These wastes are considered permanently disposed of.

3.16.1.2 Transuranic Storage Area. The TSA consists of asphalt pads adjacent to the SDA. The TSA is used for storage of transuranic wastes containing more than 10 nCi of transuranic activity per gram of waste.

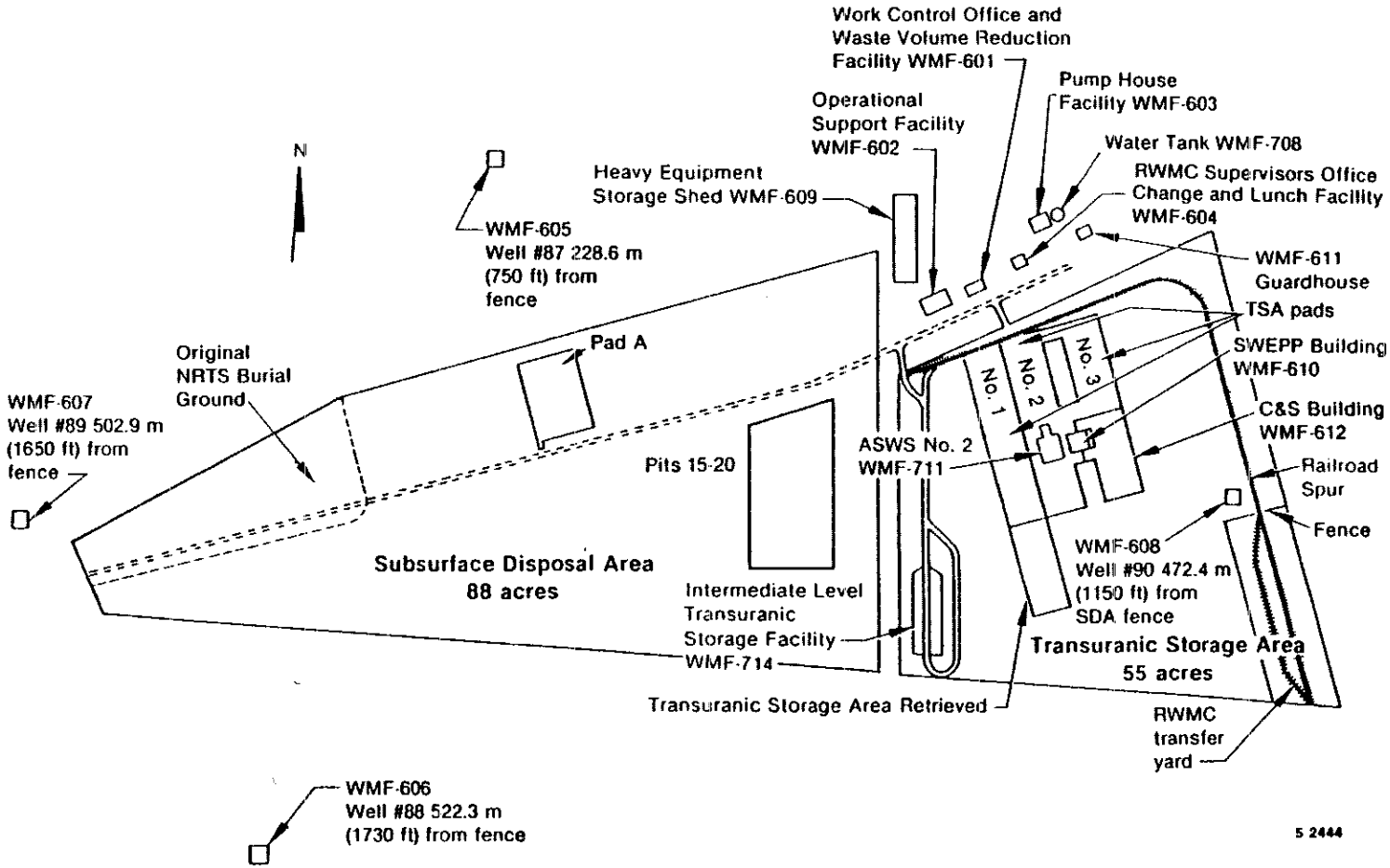


Figure 3.16.1. Radioactive Waste Management Complex.

The TSA is used for interim waste storage in which the waste is stored in containers designed for 20-year integrity. The containers are stacked, covered with plywood and nylon-reinforced polyvinyl, and then a final covering of two to three feet of earth. This waste is retrievable and will be removed to a federal repository when one becomes available.

The RWMC is enclosed by fences and surrounded by dikes and drainage channels.

3.16.2 Sources of Waste Stored at the RWMC

3.16.2.1 Idaho National Engineering Laboratory. The buried waste consists of a variety of radioactively contaminated materials including: Construction and demolition material, laboratory equipment, protective clothing, maintenance equipment, decontamination materials, and waste processing products. Some of this waste may be considered hazardous. The hazardous wastes known to be buried at the RWMC include: Acetone, antimony, benzene, cadmium, hydrofluoric acid, mercury, and thallium. Other buried hazardous materials include asbestos, beryllium, gasoline, lead, nitrates, oil, palladium, polychlorinated biphenyls, and zirconium. Exact types and quantities of contaminated, hazardous materials buried at the RWMC are unknown, but quantities of most are thought to be small.

Review of Unusual Occurrence Reports provided the information in this section. During normal Initial Drum Retrieval (IDR) operations on June 22, 1978, a drum labeled "Cyanamide - Cyanide Poison" was discovered. The drum was repackaged and will be opened at a later date. Another drum, labeled "Fragmentation Bomb" was discovered during the IDR. This drum was opened under controlled conditions and found to contain ordinary waste. It is suspected that the waste generator had reused an empty container without bothering to change or do away with the old label. It is quite likely that the drum labeled "Cyanamide" is from a similar action.

During compaction of CPP Dumpster D-249 on June 21, 1984, a waste liquid was observed. The waste liquid appeared to be a strong acid. CPP identified the liquid as fuming nitric acid. This would indicate that small amounts of acids are present at the RWMC as part of laboratory waste.

Recent records (1980 to present) give more details on the composition of the waste buried at the RWMC. Approximately 37% of the total disposed waste from 1980 on has come from CPP. Of this, lead is the most often mentioned hazardous material. Cadmium is also mentioned frequently, although exact amounts for both are unknown. Other identifiable hazardous wastes present, or believed to be present, at the RWMC are given in Table 3.16.1. These are INEL-generated wastes.

A variety of hazardous wastes from other national laboratories has been disposed of at the RWMC, although the total amount of hazardous waste is thought to be small. Table 3.16.2 gives a general overview of the following information.

3.16.2.2 Rocky Flats Plant. Beryllium (Be) contamination exists in first- and second-stage sludges and in solidified organic wastes. In addition, small amounts of Be are generated by various R&D efforts in plutonium processing areas. The concentration of Be in drums of solidified organic waste is unknown.

Prior to 1973, mercury and lithium batteries were periodically placed in second-stage sludge drums. At this time, second-stage sludge drums were also used periodically to dispose of bottles of liquid chemical wastes and small containers of elemental mercury. The number of batteries and volume or type of chemicals placed in the sludge drums are unknown. First- and second-stage sludge drums also contain a variety of residual toxic heavy elements from processing various plant-generated liquid wastes.

TABLE 3.16.1. IDENTIFIABLE HAZARDOUS WASTES AT THE RWMC*

AREA	MATERIALS	HAZARDOUS RATING
ARA	Pb - Pb shielding	Very-likely-present hazardous material[a]
	Zr - not fine enough to be ignitable	Very-likely-present hazardous material
CFA	Pb - Pb dross from Pb Shop	Identifiable hazardous material[b]
	Pb - Pb pig for shielding source	Very-likely-present hazardous material
CPP	Pb, Cd, Pb - brick form uranium - nonpyrophoric form	Identifiable hazardous material
	Pb, Cd, Hg	Very-likely-present hazardous material
	Zr, acids, - raffinate grab samples "everything" basin cleanup sludge, acids and nitrates in 1983 soil	Known-to-be-present hazardous material[c]
NRF	Asbestos, Pb - Pb shielding	Very-likely-present hazardous material
	Chromate in (nonroutine) resin	Known-to-be-present hazardous material
PBF	Pb -Pb shielding	Very-likely-present hazardous material
TAN	Pb - shielding for "hot" waste in waste package	Very-likely-present hazardous material
TRA	U, UO_2 - uranium scrap	Identifiable hazardous material
	Be - Be reflect pieces	Very-likely-present hazardous material
	Cr, Na - resin	Known-to-be-present hazardous material

a. Very-likely-present hazardous material constituent - depended on the knowledge of the waste based on the description, building of origin, timeframe, and other sources of the person interviewed.

b. Identifiable Hazardous Material - if hazardous material was specifically mentioned, i.e., lead pig or lead bricks.

c. Known-to-be-present hazardous material constituent - same basis as "very likely present" but more of an educated guess or inference.

* Information taken from correspondence written by T. Watanabe and sent to D. L. Uhl from E. A. Jennrich.

TABLE 3.16.2. HAZARDOUS MATERIALS INCLUDED IN STORED TRU WASTES

	Waste Generators					
Hazardous Material	MND	BCL	BAPL	ANL-E	RFP	INEL
Mercury (elemental)	X				X	
Beryllium (compounds)	X			X	X	X
Asbestos		X				X
Nitrated Wastes	X			X	X	
Organic Wastes (mixtures unknown)				X	X	
Polychlorinated Biphenyl (PCB)		O		O	X	
Polyethylene Glycol			X			
Other Chemical Unknown					X	
Gas Generation/Pressurization in Waste Containers	O				X	
Pressurized Vessels					O	
Batteries (lithium, mercury)					X	
Biological Wastes					X	
Pyrophorics					O	

MND = Mound Laboratory
BCL = Battelle Columbus Laboratory
BAPL = Bettis Atomic Power Laboratory
ANL-E = Argonne National Laboratory--East
RFP = Rocky Flats Plant
INEL = Idaho National Engineering Laboratory
X = Hazard identified as existing in stored waste
O = Hazard identified as potentially existing in stored waste

Large quantities of nitric acid are used in plutonium-recovery operations and smaller quantities are used by many other plutonium operations. Generally, no free nitric acid is present in solid waste packages, as it was absorbed on paperwipes, rags, or other absorbent material.

Ion-exchange resins are used by production plutonium-recovery operations to purify plutonium-bearing solutions. Ion-exchange column resins are usually changed once or twice a year, depending on the rate of production plutonium-recovery operations. During recovery operations, the resins are exposed to various concentrations of nitric acid. Since 1972, resin wastes have been leached with water and then solidified with Portland cement in 1-gallon polyethylene bottles before placement in a waste drum. It is believed cemented resins should not represent a significant hazard. The number of drums containing resin wastes that may represent a hazard is unknown.

Small amounts of unoxidized (metallic) plutonium and/or metastable plutonium suboxides may be present in vacuum pots that were connected to plutonium machining stations. The pots were included with other wastes generated by D&D operations conducted in 1969. Another potential source of pyrophorics includes any depleted uranium wastes retrieved and placed in storage during INEL retrieval projects.

Transuranic contaminated oils containing polychlorinated biphenyls were periodically processed with other organic wastes until 1979 at RFP. The concentration of PCBs in these oils is believed to be >500 ppm, although records concerning processing of PCB oils are not complete. The total number of PCB-contaminated drums is unknown.

Large quantities of asbestos or materials containing asbestos (filters, insulation, fire blankets, gloves, etc.), have been included in waste shipments to the INEL. Specifics concerning asbestos content or volume are unknown.

Pressurized gases have been used at RFP for calibration of laboratory and monitoring instrumentation and for use in production areas. A large number of contaminated gas cylinders, including CO_2 fire extinguishers, were included in waste shipments to the INEL, after a fire in 1969. It was believed most of the gas cylinders were depressurized prior to placement in waste containers. Certain gases may have been hazardous to depressurize in the work environment and would have been placed directly into waste containers. Information concerning the type of gases, cylinder sizes, shipment dates, and related data was not available.

During 1979 and 1980, 70 RFP-generated waste drums were retrieved from storage at the INEL and returned to RFP for characterization. Results of the characterization project revealed that four drums had elevated levels of hydrogen (6, 12, 13, and 19% by volume). The lower explosive limit for hydrogen in air is 4.1% by volume. Hydrogen generation may occur from alpha-radiolysis of water and organic or cellulosic materials.

Pressurization of waste drums may occur from gases (hydrogen, oxygen, etc.) produced by radiolytic, bacterial, and chemical actions. During 1980, a first-stage sludge drum, placed in storage at the INEL during 1978, was discovered to be pressurized. Analysis of the drum indicated the pressure to be 19.6 psig. Other stored waste drums, particularly first-stage sludge drums, may also be pressurized.

3.16.2.3 Argonne National Laboratory--East. Argonne National Laboratory--East, Argonne, Illinois, has been shipping wastes to the INEL since 1974. Some of these shipments have included small amounts of beryllium, the volume of which is unknown. Organic wastes such as scintillation liquids, alcohols (low-carbon aliphatic, generally butyl), and various oils, have been included in waste shipments. The wastes were absorbed on vermiculite contained in metal cans and polyethylene bottles. Some of the wastes were the result of D&D operations. The number or volume of cans or bottles containing absorbed scintillation liquids, absorbed alcohols, or oil included in waste shipments is unknown. It is also unknown if any of the oils contained PCBs.

Organic-based resins are generated by isotope separation and recovery experiments. The resins are exposed to various concentrations of nitric acid and are usually rinsed with either oxalic acid or a mixture of HCl/HF acids before disposal. Oxalic acid denitrates the resin and removes most of the fissile material. Resins rinsed with HCl/HF may be in the nitrate form. The overall volume of ion-exchange resins generated by ANL-E operations is believed to be small. Specific information is not available.

3.16.2.4 Bettis Atomic Power Laboratory. Bettis Atomic Power Laboratory, West Mifflin, Pennsylvania, began shipping wastes to the INEL in 1983. Polyethylene glycol (carbo wax), in the form of solid powder or flakes, was packaged in metal cans and then placed in waste drums. The volume of material included in waste shipments is unknown.

3.16.2.5 Battelle Columbus Laboratories. PCBs may be present in waste oils removed from various equipment pieces (lathes, presses, etc.) during D&D operations. The oils were absorbed with Oil-Dri (trade name) and are contained in approximately 20 1-gallon metal cans.

3.16.2.6 The Mound Laboratory. The Mound Laboratory, Miamisburg, Ohio, has sent approximately 61 cartons of contaminated elemental mercury to the RWMC. The total estimated quantity of mercury included in the waste is 7.63 gallons (864 lb).

Several 1-gallon cartons of beryllium-contaminated wastes are generated on a yearly basis by analytical operations at the Mound Laboratory. The beryllium in these cartons is estimated to be >0.05 grams each.

An estimated 20 drums of absorbed acidic wastes were shipped from Mound to the INEL. These drums may be pressurized due to a chemical reaction between the calcium carbonate contained in the absorbent agent and the acidic waste. Radiolytic production of hydrogen gas may also occur in certain waste drums from here. Suspect drums would be in-line-generated combustible wastes and >100 nCi/g combustible waste drums.

Spent ion-exchange resins, from recovery operations, have been included in waste shipments. The resins were exposed to various concentrations of nitric acid during recovery operations. Although believed to be washed with water, it is not known how completely the resins were denitrated. Numerous cartons of asbestos filters and some asbestos gloves have also been included in waste shipments.

3.16.3 Evidence of Migration

3.16.3.1 Surface Waters. Surface-water runoff was collected at the RWMC for radionuclide analysis following periods of rainfall or snowmelt. Results are shown in Table 3.16.3. Generally, only naturally occurring radionuclides were detected in SDA pump samples. On March 14, Cs-137, Pu-239, -240, Sr-90; and Am-241 were detected in the sample collected at the SDA pump. The detection concentrations probably reflect the increase in particulate concentrations during this time. The higher-than-normal values for plutonium and americium on March 22 are the result of an unusual occurrence and are not representative of RWMC surface waters.

Preliminary modeling of environmental transport of radionuclides at the RWMC indicates that the water pumped from the SDA may be a chief transport pathway of radionuclides from the SDA. However, it is relatively inconsequential in terms of dose.

Radionuclides in the discharged water become adsorbed or attached to soil particles and can accumulate. Although the pumped runoff water may be one of the largest radionuclide transport pathways at the RWMC, the pathway is not connected with any potable water source and therefore does not represent a hazard to personnel or to the off-site population.

Surface waters are monitored for nitrates to determine the potential migration of waste containing soluble nitrates.

Water samples were collected at the lowest point in the Pad A drainage system. Results of nitrate analysis are shown in Figure 3.16.2.

TABLE 3.16.3. WATER SAMPLE RESULTS FROM SPECIFIC RADIONUCLIDE ANALYSIS

Date of Collection	Sampling Location	Radionuclide	Concentrations (10^{-8} mCi/mL)[a,b,c] Detected in Filtrate Only	Detected in Particulate Only	Weight of Particulates (mg)
03/14/84	SDA Pump	Cs-137	1.62 û 0.17[b]	4.50 û 0.34	7200
		Pu-239-240	0.016 û 0.006	Not analyzed[d]	7200
		Am-241	0.80 û 0.020	Not analyzed	7200
		Sr-90	2.20 û 0.20	Not analyzed	7200
	Pad A, TSA 1, TSA 2, Control	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA[e]
03/19/84	SDA Pump, Control, Replicates	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA
03/22/84	Pit 10[f]	Pu-238	4.30 û 0.10	Not analyzed	840
		Pu-239-240	122 û 3.00	Not analyzed	840
		Am-241	88.6 û 7.2	65.8 û 3.20	840
		Sr-90	0.15 û 0.07	Not analyzed	
03/22/84	SDA Pump, Replicates	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA
03/28/84	SDA Pump, Control	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA
06/19/84	Pad A,	Cs-137	0.37 û 0.085	Not analyzed	1920
	TSA 1,	Only naturally occurring	Only naturally occurring	Only naturally occurring	NA
	TSA 2, Control	radionuclides detected	radionuclides detected	radionuclides detected	
07/25/84	Pad A, TSA 1, Control	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA
08/02/84	SDA Pump	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA
10/25/84	TSA 2	Pu-239, -240	0.013 û 0.004	Not analyzed	480
		Am-241	0.001 û 0.0005	Not anlayzed	480

TABLE 3.16.3. (continued)

Date of Collection	Sampling Location	Radionuclide	Concentrations (10^{-8} mCi/mL)[a,b,c] Detected in Filtrate Only	Detected in Particulate Only	Weight of Particulates (mg)
10/25/84	Pad A	Am-241	0.014 û 0.005	Not analyzed	1280
10/25/84	Control	Pu-239, 240	0.009 û 0.004	Not analyzed	1040
		Am-241	0.06 û 0.02	Not analyzed	1040
		Total U	0.02 û 0.01	Not analyzed	1040
10/25/84	TSA 1, TSA 3	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	Only naturally occurring radionuclides detected	NA

a. Naturally occurring radionuclides (Ra-226, Th-232, Po-214, Bi-214, and K-40) were detected in all samples, but are not reported here.

