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BURIAL OF RADIOACTIVE WASTE IN THE USAF

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15 March 1972

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ABSTRACT

This report summarizes the results of a Hq USAF survey (SCN 71-28) on the existence of radioactive waste disposal sites at USAF installations. General recommendations concerning these sites, formulated by the USAF Radioisotope Committee, are presented, as well as individual recommendations for each installation reporting the presence of such a site.

This report was prepared by a special subcommittee of the USAF Radioisotope Committee, consisting of Major Victor C. Furtado, Captain David R. Case, and Captain Joseph R. Stencel. The subcommittee is grateful for the cooperation received from many individuals at both Major Command and base levels. In particular, we acknowledge the assistance provided by Captain Thomas Jones, USAF, at the Defense Nuclear Agency, Kirtland AFB, in investigating the former Atomic Energy Commission sites now under Air Force control.

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Burial of Radioactive Waste in the USAF

I. Introduction

A. In the early 1950's, it was common practice in the United States Air Force to bury radioactive waste. This was merely a reflection of the AEC policy of those times. A technical order (T.O. 00-110A-1) specified procedures to be followed, including identification of the burial site location on appropriate maps and fencing to prevent entry of unauthorized personnel (reference Appendix A). Although a wide range of radioactive materials was buried throughout the Air Force, a majority of the waste volume could be divided into three categories. The first was electron tubes containing small amounts of radioisotopes. These items were used under the terms of a general license issued by the Atomic Energy Commission. The second category was low-level wastes generated in nuclear weapons maintenance operations. The last category was radioactive self-luminous instrument dials, usually containing radium.

B. In the period 1958-59, several important changes occurred. The general authority to bury radioactive wastes was deleted from T.O. 00-110A-1. Instead, the Air Force converted to a contractor disposal system, as outlined in T.O. 00-110N-2. The alternative of burial still existed, but only with the permission of the USAF Radioisotope Committee. It is important to note that, when the authority to bury was deleted from T.O. 00-110A-1, no instructions were provided for maintaining the existing burial sites and their associated records. Finally, the AEC agreed with an Air Force proposal to treat radioactive electron tubes as normal waste, with the restriction that such tubes would not be accumulated. The result of these changes was a general closing down of Air Force burial operations, although isolated cases of unauthorized burials probably occurred for several more years.

C. Current AEC policy on radioactive waste disposal is detailed in its Rules and Regulations, Title 10, Chapter I, Code of Federal Regulations. The pertinent sections (Parts 20.301 - 20.305) were published in 1960. The specific paragraph covering burial (20.304) permits burial of licensed material, but restricts the amount buried, the depth and location of the burial site, and the number of burials in one year. (Reference Appendix B.)

D. Current Air Force policy is more conservative than the AEC burial regulations. The USAF Radioisotope Committee decided that, since the AEC burial restrictions were difficult to enforce, it would be

safers to continue using contractor disposal facilities. During the 1960's the Committee, on several occasions, did approve one-time burial of special wastes. However, the Committee's current policy is to disapprove virtually all routine burial requests, since it is the consensus of the Committee that current national concern over the pollution of the environment dictates a conservative policy in the management of radioactive wastes.

E. In 1970 it became increasingly apparent that the records covering each disposal site were gradually being lost. In some cases, because of transfer of personnel and disposal of records, current Base Civil Engineering personnel were completely unaware of the existence of a burial site at their installation. In keeping with a continuing responsibility for radiological safety, it became imperative that the location and condition of existing burial sites be identified and recorded.

F. Accordingly, a Hq USAF survey letter (Radioactive Waste Disposal, Hq USAF SCN 71-28, 19 Feb 71) was sent to all major commands. (Reference Appendix C.) It directed that all existing burial sites should be identified in the Base Master Plan (Tab C-1), and that certain details concerning construction and utilization of the site be forwarded to the USAF Radioisotope Committee, which would subsequently make recommendations on the maintenance of the sites. This report will summarize the survey returns, and make recommendations where appropriate.

II The Survey (Hq USAF SCN 71-28)

A. The original survey letter went to all Major Commands. Most commands forwarded the letter to their individual bases, with appropriate instructions. The individual base replies varied greatly in the details of submission. As a result, a large follow-up effort was required. In the case of several bases (see Section IV), the action was not completed when this report was prepared. This section will provide a brief summary of the responses. A more detailed report of the positive responses will be found in Section IV.

B. Replies were received from 136 USAF installations. Of these, 46 were classed as "positive." A positive reply is one which indicates that either radioactive waste burial did in fact occur, or that a burial site exists or existed. In the latter cases, it may not be possible to determine if the burial sites were ever used.

C. If we consider replies from installations in the 50 states, 45 of 108 were positive. Only 1 of 28 foreign replies were positive. Tables I and II list the positive and negative replies, while Figure I presents a breakdown by Major Command.

D. Please note that the above summary does not include responses from USAF installations in Europe. Hq USAFE/DEMU submitted a negative reply for the entire command.

III Recommendations

A. This section will discuss, in general terms, the USAF Radioisotope Committee's recommendations concerning radioactive waste burial sites in the USAF. Specific recommendations for individual installations are given in Section IV.

B. The USAF Radioisotope Committee considers the optimum solution to be removal of all buried radioactive waste, with subsequent disposal through a licensed contractor. However, the Committee must consider the feasibility of disinterment in the light of such factors as the present conditions of the site, anticipated volume of waste to be shipped, and how precisely the site location is known. In all cases where the Committee has recommended disinterment, the location of the site is clearly marked and the cost of removal is estimated to be moderate (i. e., less than \$1,000). In some cases, the Committee feels that, while disinterment is desirable, the higher costs involved would require advance budgeting and funding. (Reference Section IV, Randolph AFB, Robins AFB, and McGuire AFB.) The Committee has prepared, as a guideline, a set of Health Physics precautions to be observed during disinterment operations. (See Appendix D.)

C. In cases where removal is not recommended, the Committee's recommendations reflect the need for the following:

1. Site location must be permanently marked on Base Master Plan, Tab C-1, and clearly marked as a "radioactive" waste site.

