ENERGY TECHNOLOGY ENGINEERING CENTER

OPERATED FOR THE U.S. DEPARTMENT OF ENERGY
ROCKETDYNE DIVISION, ROCKWELL INTERNATIONAL

No. 029-AR-0001 Rev. ____
Page 1 of 34
Orig. Date 3/28/96
Rev. Date ____

DRR 25467

TITLE: FINAL D&D REPORT FOR BLDG. T029

- APPROVALS -

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1.0 INTRODUCTION AND BACKGROUND

1.1 FACILITY LOCATION

Building T029 is located within Rockwell International's Santa Susana Field Laboratories (SSFL) in the Simi Hills of southeastern Ventura County, California, adjacent to the Los Angeles County Line and approximately 29 miles northwest of downtown Los Angeles. Location of SSFL relative to Los Angeles and vicinities is shown in Figure 1–1. An enlarged map of neighboring SSFL communities is shown in Figure 1–2. Figure 1–3 shows relevant portions of a 1967 edition of the U.S. Geological Survey's (USGS) topographic map of the Calabasas Quadrangle where SSFL is located, with the author's markup of the location of Building T029. Using USGS terminology, the current USGS location description for Building T029 is: Township T2N; Range R17W; and Section 30, Calabasas Quadrangle.

Figure 1–4 is a plot plan of the western portion of SSFL (known as "Area IV") where Building T029 is located. As shown in this figure, access to T029 is by way of 10th Street, which intersects "G" Street just southwest of building T064. An asphalt roadway (10th Street) runs right up to the facility. A portion of the roadway is fenced in as part of the facility. Figure 1–5 is an old photograph of T029 and the surrounding area, looking south–southwest. Figure 1–6 shows the entrance gate on 10th Street and the west wall of T029, and Figure 1–7 shows a close–up view from the south.

1.2 BUILDING CHARACTERISTICS

Constructed in 1959, as an open bay facility, T029 is a Butler–type building with a steel frame and corrugated metal siding and roofing. The building is 20 ft x 40 ft with a 12–ft eave height. It is a single room with no office, support laboratory, rest room areas, or installed air conditioners. The ceilings and walls are insulated with 1–in. thick fiberglass mat. The floors were originally tiled with asphalt tile, the tiles were subsequently removed, and the floor is now a bare concrete slab.

1.3 FACILITY OPERATING HISTORY

From 1959 to 1974, Building T029 was used as a facility for calibrating radiation detection instruments. In 1959, and in subsequent years, it was called the Radiation Measurements Facility and the Old Calibration Facility, respectively. The plot plan shows locations within the building where the calibration sources were housed. Table 1 lists the calibration sources used in the facility, their source strengths and the source calibration dates. Of these, the three Ra–226, and later the two Cs–137 sources were housed inside a source storage well made from a 12–in. diameter, 10 ft long, Schedule–20 galvanized pipe casing which was installed below grade. Figure 1–9 shows details of the Ra–226 source storage well. The sources were attached to nylon strings and were guided through 1–in. diameter pyrex tube thimbles within coaxial, Schedule–40 galvanized pipes which were evenly spaced within the casing and embedded in concrete. The three