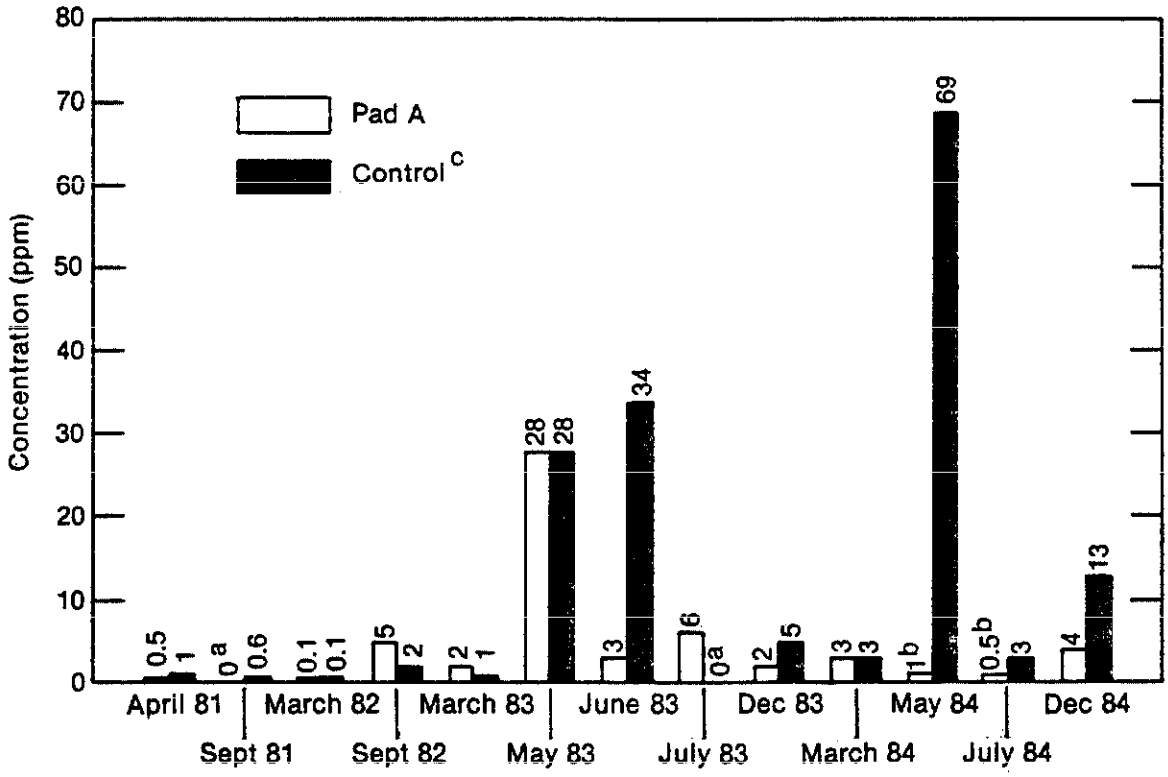
b. Because the water samples are acidified prior to filtration, radionuclides originally ion-exchanged or physically sorbed onto suspended solids may have been solubilized to some degree. Thus, the radionuclide concentrations in the liquid may be higher than that which existed in the environment. Likewise, the radionuclide concentrations in the particulate portion may be lower than in the environment.

c. Results presented as positive in this table are ±2 analytical uncertainties; analytical uncertainties are presented at û 1 s.

d. The particulates were not analyzed by radiochemistry in 1984, but will be in 1985.

e. NA = Not applicable.

f. Values obtained for these samples are the result of a spill within the RWMC and are not representative of normal conditions.



a. No water available
b. Below detection limit
c. In 1981 and 1982, the control was taken from the Big Lost River. In 1983 and 1984, the control was taken 3 miles northeast of the RWMC

5 1825

Figure 3.16.2. Nitrate concentrations in water samples from Pad A.

The results are variable and no trends of increasing or decreasing concentrations are apparent. For several reasons it cannot be inferred from these data that no leaching of nitrates from Pad A has occurred. The control location may not be representative of Pad A conditions because Pad A is covered with lakebed soils, which may contain more nitrates. It is also difficult to interpret the inconsistent fluctuations in the data. Finally, the water samples were not collected from an optimal location. Dilution of water occurred because it mixed with surface runoff from the asphalt pad adjoining Pad A.

3.16.3.2 Subsurface Water. The United States Geological Survey (USGS) routinely samples subsurface water from monitoring wells located in and adjacent to the RWMC. These well locations are shown in Figure 3.16.3. Traces of tritium were discovered in several wells during one such sampling (See Table 3.16.4). The source of the tritium is from past disposal of wastewater at the ICPP and TRA operations. No gamma-emitting radionuclides or plutonium were observed in any of the wells. A very small quantity of Am-241 was observed in one well. The last time Am-241 was observed was in July of 1982.

Results of chemical analyses performed on samples of subsurface water collected by the USGS in 1984 are shown in Tables 3.16.4 and 3.16.5. Except for wells 88 and 92, specific conductance (an indicator of total mineral content) measurements appear to be consistent with past results. Several factors may have contributed to the rise in conductivity in well 88. Briefly these include, but are not limited to, the following. The aquifer may be receiving highly mineralized water from the perched-water table. Minerals could be leaching from the previously unleached cement well casing as a result of the current rising subsurface water levels. The increase may represent normal hydrological conditions. Finally, material from the RWMC may have become mobilized by past flooding and transported through the unsaturated zone.

Based on the available data, conclusions cannot be made regarding the cause of the fluctuations.

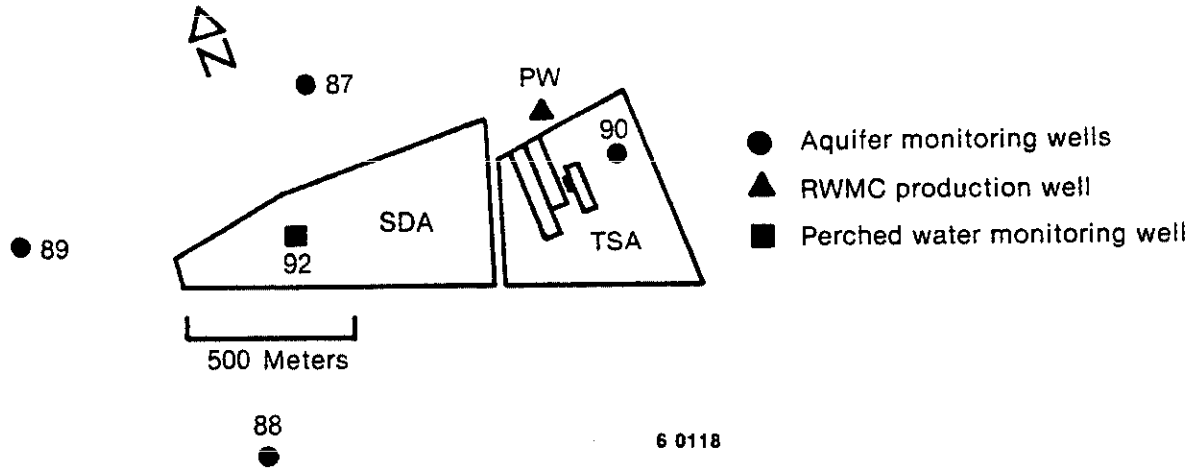


Figure 3.16.3. USGS well locations in and adjacent to the RWMC.

TABLE 3.16.4. RESULTS OF RADIOCHEMICAL ANALYSES OF RWMC SUBSURFACE WATER IN 1984

Well	Month Sampled	Radionuclide	Concentration[a] (10^{-6} µCi/ml)	Percentage of CG[b]
87	January	H-3	1.4 ± 0.3	0.05
	April	H-3	1.4 ± 0.3	0.05
	July	H-3	1.3 ± 0.3	0.04
	October	H-3	1.4 ± 0.3	0.04
88	January	None	--[c]	--
	April	None	--	--
	July	None	--	--
	October	None	--	--
89	January	None	--	--
	April	None	--	--
	July	None	--	--
	October	None	--	--
90	January	H-3	2.1 ± 0.3	0.07
	April	H-3	1.9 ± 0.3	0.06
	July	H-3	1.5 ± 0.3	0.05
	October	H-3	1.2 ± 0.3	0.04
RWMC Production Well	January	H-3	1.8 ± 0.3	0.06
	April	H-3	1.5 ± 0.4	0.05
	July	H-3	2.1 ± 0.3	0.07
	October	H-3	1.7 ± 0.3	0.06
		Am-241	0.000015 ± 0.000006	0.0004
92	April	None	--	--
	October	None	--	--
Natural Background		H-3	0.05 to 0.1	--

a. Analytical uncertainties presented are ± 1σ.

b. Detected concentration as a percentage of Concentration Guide (CG) values for uncontrolled areas from DOE Order 5480.1A. Chapter XI, Table II, Column 2.

c. -- Not applicable.

TABLE 3.16.5. RESULTS OF CHEMICAL ANALYSIS OF SUBSURFACE WATER AT THE RWMC IN 1984

Well	Month Sampled	Specific Conductance 10^{-4} (mhos/cm)	Concentration[a] (mg/L or ppm) Cl^-	Concentration[a] (mg/L or ppm) Na+
87	January	2.8 ± 0.3	14 ± 1	--
	April	2.9 ± 0.3	14 ± 1	--
	July	2.8 ± 0.3	11 ± 1	--
	October	3.0 ± 0.3	15 ± 2	12 ± 1
88	January	6.1 ± 0.3	137 ± 14	--
	April	6.1 ± 0.3	105 ± 10	--
	July	5.8 ± 0.3	130 ± 13	--
	October	5.4 ± 0.3	98 ± 10	47 ± 5
89	January	3.2 ± 0.3	36 ± 4	--
	April	3.1 ± 0.3	27 ± 3	--
	July	3.0 ± 0.3	32 ± 3	--
	October	3.3 ± 0.3	26 ± 3	15 ± 2
90	January	3.1 ± 0.3	12 ± 1	--
	April	3.0 ± 0.3	10 ± 1	--
	July	2.9 ± 0.3	11 ± 1	--
	October	3.3 ± 0.3	12 ± 1	10 ± 1
RWMC Production Well	January	3.2 ± 0.3	13 ± 1	--
	April	3.1 ± 0.3	10 ± 1	--
	July	2.9 ± 0.3	12 ± 1	--
	October	2.9 ± 0.3	11 ± 1	8 ± 2
92	April	8.0 ± 0.3	69 ± 7	--
	October	8.5 ± 0.3	68 ± 7	--[b]
Natural Background (of aquifer)		300 - 325	8 - 15	8 - 20

a. Analytical uncertainties presented are ± 1σ.

b. Not analyzed.

3.16.3.3 Soils. Since small- mammal burrowing is a mode of radionuclide transport, excavated soils were collected from small-mammal burrows in the five major areas of SDA (see Figure 3.16.4). The samples were analyzed using gamma spectroscopy and radiochemistry. The results are presented in Table 3.16.6. Results are similar to those of routine soils. The concentrations detected through radiochemistry analysis also fall within normal ranges for that area.

Nitrate analysis was performed on soil samples from the RWMC. Results of nitrate analysis of Pad A soil samples are shown in Figure 3.16.5. The pattern among these data is consistent, with the exception of the spring of 1984. It is thought that the addition of new soil spread over the area in the fall of 1983 influenced the drainage ditch data. Measured nitrate concentrations for all other samples taken in the spring of 1984 are unusually high. If error in laboratory analysis can be ruled out, then some unusual source of nitrates raised the surface soil concentrations over a wide area. Possible sources of these nitrates are the waste in the Pad A mound or the soil used for final cover. There is no apparent trend of increase or decrease in the Pad A ditch soil concentrations from 1980 through 1984.

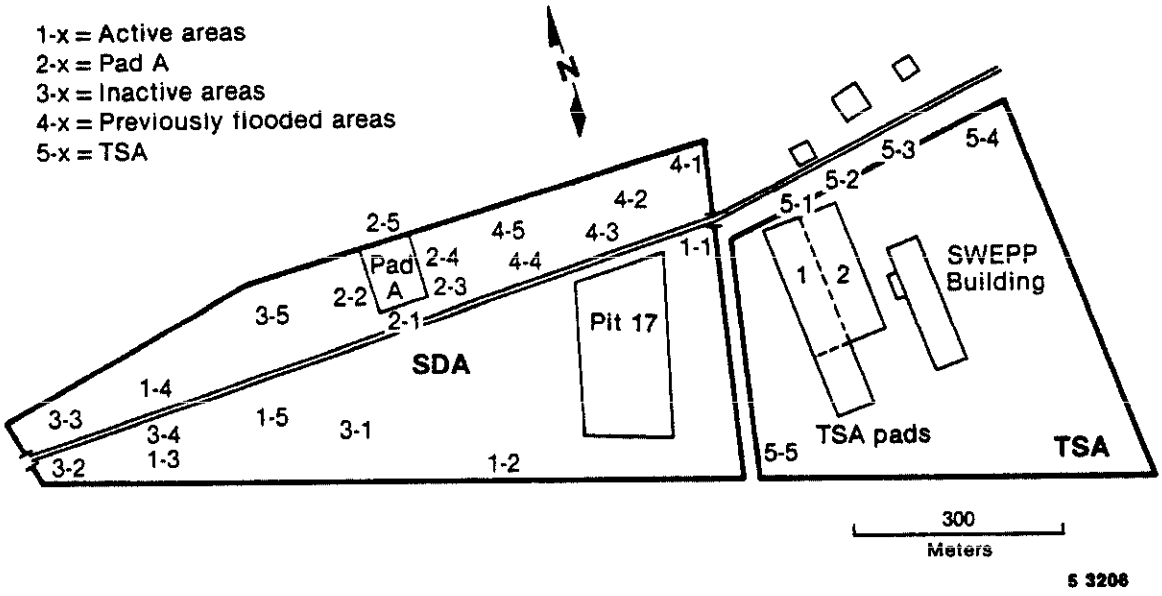


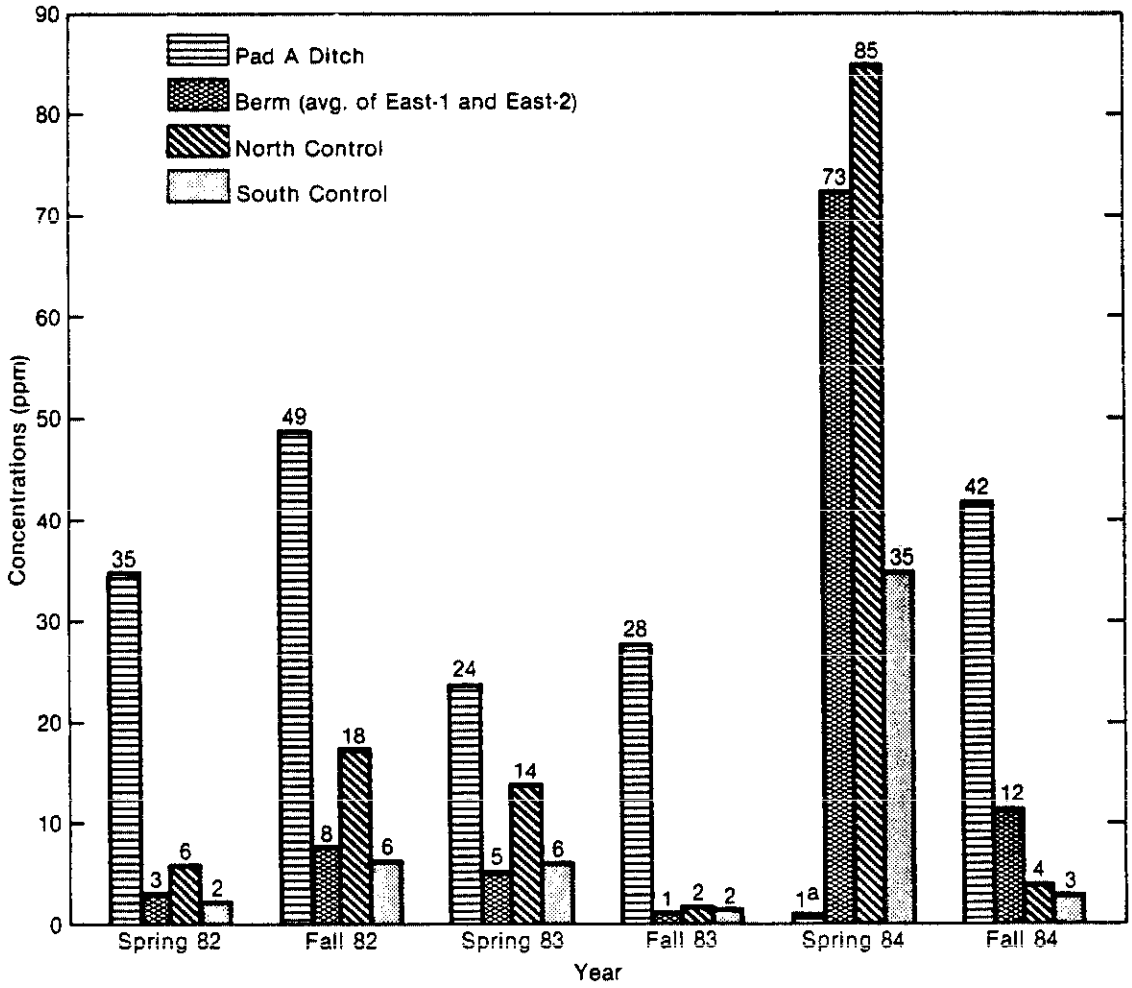
Figure 3.16.4. RWMC soil-sampling locations.

TABLE 3.16.6. EXCAVATED SOIL SAMPLES FROM SMALL-MAMMAL BURROWS

Location	Radionuclide	Concentration[a] (10^{-6} µCi/ml)
1-2	Co-60	0.77 ± 0.14
	Sr-90	0.11 ± 0.01
	Pu-239, 240	0.37 ± 0.04
	Am-241[b]	1.3 ± 0.2
1-3	Ce-144	0.90 ± 0.16
2-1	Am-241	0.66 ± 0.9
	Sr-90	0.4 ± 0.1
	Pu-239, 240	0.22 ± 0.05
2-2	Cs-137	0.94 ± 0.24
4-1	Am-241	2.1 ± 0.2
	Sr-90	0.6 ± 0.1
	Pu-239, 240	1.0 ± 0.2
4-2	Am-241	32. ± 3.0
	Sr-238	0.32 ± 0.04
	Pu-239, 240	16.5 ± 0.8
4-3	Sr-90	0.5 ± 0.1
	Cs-137	0.45 ± 0.10
	Pu-239, 240	0.46 ± 0.09
	Am-241	1.8 ± 0.5
5-1	Cs-137	0.38 ± 0.12

a. Analytical uncertainties presented are ± 1σ.

b. All the americium results shown here are from radiochemical analysis.



a. Approximate detection limit is 1 ppm

5 3184

Figure 3.16.5. Nitrate concentrations in soils from Pad A.

4. CONCLUSIONS FOR EG&G SITES

The purpose of this effort is to locate and identify those inactive hazardous waste disposal sites that may pose a potential threat to health, safety or the environment as a result of hazardous substance migration. The proceeding section presented the findings of document searches and personnel interviews. The conclusions given in this section are based on those findings and are presented according to the general geographical divisions made in Section 3. Table 4.1 contains the priority ranking of potential contamination sources within the INEL which are operated or controlled by EG&G Idaho, Inc. The rankings are based on scores obtained using the EPA Hazard Ranking System (HRS) for chemical hazards and the DOE modified HRS (MHRS) for hazards. The HRS was used as an aid in judging the relative significance of the various sites.

4.1 Test Reactor Area (TRA)

4.1.1 TRA-758, Warm-Waste Pond

Sections of the Warm-Waste Pond have been active since 1952 and have more or less continuously received low-level radioactively contaminated wastewater since that time. The chemical hazardous constituent of primary concern is chromium, which was sent to the pond from 1952 through about 1964 in the form of cooling water treated with chromates. The site received an HRS score of 51.9. The high score was due in large part to the fact that a migration path exists between contaminants in the pond and the Snake River Plain Aquifer. Measurable contaminants in the aquifer that can be linked to the Warm-Waste Pond are limited to specific radionuclides. Migration of chromium from the pond to the aquifer has not been verified, but chromium has been found in a perched water table that exists beneath much of the TRA site. Without considering other physical conditions, the potential for chromium migration must also be considered to be present since an avenue of radionuclide migration has been shown to exist.