2. All sites must have warning signs. Wording is optional, but as a minimum, should include the words, "Caution - Radioactive." It is desirable for the sign to be of standard colors, with the standard radiation warning symbol. [Referring to MIL-STD-595, the background should be yellow (Standard color chip No. 23655) and the symbol should

TABLE I - Positive Responses

Altus AFB	Loring AFB
Andrews AFB	Lowry AFB
Barksdale AFB	Luke AFB
Bergstrom AFB	McCoy AFB
Carswell AFB	McGuire AFB
Columbus AFB	Moody AFB
Craig AFB	Mountain Home AFB
Davis-Monthan AFB	Nellis AFB
Eglin AFB	Patrick AFB
Ellsworth AFB	Perrin AFB
Elmendorf AFB	Randolph AFB
England AFB	Richards-Gebaur AFB
Fairchild AFB	Robins AFB
George AFB	Scott AFB
Hamilton AFB	Sheppard AFB
Holloman AFB	Sundance AFS
Johnston Atoll AFB	Tinker AFB
Keesler AFB	Travis AFB
Kelly AFB	Vandenberg AFB
Kincheloe AFB	Westover AFB
Kirtland AFB	Whiteman AFB
Lackland AFB	Williams AFB
Laredo AFB	Wright-Patterson AFB

TABLE II - Negative Responses

Aero Chart & Info Ctr	L. G. Hanscom Field
AF Acctg & Fin Ctr	Little Rock AFB
Albrook AFB	Lockbourne AFB
Anderson AFB	Los Angeles AFS
Arnold Eng Dev Ctr	MacDill AFB
Beale AFB	Malmstrom AFB
Bien Hoa AB	March AFB
Blytheville AFB	Mather AFB
Bolling AFB	Maxwell AFB
Brooks AFB	McChord AFB
Cam Ranh Bay AB	McClellan AFB
Cannon AFB	McConnell AFB
Castle AFB	Minot AFB
Chanute AFB	Misawa AB
Charleston AFB	Myrtle Beach AFB
Ching Chuan Kang AB	Naha AB
Clark AB	Nakhon Phanom Aprt
Da Nang Aprt	Niagara Falls Int Aprt
Don Muang Aprt	Norton AFB
Dover AFB	Offutt AFB
Duluth Int Aprt	Osan AB
Dyess AFB	Otis AFB
Edwards AFB	Pease AFB
Eielson AFB	Peterson Field
Ent AFB	Phan Rang AB
F. E. Warren AFB	Phu Cat AB
Forbes AFB	Plattsburgh AFB
Goodfellow AFB	Pope AFB
Goose AB	Ramey AFB
Grand Forks AFB	Reese AFB
Griffis AFB	Selfridge AFB
Grissom AFB	Seymour Johnson AFB
Gunter AFB	Sonderstrom AB
Hancock Field	Shaw AFB
Hill AFB	Tainan AB
Homestead AFB	Taipei AS
Howard AFB	Thule AB
Kadena AB	Tan Son Nhut Afld
Kingsley Field	Tyndall AFB
Korat AB	Ubon Afld
K. I. Sawyer AFB	Udorn Afld
Kunsan AB	USAF Academy
Lages Field	Vance AFB
Langley AFB	Webb AFB
Laughlin AFB	Wurtsmith AFB

Note: No individual responses from USAFE.

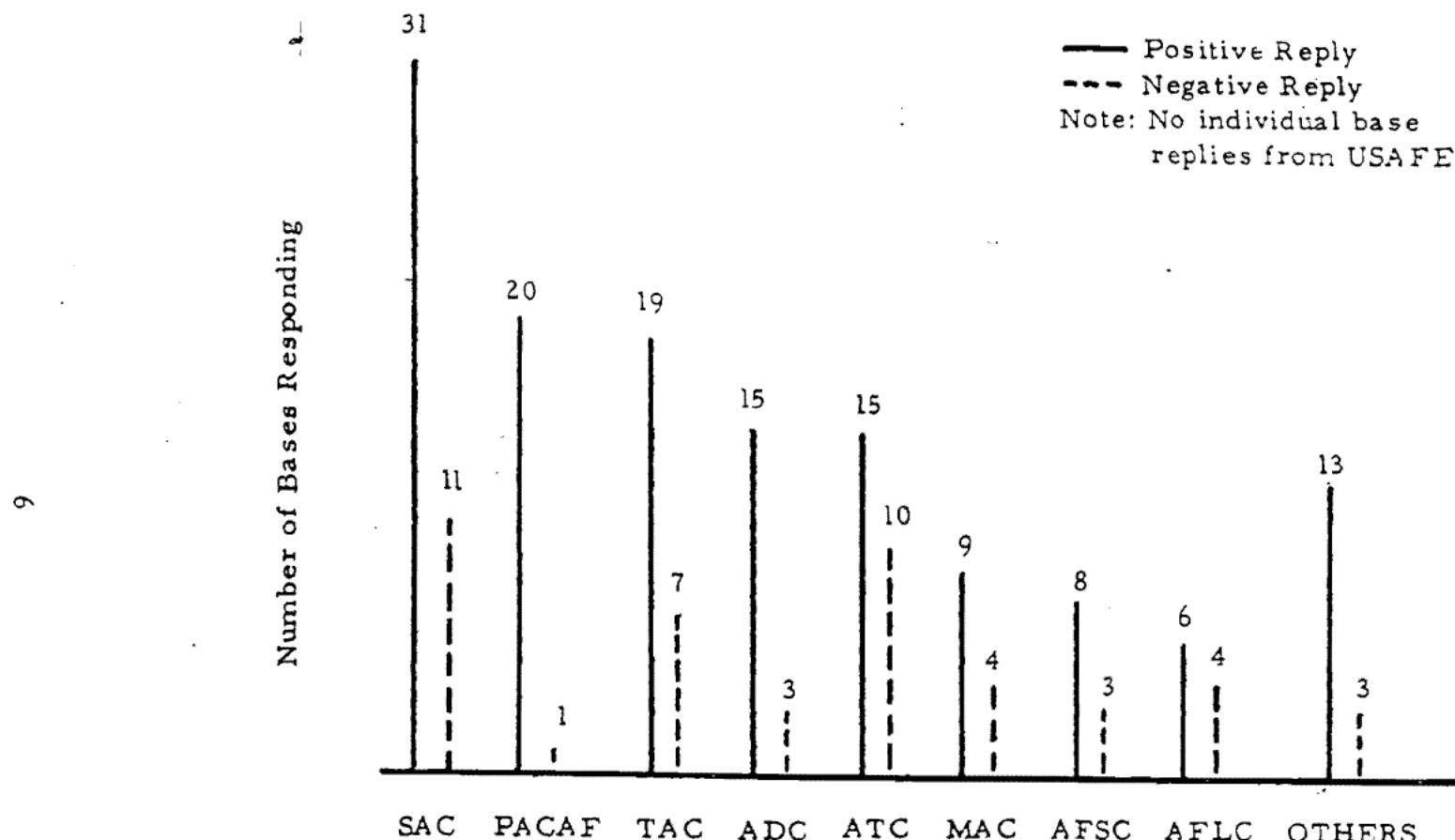


FIGURE I: Distribution of Replies, By Major Command

be magenta (Standard color chip No. 27142); lettering should be block type in black.] If the site is fenced, signs must be posted on at least two sides, but signs posted on four sides would be preferable.

3. Existing fenced enclosures should be maintained in good condition (periodic inspection, painting, brush removal, repairing breaks, etc.).

4. Fenced enclosures must be locked!

D. A major problem that remains unresolved is retired and/or inactive USAF installations. Many installations that were active during the period when radioactive waste burial was permitted are no longer used. As a result, there was no direct way to determine if burial sites ever existed. A list of 23 such installations was sent to Hq USAF/PREES for research in the permanent master records, but no trace of radioactive burial sites was found. (See Appendix E for a partial list of retired bases in the ZI.) The Committee is not satisfied with this negative reply. This survey has provided ample evidence that examination of Base Master Plans is a poor method of searching for radioactive waste sites. Although this Committee cannot now offer a reasonable alternative course, it still considers the question to be of considerable importance, since in many cases the installations have been returned to civilian control.