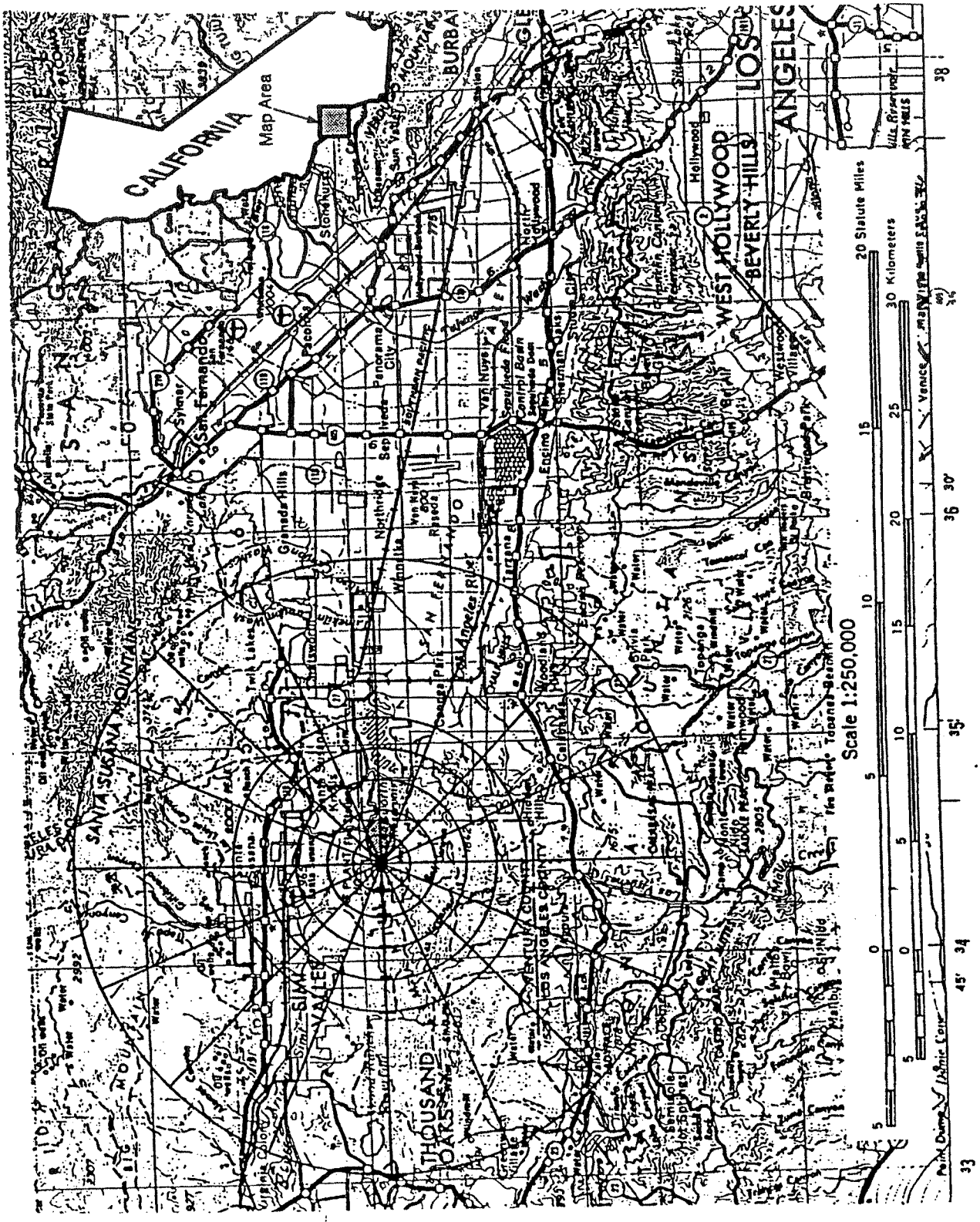

Figure 1–1. Map of Los Angeles Area

Figure 1–2. Map of Neighboring SSFL Communities

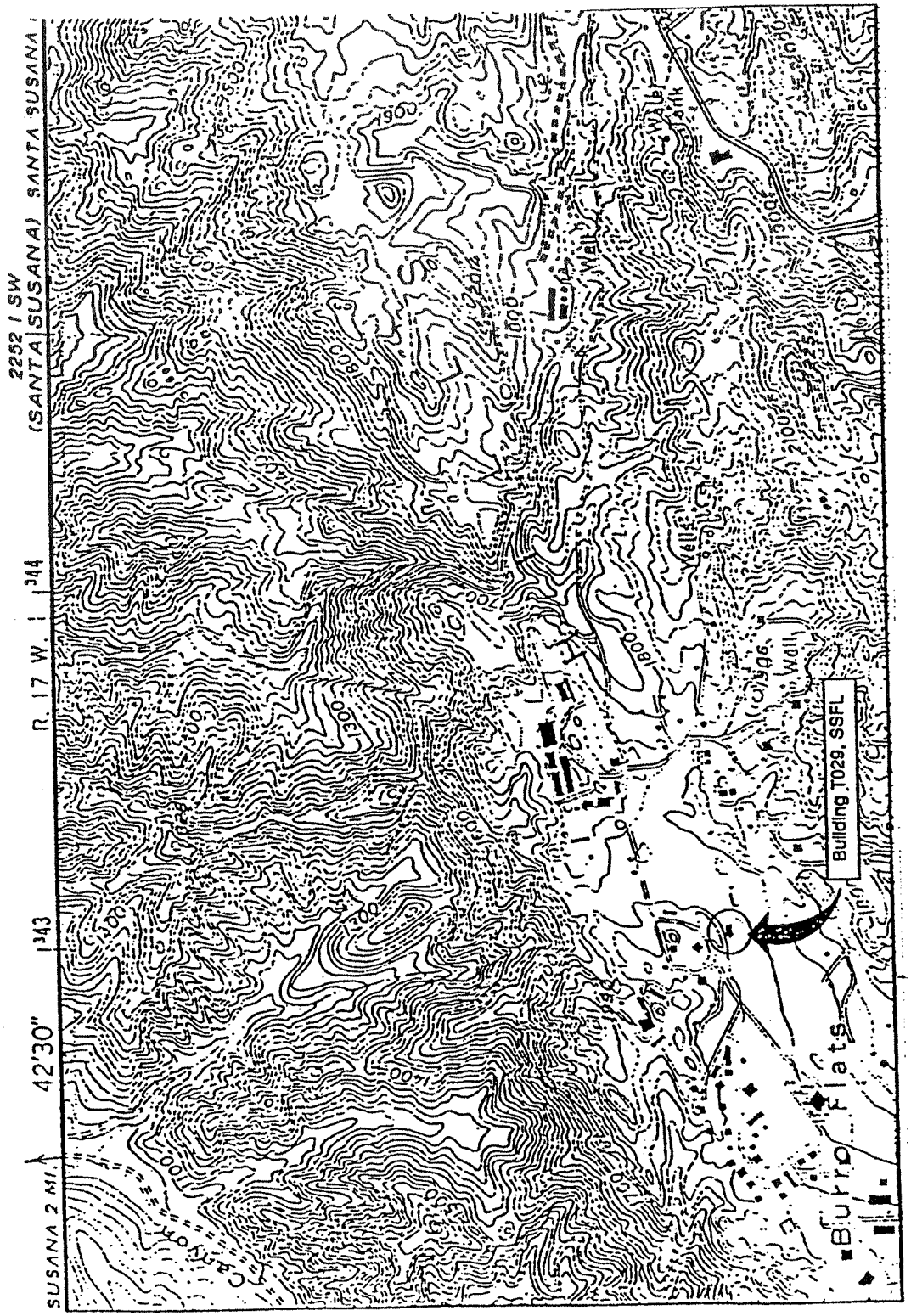

Figure 1–3. USGS Topographic Map of Portions of Calabasas Quadrangle; Bottom Left Area Corresponds to SSFL