TABLE 4.1. HAZARD RANKING SCORES FOR EG&G SITES

Site	HRS Score
TRA Warm-Waste Leach Pond	51.9
TRA Warm-Waste Retention Basin	22.0
TRA Waste Disposal Well	39.9
TSF Injection Well	31.6
CFA Landfill	17.7
WRRTF Injection Well	14.5
TRA Chemical Waste Pond	12.0
PBF Corrosive-Waste Injection Well (PBF-302)	12.0
CF-674 Pond	12.0
TSF Disposal Pond	10.5
ARA-III Radioactive-Waste Leach Pond	10.5
ARA-III Sanitary Sewer Leach Field (ARA-740)	10.0
TSF TAN-607 Mercury Spill	9.5
IET Injection Well (TAN-332)	9.5
Minor spills at TRA Open Loading Dock (TRA-722)	9.2
RWMC	9.0
CFA Motor Pool Pond	8.5
OMRE Leach Pond	7.1
CF-633 French Drain	7.8

TABLE 4.1. (continued)

Site	HRS Score
TSF TAN-607 Fuel Spill	7.3
LOFT TAN-629 Diesel Fuel Spills	7.3
TRA Acid Spill (TRA-608)	7.1
TRA Paint Shop Ditch (TRA-606)	7.1
EOCR Leach Pond	7.1
TSF Service Station Spill (TAN-664)	6.8
WRRTF Burn Pit	6.8
WRRTF Two-Phase Pond (TAN-763)	6.3
LOFT Disposal Pond (TAN-750)	6.3
SPERT I Corrosive-Waste Seepage Pit (PBF-750)	6.0
NODA	5.9
TSF Burn Pit	5.8
WRRTF Evaporation Pond (TAN-762)	5.3
ARA-I Chemical Leach Field (ARA-745)	5.3
SPERT-III Small Leach Pond	5.0
SPERT IV Leach Pond (PBF-758)	5.0
SPERT II Leach Pond	4.5
PBF Evaporation Pond (PBF-733)	4.0
TSF Gravel Pit	3.8
BORAX II-V Leach Pond	3.8
LCCDA	3.7
TSF Intermediate-Level (Radioactive) Waste Disposal System	3.4
IET Hot-Waste Tank (TAN-319)	2.4

4.1.2 TRA-712, Warm-Waste Retention Basin

The wastewater that flows to the Warm-Waste Pond first passes through this retention basin, which has also been in use since 1952. The basin was discovered to be leaking in the early 1970's and has since been contributing the same contaminants to the perched water table as has the Warm-Waste Pond. The same avenue of migration exists for the wastewater in this basin, and it must therefore be assumed that radionuclides reaching the aquifer may have come from this source as well as from the pond. However, significant chemical contamination from the Retention Basin is not suspected, since chromium was not discharged to this waste stream after October 1964. The site received an HRS score of 22.0. The scores were lower than those of the Warm-Waste Pond because quantities discharged to the ground were smaller and no chromium release was suspected.

4.1.3 TRA Waste Disposal Well

This injection well was operational from 1964 to 1982 and was used to inject water (then considered nonhazardous) directly into the Snake River Plain aquifer. The well is perforated at several intervals between 156 and 386 m; the aquifer starts at about 145 m. The only identified contaminant of concern that was sent to the well was the chromated cooling water that had previously gone to the Warm-Waste Pond. Chromates were used in the cooling water until 1972. The USGS reported a definable chromium plume in the aquifer during the period from the mid 1960's to the mid 1970's. But their most recently published hydrological characterizations show no such definable plume. It seems reasonable to assume that the significant contamination from this activity has already migrated and dispersed into the aquifer and that contamination above background is therefore no longer detectable. However, the site received a relatively high HRS score (39.9) because an observed release was assumed.

4.1.4 TRA Chemical Waste Pond

This pond undoubtedly received corrosive wastewater (acidic and basic solutions) from 1962 to 1984 and has received pre-neutralized wastewater since that time. The water reaching this pond has the same potential for migration as does water going to the TRA Warm-Waste Pond since they would both contribute to the same perched water table. However, it is unlikely that this pond would ever have contributed any hazardous constituents to the migration path. In-pond neutralization due to mixing of acidic and basic solutions, the natural buffering capacity of the soil, and dilution with the perched water table could all contribute to preventing any corrosive characteristics from migrating to the aquifer. This site appears to have a low potential of presenting a threat to health, safety or the environment and has an HRS score of 12.0.

4.1.5 TRA-722, Open Loading Dock

The potential for migration of contaminants from this site is basically unknown, although it is expected to be minimal. Any contamination release would be due to spillage/leakage from drums of unused petroleum products and solvents. The extent of such releases is unknown but residues were visible beneath the dock. The site obtained an HRS score of 9.2 by assuming a conservatively high release quantity.

4.1.6 TRA Acid Spill (TRA-608)

This 1983 spill of 379 L (100 gal.) of sulfuric acid should present no significant potential for contaminant migration. It received an HRS score of 7.1. This incident was scored because the release exceeded the Reportable Quantity of 1,000 pounds for sulfuric acid as identified in 40 CFR Part 302.

4.1.7 TRA Paint Shop Ditch (TRA-606)

The open disposal of approximately 10,400 L of paint thinners and solvents should present little potential for contaminant migration because of the relatively low persistence of the waste involved. The fact that the waste was disposed of in small increments decreases the chances of the material's being pushed to any depth. The site received an HRS score of 7.1.

4.2 Test Area North/Technical Support Facility (TAN/TSF)

4.2.1 TSF Injection Well (TAN-330)

The TSF Injection Well received an HRS score of 31.6, which is the highest score for sites within TAN. The relatively high score was due largely to the fact that it was judged to have an observed release even though there were no specific analytical results to verify this. The logic in assuming such a release is based on the fact that the well allowed discharge directly to the Snake River Plain Aquifer. Although minor amounts of chromium, lead, and mercury are suspected of going to the well, corrosive waste was the major hazardous constituent discharged. There would appear to be limited potential for additional migration occurring from the site since it was operative from 1955 to 1972. USGS sampling of groundwater has not identified a contamination plume from the site, and it is suspected that, if there ever were such a plume, it has been diluted and dispersed so that it is no longer detectable.

4.2.2 TSF Disposal Pond, TAN-736

This percolation pond has received miscellaneous wastewater since 1972. Prior to 1984, these wastewaters may have contained hazardous constituents as well as minor amounts of radiological contamination. The site received an HRS score of 10.5. The fact that the pond continues to receive water definitely increases the potential for migration, but it is questionable whether the actual pond water has ever been hazardous, at least by RCRA definitions. The most significant volume of hazardous constituents identified as going to the pond are corrosives that may have been neutralized by the time they were discharged. The potential for migration of liquid from the pond may be significant but the hazards presented by the contaminants involved appear to be small.

4.2.3 TSF Mercury Spill

This mercury spill was identified through an interview with personnel who were involved. There was an attempt made to retrieve the spilled material, but it is unknown how much of the estimated four liters was actually recovered. The spill occurred in early 1960, and the amount unrecovered probably exceeded the one-pound Reportable Quantity for mercury. The site was therefore ranked and received a score of 9.5. Considering the small quantity involved and the time since the spill occurred, the potential for any additional migration appears small.

4.2.4 TSF Fuel Spill, TAN-607

This 1982 spill from a diesel fuel tank was given an HRS score of 7.3. Five hundred gallons of fuel were released at the time the tank leak was discovered, but it is unknown how much fuel may have leaked into the ground beneath the tank before the discovery was made. For scoring purposes a conservatively high release estimate of 2,050 to 12,500 gallons was assumed. As the score would indicate, the potential for significant migration still appears to be small.

4.2.5 TSF Service Station Spill, TAN-664

This gasoline spill occurred in 1981/1982 and involved a reported 821 L (217 gal.). The incident received an HRS score of 6.8. Considering the small quantity involved in the spill and the high vapor pressure of the material spilled, it is unlikely that much residue remains for migration. The present threat to health, safety, or the environment from this spill is considered minimal.

4.2.6 TSF Burn Pit

This combination landfill/burn pit area was operated from about 1953 to 1958. There were no significant quantities of hazardous wastes identified as going to this pit, but it is suspected that some waste

petroleum was disposed of here. The site received an HRS score of 5.8, but this did not take into consideration the fact that the materials going to the pit were reportedly burned on a frequent basis. Although there is limited information available on the wastes disposed of here, the suspected small quantity of hazardous wastes, and the fact that such waste may have been destroyed (or at least made less mobile), make the potential for contaminant migration small.

4.2.7 TSF Gravel Pit

The only identified hazardous waste disposal at this gravel pit was one drum (55 gal.) of sulfuric acid. The site was ranked and given a score of 3.8 but could have justifiably been omitted from the process because the quantity released was less than the 1,000-pound Reportable Quantity for sulfuric acid. The potential for contaminant migration appears to be insignificant.

4.2.8 TSF Intermediate-Level (Radioactive) Waste Disposal System

Two large underground tanks, which are components of this system, received radioactively contaminated waste from 1955 to 1975. These tanks still contain sludge which has both hazardous chemical and radiological constituents. The chemical contamination produced an HRS score of 3.4. The score, as well as the migration potential, is very low because the tanks are reported to be sound and sit in a concrete secondary containment cradle.

4.3 Test Area North/Loss-of-Fluid Test (TAN/LOFT) Facility

4.3.1 LOFT Diesel Fuel Spills at TAN-629

During two events (one in 1982, the other in 1983), approximately 5,500 gallons of diesel fuel were spilled in the same ditch at the LOFT facility. The site received an HRS score of 7.3, which indicates a low potential for migration problems. Because of the limited amount of precipitation in the region, the fuel would probably not be carried or pushed very deep and should have had considerable opportunity to evaporate or to be biologically broken down.

4.3.2 LOFT Disposal Pond (TAN-750)

The LOFT Disposal Pond has received wastewater since 1971 and was scored for chemical contamination. The HRS score was 6.3. Since it is a percolation pond, migration of the water is expected, but there has been no evidence that any contaminants have reached the aquifer. The only significant quantities of hazardous wastes shown as having been sent to the pond are corrosive ion-exchange regenerants. Limited records show that these were neutralized before reaching the pond. Carbon tetrachloride was not used for the toxicity/persistence element of the HRS score because the total amount of carbon tet released was less than the Reportable Quantity established by EPA. Even though wastewater is still discharged to the pond, the potential for hazardous contaminants to migrate appears small.

4.3.3 Sites Within the LOFT Facility Which Were Not Scored

The LOFT Injection Well was not scored because there were no records indicating hazardous or radiological wastes had ever gone there. The acid spill that occurred in 1983 on the northeast side of TAN-629 was not scored because the records show that the spilled acid was either removed or neutralized. There should be no potential for migration of contaminants from these sites.

4.4 Test Area North/Initial Engine Test (TAN/IET) Facility

4.4.1 IET Injection Well (TAN-332)

The IET Injection Well received wastewater from 1956 to 1978. The HRS score was 9.5. The score was based on an assumed observed release from this site since the well injected directly to the Snake River Plain Aquifer. However, there were no analytical results showing an increase in contaminants in the aquifer. The only hazardous constituents going to the well were ion exchange regenerants that were mixed and at least partially neutralized prior to discharge. Any potential for migration of contaminants from this site should have been exhausted long ago. Any corrosive characteristic water reaching the aquifer has undoubtedly been diluted and buffered to background levels.

4.4.2 IET Hot-Waste Tank (TAN-319)

This tank was part of the facility's radioactively contaminated waste collection system that was periodically active from 1956 to 1978. The tank and its sludge contents received an HRS score of 2.4 because of suspected mercury contamination. There are no analytical data indicating that mercury is present, and it probably should not have been scored. However, mercury has been found in associated piping already removed. In order to get an impression of the migration potential (as determined through the HRS) the sludge was considered to be totally contaminated. As the low score would indicate, even under worst-case conditions, the potential is minimal.

4.5 Test Area North/Water Reactor Research Test Facility (TAN/WRRTF)

4.5.1 WRRTF Injection Well (TAN-331)

The injection well was operational from 1957 to 1984. Except for one incident in which a small amount of radioactivity was apparently released, the only potentially hazardous discharges were ion-exchange column regenerant. The site received an HRS score of 14.5. The scores were based on an observed release because the well injected directly into the aquifer. However, it was reported that the corrosive regenerants were neutralized prior to release to the injection well. The scoring was based on the conservative estimate that no neutralizing was done; if the discharge was always neutralized the HRS score would be zero. In any event, the regenerants would have been buffered and/or diluted by the aquifer and there should be no further threat to safety, health or the environment.

4.5.2 WRRTF Burn Pit

This combination landfill/burn pit was operated from about 1958 to 1967. It received the same waste that had previously gone to the TSF Burn Pit and was operated in the same manner. There were no significant quantities of hazardous waste reported as having been discharged to this pit, but disposal of various petroleum products is suspected. The site received an HRS score of 6.8, but this did not take into account that the waste was frequently burned. As with the TSF Burn Pit, records are nonexistent, but the quantities of hazardous waste are suspected to be small and the frequent burning should have decreased the potential for any migration problems. Zinc bromide was not used for the "toxicity/persistence" portion of the scoring because it is highly unlikely that more than the Reportable Quantity was ever disposed of.

4.5.3 WRRTF Two-Phase Pond (TAN-763)

This percolation pond has been used since 1981 to receive wastewater with small concentrations of hydrazine. The HRS score of 6.3 (shown in Table 5.1) is based on the assumption that about 3.5 L of hydrazine were discharged to the pond. Since hydrazine is such a strong reducing agent, it is unlikely that the wastewater could migrate far through the ground without reacting. The potential for migration of a hazardous substances from this site appears very small.

4.5.4 WRRTF Evaporation Pond (TAN-762)

This evaporation/infiltration pond, which is the enlarged south cell of the sewage lagoons, receives the wastewater that previously went to the WRRTF Injection Well. It has been in use since 1984 and received an HRS score of 5.3. The score is based upon the assumption that no neutralizing of the corrosive ion-exchange regenerants was done before discharge. However preneutralization is suspected and there are no other identified hazardous constituents involved. Therefore, it is likely that there are no hazardous materials in the pond and that the potential for migration is therefore non-existent.

4.6 Auxiliary Reactor Area (ARA)

4.6.1 ARA III, Radioactive Waste Leach Field

This percolation pond has received small quantities of both radiological and chemical contamination. It received an HRS score of 10.5. There has been no wastewater intentionally discharged to the pond since 1965; however, a small amount of water still flows into it. It is suspected that the continuing discharge is clean water but it could aid in the migration of any contaminants already in the pond sediments. The review of past operations indicates that the quantity of such contaminants is small and no migration has been detected in monitoring wells. However, the number of monitoring wells in the area is probably insufficient to ensure the detection of any releases.

4.6.2 ARA III, Sanitary Sewer Leach Field (ARA-740)

From 1980 through 1983, very small quantities of laboratory wastes have gone to this septic tank/drainage field system. The drainage field received an HRS score of 10.0 due to this contamination. The continued use of the sewer system contributes to migration potential but there is no analytical data available to indicate which contaminants, if any, have reached the leach field and whether or not they have moved. With the small quantities of hazardous constituents involved, the seriousness of migration from this source would be relatively small, even as a worst case.

4.6.3 ARA I, Chemical Leach Field

This percolation pond has been used since 1971 for miscellaneous wastewaters. The small quantities of hazardous waste suspected are due to laboratory operations and were responsible for the HRS score of 5.3. The wastewater continuing to be discharged to the leach field increases the potential for migration, but the small quantities of wastes involved would minimize the significance of any such migration. The quantities of

individual contaminants identified as going to this site were actually below their respective Reportable Quantities, as identified in 40 CFR Part 302. A strict application of the HRS would have excluded these wastes from the scoring process and the resulting score would be zero.

4.7 Power Burst Facility (PBF)

4.7.1 PBF Corrosive Waste Injection Well (PBF-302)

This injection well was active from 1972 through 1978 and received corrosive ion-exchange column regenerant and cooling water treated with chromates. The well terminated at a depth of 35 m (115 ft), about 104 m (340 ft) above the surface of the Snake River Plain Aquifer. Assuming all the regenerant solutions were hazardous, the site was given an HRS score of 12.0. From recent discharge data there seems to be a good chance that the regenerants have always been neutralized (due to mixing) before they were released to the well. It is also unlikely that corrosive characteristics would have remained after migration through a soil column. This leaves the chromium as the primary constituent of concern for migration. Since the well has not received water in over seven years and the location is not considered an aquifer recharge area, it is likely that the hazardous waste constituents have migrated as far as they will. Monitoring data are insufficient to determine whether or not detectable levels have ever reached the aquifer. The potential for significant quantities of contamination to migrate from this site in the future appears to be small.

4.7.2 SPERT I Corrosive Waste Seepage Pit (PBF-750)

This 5-m (15-ft) deep seepage pit received corrosive ion-exchange column regenerant solutions from 1955 through 1964. The site received an HRS score of 6.0 based on the estimated quantities of sulfuric acid and sodium hydroxide that were used to make up the regenerant solutions. As with other sites that received this type waste, the corrosive characteristics of the wastewater that went to this site are not expected to have remained with the water for long due to the buffering capacity of the soil. Continuing migration of contamination from this site does not appear to be a problem.

4.7.3 SPERT III Small Leach Pond

This percolation pond received ion-exchange column regenerant solutions from 1958 to 1968. These corrosive solutions resulted in an HRS score of 5.0 for the pond. No other hazardous wastes are suspected in this pond. The potential for hazardous waste to migrate from this pond is very small.

4.7.4 SPERT IV Leach Pond (PBF-758)

This percolation pond was used from 1961 to 1970 for disposal of chemically contaminated wastewater from a demineralization plant and radioactively contaminated wastewater from reactor operations. Chemical contamination was limited to corrosive ion-exchange column regenerants resulting in an HRS score of 5.0. The radiological contamination was always small enough that DOE release criteria were not exceeded. Significant migration of chemical contamination from this site is not expected to occur.

4.7.5 SPERT II Leach Pond

As with the SPERT IV Leach Pond, this percolation pond was used for the disposal of wastewater from a demineralization plant and low-level radioactive wastewater from reactor operations. It received these wastewaters from 1960 to 1964. Radioactive contamination discharges had always been very low in activity and recent surveys have shown only background levels. The site received an HRS score of 4.5 which is lower than the SPERT IV Pond score because the quantity of chemicals was less. Again, migration of corrosive contaminants is not expected to present a problem. The quantities of individual hazardous constituents were actually small enough to be lower than their respective Reportable Quantities. A stricter application of the HRS would actually have led to a score of zero.

4.7.6 PBF Evaporation Pond (PBF-733)

Since 1979 this Hypalon-lined pond has received ion-exchange column regenerant solutions (potentially corrosive) and blowdown from the reactor's secondary cooling system (pretreated with chromates until 1984). The pond received a relatively low score of 4.0 since the liner should prevent migration of chrome, which is the contaminant of primary concern.

4.8 Experimental Organic Cooled Reactor (EOCR)

4.8.1 EOCR Leach Pond

The only site within EOCR identified as having received hazardous wastes is this percolation pond. It was active from 1960 to 1962 and received ion-exchange column regenerants. These corrosive wastewaters resulted in an HRS score for the site of 7.1; no other hazardous materials were identified as going to this pond. The potential for migration of hazardous constituents from this pond is very low because of the natural buffering capacity of the soil.

4.9 Organic Moderated Reactor Experiment (OMRE)

4.9.1 OMRE Leach Pond

The only site within OMRE identified as having received hazardous wastes is this percolation pond. The pond was active from 1959 through 1963 and primarily received radiologically contaminated wastewater. Records also indicated that the pond received small amounts of waste xylene. The site received an HRS score of 7.1 due to the xylene. Xylene has a relatively low persistence and should not offer a significant threat of migration.

4.10 Boiling Water Reactor (BORAX) Area

4.10.1 BORAX II-V Leach Pond

This percolation pond was used from 1955 to 1964 for wastewaters from the BORAX II, III, IV, and V tests. The only significant chemical contaminants identified as definitely going to the pond were ion-exchange column regenerants (acids and bases). The pond also received low-level radioactively contaminated wastewater. The site received an HRS score of 3.8 due to the corrosive waste. As the score would indicate, the types and quantities of hazardous contaminants present would not appear to pose a threat (due to migration) to health, safety or the environment.

4.11 Experimental Breeder Reactor-I (EBR-I)

There were no disposal sites identified in association with the EBR-I operation.

4.12 Zero Power Reactor-III (ZPR-III)

There were no disposal sites identified in association with the ZPR-III operation.

4.13 Liquid Corrosive Chemical Disposal Area (LCCDA)

This area consisted of two pits used for the disposal of corrosive (acids and bases) liquids. One pit was used from 1961 through 1970 while the other, which had limestone placed in the bottom, was used from 1972 to 1980. The site received significant quantities of waste, including liquids, but because of the corrosives' relatively low persistence and the location of the site, it received an HRS score of only 3.7. Due to the buffering capacity of the soil, it is not expected that waste with corrosive characteristics could migrate to any significant extent.