E. It is possible that some of the 46 bases reporting burial sites will be inactivated in the future. To prevent their return to civilian control without some consideration of the radioactive contamination, the USAF Radioisotope Committee recommends that AFR 87-4, Disposal of Real Property, be appropriately amended to consider such contamination. At present, paragraph 7 of this regulation refers only to explosive ordnance disposal, but it could easily be expanded to cover radioactive waste disposal. Furthermore, paragraph 1h, Site Restoration, could include a reference to radioactive decontamination. The only reference to radioactive material in the current regulation is in paragraph 1 of Attachment 1 thereto.

F. Nine of the bases covered in Section IV are grouped as "former AEC sites" (see Appendix F). This refers to the high security installations built by the Atomic Energy Commission after World War II to store and maintain nuclear weapons. Since the maintenance procedures could generate varying amounts of low-level radioactive wastes, the facilities usually had both trenches for dry waste burial and large tanks for interim storage of liquid wastes. The AEC relinquished control of

these facilities around 1961-62. Radioactive waste disposal had tapered off as the introduction of sealed pit weapons eliminated the waste-generating maintenance activities. The Committee requested water samples from all liquid waste tanks. To date, all samples have been essentially negative. However, because of the inclement winter weather, many samples have not yet been collected.

G. In several instances, the existence of radioactive waste burial sites involves either classified or sensitive information. All material in this report is unclassified. A separate classified letter will be prepared for HQ USAF/SGPAAP, to report the nature of these sites and this Committee's recommendations.

IV Positive Replies

This section will include a brief summary of each positive reply. While much supporting material has been omitted, the pertinent points will be covered. An even more limited summary is presented in tabular form at the end of this section (Tables IIIa, IIIb and IIIc). Recommendations are listed in order of priority (i.e., if recommendation No. 1 is disapproved, consider No. 2 as an alternative).

Altus AFB

A 100' x 100' fenced site, at the eastern edge of the base. Six markers indicate separate burial sites. A civilian employee remembers burial of 5-gallon cans at depth of about 10 feet. Signs exist, but are badly deteriorated.

Recommendations:

1. Disinter buried cans, dispose as per T.O. 00-110N-2;
remove fence.
2. Replace warning signs and schedule regular site inspections.

Andrews AFB

A 25' x 30' fenced site, at southern end of base. Civilian employees recall burial of 5 or 6 concrete containers containing radioactive tubes and dials, at a minimum depth of two feet. Exact burial sites not marked, nor are warning signs posted.

Recommendations:

1. Remove fence, excavate entire site to depth of 3 feet. If concrete containers are found, dispose of them intact, as per T.O. 00-110N-2. If containers are not found, replace earth fill, post warning signs, and maintain.
2. Post warning signs and schedule regular site inspections.

Barksdale AFB

A former AEC facility, with one dry waste and two wet waste sites reported. A fourth site reportedly contains contaminated debris from a crashed C-124. No further details provided.

Recommendation: None at this time. Awaiting response to follow-up inquiry dated 17 Nov 71. (See page 21 below.)

Bergstrom AFB

Three cast iron pipe wells 20' deep, one pipe 12" diameter, two pipes 20" diameter. Top of wells capped with 4" concrete. No record of actual disposal of radioactive waste. No fence or signs.

Recommendations:

1. Remove all three pipes; dispose of contents as per T.O. 00-110N-2.

2. Post warning signs at each pipe. Schedule regular site inspections.

Carswell AFB

A 10' x 20' site in ordnance storage area west of base. Three 12" diameter cast iron pipes, 18' deep, capped 1' of above grade with steel plates welded to pipe. No information on contents. Site fenced, but no caution signs.

Recommendations:

1. Remove pipes, dispose of contents as per T.O. 00-110N-2.
2. Post caution signs; permanently annotate Base Master Plan, Tab C-1.

Columbus AFB

A slit trench was used to bury electron tubes, luminous dials, and aircraft air filters under five feet of earth. Precise location not now known. No fence or sign.

Recommendation: Post warning sign.

Craig AFB

A 6' x 6' fenced site on western edge of base. A 24" diameter concrete pipe, 12' deep. No record of contents; no warning sign. Base requested permission to remove.

Recommendation: Remove pipe; dispose of contents as per T.O. 00-110N-2.

Davis-Monthan AFB

A 20' x 20' fenced site in southeastern part of base. Four 12" cast iron pipes, 18' deep. "No Trespassing" sign posted. Contents reported as electron tubes.

Recommendations:

1. Remove pipes; dispose of contents as per T.O. 00-110N-2.
2. Post appropriate sign; schedule regular site inspections.

Eglin AFB

There are six separate burial sites. The first three are on isolated test ranges. One, located near test area C-80A, contains 0.8 pounds of depleted uranium in the form of expended 20mm flechettes. A second, located near test area 64, contains 0.3 pounds of depleted uranium in the form of expended 30mm rounds. The third site, located near test area C-64A, contains 5 pounds of depleted uranium in the form of expended 20mm flechettes.

Of the three remaining sites, two also contain depleted uranium. The first is in the base sanitary land fill, in an unspecified location. A steel target plate for uranium ordnance is buried here. The second is a firing range backstop near Building 420 containing 3 pounds of expended uranium ammunition.

The final site, in test area C-74L, contains zinc-65 from marked bullets deflected into a trench 30' long by 8' deep. A total of 115 millicuries was buried in March 1960. Because of radioactive decay, less than 1 microcurie now remains.

Recommendation: None.

Ellsworth AFB

A former AEC facility. There are five liquid waste tanks (3 at 1000 gallons, 1 - 1500 gallons, and 1 - 5000 gallons), all fenced except for the 5000 gallon tank. There are two dry waste facilities, both fenced. All facilities under ground.

Recommendation: None at this time. Base has not yet responded to follow-up inquiry dated 17 Nov 71. (See page 21 below.)

Elmendorf AFB

A 150-square foot area, used for one-time burial of unspecified number of 55-gallon drums in 1955-56. Contents unknown. Buried 5-7 feet, covered with about 4" of concrete. Barbed wire fence, with warning signs.

Recommendations:

1. Excavate and remove 55-gallon drums; repack contents for disposal as per T.O. 00-110N-2.
2. Schedule regular site inspections (in season) to insure integrity of fence and legibility of warning signs.

England AFB

Two burial sites used in past, but method of burial and contents of containers not known. Current CE Work Order will erect 4' fence (with gate, lock, and signs) around both sites. One will be 20' x 20', the second 50' x 50'.

Recommendation: Providing that fence and signs are erected as planned, only periodic site inspections required. Confirm that Base Master Plan, Tab C-1, is permanently annotated.