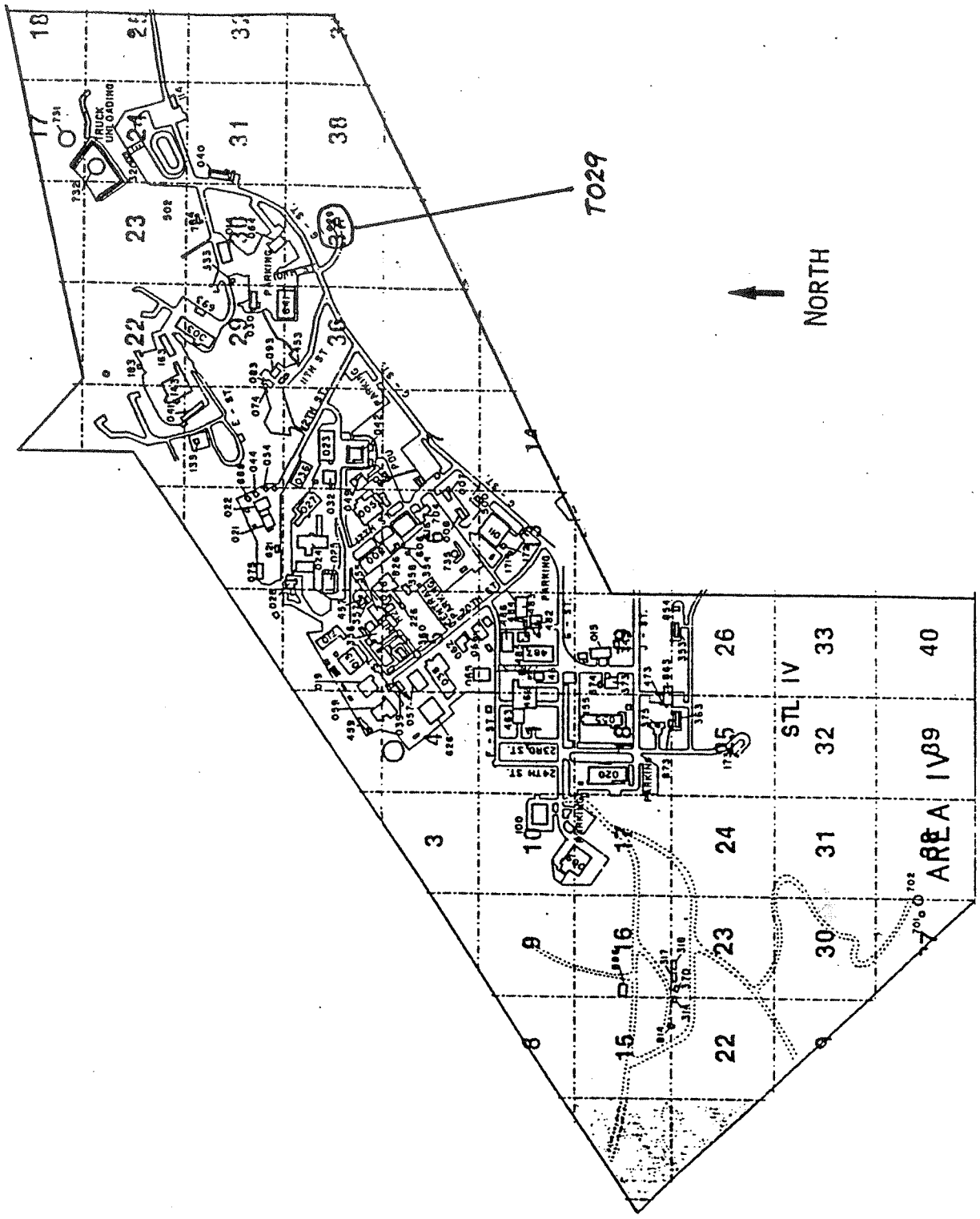

Figure 1–4. SSFL Layout Showing the Location of Building T029

Figure 1–5. Photograph of T029 Looking South Southwest

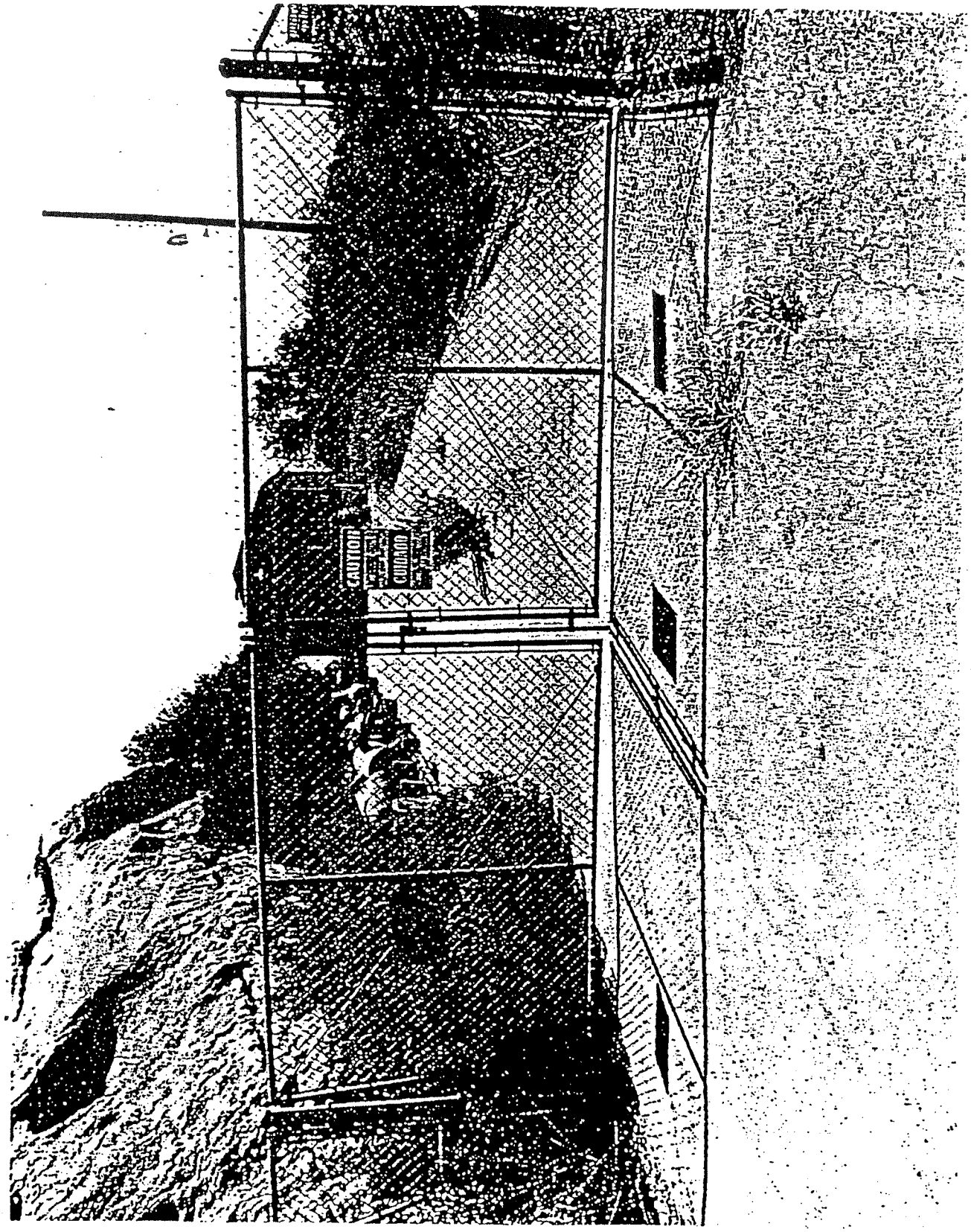

Figure 1–6. Entrance Gate to Building T029, From the West

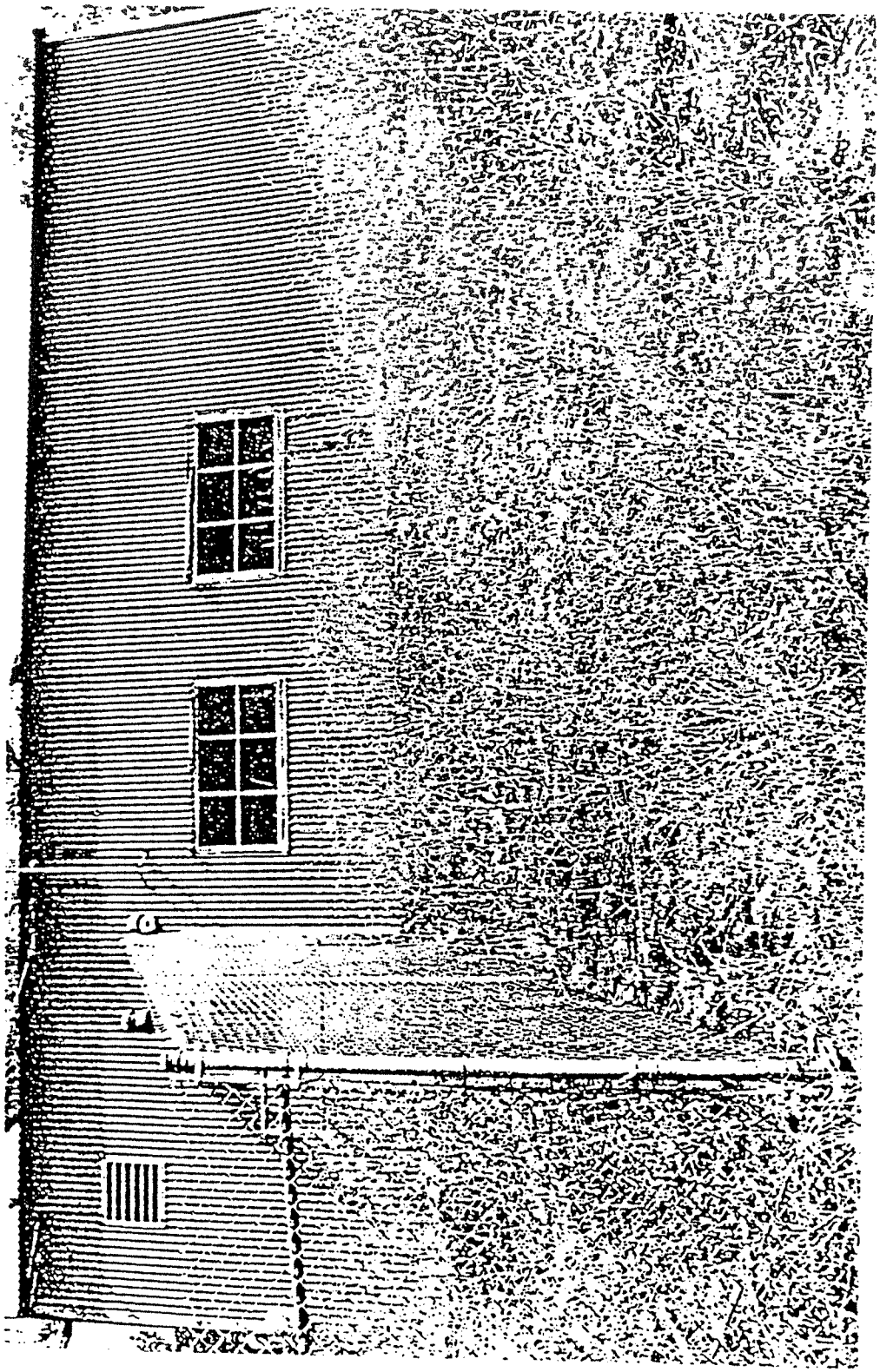

Figure 1–7. Building T029 View From the South (close–up)