4.14 Munition/Ordnance Areas

4.14.1 Naval Ordnance Disposal Area (NODA)

This site received an HRS score of 5.9 for its past use as a storage site for hazardous waste. There is analytical evidence that some of the waste may have been spilled or leaked on the ground. However, there are no records of such spills occurring, so an estimated release was used to obtain the score. Although it is suspected that some relatively persistent compounds such as methylene chloride may have been released, the quantities are also suspected to be quite small and should not present a significant potential for migration.

4.14.2 Miscellaneous Munition/Ordnance Areas

There were numerous sites identified in Section 3.14 where unexploded ordnance have been found or are expected to be located. These sites, which include the NODA, were not scored because they are not readily adaptable to the HRS and basically present an "unknown" in quantity. The materials of concern are solid, potentially explosive items which exhibit no significant potential for migration. The danger, rather, is in their being a safety hazard to people moving or working in uncleared (unsurveyed for explosive ordnance) areas.

4.15 Central Facilities Area (CFA)

4.15.1 CFA Landfill

The old CFA Landfill was the primary disposal site for nonradioactive solid waste generated on the INEL from 1951 to 1981. Records show that significant quantities of hazardous waste were discharged to this landfill. It is suspected that much of it was not documented. The site received an HRS score of 17.7 based on an assumed hazardous waste quantity derived from current generations. It was assumed that past generations were similar in quantity and that all were disposed of in the CFA Landfill. This should represent a conservatively high estimate. Free liquids, even if containerized, are expected to be present in the landfill, and the potential for migration of hazardous constituents does exist. The location of the active portion of the landfill changed in about 1981. This corresponds roughly to the timeframe when hazardous wastes were segregated and handled separately for off-site disposal. Therefore, it is assumed that no significant quantities of hazardous waste were disposed of in the newer landfill area.

4.15.2 CF-674 Pond

Investigations indicate that it is very likely that hazardous constituents went to this percolation pond, but the quantities of such materials are unknown. The pond was used from 1954 to 1965 to receive wastewater from a prototype fuel-processing operation. There is no evidence that additional wastes were sent to the site after that time. An HRS score of 12.0 was obtained, using a conservatively high estimate of hazardous waste that may have been disposed of. The potential for additional migration of contaminants from the site should be small because there have been no recent discharges to the pond and because the area climate is quite dry. However, the extent of migration, if any, that has already occurred is unknown.

4.15.3 CFA Motor Pool Pond

This percolation pond is connected to the CFA equipment repair facility that is referred to as the "Motor Pool". It was active from 1951 to 1983 and received significant quantities of battery acid during that time. The pond also undoubtedly received high levels of oil and grease, but these were not included as hazardous waste in calculating an HRS score of 8.5. The pond has received no water other than precipitation since 1983 and should present little potential for contaminant migration since only acid is involved and it was diluted with wash water at the time of discharge.

4.15.4 CF-633 French Drain

This covered French drain or percolation pit received laboratory wastewater from 1950 to 1984. This water is suspected to have contained small quantities of hazardous constituents. The site received an HRS score of 7.8 based on an assumed quantity of hazardous waste that is probably conservatively high. Hazardous waste no longer goes to the drain, but since it still receives wastewater, the potential for continuing migration of contaminants is present.

4.16 Radioactive Waste Management Complex (RWMC)

This land disposal operation was designed to receive low-level radioactive wastes, but it is suspected of also containing significant quantities of radioactive-hazardous mixed wastes. The site has been active since 1952. Radioactive wastes disposed of at the RWMC have been fairly well documented, particularly in later years; records of mixed wastes, however, are minimal. The site was given maximum values of waste characteristics for chemical constituents and received an HRS score of 9.0. Because of the large quantities of wastes, the potential for migration would appear to be significant. The site received a relatively low score because of its remoteness, dry climate, and depth to groundwater. These factors, and the fact that there are suspected minimal amounts of free liquids in the wastes, and the surface is now graded to remove precipitation, combine to reduce (to some extent) the potential for migration. The site, however, remains one of concern.

5. RECOMMENDATIONS FOR EG&G SITES

The basic recommendation to be made as a result of this report is to propose which sites warrant additional study. The HRS is an attempt to put a numerical value on the potential for a site to have adverse environmental impact due to migration of hazardous materials. EPA has established an HRS score of 28.5 as a general criterion for inclusion of a site on the National Priority List (NPL). However, for the purposes of this report, the 28.5 level is not used as a minimum criterion for a site to warrant additional study. Considering the sites individually, a general "no-action-required" cutoff of about 7.5 appears to be appropriate. There are several sites scoring higher than 7.5 for which no action is being recommended; only a very few scoring below that level appear to warrant additional attention.

There are also several sites described in this report which will be closed under RCRA regulations rather than under the DOE CERCLA Program. Since the closure or remedial actions for these sites will have to meet different requirements, under a different schedule, this section contains no recommendations for them.

The recommendations are presented according to the general geographical divisions used in previous sections and are summerized in Table 5.1.

TABLE 5.1. RECOMMENDED MONITORING PROGRAM FOR EG&G FACILITIES UNDER PHASE II OF THE DOE CERCLA PROGRAM

Site	Rating Score	Recommended Monitoring
TRA		
1. TRA Warm-Waste Leach Pond	51.9	1.1 Sample and profile contaminants in pond sediments 1.2 Improve and continue local sampling of perched water table and Snake River Plain Aquifer 1.3 Evaluate appropriateness of existing monitoring wells to detect Contaminant migration
2. TRA Warm-Waste Retention Basin	41.9	2.1 Recommendations 1.2 and 1.3 also apply to this site
3. TRA Waste Disposal Well	39.9	3.1 No specific recommendations are made, 1.2 and 1.3 also apply
4. TRA Open Loading Dock (TRA-722)	9.2	4.1 Sampling survey of soil beneath dock
TAN/TSF		
5. TSF Injection Well	31.6	5.1 Improve and continue local monitoring of Snake River Plain Aquifer. 5.2 Evaluate appropriateness of existing monitoring wells to detect contaminant migration
6. TSF Disposal Pond	10.5	6.1 Sampling survey of pond sediments 6.2 Recommendations 5.1 and 5.2 also apply to this site
ARA		
7. ARA III Radioactive-Waste Leach Pond	10.5	7.1 Sampling survey of pond sediments
PBF		
8. PBF Corrosive-Waste Injection Well	12.0	8.1 Improve and continue local monitoring of Snake River Plain Aquifer 8.2 Evaluate appropriateness of existing monitoring wells to detect contaminant migration
MUNITIONS/ORDNANCE AREAS		
9. NODA Storage Area	5.9	9.1 Sampling survey of soil where wastes were once stored
10. Miscellaneous Munitions/Ordnance Areas	Unscored	10.1 Pursue having DOD accept responsibility for their old materials or fund annual surveys of small areas
11. CF-674 Pond	12.0	11.1 Sampling survey of old pond sediments

5.1 Test Reactor Area (TRA)

Of the seven sites scored within TRA, only four are being recommended for continued study. Excluded are the Chemical-Waste Pond and the Paint Shop Ditch, which will both be closed under RCRA, and the Acid Spill (TRA-608) which scored only 7.1 and which presents negligible potential for contaminant migration.

The TRA Warm-Waste Pond should be included in continuing studies. The pond is still being used for the disposal of low-level radioactive wastewater and does so under DOE license. There is, however, a project that has been submitted for funding that will eliminate the discharge of this wastewater to the ground. Under this project, a majority of the water will be recycled and the remainder will go to a lined evaporation pond. Any remedial action for this pond should begin by encouraging funding of this project so that the pond's usage could be halted without additional expense for alternate disposal methods that would be used only on an interim basis.

It is recommended that the Phase II effort on the Warm-Waste Pond include sampling of the pond sediments and continued sampling of the perched water table and the Snake River Plain aquifer. The pond sediments should be sampled to obtain vertical and horizontal distribution of the contaminants (primarily chromium and radionuclides). It will be valuable to know, for any future remedial action, if significant quantities of the contaminants remain near the surface or if some species have not migrated through the sediments. Additional groundwater monitoring needs to be done to determine the fate of any contaminants that have migrated. USGS is concerned about the validity of some past sampling efforts because they were primarily thief samples that may have represented isolated conditions within the well casings, and because there have been some discrepancies in analytical results. There is also some concern that chromium detected in the perched water table, as well as in the aquifer, may be partially due to naturally occurring chromium. Additional sampling of the groundwaters,

after purging, needs to be done in hopes of resolving some of these issues. Finally, the locations of existing groundwater monitoring wells need to be evaluated as to their appropriateness in detecting releases from this area. As a starting point, the wells may be evaluated according to the groundwater monitoring requirements of 40 CFR 264 and 265.

With the exception of the recommendations for sediment sampling, the Phase II efforts for the Warm-Waste Pond are also applicable to the Warm-Waste Retention Basin. Since the early 1970s, the contaminants (this timeframe excludes chromium) going to the Warm-Waste Pond have also leaked from this facility.

No specific recommendations are proposed for the TRA Waste Disposal well, since it is assumed that any adverse impact from this operation has already occurred and it no longer poses a problem due to dispersion and dilution. The improved groundwater monitoring proposed for the other TRA sites should detect any contradictions to this assumption.

The open loading dock at TRA-722 received a relatively low score (9.2) and probably exhibits a low potential for migration problems. However, the site presented an unknown problem. In order to quantify the problem, it is recommended that a sampling survey of the soil beneath the dock be conducted. The samples should be analyzed for oils and grease and the common solvents used at TRA that may have been stored on the dock (i.e., trichloroethane and methylene chloride). If detectable quantities are present at the surface, additional sampling should be done to determine both the vertical and horizontal extent of contamination.

5.2 TAN/Technical Support Facility (TAN/TSF)

Five of the eight sites within TAN/TSF received scores below 7.5; it is recommended that they be excluded from additional study. These sites are: The Fuel Spill outside TAN-607, the Service Station Fuel Spill, the Burn Pit, the Gravel Pit and the Intermediate-Level (Radioactive) Waste Disposal system. These sites exhibit such low potential for migration that additional study is not justified. It is also recommended that the Mercury Spill outside TAN-607 be deleted from further study. It is suspected that only a small quantity of the mercury was not cleaned up from this spill that occurred in the 1960s. Attenuation by soil and evaporation would have left little, if any, mercury available for migration.

The highest ranked of the three TAN/TSF sites remaining is the Injection Well. As with other wells that injected directly to the aquifer, if problems have not yet been encountered, they probably will not occur. The only way to verify this premise is to continue monitoring. Therefore, it is recommended that the USGS monitoring of existing wells continue for an increased array of indicator parameters such as those established in 40 CFR 265 under groundwater monitoring requirements. Analysis for chromium, lead and mercury on a continuing basis is specifically appropriate. It is also recommended that the locations of the existing monitoring wells be evaluated as to their appropriateness in detecting releases from this area.

The TSF Disposal Pond (TAN-736) also scored above 7.5 and appears to warrant some additional study. The contaminants that pose the largest threat of migration are chromium, lead, and mercury and are only suspected to be present. It is recommended that a sampling survey be taken on the pond sediments to determine whether hazardous materials are present in significant quantities. The groundwater monitoring recommendations made for the Injection Well also apply to this site.

5.3 TAN/Loss-of-Fluid-Test (TAN/LOFT) Facility

Neither of the two scored sites at LOFT is recommended for additional study; both scored below 7.5. The two sites involved are the LOFT Diesel Fuel Spills at TAN-629 and the LOFT Disposal Pond (TAN-750).

5.4 TAN/Initial Engine Test (IET) Facility

Two sites at IET were scored. One of these (the Hot-Waste Tank received a score of less than 7.5 and is recommended to be deleted from additional study. The second site (the Injection Well) received a score slightly higher than 7.5 but is also recommended for deletion. Available records of operating procedures indicate that the only hazardous wastes (corrosives) going to this well were at least partially preneutralized. The score was based on the conservative estimate that the wastewater may have been corrosive when injected. Even under this conservative assumption, there would be no hazardous characteristics remaining from these past operations due to the high groundwater volumes and flow in the aquifer.

5.5 TAN/Water Reactor Research Test Facility (WRRTF)

Three of the four sites at WRRTF scored under 7.5 and are recommended for no further action. These sites are the Burn Pit, the Two-Phase Pond, and the Evaporation Pond. The only site scoring above 7.5 is the Injection Well which also appears to warrant no further study. As with the IET Injection Well, the only hazardous waste suspected was corrosive wastewater. Descriptions of past operations indicate these wastes were neutralized before discharge. The site probably should not have been scored. In either case, it is safe to say that, due to the high flows in the aquifer, no hazardous constituents remain from these past operations.

5.6 Auxiliary Reactor Area (ARA)

ARA had two sites which scored above 7.5, and one site below. It is recommended that the one lower scoring site be eliminated from additional study. It is the ARA I Chemical Leach Field. No further study is recommended on the ARA III Sanitary Sewer Leach Field because it is to be closed under RCRA regulations.

The remaining site at ARA, not yet addressed, is the ARA III Radioactive-Waste Leach Field. Contrary to the name, the site received its score due to chemical contamination. It is suspected that chromate-contaminated cooling water may have reached this field. A soil-sampling survey appears appropriate to determine if significant contamination is present. At a minimum, the samples should be analyzed for chromium and some general indicator parameters.

5.7 Power Burst Facility (PBF) Area

Six sites in the PBF area were scored; five of them were below 7.5. The five low-scoring sites (SPERT I Corrosive-Waste Seepage Pit, SPERT II, III, and IV Leach Ponds, and PBF Evaporation Pond) are recommended to be dropped from the Phase II studies. Also, the lined PBF Evaporation Pond will be closed under RCRA regulations.

The highest scoring site in the PBF area is the PBF Corrosive-Waste Injection Well. Chrome and corrosives are suspected of going to this well. Since the well injected wastewater at a depth of 35 m (115 ft) and its use has already been stopped, there is little else that can be done on the surface to prevent migration. Even though the potential for serious environmental impact appears small, it may be appropriate to include analysis for hazardous waste parameters (particularly chromium) in the existing groundwater monitoring in the area. It is also recommended that the locations of existing monitoring wells be evaluated as to their ability to detect contamination from the PBF area.

5.8 Experimental Organic Cooled Reactor (EOCR)

The only site (EOCR Leach Pond) within the EOCR facility was identified and received a score of less than 7.5. This site is recommended for no additional study.

5.9 Organic Moderated Reactor Experiment (OMRE)

The only site identified at the OMRE facility is the OMRE Leach Pond. It received a score of less than 7.5. The site is recommended for no additional study.

5.10 Boiling Water Reactor (BORAX) Area

The BORAX II-V Leach Pond site received a score significantly lower than 7.5 and is not recommended for additional study.

5.11 Experimental Breeder Reactor-I (EBR-I)

There were no sites identified in this area.

5.12 Zero Power Reactor-III (ZPR-III)

There were no sites identified in this area.

5.13 Liquid Corrosive Chemical Disposal Area (LCCDA)

The LCCDA received a score of less than 7.5 and is not recommended for additional study. It is unlikely that waste could ever have migrated very far from this site without losing its corrosive characteristics.

5.14 Munitions/Ordnance Areas

Although the NODA received a score of less than 7.5 for its past use as a hazardous waste storage area, additional study may be appropriate. If more toxic and persistent chemicals were spilled than were considered in the scoring effort, the score would be raised. To verify whether or not this is the case, a more detailed sampling survey of the area where waste was stored is recommended. Since a wide variety of wastes may have been stored, a wide variety of parameters should be included in the analytical work. Appropriate indicator parameters may be substituted for individual species.

The areas suspected of containing munitions/ordnance that were described in Section 4.14 were not scored. These areas do not represent a significant potential for contaminant migration and hence are out of the scope of the CERCLA program. These areas do, however, present a safety hazard to people involved in present and future use of the INEL. Therefore, it is recommended that DOE pursue the possibility of having DOD accept the responsibility of dealing with these areas, and that a small amount of funding be set aside annually to allow INEL personnel to do detailed surveys and clear, if possible, small areas at a time.

5.15 Central Facilities Area (CFA)

Four sites within CFA were identified and scored; all four received scores greater than 7.5. Three of the sites, however, will be addressed and closed under RCRA regulations, since they received hazardous waste after November 19, 1980. These three sites are the CFA Landfill, the Motor Pool Pond, and the CF-633 French Drain.

It is recommended that the remaining site be surveyed to verify the presence of hazardous constituents and, if possible, the extent of any migration. The CF-674 Pond is suspected of receiving moderate quantities of various hazardous constituents. A sampling survey of the old pond sediments should include measurements for metals, particularly mercury, and organic indicators to verify that no solvents went to the pond.

The RWMC will be omitted from further study under EPA regulations, as it is, and has always been, operated pursuant to the Atomic Energy Act. Long-range closure and stabilization plan already in existence, should, however, meet or exceed the goals of similar efforts required under RCRA and CERCLA.

WINCO Facilities

Department of Energy

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P.O. Box 2469
Idaho Falls, Idaho 83403-2469

NR:IBO-86/59

February 25, 1985

T. E. Wade II, Manager
Idaho Operations Office
U. S. Department of Energy
785 DOE Place
Idaho Falls, Idaho 83401

SUBJECT: Naval Reactors Facility Response to Resource Conservation and Recovery Act-3004(u)

The attached information is provided for your information and use in response to U. S. Environmental Protection Agency (EPA) letter M/S 533 (undated). This letter contains NRF's response to information on Resource Conservation and Recovery Act Section (3004[u]).

Any additional use of this information should be cleared in advance through this office.

T. M. Bradley
Manager, Operations

cc: C. H. Schmitt, NR
J. J. Mangeno, NR

Naval Reactors Facility - Providing Information for RCRA 3004(u)

Prior to 1980, NRF released low levels of chemical substances which are now controlled under RCRA to the NRF Industrial Ditch; this practice stopped in 1980 except for dilute acid and base rinse solutions which occurred up to April 1985. No releases have been made since that time. Moreover, there is no evidence that the releases made prior to April 1985 have had a significant impact on the environment or that the chemical constituants are migrating from the region around the ditch.

NRF currently uses the NRF Industrial Ditch for discharge of rain run-off and other site waste water. These discharges contain no RCRA substances.

NRF has conducted some sampling of the soil and water in the Industrial Ditch which demonstrates no significant environmental impact. Attachment 1 provided a detailed report on the Industrial Ditch.

NRF is currently preparing a formal closure plan for the Industrial Ditch which will be ready in March 1986. Also, NRF is preparing for additional sampling of the soil and water in the ditch in order to closely monitor the conditions there and confirm the absence of environmental impact.

Attachment I

Information Concerning History of and Plans for Use of the Naval Reactors Facility Industrial Ditch

Background: Naval Reactors Facility (NRF) is located at the Idaho National Engineering Laboratory (INEL) as shown on the attached topographic map segment. This facility is owned and controlled by the United States Government. All operations conducted at this facility are for the sole purpose of carrying out the responsibilities of the U. S. Department of Energy (DOE) such as those set forth in applicable statutes and regulations including the Atomic Energy Act of 1954 and the Department of Energy Organization Act.

The day-to-day control and management of operations at this facility are conducted for the Office of Naval Reactors, DOE, by Westinghouse Electric Corporation under a cost-type, management and operating contract. Although Westinghouse acts as the "Operator" of the facility, it should be noted that DOE retains and exercises general control and responsibility for the facility's overall operation.

History: NRF was established in 1950 as a proving ground for the nuclear propulsion of ships. During construction of the first portions of NRF in 1951, an industrial ditch extending north from NRF was built to accommodate non-radioactive, non-sewage water discharges. These discharges consisted predominantly of normal rain and snow runoff, and discharges of non-hazardous, essentially pure water from facilities such as steam systems and non-radioactive cooling ponds.

Between 1953 and 1964, the industrial ditch was expanded to accommodate new plants at NRF. The current ditch has been essentially in place since that time. The ditch is about 10 feet deep, 20 feet wide, and extends 3.2 miles north-northeast of NRF. It is shown on the attached topographic map.