Fairchild AFB

Former AEC facility. Two liquid waste tanks (1000 gallon and 5000 gallon) and two dry waste facilities, all fenced, but no warning signs. Water samples from both tanks analyzed as essentially negative.

Recommendation: Scheduled inspections and maintenance; post warning signs on all four facilities.

George AFB

Small metal containers, probably holding electron tubes, were buried 8 - 10 feet deep in sanitary land fill area. Area is posted with sign warning against uncovering.

Recommendation: Routine inspection to ensure integrity of sign.

Hamilton AFB

A 14" - 18" diameter corrugated steel pipe, of unknown length, was buried and fitted with a metal cover. Site was definitely used, but nature of waste is now unknown. When abandoned, it was covered with about 12" of soil. Site is below sea level, but protected by dikes. There is no fence or warning sign. Precise location is not now known, although local CE staff feel it would be easy to locate.

Recommendations:

1. Remove pipe, dispose of contents as per T.O. 00-110N-2.
2. Erect warning signs; routine maintenance and inspection.

Holloman AFB

A 4' x 4' concrete pad, within a large fenced area in northern part of base. No information on construction of site, type of waste container, depth of burial, or nature of waste. No signs.

Recommendation: Post warning sign near concrete pad; schedule regular inspections.

Johnston Atoll AFB

Nature of waste is classified. Deliberate sea burial, in lagoon, has been reported. However, existence of land "burial" sites is known.

Recommendation: A radiological survey of the involved land areas should be accomplished, using the most modern field detection equipment. Further details provided in separate letter to Hq USAF / SGPAAP.

Keesler AFB

Accidental burial, in sanitary land fill, of a device containing 4.5 microcuries of radium. Precise location unknown.

Recommendation: None.

Kelly AFB

A plot 141' x 63' contains 23 concrete pipe disposal wells. Four are 24" in diameter, the remainder are 12" in diameter. All wells plugged, top and bottom, with concrete. The contents of most wells are unknown. A partial record for Well No. 23 shows a variety of electron tubes and radium and cobalt-60 test sources. The site now lies between fairways 6 and 7 of the Kelly West (new) Golf Course. During construction of the course, the site was covered with four feet of concrete rubble and dirt fill. The corners of the former site are now permanently marked by grass-level concrete monuments. Warning signs are posted on top of these monuments. Approximately half of the former site lies under the 6th fairway.

Recommendation: Periodic site inspection.

Kincheloe AFB

An 82' x 82' fenced site approximately one-half mile east of the intersection of the two runways. The site contains three separate 10' x 10' plots, where tubes were buried, encased in concrete in 55-gallon drums, to a minimum depth of 5 feet. Signs are posted.

Recommendation: Remove barrels from the three sites; disposal as per T.O. 00-110N-2.

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Kirtland AFB

Kirtland AFB submitted a negative reply in April, 1971. However, on 1 July 1971, Kirtland AFB absorbed Sandia Base, which had been administered by the U. S. Army. There have been extensive radioactive waste burial activities at Sandia Base. These are well summarized in a confidential Defense Nuclear Agency report issued in August, 1971.

Recommendations: Specific recommendations will be made in a separate letter to Hq USAF/SGPAAP.

Lackland AFB

A former AEC facility, with three waste water tanks and one dry waste facility. No records are available on the nature of the wastes buried in this latter area. The vent pipes to two of the tanks have been cut off below grade and capped. A water sample was taken from the remaining tank and found to be essentially negative. The remaining tank and the dry waste facility are fenced; warning signs are to be posted at all four sites.

Recommendation: Regular inspections and maintenance.

Laredo AFB

A burial site exists about 1,000 feet southeast of the intersection of runway 32R and the closed runway. There is no fence or sign. There are no records of use or type of construction. The site is not permanently annotated on the Base Master Plan, Tab C-1.

Recommendation: Permanently annotate the Base Master Plan, Tab C-1, to show precise location of site, with words, "Radioactive waste burial site (inactive)." Erect warning sign at site.

Loring AFB

Former AEC facility. There are six disposal sites, reported as 5 tanks (3 - 1000, 1 - 1500, 1 - 5000 gallon) and one dry waste facility. However, AEC records indicate that one site, reported as waste tank, is really dry waste trench. Discrepancy will be resolved when snow clears this spring. All facilities are fenced. No disposal records available. Water samples will be collected from tanks when weather permits.

Recommendation: Scheduled inspections and maintenance; post warning signs on all six facilities.

Lowry AFB

Lowry AFB submitted a negative report. However, a SSgt at Robins AFB reported that he personally participated in a radioactive waste burial at a remote site known as "the fire protection branch area," about 3 miles from Buckley Field. Investigation by Lowry AFB personnel was unable to confirm or deny this report.

Recommendation: None.

Luke AFB

A site is located about 300 yards northwest of sewage treatment plant; precise location not known. In 1956, electron tubes were buried at a depth of 12 feet, then covered with concrete and earth. No fence or warning sign.

Recommendation: Post warning sign in approximate area of burial site.

McCoy AFB

A 32' x 100' site about 200' east of the southern end of the east parallel taxiway. No disposal records exist. Last reported use was in November, 1953. No fence or sign.

Recommendation: Recommendation provided by separate letter to Hq USAF/SGPAAAP.

McGuire AFB

Hq MAC/DEEE, in two separate letters, submitted negative replies for this base. However, based on previous knowledge, this Committee has information to the contrary.

Recommendation: Recommendations will be provided in separate letter to Hq USAF/SGPAAAP.

Moody AFB

This base reports that an area marked with stakes indicating "Disposal Area for Radioactive Materials" formerly existed at the southern end of the area between the parallel runways. However, the precise location is not now known. There is no fence or sign, and there are no disposal records.

Recommendation: Base Master Plan, Tab C-1, should be annotated to indicate the general area of the former radioactive waste burial site.

Mountain Home AFB

A site near northwest end of runway, off perimeter road. A 12" cast iron pipe, of unspecified depth, sealed in concrete with a locked cover plate. No fence, sign, or disposal records.

Recommendations:

1. Remove pipe; dispose of contents as per T.O. 00-110N-2.
2. Erect warning sign, and permanently annotate Base Master Plan, Tab C-1, to show burial site.

Nellis AFB

A former AEC facility, with a 5000-gallon liquid waste tank and one dry waste facility. Both sites have fences and signs. Dry wastes were buried in augered holes of 7' - 10' depth. The AEC estimates that about 2650 pounds of waste were buried in this 25' x 100' site. Water samples from waste tank were analyzed as essentially negative.

Recommendation: Scheduled site inspection and maintenance.

Patrick AFB

In July 1969, this Committee authorized the burial of three contaminated animal carcasses in the base sanitary land fill. The burial conformed to the requirements of 10 CFR 20.304. The buried isotopes were 8.7 microcuries of chromium-51 (halflife is 28 days) and 21 microcuries of tritium (halflife is 12.2 years). The chromium-51 is now essentially completely decayed. There is no fence or warning sign.