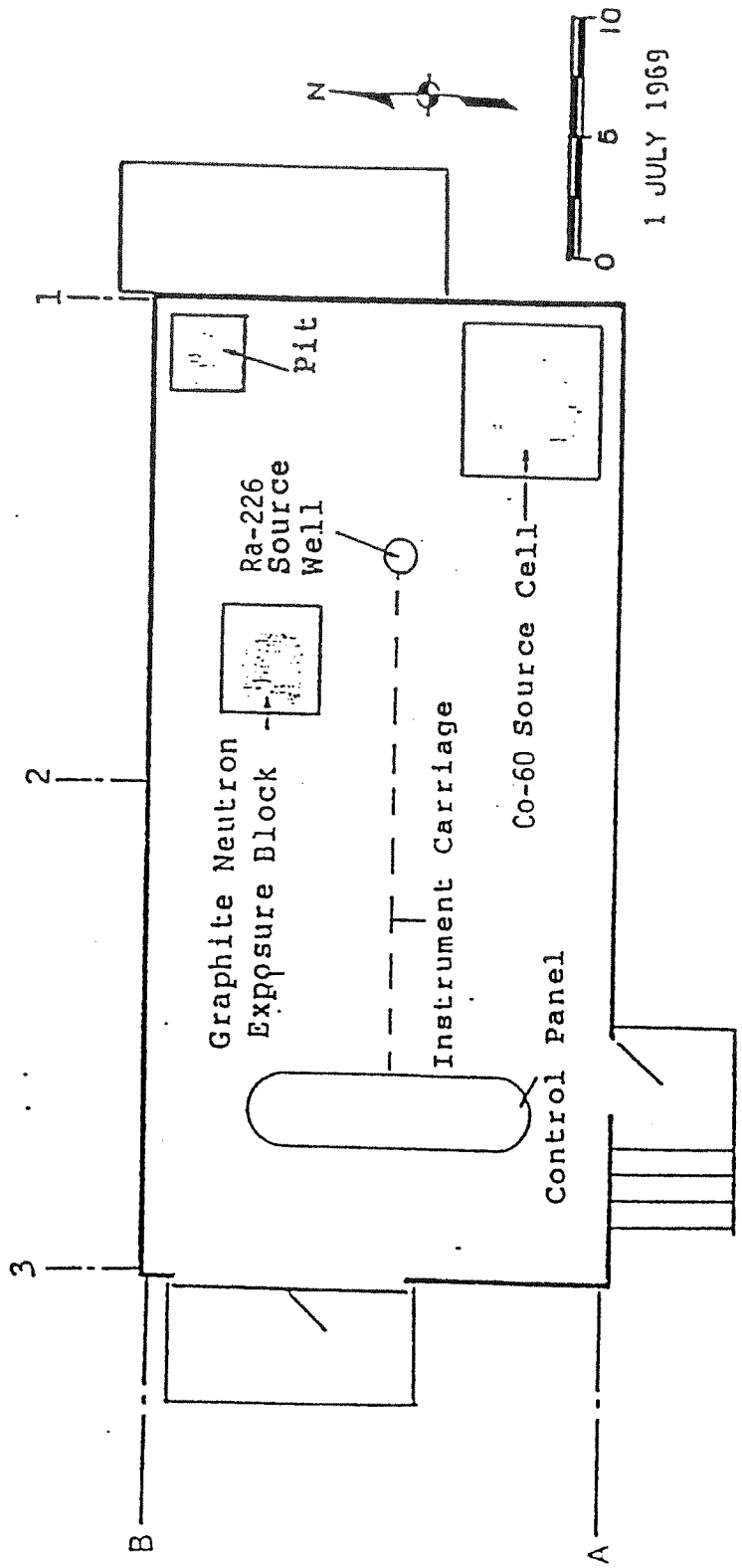

Figure 1–8. Plot Plan of the Radiation Measurements Facility, Building T029

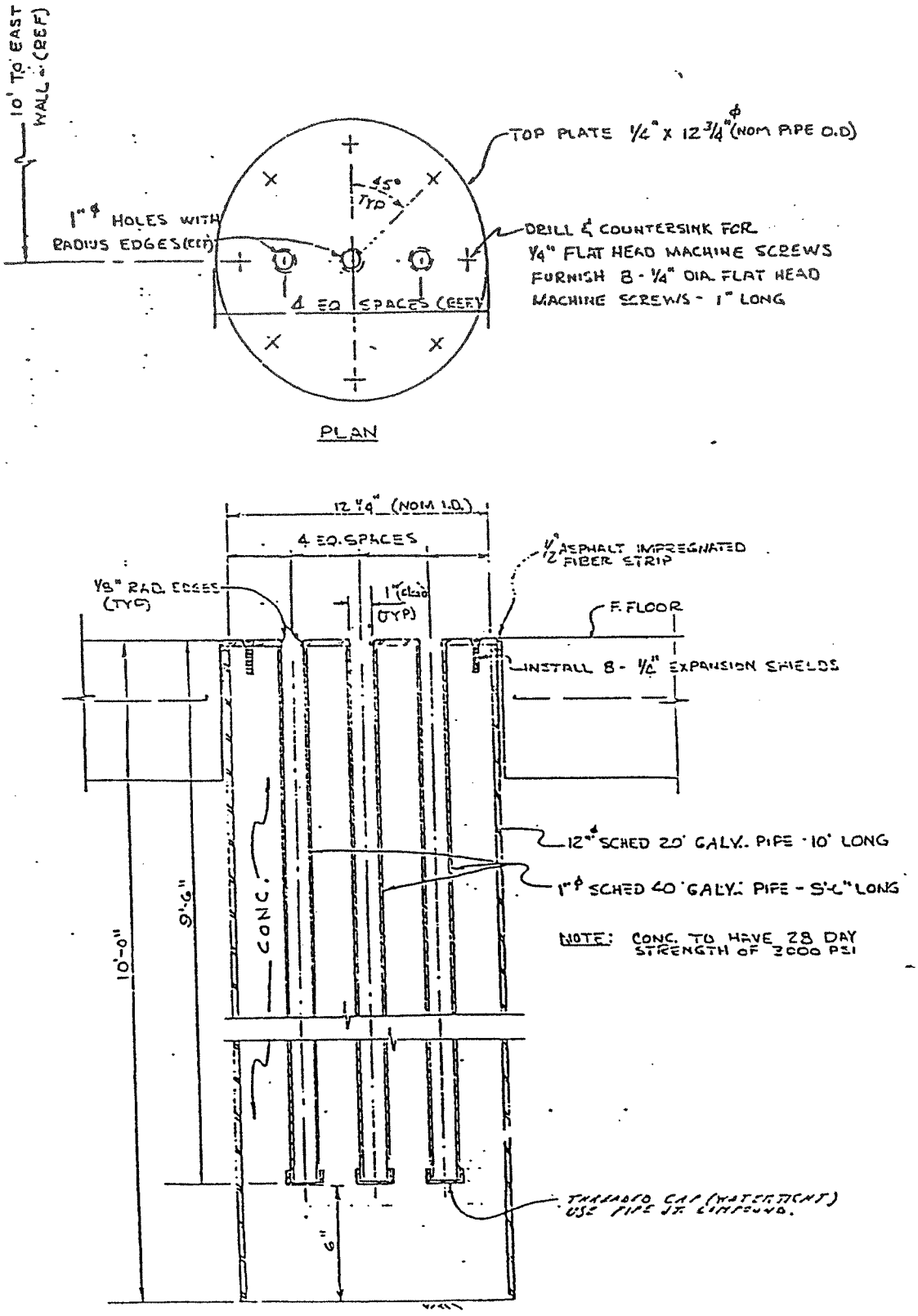

Figure 1–9. Ra–226 Source Storage Well Detail

encapsulated Co–60 sources were housed separately in a 12–in. diameter pipe which extended 10 ft below grade and 4 ft above grade. Above grade, the pipe was enclosed with lead shielding, and covered by a 77–in. square concrete rolling door. The PoBe and PuBe neutron sources were housed in a 3 ft x 3 ft x 2 ft–deep pit, with a graphite neutron exposure block, shown in Figure 1–8.

Table 1. Calibration Sources Used at T029

Source	Source Strength (mCi)	Date*
(1) Ra–226	24.8	1960
(2) Ra–226	132	1960
(3) Ra–226	930	1960
(4) Co–60	Unknown	
(5) PoBe	Unknown	
(6) PuBe	Unknown	
(7) Cs–137	5310	September 1963
(8) Cs–137	5260	September 1963
*Date source strength was measured.		

All of the sources were fully encapsulated, were leak–tested at least every six months in compliance with State of California Radiation Control Regulations, and subsequently removed from T029. The only known cause for radioactive contamination in the facility was one incident involving the dropping of a Ra–226 capsule (described below).

Radioactivity was released from one of the Ra–226 source capsules (Source No. 1) on March 23, 1964, when this source became detached from the nylon string and fell into the bottom of the source thimble. The 13–ft fall cracked the outer plastic encapsulation surrounding the inner capsule and released some loose Ra–226. Release of radioactivity was primarily confined to the well and the source thimble. An April 10, 1964, report describing the incident, the subsequent recovery of the source, and the decontamination of the area outside the well is found in Ref. 5, Appendix A.

Operation of the facility continued by replacing all the Ra–226 sources with two Cs–137 sources. On November 20, 1970, the 4.6 Ci Cs–137 source dropped 10 ft to the bottom of the well. No contamination release occurred. When all sources were removed from T029 in 1974, a radiation survey was performed which showed that the facility was radiologically clean except for the interior of the RA–226 storage well (Ref. 5).

All operations in Building T029 with radioactive materials had been in support of DOE's and its predecessor agency programs. The facility was transferred to the DOE's Energy Technology Engineering Center (ETEC) operating contract in September 1989.

2.0 PRIOR DECONTAMINATION EFFORTS

Partial decommissioning of building T029 was accomplished in April 1974 when all radioactive sealed sources were removed and transferred to another facility. Subsequently, T029 was redesignated as a nonradioactive hazardous waste storage facility for the storage of excess alkali metals and components containing alkali metals.

In 1985, building T029 was included in an overall survey plan for SSFL facilities (Ref. 1). A purpose of the survey plan was to inspect the facilities for residual radioactive contamination and recommend remedial actions.

3.0 SUMMARY

PURPOSE. This report documents work performed to remove residual radioactive contamination in certain relatively inaccessible areas of Building T029, located in Rockwell International's Santa Susana Field Laboratories (SSFL), and to demonstrate that the facility is acceptably free of radioactive contamination.

BACKGROUND. Between the late–50's and April 1974, several radioisotope sources (Ra–226, Cs–137, Co–60, PoBe, and PuBe) were stored and utilized in T029 for calibration of radiation detection instruments. In 1964, release of radioactivity from a Ra–226 sealed source caused localized contamination of the below–grade source storage well. Outside of this inaccessible area, radiation surveys performed in 1974 and 1988 showed that radiation levels in T029 correspond to normal background levels at SSFL. All sources had been removed by 1974, and the facility is now being used to store reactive metals (sodium and NaK) prior to disposal.

WORK PERFORMED. To further reduce contamination to levels that are as low as reasonably achievable, the Ra–226 source storage well was excavated along with the Ra–226 source holder and both were disposed of as low–level radioactive waste. At the same time, the housing used for the Co–60 source was also demolished and the resulting uncontaminated debris was disposed of as nonradioactive waste. In addition, the exhaust system outside the building was removed, surveyed and determined to be clean for reuse. Soil samples collected during these operations were analyzed for radioactivity and showed no activity above background. The excavated area was then refilled.