In addition to pure water discharges, small amounts of dilute hazardous materials were also discharged to the ditch until 1980. These included photographic chemicals, corrosion inhibitor, cleaning solvents, and used laboratory reagents. In addition, acids (pH less than 2.0) and bases (pH greater than 12.5) resulting from the regeneration of ion exchange resin (used to deionize well water to the extent necessary for use in nuclear reactors) was discharged to the ditch until 1985. The actual amount of such discharges is unknown; however, the following is estimated to be a typical annual discharge to the NRF industrial ditch immediately prior to 1980:

Rain and snow runoff:	33,000,000 gallons
Nonhazardous facilities discharges (essentially pure water):	70,000,000 gallons
Water containing potassium chromate (2000 ppm):	1000 gallons
Photographic chemicals (3000 ppm):	1000 gallons
Laboratory reagents (predominantly mercuric nitrate, 10 ppm, silver nitrate, 35 ppm, and formaldehyde, 1 ppm):	1000 gallons
Ion exchange resin flush acid (pH less than 2.0):	2,000,000 gallons
Ion exchange resin flush base (pH greater than 12.5):	2,000,000 gallons

The above numbers were not continuous discharges in general, but were intermittent depending on the nature of day-to-day activities at NRF.

In addition to the numbers above, a discharge of up to a million gallons of water containing up to 500 ppm sodium chromate was conducted every few years between 1958 and 1967. This water came from the prototype cooling water systems which used sodium chromate as the corrosion inhibitor. In 1967, the cooling water corrosion inhibitor was changed to a nonhazardous material.

By June 1980, NRF had stopped all hazardous waste discharge (except acids and bases) to the NRF industrial ditch as a general site improvement project. This was accomplished by recycling of hazardous waste, collection and off-site disposal of remaining waste streams, and procedural controls.

With regard to acids and bases, NRF conducted extensive surveys of the discharge of ion exchange resin rinse water in 1980. These surveys noted that:

- Acids and bases are discharged in roughly equal amounts and at about the same time, and are therefore largely self-neutralizing.
- The soil at NRF has a natural pH of about 8.0 and is highly buffering, particularly to acids.
- Soil samples downstream of the discharge point were slightly more acidic than the natural soil, with the degree of acidity declining with distance from the discharge point.
- Routine weekly water samples taken 250 yards downstream of the discharge point showed pH to be strongly acidic or basic during acid/base discharge (about an hour a day). However, the pH returned to normal values between pH 7 and pH 8 during periods in which acids and bases were not being discharged.

Based on the above, including in particular the essentially self-neutralizing characteristics of acid and base discharges, the relatively high cost of a pre-neutralization facility, and the vital nature of pure water production to NRF's responsibilities under the Atomic Energy Act, DOE in 1980 concluded that continued discharge of acids and bases was technically acceptable.

Water and soil surveys of the ditch since then, and observation that flora and fauna thrive on the ditch water, have confirmed that there is no obvious adverse impact on the environment due to discharge of acids and bases.

Nonetheless, in 1983, DOE reconsidered installation of a neutralization facility which would allow the acids and bases to self-neutralize before discharge, solely to comply administratively with RCRA. This facility, consisting primarily of two 15,000-gallon accumulation tanks, was purchased and put in service in early 1985. Since April 1985, no acids or bases have been disposed of in the NRF industrial ditch.

Water and soil surveys of the ditch have found that only residual chromium and, to a much smaller degree, residual silver possibly exceed EPA limits. Chromium and silver are considered hazardous when leachable levels (the EP toxicity test) exceed 5 ppm. The survey found:

Chromium levels in very localized areas were as high as 1200 ppm total chromium. Average areas near the discharge points were 100 ppm total chromium. Natural background levels well away from human disturbance average 25 ppm; i.e., there are extensive naturally occurring low levels of chromium throughout this area above EPA maximum levels. A few areas near the discharge point had silver levels up to 80 ppm for total silver. The great majority of silver samples in the ditch were below 0.5 ppm total silver.

The ditch soil has not yet been analyzed for leachable chromium and silver levels by the EP toxicity test. Instead, only total chromium and silver has been measured in the samples. The leachable levels of chromium and silver can be no higher and will probably be much below the total metal ion levels. All water samples in the ditch show no detectable chromium or silver contamination.

The chromium (above background levels) extends not more than two feet into the ground. This chromium has not migrated significantly over the past five years.

The areas of the ditch having the highest chromium levels have been replaced with a completely enclosed culvert. This action was taken as a site security measure, not because of the contamination levels in the ditch. Remaining open areas of the ditch are further downstream.

Future Plans: Based on the above, DOE considers there is no adverse environmental impact associated with the continued discharge of nonhazardous, essentially pure water to the NRF industrial ditch. NRF will perform analyses of the residual chromium to determine its performance in the EP toxicity test. If the leachable chrome levels are below the EPA limits, the ditch will be considered uncontaminated. Personnel access will continue to be restricted as good engineering practice.

If the chromium is found to be above the EP toxicity limits, its location will be evaluated by periodic soil samples to confirm that no adverse migration of the chromium is taking place. In the unlikely and unexpected event that excessive migration of hazardous levels of chromium is occurring and adversely affect-int the environment, additional actions will be taken to contain the chromium or to restrict water input to the NRF industrial ditch, to stop such migration.

4. FINDINGS

Past activities involving both waste generation and disposal were reviewed to assess the hazardous waste operations that generated inactive disposal sites at Argonne National Laboratory-West (ANL-W) on the Idaho National Engineering Site (INEL). This section contains the findings of the activity reviews by individual activity.

File information, past reports, interviews, and facility visits provided identification of hazardous material usage and hazardous waste generation from operations at ANL-W. A master list of building and facilities was generated and is included in Appendix C, Table C.1. This master list includes any laboratory or shop operation where hazardous materials or wastes may have been involved. If further investigation determined that hazardous materials were not used and hazardous wastes were not produced at a particular operation, then it is not addressed further in the main text.

Since 1971, records have been kept on incidents occurring at ANL-W's facilities which have disrupted operations or presented unusual problems. The records, Unusual Occurrence Reports (UOR's) are maintained by Safety, Security and Safeguards Division and include documentation of spills that have occurred since 1971. Also included in this section is an identification of the individual disposal sites at ANL-W.

4.1 ANL-W Past Activity Review

4.1.1 ANL-W Description

ANL-W is one of the best equipped sites in the nation for research and development on the base technology of liquid metal fast breeder reactors. The ANL-W facilities tie together in a way that covers many of the outstanding problems in breeder reactor development. Normal-power operation of a breeder-reactor power plant is demonstrated by Experimental Breeder Reactor II (EBR-II), which also provides irradiation tests and operational reliability tests. High-power

transient operation for safety tests is provided by the Transient Reactor Test Facility (TREAT). Low-power operation for studying the physics of very large breeder-reactor cores is provided by the Zero Power Plutonium Reactor (ZPPR). Remote handling and examination of radioactive materials is provided by the Hot Fuel Examination Facility (HFEF). Backing up these major facilities are a full array of shops, warehouses, laboratories, and offices. Figure 4.1 is a plot plan of ANL-W.

4.1.2 ANL-W Wastes Generated by Specific Activity

4.1.2.1 Reactor/Utility Operations (Shops, Labs, and Processes)

Evaluation of the facilities identified in Table C.1 of Appendix C produced a list of shops, labs and processes at ANL-W which were considered to pose a potential for contamination. Table 4.1 provides the list of facilities considered potential contamination risks. Table 4.1 provides also the hazardous waste constituents involved, the time frames in which the hazardous wastes were produced, and the disposal methods. Several facilities on the Appendix C list have been deleted from Table 4.1 due to insignificant waste quantities. The facilities in Table 4.1 are further discussed in the following paragraphs.

Building 752: Building 752 [Laboratory and Office Building (L&O)], serves as a multifunction administrative and support services facility. The building houses administrative offices, drafting, photo and reproductive services, cafeteria, library, computer services, chemical-metallurgical laboratory [which includes the Junior Caves (hot cells)], glove box facilities, analytical chemistry laboratories, and nondestructive analysis laboratory. Evaporative and concentrating equipment for processing radioactive liquid wastes from all ANL-W site facilities is also housed in this building. The use of the evaporative and concentrating equipment was discontinued in July

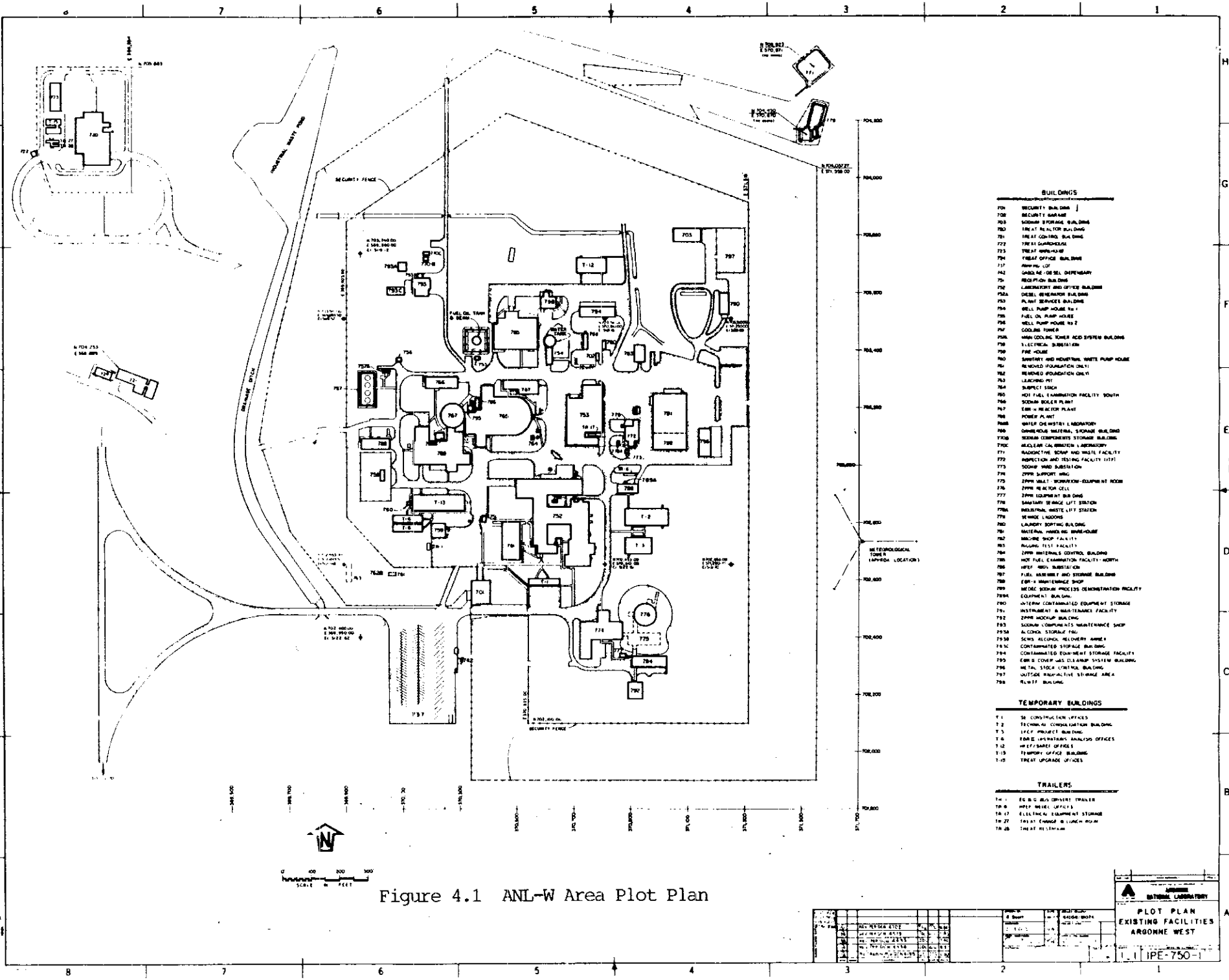

Figure 4.1 ANL-W Area Plot Plan

TABLE 4.1. ANL-W BUILDINGS/FACILITIES WASTE GENERATION

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities** (if known)	Treatment/Storage/ Disposal
752	Chem Labs.	Ignitable Wastes	1962-1969		Open burn pit
			1969-1971		RWMC
		Reactive wastes	1962-1969		Evaporator (Bldg. 752)
			1968-1971		Evaporator (Bldg. 752)
		Corrosive Wastes	1962-1969		Evaporator (Bldg. 752)
			1969-1971		Evaporator (Bldg. 752)
		EP Toxic Wastes	1962-1969		Evaporator (Bldg. 752)
			1969-1971		Evaporator (Bldg. 752)
		All hazardous lab wastes	1971-present		Drummed and shipped off-site as HW
753	Paint Shop	Waste thinners, and solvents	1961-1978	114 L/yr	Waste oil drums shipped to CFA landfill
		Waste thinners, and solvents	1978-present	114 L/yr	Drummed and shipped off-site as HW
		Empty cans (1 gal cans)	1961-present	30 cans/yr	CFA landfill
	Mechanics Shop	Oil with small quantities of hydraulic fluids	1967-1977	Small	Applied to dirt roads
			1961-present	2500 L/yr	ANL-W boilers
765	Spray Chamber	Potassium hydroxide	1964-1976	272 kg/yr	Bldg. 752 evaporator
		Potassium chromate	1964-1976	18 kg/yr	Bldg. 752 evaporator
		Potassium permanganate	1964-1976	73 kg/yr	Bldg. 752 evaporator

** Total unless stated otherwise.

TABLE 4.1. ANL-W BUILDINGS/FACILITIES WASTE GENERATION (contd)

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities** (if known)	Treatment/Storage/ Disposal
765 (contd)		Oxalic acid	1964-1976	54 kg/yr	Bldg. 752 evaporator
		Ammonium oxalate	1964-1976	290 kg/yr	Bldg. 752 evaporator
		Oxalic acid	1964-1976		Bldg. 752 evaporator
		Radiacwash*	1980-1980		ICPP
		Boric Acid	1980-1980	607 kg	ICPP
768	Main & auxiliary cooling towers	Hexavalent chromium	1962-1964	162 kg	Industrial waste pond
		Trivalent chromium	1964-1980	4207 kg	Industrial waste pond
	Demineralization Plant	Regeneration discharge from ion exchangers			
		Sodium hydroxide (50% NaOH)	1960-present	1,045L/yr	Industrial waste pond
		Sulfuric acid	1960-present	2,725L/yr	Industrial waste pond
782	Machine Shop	Acetone	1968-1985	3.8 L/yr	Waste oil shipped to CFA landfill
			1985-present	3.8 L/yr	55-gal drum shipped off-site as HW
		Freon TF	1968-1985	3.8 L/yr	Waste oil shipped to CFA landfill
			1985-present	3.8 L/yr	55-gal drum shipped off-site as HW

* Radiacwash used in the refurbishment in 1980.
** Total unless stated otherwise.

TABLE 4.1. ANL-W BUILDINGS/FACILITIES WASTE GENERATION (contd)

Shop Location	Function	Waste Stream	Time Frame	Estimated Quantities** (if known)	Treatment/Storage/ Disposal
782 (contd)		Stoddard Solvent	1968-1985	3.8 L/yr	Waste oil shipped to CFA landfill
			1985-present	3.8 L/yr	55-gal drum shipped off-site as HW
785	Argon cell decontamination spray chamber	Freon-13	1975-1983		Bldg. 752 evaporator
			1983-present		Bldg. 798 evaporator
		Radiacwash	1975-1983		Bldg. 752 evaporator
			1983-present		Bldg. 798 evaporator
	Metal etching (containment box)	Oxalic acid (10% aqueous solution)	1976-1985	1000 ml/yr	Solid waste shipped to RWMC
			1985-present	1000 ml/yr	Mixed waste shipped to EG&G
		Kerosene	1976-1985	1893 ml/yr	Solid waste shipped to RWMC
			1985-present	1893 ml/yr	Mixed waste shipped to EG&G
	Metal etching (Nonradioactive)	Phosphoric acid	1976-1985	3785 ml/yr	Absorbed in oil-dry and shipped to RWMC
			1985-present	3785 ml/yr	Mixed waste shpped to EG&G
		Chromic acid	1976-1985	1 kg/yr	Absorbed in oil-dry and shipped to RWMC
			1985-present	1 kg/yr	Mixed waste shipped to EG&G
		Oxalic Acid	1976-present	2000 ml/yr	Industrial waste pond
		HNO_3	1976-present	200 ml/yr	Industrial waste pond
		HCL	1976-present	200 ml/yr	Industrial waste pond

** Total unless stated otherwise.

1983, when the Radioactive Liquid Waste Treatment Facility (Bldg. 798) became operational. This facility is discussed later.

Prior to 1971, the chemistry labs in Bldg. 752 routinely poured sample waste, reacted chemicals and reagents down lab drains. These drains are radioactive and are connected to the central liquid-processing facility (evaporator) located in the basement of Bldg. 752. The exception to this was organic wastes (nonradioactive) which, prior to 1969, were burned in an open burn pit at ANL-W. The quantities disposed of are unavailable. It is believed that the organic wastes deposited in the burn pit would have been completely consumed. From 1969 to 1971, these organic wastes were absorbed in oil-dry within a 208 liter (55-gallon) drum and shipped to the Radioactive Waste Management Complex (RWMC) at the INEL and buried. Since 1971, these laboratory wastes have been placed in lab packs for ultimate disposal/ treatment and shipped to EG&G Idaho, Inc. on the INEL, as hazardous waste.

In the latter part of 1973, a modification was made to the chemistry lab's drain system in Bldg. 752. An acid collection system was installed with 11 sinks draining to it. These sinks drain to a 908 liter (240-gallon) fiberglass retention tank. A caustic solution is added to the acid retention tank, neutralizing the radioactive liquid prior to processing. The neutralized solution is then evaporated in a disposable container and the residue (which is radioactive) is disposed of at the RWMC.

The central liquid-processing facility (evaporator) as shown in Figure 4.2 was used through July 1983 for processing radioactive liquid waste from all facilities at ANL-W. The evaporator condensate tank was sampled and analyzed after evaporation of the radioactive liquid. If the activity was within 100 times the then-AEC guidelines for release to controlled areas, the liquid was discharged to the leaching pit (facility 763) through the Industrial Waste/Suspect Waste lines. The leaching pit and the Industrial Waste/

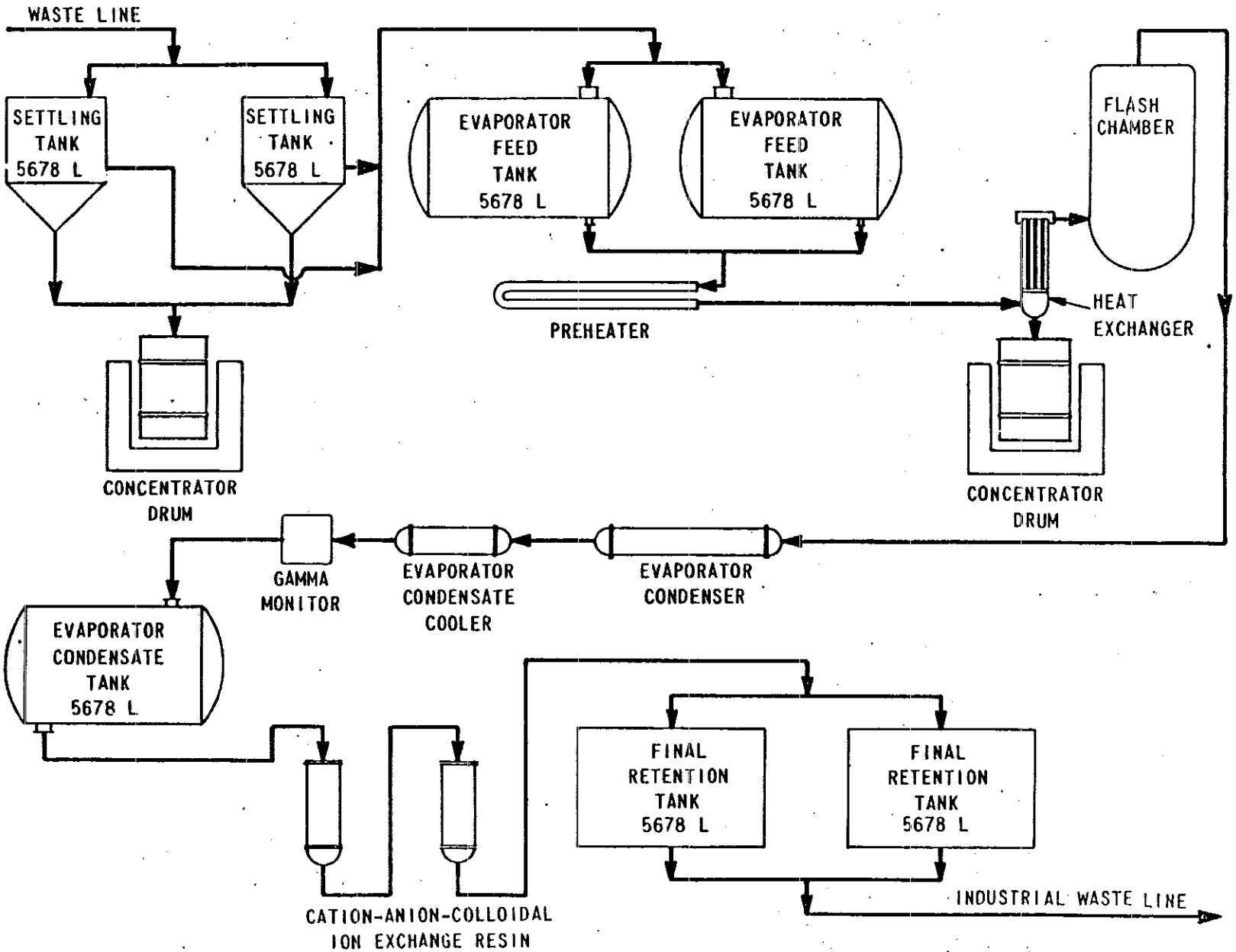

Figure 4.2. Schematic of Central Liquid Processing Facility

Support Waste lines are discussed further in section 4.1.3. Included within the evaporator system were cation-anion-colloidal ion exchange columns. These resin columns were replaced upon depletion and shipped to the RWMC as radioactive material for disposal. No regeneration was performed. The evaporator bottoms were slurried in 208 liter (55-gal) drums, which were encased in concrete-filled corrugated culvert pipes and shipped to the RWMC for disposal. The slurry was evaporated to dryness with disposable steam coils within the drums.