Recommendation: Permanently annotate Base Master Plan, Tab C-1, to indicate burial site.

Perrin AFB

A burial site is located on a hill about 250' north of the small arms range backstop. The waste consisted of electron tubes encased in concrete in a 5-gallon container, buried about 6' deep in an augered hole. No fence or sign reported. This Committee has been unable to determine if the precise location of this burial site is known.

Recommendation: This base is in an inactive status. It would be desirable to remove the waste if it can be located.

Randolph AFB

Two adjacent burial sites, near the southwest corner boundary, between the fence and the perimeter road. Burials are reported to be in accordance with T.O. 00-110A-1, but there is no evidence of concrete or steel pipes. Each burial is marked with a concrete monument. There are 8 - 10 such monuments in the most southern plot alone. Both sites are fenced, with signs, but a portion of the fence on the southern plot is down. Majority of waste is reported to be contaminated medical material from the time when the School of Aviation Medicine was at Randolph.

Recommendations:

1. Since the burial activity was fairly extensive, disinterment will be a large project. Recommend such a project be planned and funds budgeted.
2. Repair fence and signs, clear brush, schedule periodic inspection and maintenance.

Richards-Gebaur AFB

A burial site is located about 1200' east of the north-south runway. A 10" - 12" diameter cast iron pipe buried 23' deep, with concrete end caps. No information available on nature of wastes, or on existence of fence or sign.

Recommendations:

1. Remove pipe, dispose of contents as per T.O. 00-110N-2.

2. Confirm presence of fence and warning sign; if no sign, erect one; schedule regular inspection and maintenance.

Robins AFB

A burial site is located in the southeast section of the base, south of the pistol range. Burial was in a reinforced concrete vault, 20' x 20' x 15'. Vault walls are 6" - 12" of concrete. The waste in the vault was covered with 2' - 3' of compacted earth, then covered with 2' - 3' of concrete to seal the vault. The entire vault was covered with earth to an unspecified depth. The facility is fenced, with warning signs on all four sides. Most of the waste involved materials used in the painting of luminous dials and parts (radium).

Recommendations:

1. Scheduled site inspections and maintenance, as long as site is under Air Force control.
2. The cost of removing this facility would be high and, considering the nature of the wastes, stringent radiological health controls would be required. However, should Hq USAF direct decontamination of this site, it is technically feasible to accomplish in a safe manner.

Scott AFB

A 25' x 25' fenced site is located just south of Scott Lake. The base report is vague, but personal inspection by members of this Committee suggests the site is a typical well facility, as described in T.O. 00-110A-1. The well was sealed in September 1959. There is no record of what was buried. No warning signs on the fence or locked gate.

Recommendations:

1. Remove pipe, dispose of contents as per T.O. 00-110N-2.
2. Post warning signs; schedule regular site inspections and maintenance.

Sheppard AFB

There are two burial sites. The first, just east of Highway 240, is fenced and has warning signs. The second, north of the hospital, has a warning sign, but no fence. No further details were reported for either site.

Recommendation: Schedule site inspections and maintenance.

Sundance AFS

This buried radioactive waste at this station resulted from the decommissioning of the PM-1 nuclear power plant. Complete details are available in HQ ADC report, "Final Inspection of the PM-1 Nuclear Power Plant Decommissioning and Dismantling Site," 30 September 1969.

Recommendation: Continued environmental surveillance.

Tinker AFB

At various times Tinker AFB has had three separate burial sites. The first of these was south of Facility 1025. Reportedly, equipment contaminated with radium from dial painting operations was buried there, but later removed. There is no hard evidence for either presence or absence of this waste. There are no fences or signs, and the precise location cannot be established.

A second site, northwest of Building 1030, purportedly contained more radium dial wastes. A verbal report asserts that the entire waste site was removed in 1955, when a sanitary land fill was established.

The third site, west of Building 205, also is reported to contain radium paint and radium paint solids. No fence or sign exists.

Recommendation: Careful excavation at the site near Building 205, to recover any buried container. Because of nature of waste (radium), this recovery operation should be accomplished under the direct supervision of a Health Physicist.

Travis AFB

A former AEC facility, with one 5000-gallon underground wastewater tank and one dry waste site. Both sites are fenced, but only the dry waste site has warning signs. Radioactive waste sites not annotated on Tab C-1 of Base Master Plan. Water samples from tank analyzed as essentially negative.

Recommendation: Schedule regular inspections and maintenance; properly annotate Tab C-1 of Master Plan; post warning signs at wet waste site.

Vandenberg AFB

There are two separate burial sites at this base, both containing magnesium-thorium alloy scrap from Bomarc missile accidents. At the first site (Grid B-7, Sheet 17, Tab C-1), approximately four pounds of thorium was buried on 28 September 1966. At the second site (Grid D-5, Sheet 17, Tab C-1), about ten pounds of thorium was buried to a depth of 8 - 10 feet on 5 March 1969. Both burials were on Federal property, and with the explicit permission of the USAF Radioisotope Committee. There are neither fences nor signs at either site. Both sites are in remote locations.

Recommendation: None.

Westover AFB

An AEC facility, containing two liquid waste tanks (5000 and 1000 gallon) and a dry waste facility. All sites are fenced, but only the tank sites have warning signs. There are no disposal records available. Water samples from both tanks were analyzed as essentially negative.

A fourth site (Facility 11922) exists north of the small arms range. No details are available as to its construction. The base reports that, since it has no record of the site ever being used, the fence was removed and action is being taken to remove reference to the site from Real Property records and the Base Master Plan. There is no warning sign.

Recommendation: Post warning signs at Facility 11922 and the dry waste site (Facility 917); do not remove references to Facility 11922 from Real Property records and Base Master Plan; schedule site inspections and maintenance.

Whiteman AFB

A 59' x 36' site, Facility 1275, is located at the south end of the base. There are no construction details available, except that the burial containers were concrete. Contents are reported to be electron tubes. A warning sign is posted.

A second site may exist west of Facility 2005 (Water Treatment Plant), but no physical evidence is available at the site.

Recommendation: Scheduled site inspection and maintenance (Facility 1275).

Williams AFB

A burial site is located near the southwest corner of the base. There is a fence and sign, but no disposal records. A piece of the concrete cap is protruding above grade.

Recommendation: Remove burial container and dispose as per T.O. 00-110N-2.

Wright-Patterson AFB

A disposal site is located in Area B, near the intersection of P Street and Twelfth Street. Site is marked by a concrete slab, and is fenced. No disposal records are available.

Recommendation: Remove the waste containers and dispose of as per T.O. 00-110N-2.

The following information was received too late to insert in the appropriate place above:

Barksdale AFB. Reported facilities have both fences and warning signs.

Recommendation: Regularly scheduled inspections and maintenance as needed.

Ellsworth AFB. Most recent information from base indicates that description on page 11 should be corrected to show just one dry facility. This site is a 6' x 6' x 10'-3/4" plywood box, with the lid at ground level. Furthermore, all fences and signs have been removed.