STATUS. Building T029 currently stores nonradioactive hazardous materials (principally metallic sodium and NaK) prior to their planned disposal.

CONCLUSION. Based on results of the comprehensive 1988 radiation survey and the subsequent work described here, radiation and contamination levels in Building T029 meet acceptable limits and hence the facility may be released for unrestricted use.

4.0 PROJECT ACTIVITIES/RESULTS

Based on the recommendation of the 1988 radiation survey, the Ra-226 source storage well was excavated and removed from Building T029. In addition, the structure that formerly stored the Co-60 sealed sources, and the building exhaust system located outside of T029 were also removed. Soil samples were collected and analyzed. The excavated areas were then refilled. These activities are described in this section.

4.1 PROCEDURE

Excavation and removal of the Ra-226 source storage well and other activities in T029 were performed under a documented procedure (Ref. 3). As specified in the procedure, a Controlled Work Permit was issued for monitoring and controlling radioactivity in the work area and exposures to personnel. Routine contamination surveys were performed to determine contamination levels and for segregation of contaminated material for subsequent disposal.

4.2 Ra-226 SOURCE STORAGE WELL REMOVAL

Following temporary removal of the material stored inside the building, a rectangular area of the floor surrounding the Ra-226 source storage well was excavated (see Figure 4-1) using concrete saws and jack-hammers. A back-hoe was used to dredge the soil from the cut-up area. A vacuum cleaner was then used to remove soil in the immediate vicinity of the 12-in.-diameter casing. Removal of the soil in this manner loosened the casing from the soil, with its inner contents of contaminated source thimble tubes (shown previously in Figure 1-9) still intact. A sling was attached to the casing and a fork-lift was used to move it to the floor where it was covered with plastic bags, tagged as radioactive material and transported to the Radioactive Material Disposal Facility (RMDF) at the SSFL. Figure 4-2 shows a photograph of the casing upon its arrival at the RMDF. A photograph of the excavated area of the well after removing the casing is shown in Figure 4-3. The Co-60 source cell and the pit where the PuBe and PoBe sources were formerly located are seen to the right and left side of the excavation respectively.

4.3 REMOVAL OF OTHER ITEMS

The Co-60 source cell was demolished, and its storage well was excavated partially to a depth of approximately 2 ft below grade in the same manner as the Ra-226 source storage well. Although, as noted previously, there was no contamination present in this location, the Co-60 structure was eliminated to an extent that provides an obstruction-free floor-space for future storage of nonradioactive materials. Routine smear surveys were performed at this location and the pit area to assure absence of contamination. Figures 4-4 and 4-5 show photographs taken during demolition of the Co-60 source cell and its storage well. The facility's exhaust blower was also removed.