Records are unavailable to show what hazardous chemicals may have passed through the evaporator and into the condensate stream. The concentrate from the evaporator system may also have contained small quantities of hazardous chemicals but these concentrates were eventually solidified before disposal at the RWMC. The chemicals used at ANL-W should pose little problem in a solidified form.

Building 753: Building 753 (Plant Services) is used as a maintenance shop and includes parts and equipment storage, paint storage and mixing area, and a mechanic's shop devoted primarily to preventive maintenance on vehicles at ANL-W.

Paint mixing and cleaning operations have produced a mixture of waste thinners, solvents, and paint strippers. It is estimated that 114 liters (30 gallons) of waste from paint mixing and cleaning operations are generated each year.

Prior to mid-1978, this waste was disposed of in waste oil drums and shipped for burial or disposal at the Central Facilities Area (CFA) landfill located on the INEL. From mid-1978, thinners and solvents have been poured in 208-liter (55-gal) drums and accumulated at ANL-W. These eleven drums are under investigation as to their contents and quantities for ultimate disposal/treatment off-site as hazardous waste. Paint strippings and solvents (methylene chloride) have been shipped off-site as hazardous waste since 1983. Up to this time, small quantities of paint stripping material were used

(approximately 38 liters per year). This material may have been diposed of in the clean waste and sent to the CFA landfill, or is contained in the above-mentioned drums under investigation.

The paint shop generates a considerable number of empty cans and dirty rags. These are thrown in dumpsters (nonradioactive) and are disposed of in the CFA landfill. It is estimated that 30 1-gal cans (latex paints, epoxies and lead-based primers and lacquers) are thrown in these dumpsters every month. These cans are assumed empty based on past and present practices by the painters.

The mechanics shop at Bldg. 753 generates oils, hydraulic fluids, and small quantities of solvent used for cleaning parts. Approximately 2500 liters (660 gal) of waste oil are generated each year. From the beginning of operation at ANL-W, waste oil has been disposed of in the ANL-W boilers. Small quantities of waste oil, in the early years of operation at ANL-W, were used for dust suppression and spread over roads surrounding ANL-W. This practice was discontinued in 1970. Quantities spread over roads are not available.

The small amount of hydraulic fluids generated at Bldg. 753 are combined with waste oils and burned in the ANL-W boilers. The solvents are shipped offsite as hazardous wastes.

Building 765: Building 765 [Hot Fuel Examination Facility/South (HFEF/S)] was originally the Fuel Cycle Facility for Experimental Breeder Reactor-II (EBR-II). After four years of successful demonstration, the reprocessing line was removed in 1969, and HFEF/S was devoted to examination of experiments and other support operations.

HFEF/S is comprised of an argon atmosphere cell (at present not in use) where inspection of irradiated fuel is accomplished and an adjacent air atmosphere cell where irradiated

reactor subassemblies are dismantled, inspected, and reassembled. Decontamination of these cells consist of using damp rags containing either water, alcohol, or Freon-13. These rags, by procedure, are allowed to dry in the cells and then when completely dry are placed in the radioactive waste that is shipped to the RWMC. The quantities of alcohol or Freon-13 generated are insignificant due to the evaporative loss, therefore, negligible amounts of these solvents are actually disposed of.

A spray chamber located in HFEF/S, for decontamination of equipment, used cleaning solutions comprised of Turco products 4502 and 4521 from 1964 to 1976. The active ingredients of Turco 4502 are 75% potassium hydroxide, 5% potassium chromate and 20% potassium permanganate; ingredients of Turco 4521 are 15% oxalic acid and 80% ammonium oxalate. The products were initially in powdered form and were mixed in water at concentrations of 1 to 2 lb/gal. An estimated 3000 liters (800 gal) of solutions per year were sent through the spray chamber for decontamination purposes. Oxalic acid was used as a follow-up wash when Turco 4502 was used. This was needed because of the purple residue left by the solution.

For the estimated quantities in Table 4.1, it is assumed that the strength of the mixture was 2 lb/gal and that equal quantities of each Turco product were used. Oxalic acid has been estimated to be 1.89×10^2 liters (50 gal) per year for residue removal.

Liquid from the spray chamber drains to a 5.678×10^3 L (1500 gal) retention tank. This radioactive retention tank receives all radioactive (suspect) liquid in HFEF/S. The tank's content is sent to the radioactive liquid evaporator [Bldg. 752 (until July 1983) or Bldg. 798 (July 1983 to present)].

Other than water, which has been used exclusively since 1976, the only cleaning solution used besides the

above mentioned was Radiacwash (brand name detergent). However, the quantity used is unavailable.

Casks used to transfer fuel from EBR-II to HFEF/S or HFEF/N are the IBCs (Inter Building Coffins). These two casks have been decontaminated twice in the history of ANL-W. Wastes generated are terri-towels that have been dampened with acetone. These towels are allowed to dry prior to placing them in radioactive waste that is shipped to the RWMC for burial. In decontaminating the interior of the IBCs, 2.27×10^1 liters (6-gal) of HNO_3 acid are used and then drained to a holding tank, which is an integral part of the process. After flushing the IBC with HNO_3 acid, 9.46×10^1 liters (25 gal) of demineralized water is flushed through the IBC to the holding tank along with 2.27×10^1 liters (6-gal) of NaOH. This mixture of HNO_3 acid, demineralized water, and NaOH results in a solution having a pH of 4-6. This solution is then drained to the radioactive retention tanks.

The T-2 casks, used for shipments off-site of fuel, are decontaminated six times every year. These two casks have been decontaminated every year since 1964. Materials used for decontamination are pink cream [HCL (9%), wetting agents, inhibitors], Radiacwash, and window cleaner. Quantities of these materials used are small. The inside of the casks are swabbed and wiped clean with terri towels and this material is disposed of as dry solid radioactive wastes at the RWMC after allowing sufficient time for evaporation.

In 1980, the argon cell at HFEF/S was refurbished. Solutions used for decontamination of this cell were Radiacwash and high-pressure steam. Approximately 1.14×10^5 liters (30,000 gal) of solutions were used and pumped to a tanker, then sent to the Idaho Chemical Processing Plant (ICPP) at the INEL for treatment. In conjunction with this, the argon cooling boxes were refurbished. Boric acid was pumped through the system, for reaction with any fuel, and pumped to the tanker containing the above-mentioned solutions and disposed of as mentioned above. See Table 4.1 for quantities of boric acid used.

Buildings 766, 767, and 768: Building 767 [Experimental Breeder Reactor Plant (EBR-II)] is an experimental liquid-metal-cooled fast-breeder reactor (LMFBR). It consists of an unmoderated heterogeneous, sodium-cooled reactor, an intermediate closed-loop heat transfer system, and a steam/electric plant (see Figs. 4.3 and 4.4). The combination of these three loops are contained within Buildings 767, 766, 768, respectively. Buildings 766 and 767 do not generate hazardous wastes, but at times hazardous materials (alcohols and solvents) are used for cleaning contaminated components.

The steam system (Building 768) consists of a steam generator, a turbine generator, and cooling towers and other conventional support systems.

Two cooling towers are associated with Building 768. The first is the main cooling tower (facility 757) located west of Building 768, the second is the auxiliary cooling tower located on the roof of Building 768. The main cooling towers sole purpose is to remove heat from the main condenser. The auxiliary cooling towers remove the heat generated by auxiliary system, such as air ejectors, air compressors, auxiliary heat exchangers, etc.

The power plant's (Building 768) main and auxiliary cooling towers, prior to July 1980, were pretreated with corrosion-prevention solutions that contained chromates. Hexavalent chromium concentrations were maintained at about 10-14 ppm. The cooling tower's liquid effluents are comprised solely of nonradioactive industrial waste produced from chemical treatment of the steam cooling system makeup water. This effluent, generally referred to as "blowdown," is extracted from the respective cooling tower supply line. The blowdown (1964-1968) would flow to a sulfur dioxide treatment tank (where hexavalent chromium ion was chemically reduced to trivalent chromium) prior to discharge via drain ditches, to the Industrial Waste Pond (IWP), facility 746.

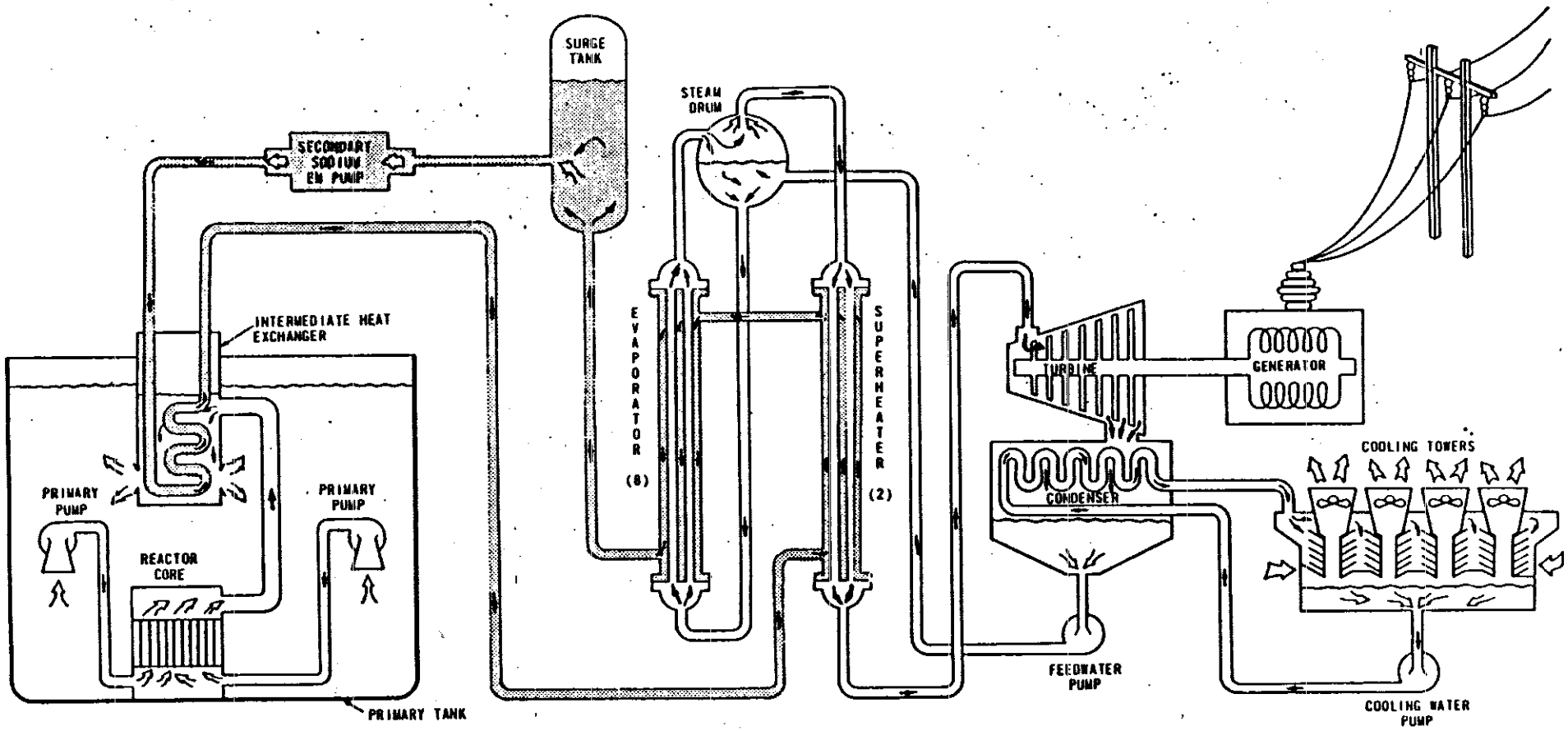

Figure 4.3. Schematic of EBR-II Primary, Secondary, and Steam System

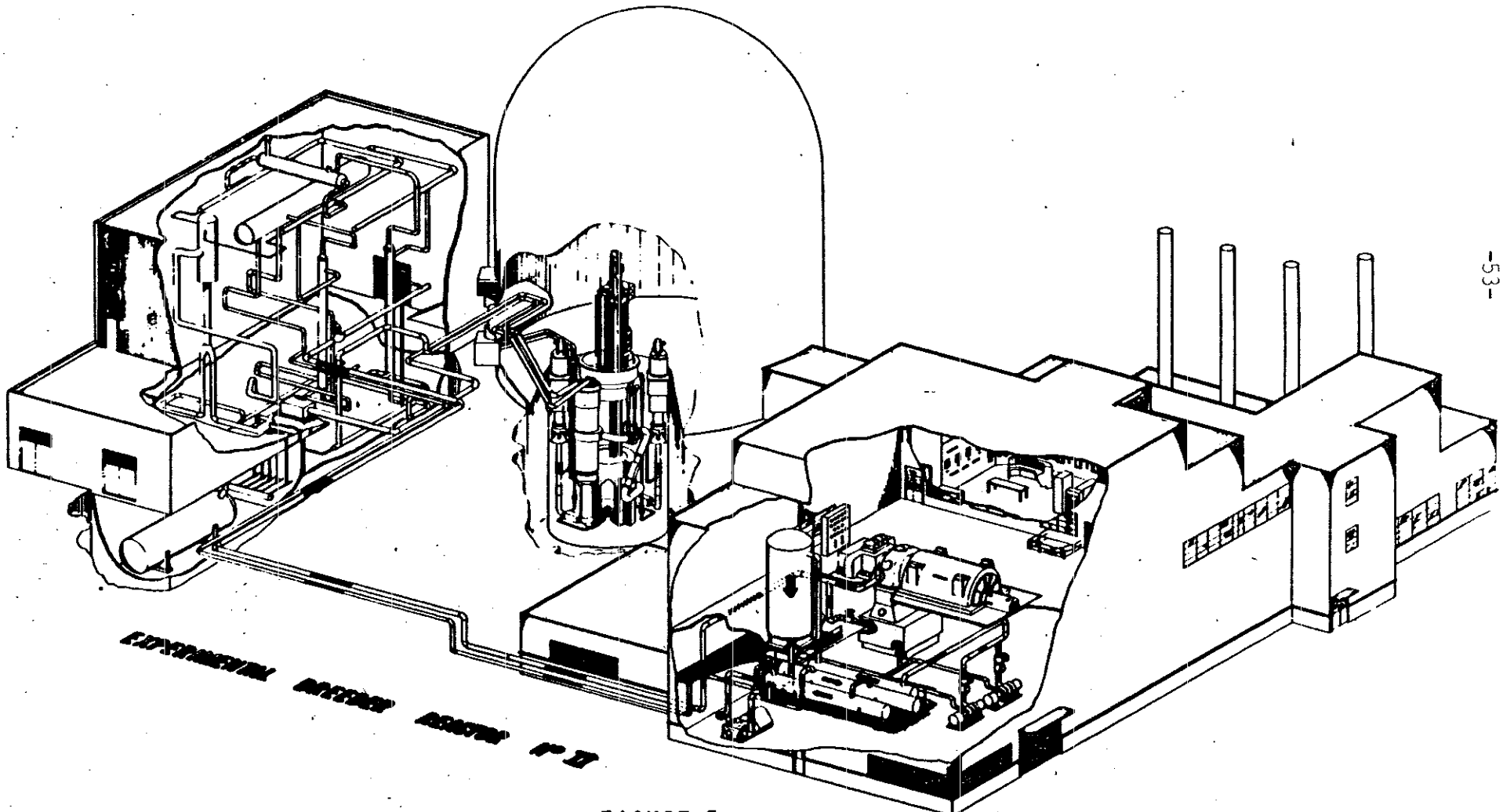

FIGURE 5

Principal EBR–II facilities. Shown from left to right are the sodium boiler building, the reactor and its containment building, and the power plant building

Figure 4.4. Principle EBR-II Facilities

In July 1980, the corrosion prevention solutions for the cooling towers were changed from a chromate-based corrosion inhibitor to a phosphate-based corrosion inhibitor. Of course, this eliminated the use of the sulfur dioxide tank which is no longer at ANL-W.

Associated with the cooling towers is the sulfuric acid tank (facility 757A). The tank's capacity is 1.51×10^4 liters (4000 gal). Sulfuric acid is used to maintain the pH in the cooling towers (main and auxiliary) between 6.8 and 7.2. Makeup to the cooling towers is raw well water.

The amount of chromium lost from the system via the blowdowns is recorded in the Industrial Waste Management Information System (IWMIS). These values are a combined total for both cooling towers. However, the first IWMIS data are for 1975 and the only records for chromium discharge are for 1975 through July 1980, at which time the phosphate-based inhibitor was implemented. The pre-1975 data in Table 4.1 were obtained from past reports. Loss of chemicals to the atmosphere in carryover and by evaporation have not been measured or estimated since they were dispersed over an unconfined area. Also, it can be assumed that a significant portion of the dissolved solids from the evaporated water remains in the cooling towers, where it may adhere to baffles, return to the cooling water system, or contribute to blowdowns.

Located at the southwest corner of Building 768 is another sulfuric acid tank. This tank's capacity is 7.5×10^3 liters (2000 gal). Use of sulfuric acid contained in this tank is for regeneration of the demineralizer's cation resin columns located in Building 768. Approximately 7.57×10^2 liters (200 gal) of sulfuric acid (93%) is used for regeneration each month. Along with the cation columns, the anion columns are regenerated and approximately 5.68×10^2 liters (150 gal) of sodium hydroxide (50%) is used. Regeneration is performed approximately every three days.

Both the sulfuric acid and sodium hydroxide are discharged to the industrial waste system along with all other industrial waste in Building 768. Some neutralization occurs within Building 768 industrial waste lines. Upon entering the industrial waste sump from Building 768, further neutralization occurs. A rough estimate of sulfuric acid and sodium hydroxide chemicals that probably did not combine before discharge are 2.27×10^2 liters (60 gals) and 8.7×10^1 liters (23 gals) respectively per month. This is an estimated 30% for sulfuric acid and 15% for sodium hydroxide. The industrial waste lines from 768 gravity drain via ditches to the IWP. Samples taken on the inlet to the IWP for ph during regeneration have resulted in a ph range of 2.5 to 10.3. Monthly samples on the Industrial Waste Pond from April through October for ph are approximately 8 to 10.