Recommendation: Disinter dry waste Facility 88228, and dispose of contents as per T.O. 00-110N-2. Replace warning signs at all remaining facilities.

TABLE IIIa - Summary of Positive Responses

<u>Installation</u>	<u>Type Site</u>	Precise <u>Location</u>	<u>Sign(s)</u>	<u>Fenced</u>	Master Plan (Tab-C)	Brief <u>Recommendation</u>
Altus AFB	5-gallon Cans	Yes	Yes	Yes	Yes	Disinter
Andrews AFB	Concrete Containers	No	No	Yes	Yes	Disinter
Barksdale AFB	AEC Facility	Yes	Yes	Yes	Yes	Maintain
Bergstrom AFB	3 Iron Pipes	Yes	No	No	Yes	Disinter
Carswell AFB	3 Iron Pipes	Yes	No	Yes	No	Disinter
Colunbus AFB	Slit Trench	No	No	No	Yes	Post sign
Craig AFB	Concrete Pipe	Yes	No	Yes	Yes	Disinter
Davis-Monthan AFB	4 Cast Iron Pipes	Yes	No	Yes	Yes	Disinter
Eglin AFB	6 Sites	No	No	No	Yes	None
Ellsworth AFB	AEC Facility	Yes	?	Yes	Yes	Maintain
Elmendorf AFB	55-gallon Drums	Yes	Yes	Yes	Yes	Disinter
England AFB	Unspecified	No	Yes	Yes	No	Maintain
Fairchild AFB	AEC Facility	?	No	Yes	Yes	Maintain; post signs.
George AFB	Unspecified	No	Yes	No	Yes	Maintain
Hamilton AFB	Steel Pipe	No	No	No	Yes	Disinter
Holloman AFB	Unspecified	Yes	No	Yes	Yes	Maintain

TABLE IIIb - Summary of Positive Responses

<u>Installation</u>	<u>Type Site</u>	<u>Precise Location</u>	<u>Sign(s)</u>	<u>Fenced</u>	<u>Master Plan (Tab-C)</u>	<u>Brief Recommendation</u>
Johnston Atoll AFB	Unspecified	No	No	No	No	Radiological survey
Keesler AFB	Land Fill	No	No	No	No	None
Kelly AFB	Concrete Pipes	Yes	Yes	No	Yes	Maintain
Kincheloe AFB	55-gallon Drums	Yes	Yes	Yes	Yes	Disinter
Kirtland AFB	Varied	No	No	No	No	To be decided
Lackland AFB	AEC Facility	Yes	Yes	Some	Yes	Maintain
Laredo AFB	Unspecified	Yes	No	No	No	Annotate Tab C-1; erect sign
Loring AFB	AEC Facility	Yes	?	Yes	Yes	Maintain
Lowry AFB	Unspecified	No	No	No	No	None
Luke AFB	Unspecified	No	No	No	Yes	Post sign; maintain.
McCoy AFB	Unspecified	No	No	No	Yes	To be decided
McGuire AFB	Unspecified	Yes	No	Yes	No	To be decided
Moody AFB	Unspecified	No	No	No	No	Annotate Master Plan
Mountain Home AFB	Cast Iron Pipe	Yes	No	No	Yes	Disinter
Nellis AFB	AEC Facility	No	Yes	Yes	Yes	Maintain

TABLE IIIc - Summary of Positive Responses

<u>Installation</u>	<u>Type Site</u>	<u>Precise Location</u>	<u>Sign(s)</u>	<u>Fenced</u>	<u>Master Plan (Tab-C)</u>	<u>Brief Recommendation</u>
Patrick AFB	Land Fill	No	No	No	No	Annotate Master Plan
Perrin AFB	5-gallon Pail	No	No	No	Yes	Disinter, if possible
Randolph AFB	Unspecified	Yes	Yes	Yes	?	Maintain; future removal
Richards-Gebaur AFB	Cast Iron Pipe	Yes	?	?	Yes	Disinter
Robins AFB	Concrete Vault	Yes	Yes	Yes	Yes	Maintain; eventual removal
Scott AFB	Well	Yes	No	Yes	Yes	Disinter
Sheppard AFB	Unspecified	No	Yes	Yes	Yes	Maintain
Sundance AFS	Unspecified	Yes	Yes	Yes	Yes	Continued surveillance
Tinker AFB	Varied	No	No	No	No	Selected disinterment
Travis AFB	AEC Facility	Yes	No	Yes	No	Maintain; annotate Tab C-1; signs.
Vandenberg AFB	Open Pit	No	No	No	Yes	None
Westover AFB	AEC Facility	Yes	No	Yes	Yes	Erect signs; maintain
Whiteman AFB	Unspecified	No	Yes	Yes	Yes	Maintain
Williams AFB	Unspecified	Yes	Yes	Yes	Yes	Disinter
Wright-Patterson AFB	Well	Yes	Yes	Yes	Yes	Disinter

a. Disposition of Solid Wastes.

Solid radioactive wastes may be disposed of by burial in the ground or at sea. In addition, certain items which contain radium such as luminous instrument dials, may be returned to a radium refining company such as the Canadian Uranium and Radium Corporation or the U. S. Radium Corporation; however, if the amounts of such dials do not justify disposition in this manner, they will be disposed of as indicated in the following paragraphs. Waste must be packaged to comply with the regulations of port authorities concerned when moved by water transportation. Personnel transporting waste materials on land and disposing of them at sea must be instructed as to the proper protective measures.

(1) Burial in the Ground.

Burial sites will be located in isolated areas of the installation and in a location identified on appropriate maps. Selection of such sites should be based upon composition of soil, absence of ground water, and the unlikelihood of erosion exposing the buried material. Locations such as limestone, or field stone, should be avoided with preference to soil in which there is little or no leaching. Burial sites will be fenced in and locked to prevent the entry of unauthorized personnel and will be posted with AFTO Form 9 Placards. In addition, the site will be periodically remonitored to keep the radiation warning placards up-to-date. Burial in the ground may be accomplished under the following general principles:

- (a) Miscellaneous small radioactive materials, such as electronic tubes, instrument dials, small test objects, and contaminated parts of equipment should be placed in salvage instrument containers, Air Force Stock No. 6700-2103431, or a similar item. AFTO Form 9A, Radiation Warning Tag, will be accomplished and placed inside the container and the container sealed. A satisfactory means of disposal of the container is in a disposal well. Such wells should be approximately 24 inches total diameter with 6-inch concrete walls and a 1-foot concrete plug at the bottom. The wells should be approximately 12 feet deep. The containers are dropped in the well and when they reach a level of 5 feet from the surface, concrete is placed around and on top of them. Large items should be sealed in 55-gallon drums, which should be similarly identified with AFTO Form 9A, encased in a block of concrete, and buried to a depth of not less than 5 feet.

(b) Large bulky items of medium to low activity should be stored until the activity decays to a point where the material may be consolidated by melting down. In some cases, large items of high activity may be melted and diluted with stable chemical of the same element in the manner as liquid wastes. Such procedures will be accomplished under close technical supervision of the Medical Service and Air Installations.