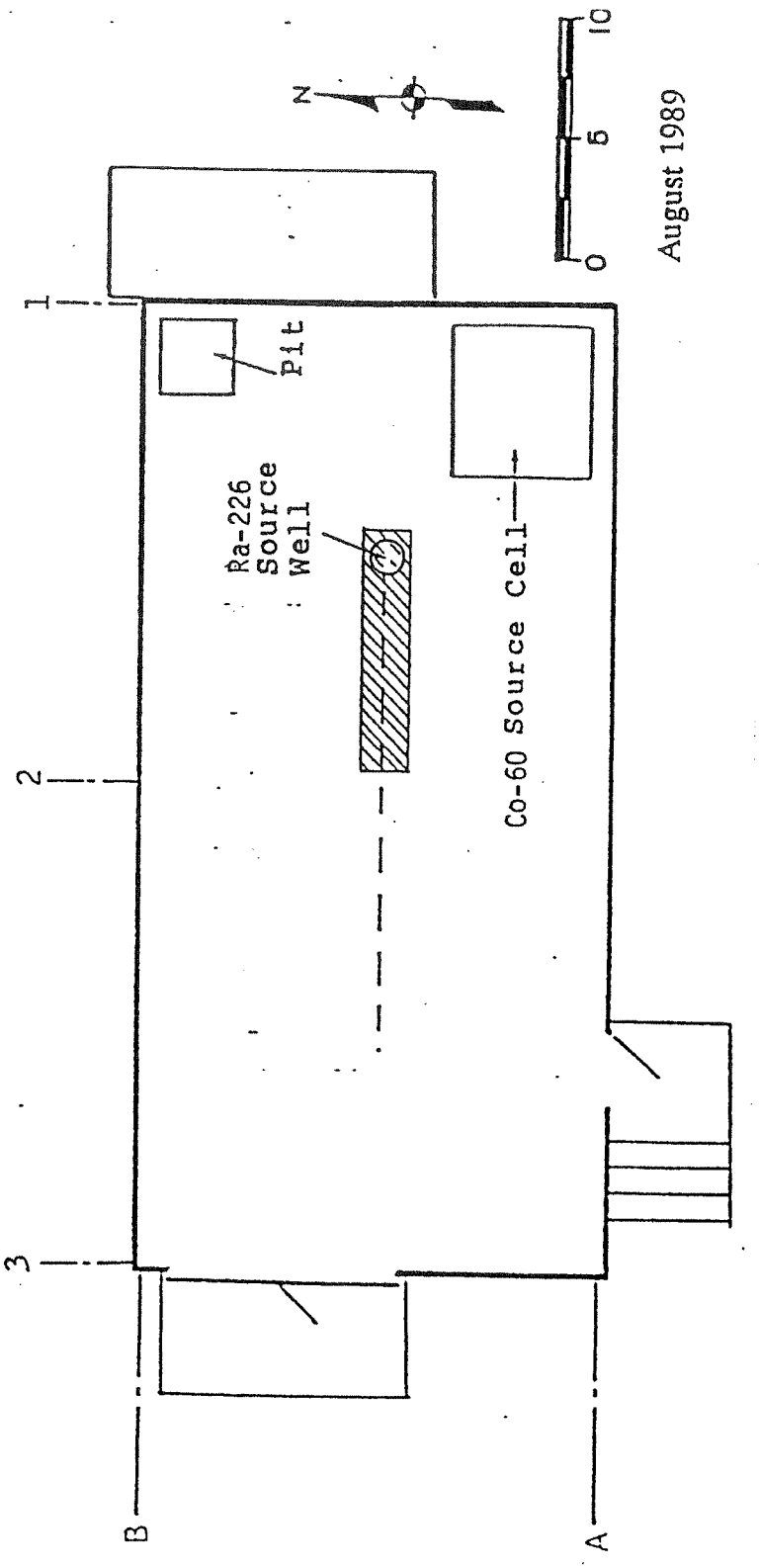

Figure 4–1. Ra–226 Source Well Floor Area (Shaded) Marked Up for Excavation

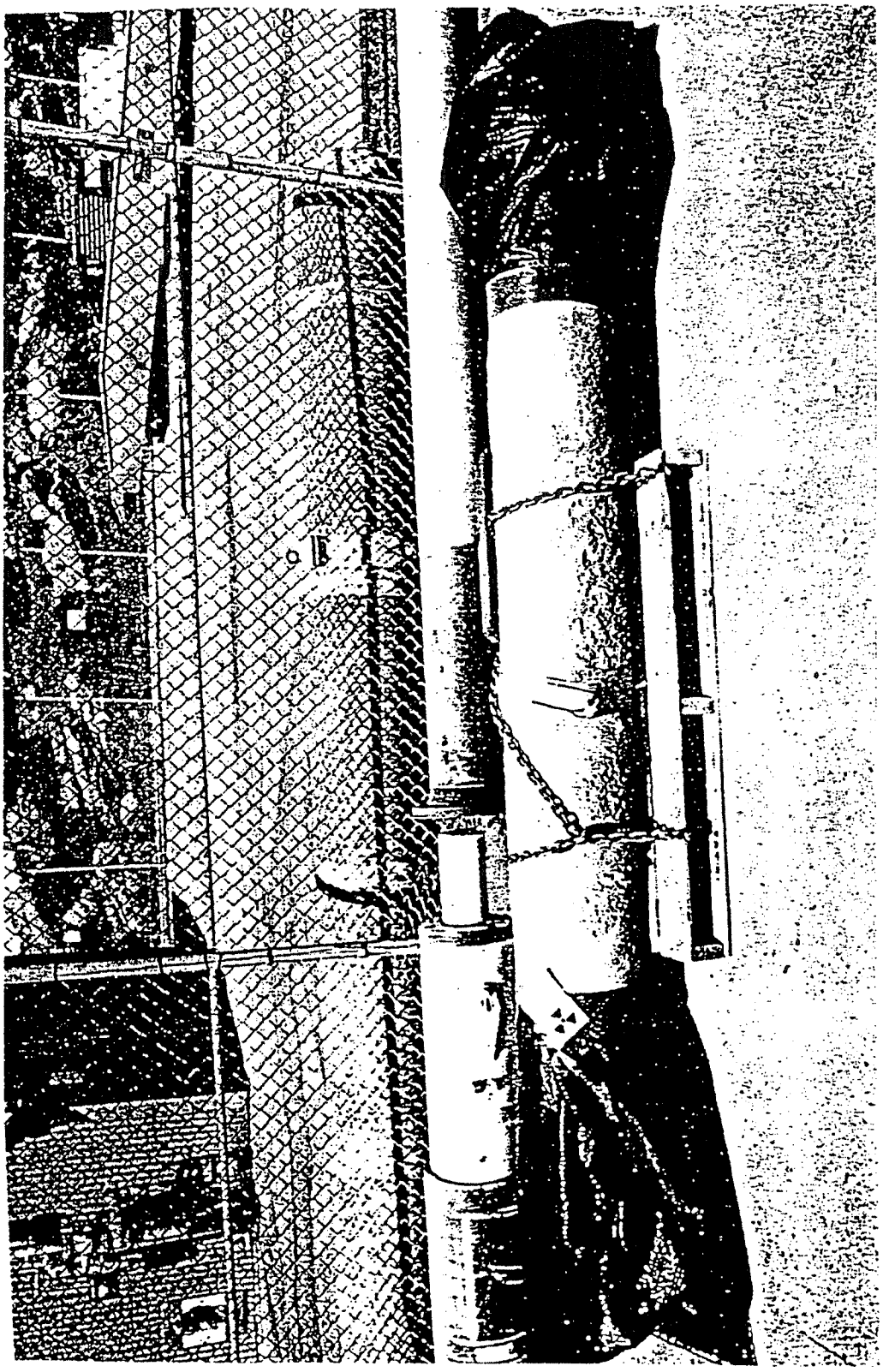

Figure 4–2. Photograph of Ra–226 Source Storage Well Upon Transfer to RMDF from T029 (front–most from fence)

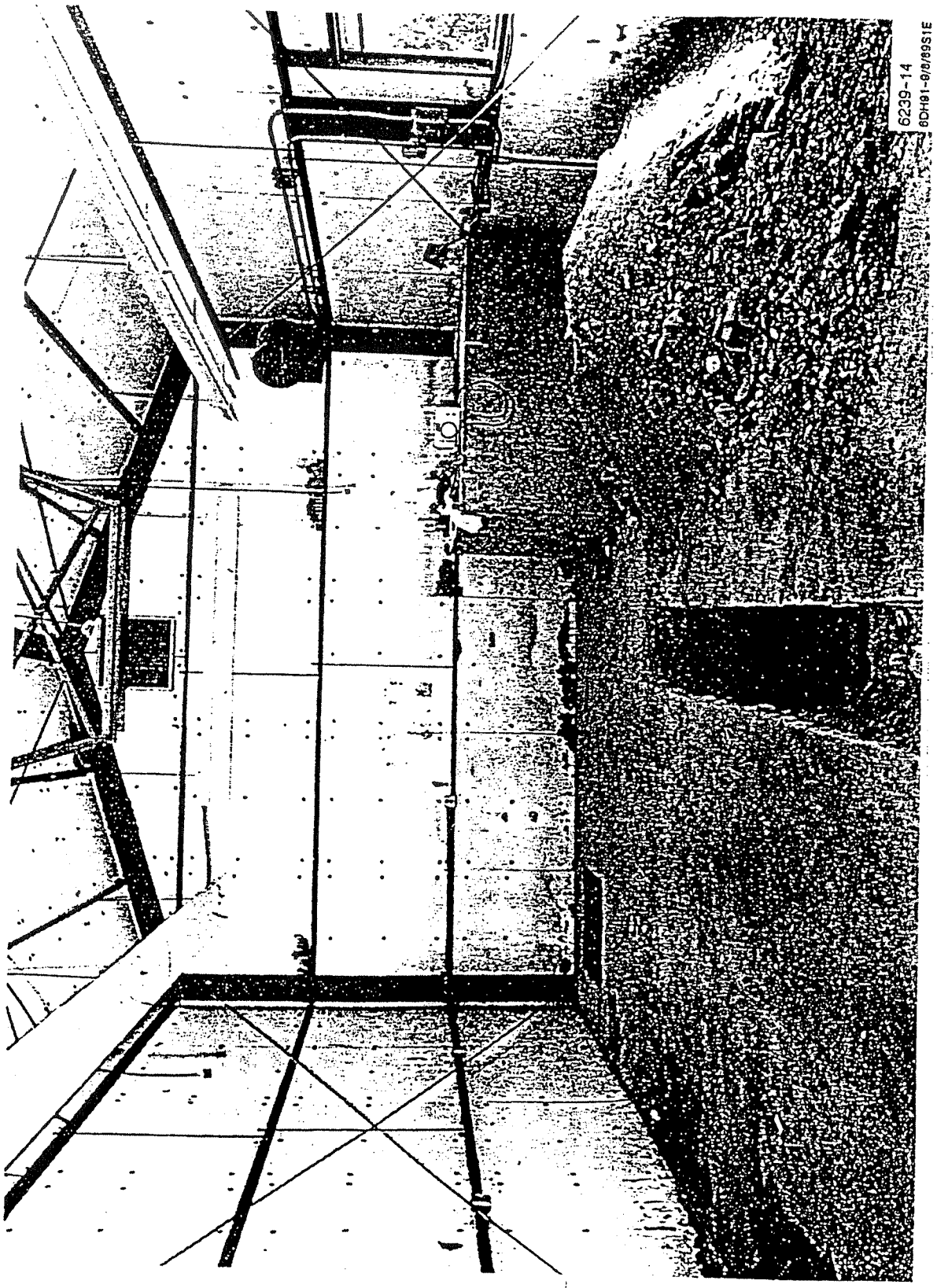

Figure 4–3. Photograph of Excavated Area of Ra–226 Source Storage Well in T029; Square Pit on Far Left at Floor Level is Former Location of PuBe, PoBe Sources. Former Co–60 Source Cell Block is to the Far Right

Figure 4–4. Co–60 Source Cell After Demolition of Surrounding Concrete

Figure 4–5. Photograph of Co–60 Source Cell Area in T029 After Partial Removal of Source Cell

4.4 DISPOSITION OF REMOVED ITEMS

4.4.1 Ra–226 Source Storage Well

Routine smear surveys were performed on the surfaces of the thimbles. Swabs were taken from within the interiors of the thimble tubes after the casing was excavated. Results of the smear survey showed normal background activity, while the swabs showed, as expected, alpha–contaminated interiors. Therefore, it was determined that the source storage well must be disposed of as low–level radioactive waste. Accordingly, to facilitate its packaging, the casing was cut longitudinally into two pieces and the concrete embedment was separated from the casing and the three inner tubes. Figure 4–6 shows a photograph of the disassembled casing. All of the components shown were then packaged for disposal as low–level radioactive waste at an authorized site.

4.4.2 Other Items

Routine smear survey data on the Co–60 source well components such as the concrete, and the removed and retained portions of the source well showed no activity above background and hence these items were disposed of as normal industrial waste; the lead shielding surrounding the source well was sold as scrap.

Routine smear survey of the exhaust blowers also showed no activity above background. These items were deemed reusable and hence were sent for refurbishment.

The survey data for all of the above items are maintained in the facility decommissioning file (Ref. 5, Appendix B).

4.5 SOIL ANALYSES

4.5.1 Soil Samples for Analysis

Soil samples were collected to determine if any Ra–226 (or Cs–137) isotopes had migrated from the source storage well casing into the adjacent soil and the extent of any such contamination. Four samples were collected in masses ranging from 227 g to 948 g for spectrometric analyses. The samples were collected from dirt adhering to the excavated source well casing (sample No. 1 and No. 3), the excavated pit (sample No. 2) and the excavated dirt pile (sample No. 4). As shown in Figure 4–7, sample No. 1 was from the side of the source well casing, while samples No. 2 and No. 3 were from its bottom. Sample No. 4, not shown in Figure 4–6, was a random sample taken from the excavated dirt pile.