The water chemistry laboratory in Building 768-B is where all the normal everyday chemistry is performed for the steam plant. Chemical waste from analysis on condensate, feed, and cooling tower water are poured down the drains in Building 768-B except for mercuric nitrate which is being collected to ship offsite as hazardous waste. These drains are connected to the industrial waste drains for Building 768, which eventually, via drainage ditches, end up in the IWP. Table 4.2 lists the water chemistry laboratory's analyses performed, chemicals used for the analyses, and the usage estimated for the year.

Dimethylamine (initially as a gas) is used by the chemistry technicians in Building 768 to raise the pH of the liquid, which is being sampled for Na ions by producing hydroxyl ions to remove interfering hydrogen ions. The gas is continually added to the liquid maintainig a ph of 11.0. The liquid is discharged to the industrial waste drains. Approximately 1.82×10^1 kgs (40 lb) of dimethylamine are used each month for the analysis.

TABLE 4.2 EBR-II (BUILDING 768-B) LAB CHEMICALS

Analysis	Chemicals	Amount Used (1)	Analysis	Chemicals	Amount Used (1)
Cu	Cu Ver I Copper Reagent	25 pillows/yr	Ortho Phosphate	Sodium Sulfate	450 gms/yr
				1-amino 2-naphthol 4-sulfonic acid	13 gms/yr
Fe	Ferro-Ver Iron Reagent	25 pillows/yr		Sodium metabisulfite	700 gms/yr
NH_3	Nessler Reagent	30 ml/yr		Ammonium molybdate	600 gms/yr
				Ammonium hydroxide	32 ml/yr
Cl	0.2256 N Mercuric Nitrate	50 ml/yr		Sulfuric acid (Reagent concentrate)	4800 ml/yr
	Diphenylcarbazone Reagent	35 pillows/yr			
Silicon	Silica I Reagent	30 ml/yr	Hydrazine	HCL (37%)	400 ml/yr
	Citric acid Reagent	30 pillows/yr		p-Dimethylaminobenzaldehyde	65 gms/yr
	Amino acid Reagent	30 pillows/yr		methyl alcohol	3500 ml/yr
Morpho-line	1, 2, Naphthaquinone - 4 Sulfonic acid	1.5 grams/yr			
	Potassium Iodide	.8 grams/yr	Calcium hardness	Sodium Hydroxide (pellets)	75 gms/yr
	Iodine Reagent (crystal)	0.64 grams/yr		CalVer Calcium Indicator	750 pillows/yr
	Sodium Bicarbonate	10 grams/yr		EDTA	*
	Thyodene	10 grams/yr			
			Total Hardness	EDTA	*
Free Chlorine	Xylene Cyanole (.02%)	300 ml/yr		Man Ver II Hardness Indicate	750 pillows/yr
	HCL	50 ml/yr		Hardness I Buffer Solution	750 ml/yr

(1) HACH Chemical Co. pillows are premeasured capsules.
* Combined total = 10 liters per year.

Building 782: Building 782 (machine shop) provides a convenient and rapid on-site source for machining and welding to nuclear standards. The machine shop was built and occupied in 1968. Prior to 1968, various operations (on a small scale) of the machine shop were performed in buildings T-1, and building 752. Information on hazardous waste generation and disposal practices is not available, but procedures are believed to have been consistent with practices discussed below.

The machine shop operations produce an estimated 1.89×10^2 liters (50 gal) of waste lubricating and cutting oils every year. These are collected in a 208-liter (55-gal) drum. Also disposed of in this drum, through the latter part of 1985, were acetone, Freon T-F, and Stoddard Solvent. Estimated quantities disposed of in this drum are 3.785 liters (1 gal) for each per year. The drum, upon filling, has been disposed of by shipping to the CFA landfill for recycling or disposal.

The hazardous wastes (acetone, Freon TF, and Stoddard Solvent) are now being collected in a 208-liter drum and will be disposed of as hazardous waste off-site.

Building 785: Building 785 [Hot Fuel Examination Facility/North (HFEF/N)] went into operation in 1975 and has taken over, for HFEF/S, most of the examination work for irradiation experiments for the breeder program.

HFEF/N consists of an argon atmosphere cell and an air atmosphere cell. The argon cell provides for remote examination in an inert atmosphere. Contained within the argon cell is a containment box that provides for metallography work.

Small quantities of oxalic acid, alcohols, kerosene, and palm oil are used in the containment box for etching. The figures in Table 4.1 represent estimated quantities of waste for the

specific chemicals involved. These quantities are based on chemical usage and do not include any consumption or evaporation which may be significant, particularly in the case of alcohols.

These waste products, which are mixed wastes (radioactive and hazardous) are absorbed in oil-dry and remain in cell for at least 7 days for evaporation, then are placed in radioactive wastes and disposed of at the RWMC. The primary concern for disposal was for radioactivity. As of the latter part of 1985, these materials are being handled as mixed waste and will be shipped to EG&G for storage.

Metal etchings performed in a nonradioactive area, within Building 785, produce small quantities of acids. The acids include phosphoric, chromic, oxalic, nitric, and hydrochloric. Phosphoric and chromic acids are absorbed in oil-dry and disposed of as radioactive material because of uranium fuel contamination. As described in the previous paragraph, these too are now handled as mixed waste. Oxalic, nitric, and hydrochloric acids are poured down the industrial waste drains, neutralizing within the piping prior to discharging out the north side of 785 and combining with the effluent from the industrial lift station being sent to the drainage ditch. As mentioned before, these drainage ditches gravity flow to the Industrial Waste Pond (facility 746).

Located beneath the cells at HFEF/N is a TRIGA reactor used for neutron radiography. Contained within the primary cooling system is a ion exchange column. This ion exchange column, upon depletion, is replaced. Therefore, no regeneration takes place.

The air-atmosphere cell in HFEF/N contains a decontamination spray chamber that uses as cleaning solutions, Freon-13, Radiacwash, or water. Quantities of these solutions used are not available. All cleaning solutions, from the spray chamber, drain to a 5.68×10^3 liter (1500 gal) retention tank. The retention tank, as in

the case for all radioactive liquid on site, is pumped to the radioactive liquid evaporator [Bldg. 752 (through July 1983) or 798 (after July 1983)].

Building 798: [Radioactive Liquid Waste Treatment Facility (RLWTF)] accepts sitewide liquid wastes that may contain radioactive contamination, such as chemistry laboratory and decontamination wastes. This facility replaced the central-liquid processing (evaporator), Building 752, in July 1983.

The solids are separated from liquids by evaporation, thus forming a sludge within a disposable unit called a shielded hot-air drum evaporator (SHADE). The SHADEs produce no liquid effluent. This allows all activity (except for tritium and nobles gases) to be retained in the SHADEs. When the capacity of a SHADE is reached, it is encased in concrete within the steel drum and shipped to the RWMC for disposal.

Quantities of hazardous chemicals contained within the sludge are unavailable, but is assumed from the hazardous waste chemicals described prior for other facilities, that in a solidified form it should pose no problem.

4.1.2.2 ANL-W Fuels/Petroleum Management

Bulk fuel usage at ANL-W is basically limited to No. 2 fuel oil which is burned in the boilers, and diesel fuel, used in standby generators. Prior to May 1972, ANL-W used No. 5 fuel oil. The product is delivered to ANL-W in tank trucks where it is pumped to above ground tanks via the fuel oil pump house (Building 755). The 100,000-gal tank feeds the 10,000-gal tank for Building 768. All other tanks, whether above ground or below ground, are individually filled. From stains on the ground around the piping manifold at the fuel oil pumphouse, it appears that there is minor spillage during the filling operations. Table 4.3 provides an inventory of the fuel/petroleum storage tanks located at ANL-W.

TABLE 4.3. ANL-W FUEL/PETROLEUM STORAGE TANKS

Bldg./Facility Location	Oil Type	Maximum Capacity (gal)	Above (A) Underground (U) Inside (I) Outside (O)	Responsibility	Level Check
701	Diesel fuel	300	U, O	--	Dipstick
720	Diesel fuel	1000	U, O	--	Dipstick
721	No. 2 fuel oil	500	U, O	---	Dipstick
742	Gasoline	4000	U, O	EG&G	Dipstick
742	Diesel fuel	6000	U, O	EG&G	Dipstick
752	Diesel fuel	1000	U, O	Plant Services	Dipstick
753 (North of)	Gasoline	3000	U, O	Plant Services	Dipstick
753 (North of)	Diesel fuel	560	U, O	Plant Services	Dipstick
753 (North of)	LP gas	1000	A, O	EG&G	Gauge
754	Diesel fuel	250	A, I	Plant Services	Gauge
755	No. 2 fuel oil	100,000	A, O	Plant Services	Gauge
755 (new tank)	No. 2 fuel oil	60,000	A, O	Plant Services	Gauge
765	Diesel fuel	500	U, O	Facility	Dipstick
768	No. 2 fuel oil	10,000	U, O	Plant Services	Gauge, Remote
768	LP gas	122	A, O	Plant Services	Gauge
768	Diesel fuel	3000	U, O	Plant Services	Gauge, Remote
774	Diesel fuel	1000	U, O	Facility	Dipstick, Gauge, Remote
785	Diesel fuel	500	U, O	Facility	Dipstick
789	Gasoline	30	U, O	---	Dipstick
798	LP gas	30	A, I	Plant Services	Gauge
T-1	Diesel fuel	1000	A, O	Plant Services	Gauge

Oil, lubricants, and small amounts of solvents are delivered to ANL-W (generally in 5-gal drums) and are usually held at their place of use. Empties that are not used to collect used materials are punctured, allowed to dry, then smashed and sent to the CFA landfill.

4.1.2.3 Spills Within ANL-W

Review of Unusual Occurrence Reports (UOR's), personnel interviews, and site observations provided information on the spills identified in this section.

During October 1969, radioactive liquid was accidently dumped to the interceptor canal (Fig. 4.5) leading to the Industrial Waste Pond, resulting in contamination to the surface of the canal. This area was roped off. The samples analyzed indicated that 90% of the activities present were zirconium-niobium-95 and cerium-144, with traces of cobalt-60, antimony-124 and cesium-137. No actions were taken to remove the dirt until November 1973. Samples analyzed at this time showed detectable activity containing only the isotope of cesium-137 except on the dirt mound (Figure 4.5) where traces of cerium-144 and cobalt-60 were detected. The dirt was removed and shipped to the RWMC.

In August 1977 while filling the 7570-liter (2000-gal) sulfuric acid tank a spill occurred. The rate of transfer exceeded the level meter response. The catch basin design (capacity) was adequate to contain the spill. The acid was neutralized with soda ash and water.

Identified during an interview was a spill of #5 fuel oil in the early 1960s. The quantity spilled is not available, but the spill resulted from a sight-glass level indicator breaking on the fuel oil tank by Bldg. 755 (fuel oil pump house). Whether any actions were taken is not known.

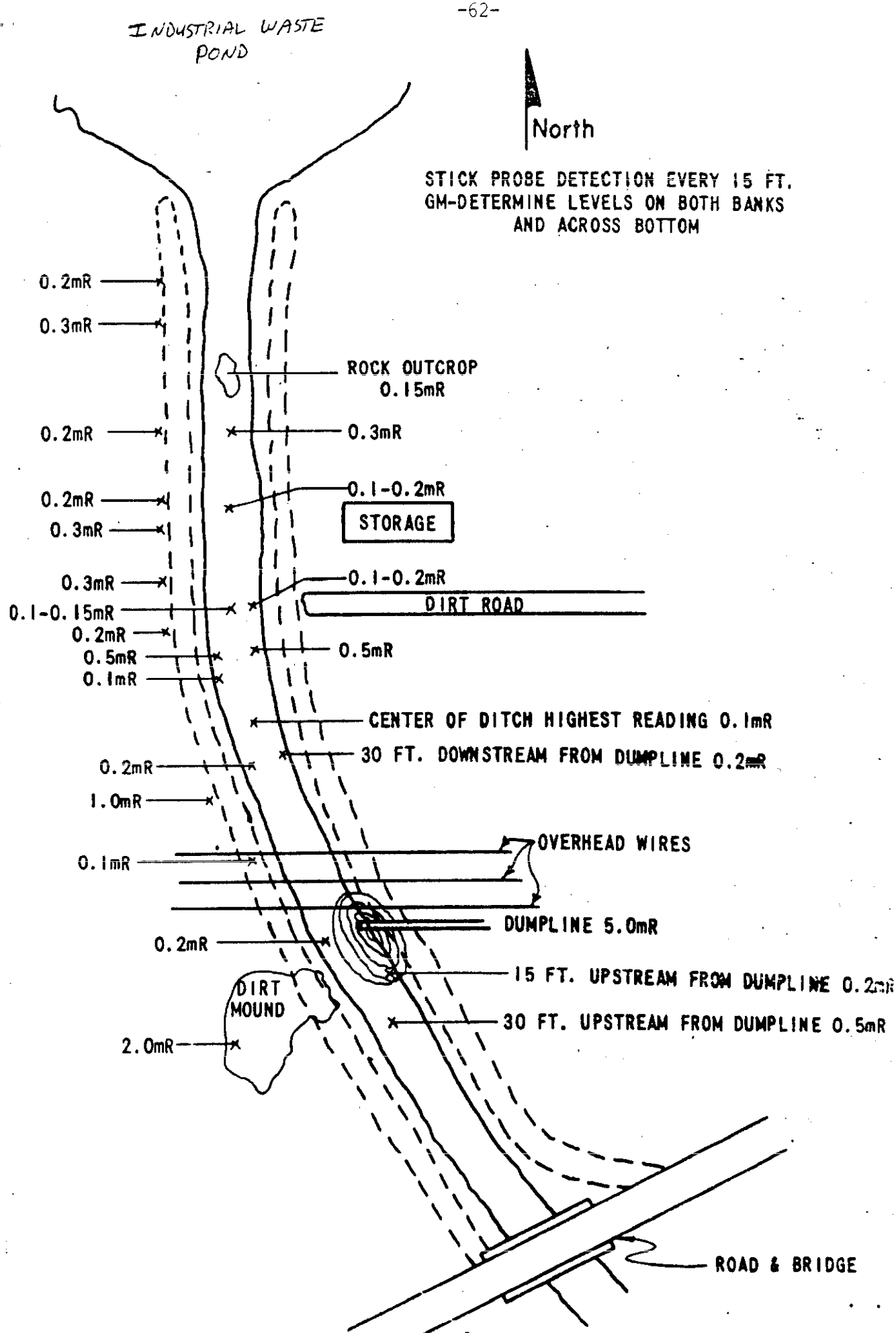

Figure 4.5. Contaminated Interceptor Canal

4.1.3 ANL-W Waste Disposal Sites

Areas or sites within the ANL-W at which hazardous and/or radioactive wastes may have been deposited at some time are discussed in the following paragraphs.

4.1.3.1 EBR-II Leach Pit (Facility 763)

1. Description. ANL-W used the EBR-II Leaching Pit (Facility 763) shown in Figure 4.6 between 1959, when it was constructed, and October 1979 when it was isolated and the pit's use was discontinued. The pit consists of an irregular underground basin approximately 5.5 m (18 ft) wide by 11 m (37 ft) long by 3 m (10 ft) deep with a capacity of 1.3×10^5 liters (3.5×10^4 gal). Explosives were used to excavate the pit in a lava rock formation. It is covered with a 20-cm (8-in.) thick slab of reinforced concrete that protects it from weather and wildlife ingress.

During the time of operation of the leaching pit, radioactive liquid wastes were collected in retention tanks within facilities, sampled and discharged to the pit if the activity was within 100 times the then-AEC guidelines for release to controlled areas. In the event the concentration exceeded 100 times the guidelines, the radioactive liquid wastes were sent to the evaporator in Building 752 prior to sending it to the leaching pit. A schematic of the ANL-W's liquid radioactive waste collection system prior to the closure of the leaching pit is shown in Figure 4.7.

2. Wastes Received. The EBR-II leaching pit and its associated collection system were designed to handle only radioactive waste water. However, there is a possibility of small quantity discharges of mixed hazardous wastes from the central facility evaporator in Building 752 and from other facilities if the discharge guidelines (for radioactivity) were met for straight-through discharge to the leaching pit. The quantities for hazardous waste carryover or straight-through discharge to the leaching pit are not available.