(2) Burial at Sea.

Burial of radioactive wastes at sea has been authorized. Burial in inland lakes is prohibited. Disposition of considerable quantities of radioactive wastes must be limited to areas located beyond the continental shelf and at depths of approximately 1000 fathoms, or in areas established by the U. S. Navy for the dumping of explosives and other hazardous materials. Proximity to areas commonly used for fishing or for submarine cable shall be avoided. Two currently approved Navy disposal sites are: for East Coast Areas -- $72^{\circ} 43'$ west longitude; $38^{\circ} 52'$ north latitude and for West Coast Areas -- $123^{\circ} 6'$ west longitude; $37^{\circ} 40'$ north latitude. Containers must have sufficient weight and density in order to sink; a specific gravity of 1.4 (87 lb per cubic foot or greater) is required. Each container must be weighed and calculations made to insure that it will sink.

PART 20 - STANDARDS FOR PROTECTION AGAINST RADIATION

of the environment, including topographical, geological, meteorological, and hydrological characteristics; usage of ground and surface waters in the general area; the nature and location of other potentially affected facilities; and procedures to be observed to minimize the risk of unexpected or hazardous exposures.

(r) The Commission will not approve any application for a license to receive licensed material from other persons for disposal on land not owned by the Federal government or by a State government.

§ 20.303 Disposal by release into sanitary sewerage systems.

No licensee shall discharge licensed material into a sanitary sewerage system unless:

- It is readily soluble or dispersible in water; and
- The quantity of any licensed or other radioactive material released into the system by the licensee in any one day does not exceed the larger of subparagraphs (1) or (2) of this paragraph:
 - The quantity which, if diluted by the average daily quantity of sewage released into the sewer by the licensee, will result in an average concentration equal to the limits specified in Appendix B, Table I, Column 2 of this part; or
 - Ten times the quantity of such material specified in Appendix C of this part; and

(c) The quantity of any licensed or other radioactive material released in any one month, if diluted by the average monthly quantity of water released by the licensee, will not result in an average concentration exceeding the limits specified in Appendix B, Table I, Column 2 of this part; and

(d) The gross quantity of licensed and other radioactive material released into the sewerage system by the licensee does not exceed one curie per year.

Excreta from individuals undergoing medical diagnosis or therapy with radioactive material shall be exempt from any limitations contained in this section.

§ 20.304 Disposal by burial in soil.

No licensee shall dispose of licensed material by burial in soil unless:

- The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed, at the time of burial, 1,000 times the amount specified in Appendix C of this part; and

(b) Burial is at a minimum depth of four feet; and

(c) Successive burials are separated by distances of at least six feet and not more than 12 burials are made in any year.

§ 20.305 Treatment or disposal by incineration.

No licensee shall treat or dispose of licensed material by incineration except as specifically approved by the Commission pursuant to §§ 20.106(b) and 20.302.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20334



REPLY TO
ATTN OF:

SGPAAP

SUBJECT:

Radioactive Waste Disposal (HQ USAF SCN 71-28)

19 FEB 1971

TO: AAC AFSC AFRES HQ COMD USAF TAC USAFSS
ADC ATC CINCPACAF MAC USAFA AFCS
AFLC AU CINCUSAFE SAC USAFSO

(Civil Engineer and Surgeon)

1. The disposition of solid radioactive waste is strictly controlled in accordance with Technical Order 00-110N-2, "Radioactive Waste Disposal". The Technical Order provides for the San Antonio Air Material Area to act as the coordinating agency between field activities and Air Force disposal contractors in all matters relating to radioactive waste disposal. Land burial is not authorized without specific approval of the USAF Radioisotope Committee, AFLC.
2. For a number of years, land burial was authorized and Technical Order 00-110A-1, 25 May 1956, specified procedures to be followed including identification of the location on appropriate maps and fencing to prevent the entry of unauthorized personnel (Atch 1). Land burial was prohibited in subsequent editions of the Technical Order, but procedures to be followed for maintaining burial sites already in existence were not specified.
3. In keeping with a continuing responsibility of radiological safety, it is imperative that the location of existing sites be identified in the Base Master Plan (Tab C-1) and that a copy of this annotated Tab be provided to the USAF Radioisotope Committee (AFLC/SGPR, Wright-Patterson AFB, Ohio 45433). All available details concerning the construction of the disposal well, waste container, depth of burial, contents or other applicable data should accompany the Tab C submission. Tab A should be revised to include this historical data.
4. Because it is possible that the only records of a disposal site will exist in the memory of various personnel, it is requested that knowledge of a disposal site on any Air Force base be included in the submitted data. Approximate location and material disposed should be included, if known.

Appendix C

Underwrite Your Country's Might - Buy U.S. Savings Bonds

5. Replies should be forwarded to reach the USAF Radioisotope Committee no later than 90 days from the date of this letter. Negative replies are required.

6. Subsequent to receipt of the requested information, the USAF Radioisotope Committee will provide instructions concerning the maintenance of the burial sites.

FOR THE CHIEF OF STAFF



BENJAMIN R. BAKER, COLONEL, USAF, MC
Dep Director for Medical & Aerospace Medicine
Directorate of Professional Services
Office of the Surgeon General

1 Atch

Extract to: 00-110A-1, 25 May 56

Cy to: AF/CIO
AF/MAUL
NO/PR
AF/AFEM
AF/AFEX
AF/AGDIM
AF/AGDIR
AF/ASDC
AF/AC

Health Physics Precautions for Disinterment Operations

The precise manner of unearthing and removing buried radioactive wastes depends in great part on the nature of the site, type of burial container, and the costs of several alternative procedures. The following precautions are general in nature; they may not be pertinent to all operations. Their application will not significantly affect the cost of the removal operation, but they will minimize the risk of radiation exposure.

Health Physics Precautions:

1. The disinterment operation should be observed by a Health Physicist or Bioenvironmental Engineer, to monitor for the existence of either external or internal hazards.
2. During removal operations, care should be taken to observe if the burial container is intact. A broken container raises the possibility of contamination of both soil and workers, and thus requires more stringent handling procedures.
3. If container is intact and very large, suggest it be opened so that the contents may be repackaged in suitable shipping containers. Workers using cutting tools during opening procedures should wear filter face masks.
4. If container is leaking or broken, samples of the surrounding soil should be collected and shipped for analysis to the USAF Radiological Health Laboratory. Appropriate identification should accompany each sample so forwarded. Be sure to send a control sample of similar, but uncontaminated soil from a nearby area.
5. Soil immediately surrounding a broken or leaking container should be placed in an interim storage container, pending evaluation of sample. If truly contaminated, this soil must also be disposed of as radioactive waste.
6. Upon completion of removal operation, annotate base master plan to record positive removal of any radioactive waste.