Soil samples in the mass range of about 500 to 900 g are required for gamma spectrometric analysis using the standard Marinelli beaker (see Section 4.5.2 below) and three of the four samples had this desirable mass. However, one sample (sample No. 2 soil adhering to the bottom of the casing) weighed only 227 g which corresponded to all the dirt that was adhering to this area.

Figure 4–6. Photograph of Disassembled Ra–226 Source Well Casing in Preparation for Disposal

Sample No. 2 was nevertheless analyzed along with the other samples, and results are presented in Section 4.5.3.

4.5.2 Analysis Procedure

Gamma spectrometry of the soil samples was performed with a Canberra Industries, Inc. Series 80 Multichannel Analyzer (MCA). The MCA is coupled to a planar high purity germanium (HPGe) radiation detector having about a 10% relative sensitivity (relative to the sensitivity of 3 in. x 3 in. NaI detector for cesium–137 gamma radiation), and a photopeak resolution capability of about 2.5 keV for the higher energy line of cobalt–60. The instrument was calibrated for gamma energy and for radionuclide quantification with a Marinelli Beaker Standard Source (MBSS) as specified in the Standard, ANSI/IEEE Std 680–1978, "IEEE Standard Techniques for Determination of Germanium Semiconductor Gamma–Ray Efficiency Using a Standard Marinelli (re–entrant) Beaker Geometry."

The soil samples collected were dried in an oven and large chunks of rock were removed. A Marinelli beaker (450–ml volume) was then filled with the soil sample, weighed and counted for 30 min.

The MCA is programmable; for any unknown sample, it will calculate the activity in μCi of any isotope it identifies corresponding to the associated library. Typically, the instrument is used to measure U–238, U–235, Th–232, and their daughter products, K–40, Cs–137, Co–60, and Eu–152. Ra–226 (U–238 daughter) activity as well as the activities of its daughters (e.g., Pb–214 and Bi–214) are also measured. The MCA–calculated Ra–226 activity (and its daughters) includes the Ra–226 daughter from naturally occurring U–238 and any postulated Ra–226 that may have migrated from the source well.

A correction to the MCA–calculated activity is required because of the peak overlap at 185–186 keV from Ra–226 and U–235. Assuming that Ra–226 is in equilibrium with U–238 and that U–235 is 0.7% by weight of –238, it can be shown that the true Ra–226 activity is equal to the MCA–calculated activity multiplied by 0.5525. The stated assumption and the correction factor are valid because no enriched uranium was ever used at the facility.

Results from analysis of the soil samples in the above manner are presented in the next section. A statistical treatment of the type provided in the 1988 survey was not performed because of the narrow scope of this effort (namely removal of a relatively small contaminated item from an inaccessible area) and because of the limited number of samples.

4.5.3 Results and Discussion

MCA–calculated activities of selected radionuclides obtained from the gamma spectrometry of the soil samples are presented in Table 2 (Table 5 of Ref. 5). All values reported are concentrations in units of picocuries per gram (pCi/g). Concentration of Ra–226 and Cs–137 are reported because these are the suspect isotopes that could have migrated from the sources housed

Table 2. Results of Soil Sample Analysis

Sample No.	Soil Sample Location	Sample Weight (g)	Radioactivity Concentration (pCi/g)					Comment
			Ra–226	Cs–137	K–40	Pb–214*	Bi–214*	
Disposed								
1	Side of casing	938	ND	ND	24.2	0.33	0.36	Soil stuck to casing. Disposed of as radioactive waste
3	Bottom of casing	227	4.1	ND	35.7	1.69	1.60	Soil stuck to casing. Removed for analysis
4	Excavated dirt	920	ND	ND	23.1	0.28	0.40	Disposed of as ordinary dirt
Remainder								
2	Bottom of excavation	948	ND	ND	23.6	0.27	0.40	Soil in excavated area
Background								
	SSFL soil average	(average of three samples)	0.82	NM	22.2	0.84	NM	For comparison. Analyzed by U.S. Testing Company (Richland) for Groundwater Resources Consultants, Inc. (Ref. 9)
Acceptance Limit (DOE)	>15 cm below surface	—	15	—	—	—	—	Criterion from Table 2 (footnote**) of this report

ND: Not detected
NM: Not measured
*Daughter products of Ra–226

in the Ra–226 source storage well to the adjoining soil. Data on K–40 (naturally–occurring) and the two Ra–226 daughters, Pb–214, and Bi–214 are also shown; of these, the K–40 and Pb–214 data can also be compared with recently obtained background data for surface soils in SSFL (Ref. 4). In addition, background for Ra–226 activity reported in Ref. 4 is also included for comparison.

Referring to Table 2, no detectable activity is observed in regard to the suspect isotopes Ra–226 and Cs–137 for samples 1, 3, and 4. Also, for these samples, the values for K–40 are in a narrow range and are nearly the same as the background value elsewhere in SSFL for this naturally–occurring radionuclide.

The values for the Ra–226 daughters Pb–214 and Bi–214, are also in a narrow range for these three samples. However, the Pb–214 concentrations are a factor of about three lower than SSFL background data. Duplicate MCA analyses of the same samples confirm these values. The background value for Bi–214 is not available for a similar comparison, but its activity, as a daughter of Pb–214, should be equal to that of Pb–214. The presence of below detectable concentrations of the parent Ra–226 could be the reason for the relatively low concentrations of these two daughters. It is conceivable that a material with lower activity of Ra–226 (from U–238, its parent) than normal soil (e.g., construction sand) was mixed with the soil during installation of the source storage well resulting in Ra–226 concentrations which are lower than the background for SSFL. The results, nevertheless, show no contribution to the activities of Ra–226, its daughters, or Cs–137, that could have migrated from the source storage well.

The data shown in Table 2 with respect to sample No. 3 warrant some discussion. This sample shows a value of 4.1 pCi/g of Ra–226. Data from this sample for the other radionuclides are also not consistent with corresponding data for the other samples or with respect to the background data. This sample is of a lower mass value than that required for performing MCA analysis, and spurious data of this nature have been found in soil samples of low mass analyzed in other facility decontamination projects. However, for the present purpose, even if this value of 4.1 pCi/g is considered valid, it is still well below the 15 pCi/g DOE limit for Ra–226 for release of the facility "without radiological restrictions" (Ref. 2). The 15 pCi/g limit is also the remedial action standard used by regulatory agencies (for example, the U.S. Environmental Protection Agency and the Nuclear Regulatory Commission) for release with respect to "unrestricted use."

As shown in Figure 4–7, samples 2 and 3 were taken from locations that are immediately adjacent to each other. Thus, barring a highly localized spot (location of sample No. 3) to which the Ra–226 migrated, it would be reasonable to assume that Ra–226 activities would be the same for the two samples. If the migration of the Ra–226 was indeed localized, then it was contained in the 227 g of soil already removed from the facility, and hence, is of no future consequence. Given the consistency of the data from sample No. 2 with respect to samples No. 1 and No. 4, however, it is appropriate to conclude that the Ra–226 data for sample No. 3 is spurious, and that there is no actual Ra–226 in that location.