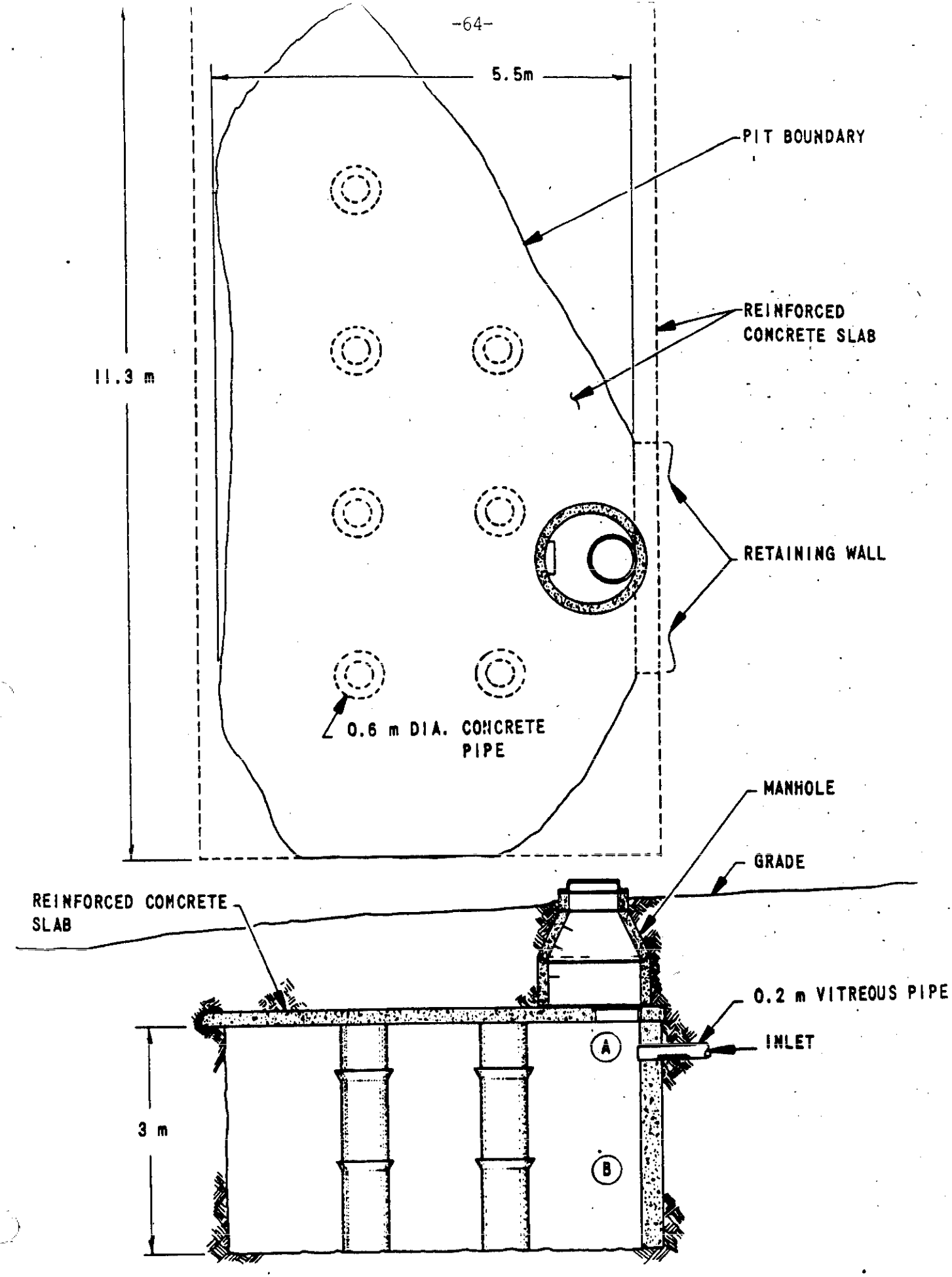

FIG. 4.6. ANL-W LEACHING PIT

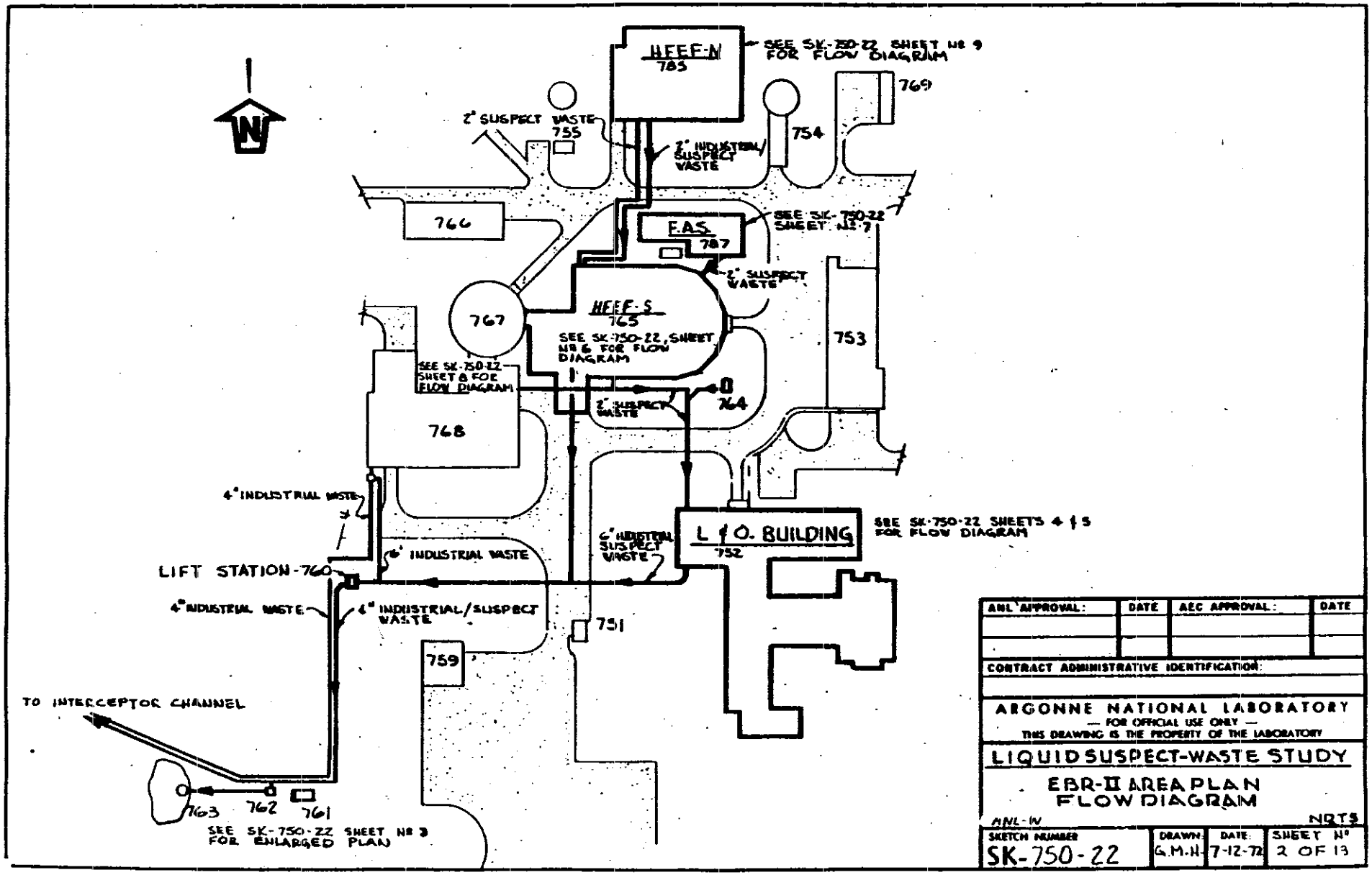

Figure 4.7. EBR-II Radioactive Liquid Waste Collection System

Up until October 1973, all radioactive liquid wastes were discharged to the EBR-II leaching pit. The average annual discharge had been about 174,000 liters from 1960 through October 1973. Table 4.4 provides the total curies by radionuclide that were released to the EBR-II leaching pit from 1960 through October 1973.

The pit was used once after October 1973. In November 1975, it was necessary to discharge tritiated water to the pit that exceeded ERDAM 0524 Protection Standard for discharge to an uncontrolled area. A total of 99 millicuries of tritium in 9,084 liters (2400 gal) of water were transferred to the pit. Other than this one isolated case, no transfers have been made to the pit since its closure.

After each discharge of radioactive liquid through the combined industrial/suspect waste lines, flush water was sent through the line prior to allowing industrial waste to be discharged. As seen in Figure 4.7, Building 762 housed the valves that allowed industrial waste to be discharged to the interceptor canal or the suspect wastes to be discharged to the leaching pit (facility 763). At no time was industrial waste discharged to the leaching pit.

4.1.3.2 Industrial Waste Pond (Facility 746)

1. Description. The Industrial Waste Pond shown in Figure 4.8 is an unlined, 1.2×10^4 m^2 (3-acre) evaporative seepage pond fed by the surface interceptor canal that receives water from site drainage ditches as shown in Figure 4.9. The pond was excavated in 1959, with a maximum water depth of about 4 m (13 ft).

2. Wastes Received. The primary sources of industrial liquid wastes discharged to the pond are the EBR-II cooling towers. The main cooling towers contribute about 1.9×10^7 liters (5.0×10^6 gal) per year and the EBR-II auxiliary cooling tower about 3.8×10^6 liters (1.0×10^6 gal) per year. The total volume of water discharged to the pond in 1984 was approximately 2.0×10^8 liters ($5.3 \times$

TABLE 4.4. CURIES RELEASED TO THE EBR-II LEACHING PIT BY RADIONUCLIDE(s) (1960 THROUGH OCTOBER 1973)

Radionuclide		Curies Released
(Ba-La)	Barium-Lanthanum-140	2.280×10^{-3}
(Ce)	Cerium-141-144	5.204×10^{-1}
(Ce)	Cerium-144	1.767×10^{0}
(Ce-Pr)	Cerium-Praseodymium-144	5.966×10^{-2}
(Co)	Cobalt-58	3.369×10^{0}
(Co)	Cobalt-60	2.709×10^{-1}
(Cr)	Chromium-51	2.372×10^{-1}
(Cs)	Cesium-134	4.620×10^{-1}
(Cs)	Cesium-137	1.671×10^{0}
(H)	Tritium	1.806×10^{-1}*
(Mn)	Manganese-54	1.242×10^{-1}
(Ru)	Ruthenium-103-106	4.620×10^{-3}
(Ru)	Ruthenium-106	1.123×10^{-2}
(Ru-Rh)	Ruthenium-Rhodium-106	5.942×10^{-1}
(Sb)	Antimony-124	1.109×10^{0}
(Sr)	Strontium-90	9.199×10^{-4}
(U)	Uranium-238	1.133×10^{-6}
	Unidentified Alpha	1.620×10^{-2}
	Unidentified Beta-Gamma	4.850×10^{-2}
(Zr-Nb)	Zirconium-Niobium-95	9.176×10^{-1}
	Total	1.087×10^{1}

* Includes discharge in 1975.

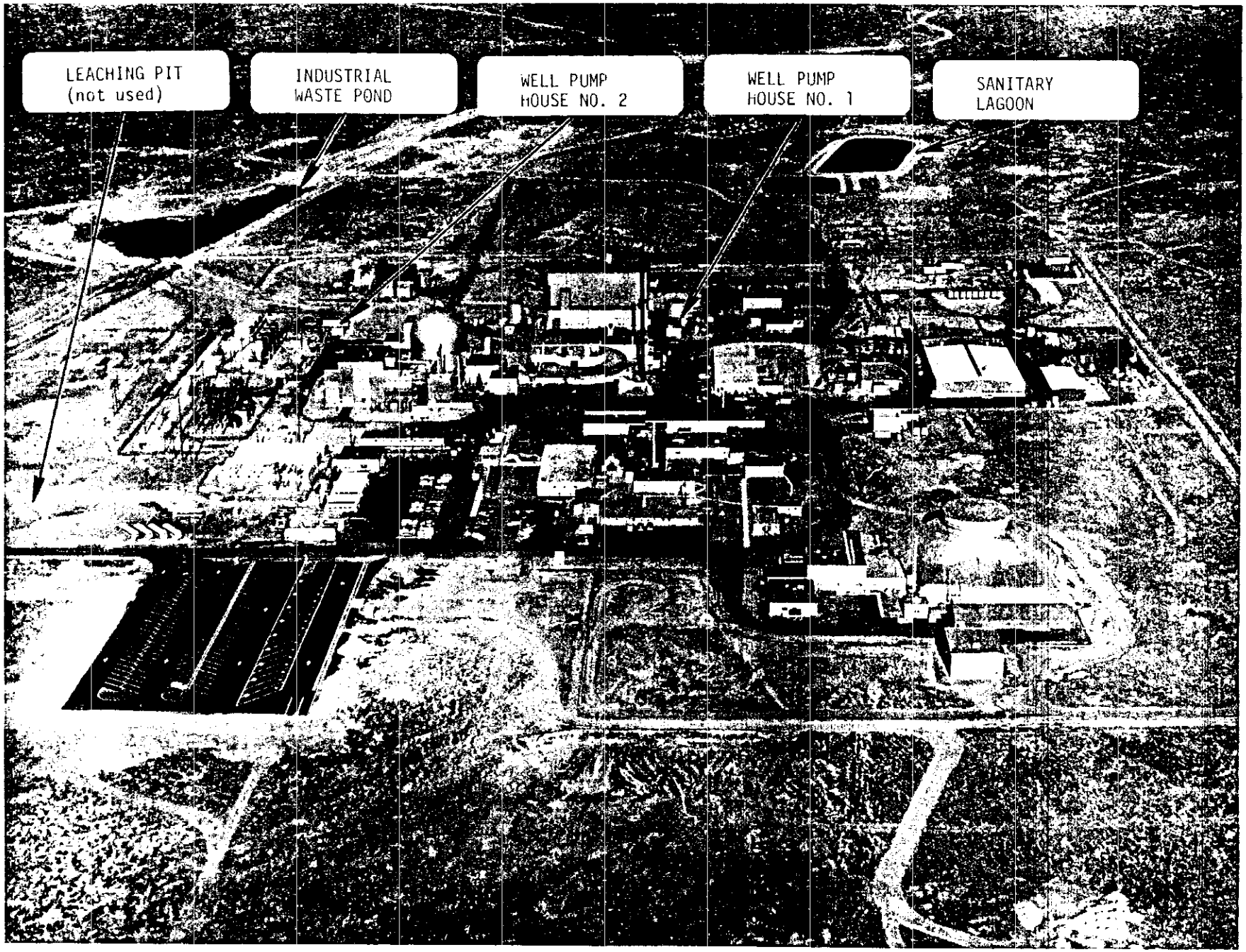

Figure 4.8. Aerial View of Argonne-West Site

Argonne National Laboratory-West Site, Showing Locations of Production Wells, Industrial Waste Pond, Sanitary Lagoon and Leaching Pit

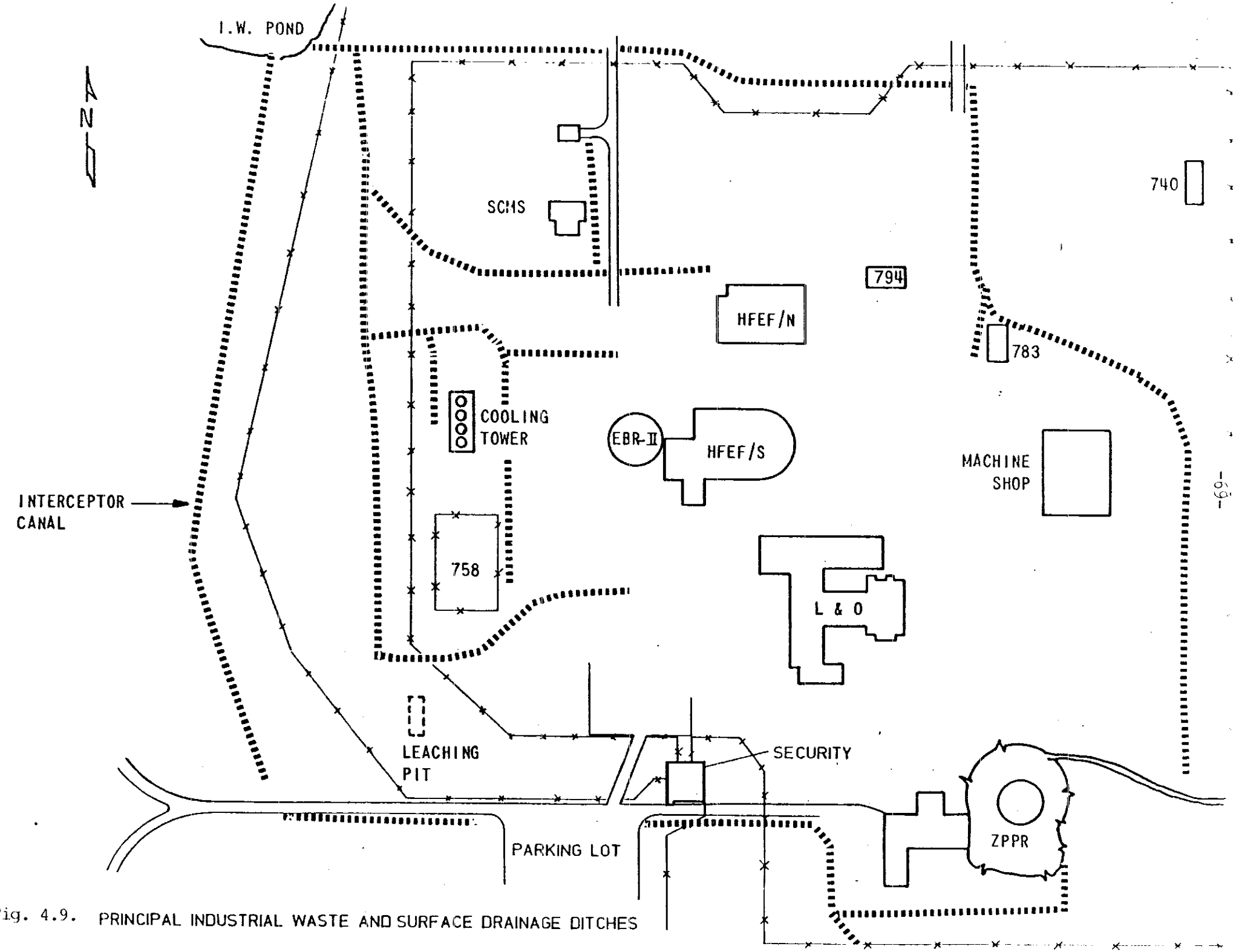

Fig. 4.9. PRINCIPAL INDUSTRIAL WASTE AND SURFACE DRAINAGE DITCHES

10^7 gal). This volume represents 43% of the water pumped from site production-wells during the year.

Prior to July 1980, the main source of impurities to the pond were cooling tower water treatment chemicals and chemicals used to regenerate the ion exchange resin used to remove minerals from water used in the EBR-II steam system.

From 1962 to July 1980, a chromate- based corrosion inhibitor was added to the cooling tower water, and the blowdown contained significant quantities of chromium. It is estimated that 4207 kg of trivalent chromium (Cr+3) and 162 kg of hexavalent chromium (Cr+6) were discharged in this manner.

Ion exchange column regeneration has occurred from 1962 to the present. Regeneration of these columns is accomplished with sulfuric acid for cation columns and sodium hydroxide for anion columns. Discharges from ion exchange regeneration has accounted for approximately 68,125L of sulfuric acid and 26,125L of sodium hydroxide to the Industrial Waste System. This system includes a 600-gallon capacity sump that collects the cooling tower blowdown and the regeneration chemicals prior to discharging to the Industrial Waste ditch. As mentioned previously, 30% of the sulfuric acid and 15% of the sodium hydroxide probably did not neutralize and were discharged to the Industrial Waste ditch. A summary of hazardous chemicals that reached the pond is provided in Table 4.5.

Upon closure of the EBR-II leaching pit in October 1973 and before the startup of the RLWTF (facility 798) in mid-1983, which produces no liquid effluent, the central liquid-processing facility (evaporator) condensate was discharged to the Industrial Waste Pond. The volume of condensate discharged to the pond was 1.529×10^6 liters (4.040×10^5 gal).

TABLE 4.5. ANL-W HAZARDOUS WASTE DISPOSAL SITES

Site	Site Name	Period of Operation	Area Size (m^2)	Suspected Types of Waste	Estimated Quantities	Method of Operation	Closure Status	Geological Setting	Surface Drainage	Evident and Potential Problems
746	Industrial Waste Pond	1959-Present	12,000	Sodium Hydroxide Sulfuric Acid Trivalent chromium (Cr+3) Hexavalent chromium (Cr+6)	26,125 L 68,125 L 4,207 kg 162 kg	Discharge to open unlined seepage pond	Active Chromate chemistry discontinued in July 1980	Level-land alluvial surface sediments over basalt. Aquifer is about 183 meters below.	No action taken to exclude surface drainage	Possible migration
—	Open Burn Pit	Unknown	Unknown	Garbage & burnable debris Petroleum products (oil, hydraulic fluids) Organic wastes (types unknown)	Unknown Unknown Unknown	Materials were dumped in the pit and burned same day.	Closed, covered, and graded.	Level-land aquifer is about 183 meters below.	No action taken to exclude surface drainage.	—

In 1974, the administrative discharge limit was reduced to 3×10^{-7} μCi/ml gross beta-gamma activity, based on the release of SR-90 to uncontrolled areas. Actual practices at ANL-W were to evaporate and ion-exchange all water that might significantly increase the annual total of radioactivity discharged. This practice is still in effect. In 1977 and 1978, no liquids discharged contained radioactivity above the limits of 1×10^{-8} μCi/ml beta-gamma or 1×10^{-9} μCi/ml alpha except for tritium contained in the waste treatment facility effluent and in the EBR-II turbine condensate.

As can be seen in Table 4.6, the major radioisotope released to the Industrial Waste Pond is tritium.

Since the operation of the RLWTF (Bldg. 798), no radioactive liquid effluent is produced in the evaporation process. Therefore, this is no longer a source of liquid effluent being discharged to the Industrial Waste Pond.

Pond water is monitored on a continuing basis to verify compliance with applicable water quality criteria. Samples are analyzed monthly during ice-free months (April through October) for alpha emitters, beta emitters, tritium, and gamma radioactivity. Additional large volume (11-liter) samples are collected semiannually and submitted to Argonne National Laboratory in Illinois for high sensitivity plutonium analysis. No radioactivity has been detected in these monthly and semiannual pond water samples.

Besides the above-mentioned analysis, the pond water samples are analyzed for pH, sulfate ion, phosphate ion, chloride ion, sodium ion, zinc, total chromium, and hexavalent chromium. Monitoring data shows that the Industrial Waste Pond water meets all listed state quality standards.

TABLE 4.6. CURIES RELEASED TO THE INDUSTRIAL WASTE POND (FACILITY 746) BY RADIONUCLIDE (1960 THROUGH NOVEMBER 1985)*

Radionuclide	Curies	Source
(Sr) Strontium-90	1.18×10^{-6}	Evaporator (Bldg. 752)
(H) Tritium	2.10×10^{-1}	Evaporator (Bldg. 752)
(H) Tritium	1.12×10^{0}	Turbine Condensate (Bldg. 768)
Unidentified Alpha	2.44×10^{-7}	Evaporator (Bldg. 752)
Unidentified Beta-Gamma	3.81×10^{-6}	Evaporator (Bldg. 752)

* Since mid-1983, no radionuclides have been discharged to the IWP except tritium and then only when below limits for release to an uncontrolled area.

4.1.3.3 Open Burn Pit

1. Description. At present, the only information obtained about this pit from interviews, is that it existed. No documentation concerning this pit has been found. Further investigation of this pit is to be performed.

2. Wastes Received. From interviews of personnel at ANL-W that have memory of this pit, it was used in the mid to late 1960's. Wastes placed in this pit during its operation are listed in Table 4.5. Any expansion on the constituents and/or quantities is not available at this time.