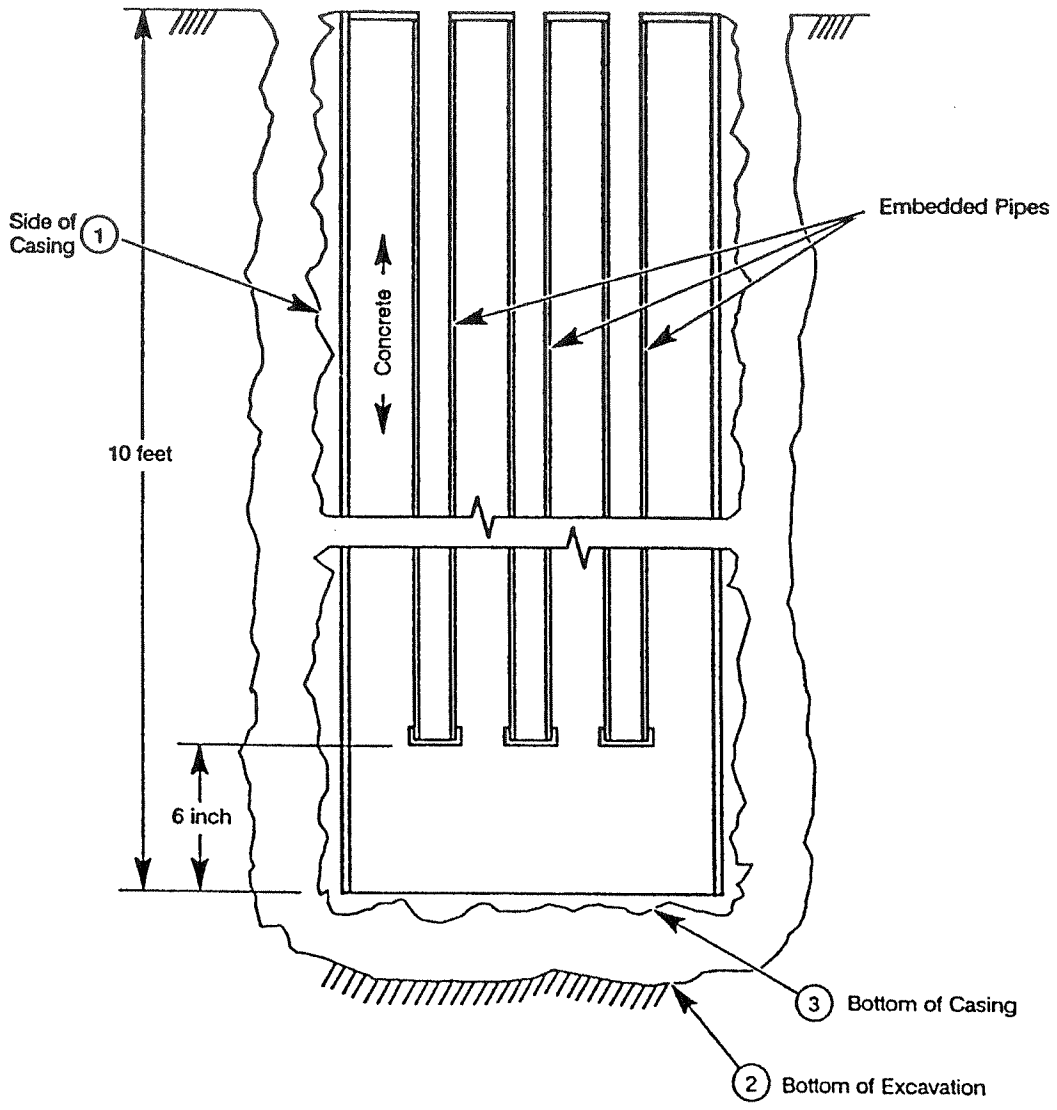

Figure 4–7. Schematic of Ra–22b Source Storage Well Showing Locations from where Soil Samples were taken for Analysis

4.6 FACILITY STATUS

Upon removal of the source storage wells and other equipment, the excavated area was refilled and re–surfaced. Figure 4–8 shows a photograph of the interior of the facility after completion of these restorations. Nonradioactive materials (principally metallic sodium in 55–gallon drums), which had been stored in the building and were temporarily stored outside during the removal operations, were returned to the reinstalled racks shown in the photograph. Building T029 continues as a nonradioactive hazardous materials storage facility.

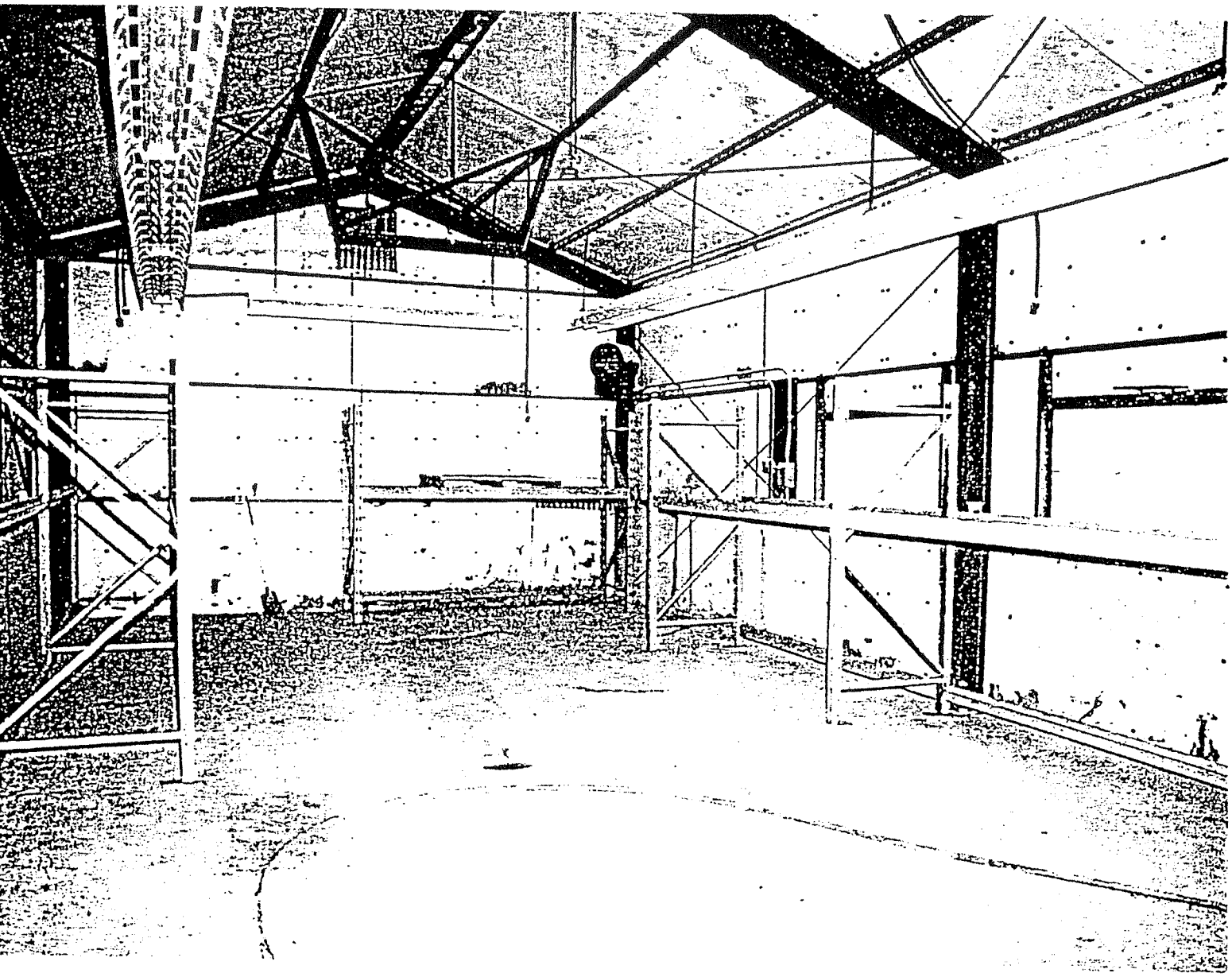

Figure 4–8. Interior of Building T029 Following Restoration

5.0 WASTE VOLUME GENERATED AND DISPOSAL

The volume of contaminated waste from the three source storage locations was approximately 40 ft^3. An additional 60 ft^3 of contaminated waste was generated from areas adjacent to the storage locations and soil and asphalt.

The housing used for the Co–60 source was disposed of as nonradioactive waste. In addition, the exhaust system outside the building was removed, surveyed, and determined to be clean for reuse. Soil samples collected during these operations were analyzed for radioactivity and showed no activity above background. The excavated area was then refilled.

6.0 PERSONNEL RADIATION EXPOSURE

No personnel radiation exposure was anticipated or encountered from the D&D activities for Building T029.

7.0 PROJECT COST EVALUATION

7.1 COST ESTIMATES

The removal of approximately 100 ft^3 of concrete, metal, and subsoil required the following man–hours for the decommissioning efforts of Bldg. T029.

Labor Classification	Expected No. EP Needed	Total Man–Hours	Man–Hours in Radiation Field
Dept. 635–123 Technician	3	360	360
Eng. & Supv.	1	120	60
Dept. 641 R&NS Technician	1	120	60

The decommissioning costs were funded by Rockwell International and complete records are unavailable.

8.0 REFERENCES

1. Badger, F. H. and Tuttle, R. J., "Radiological Survey Plan for SSFL," Rockwell International Report 154SRR000001, September 25, 1985.

2. "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites," U.S., Department of Energy, February 1985.

3. "Investigation of Naturally Occurring Radionuclides in Rock, Soils and Groundwater Santa Susana Field Laboratory, Ventura County, California," Groundwater Resources Consultants, Inc., report 8640M-77, June 1, 1990.

4. "Health and Environmental Protection Standards for Uranium Mill Tailings," U.S. Environmental Protection Agency Regulations 40 CFR 192, March 7, 1983.

5. Final Decontamination and Radiological Survey of Building T029, N704SRR990029.