List of Inactive Installations

1. Amarillo AFB, Texas
2. Bakalar AFB, Indiana
3. Biggs AFB, Texas
4. Brookley AFB, Alabama
5. Clinton County AFB, Ohio
6. Clinton-Sherman AFB, Oklahoma
7. Dobbins AFB, Georgia
8. Dow AFB, Maine
9. Ellington AFB, Texas
10. Glasgow AFB, Montana
11. James Connally AFB, Texas
12. Larson AFB, Washington
13. Lincoln AFB, Nebraska
14. Olmsted AFB, Pennsylvania
15. Paine AFB, Washington
16. Schilling AFB, Kansas
17. Seward AFB, Tennessee
18. Stead AFB, Nevada
19. Stewart AFB, New York
20. Suffolk County AFB, New York
21. Truax Field, Wisconsin
22. Turner AFB, Georgia
23. Walker AFB, New Mexico
24. Wendover AFB, Utah

Former AEC Facilities

<u>Currently</u>	<u>Formerly</u>
Barksdale AFB	Bossier Base
Ellsworth AFB	Rushmore AFS
Fairchild AFB	Deep Creek AFS
Kirtland AFB	Manzano Base
Lackland AFB	Medina Base
Loring AFB	Caribou AFS
Nellis AFB	Lake Mead Base
Travis AFB	Fairchild AFS
Westover AFB	Stoney Brook AFS

W-48-100
WP-53 Rev. 5

Radiation Survey of KAFB/DOE Controlled Areas,
Kirtland Air Force Base, Albuquerque, NM

Douglas M. Minnema
Reactor Applications Division, 6451
and
George E. Tucker
Health Physics Division, 3212
Issued August 18, 1989

4-1272

INTRODUCTION

Sandia National Labs (SNL) has performed a number of outdoor tests on weapons components and systems over the past forty years. Some of these tests involved the inclusion of radioactive material, primarily natural or depleted uranium. Increased concern over environmental issues, coupled with decreased acceptable limits, has resulted in reevaluating the test areas for potential low level contamination. As a result of this concern, SNL has performed a radiation survey of selected sites on Department of Energy (DOE), Forest Service, and Air Force areas on Kirtland Air Force Base (KAFB), Albuquerque, New Mexico. The sites studied were selected based upon input from three sources: KAFB site maps, the results of an EG&G helicopter survey of April, 1980, and interviews of selected SNL staff. The KAFB maps indicated several sites that were identified by an inspection performed by the Defense Nuclear Agency and a private firm contracted by the U.S. Air Force (ref. 1 & 2). These sites consisted of dirt mounds, test sites, and old mine diggings. The helicopter survey identified areas of above background radiation levels in the area. The interviews helped identify other sites that were known locations of past tests.

INSTRUMENTATION

The surveys were performed using SNL's mobile radiation measurement lab, consisting of a computerized multichannel analyzer, a portable intrinsic germanium gamma spectrometer, and various other portable instruments, housed in a trailer. The gamma spectrometer could be operated at distances up to 300 meters from the trailer, allowing the radiation spectra at each site to be measured directly. Also, soil and debris samples could be analyzed with the spectrometer mounted within a lead shield in the trailer. For the more inaccessible sites, a portable multichannel analyzer and battery pack were used with the spectrometer to acquire the spectra.

Each site was studied according to its particular situation. Horizontal mine shafts were entered and inspected visually and with a portable high sensitivity radiation meter, and spectra were acquired at any locations within the shaft above local background. The spectrometer was lowered into vertical shafts, or a sodium-iodide (NaI) detector was used, depending upon the condition of the shaft. Dirt mounds were surveyed at several locations around and on the top. Surface areas were evaluated by mounting the spectrometer on a tripod and analyzing spectra at several locations within the identified area. If the area surveys showed above background readings or isotopes not normally associated with background, grab samples of soil and debris were also collected and analyzed as appropriate.

The germanium spectrometer is very sensitive for most of the uses described here. Surface contamination can be detected down to levels of approximately 0.2 picoCuries per gram (pCi/g) of soil, and individual contributors of a radiation field can be identified at levels of roughly 5% of the total field. The spectrometer's resolution is sufficient to identify individual peaks that are less than 0.2% apart in gamma energies. This sensitivity is extremely good for looking at surface contamination and sources that may have been disposed of in mines. The technique is more limited in looking for buried sources due to attenuation of the radiation in the soil cover. A stronger radiation source would be required to penetrate greater than roughly 1 meter of cover soil with sufficient intensity to be detected by the spectrometer, raising the minimum detectable level to the equivalent of a few microCuries per gram for buried sources. This presented a problem for only one site consisting of 3 covered trenches of unknown depth, since all other sites had minimal or no cover. As an example of the spectrometer's sensitivity and accuracy, Cesium-137 from atmospheric weapons testing fallout was observed in almost all of the surface spectra at levels averaging roughly 0.3 to 0.5 pCi/g, agreeing well with the average found from SNL's environmental monitoring program of 0.388 pCi/g (ref. 5).

IDENTIFICATION OF SITES

The KAFB map "Radioactive Contaminated Sites, Kirtland Air Force Base", tab #C1.1a (ref. 3), identified a total of 6 dirt mounds (DM-1 through 6) and 6 mine shafts (MS-A through F) that the USAF contractor's inspection had found to be either unposted, or posted with various warning signs with no documented explanation for the purpose or contents of the location. During our investigations of these sites, 4 additional shafts (MS-G through J) were found and included in the study, and two shafts were identified at sites MS-B through D, rather than the single shafts indicated on map C1.1a, and all were included in the study. Also, the site identified as dirt mound DM-3 on map C1.1a was actually a group of 3 old burn pits. I'll check this out. *x*

The EG&G helicopter survey of April, 1981 (ref. 4), was consulted as another possible source for locating sites. One site in particular, listed as 'Area 5' in their survey (not to be confused with SNL Tech Area V) was identified as having higher than normal levels of uranium daughter products. This area is directly south of the southern boundary of Manzano Base. Investigations indicated that there were no known tests conducted in this area, so this site was also included in the survey.

Interviews with SNL personnel helped to identify another site of possible contamination, the "Pendulum Site" located directly east of Manzano Base. At this site weapon penetration tests had been conducted in a protected bunker until a test device exploded, destroying the bunker and potentially spreading depleted uranium into the surrounding area. Although this site was cleaned at the time, it was included in this survey. Some other sites were suggested as having potential for contamination, however these sites are currently in use and are monitored by the Health Physics division, and so were not included in this survey. Not KAFB SW/MU.

RESULTS OF THE SURVEY

The results of the survey can be divided into groups based upon the type of site studied. None of the 11 mines surveyed showed any signs of having been used for radioactive waste disposal. The radiation spectra showed nothing more than variations in background levels due to the types of rocks found at each location. Visual inspection of the horizontal shafts suggest that these mines were mainly exploratory shafts from prospectors working the area, however a few show signs of commercial production before they were abandoned. The vertical shafts show similar indications that they were also developed by prospectors, although these were not entered for visual inspection due to hazardous conditions. Only one shaft requires special mention, the one labeled as MS-B on map C1.1a. There has been some recent activity at this mine of unknown intent. For unknown reasons the entrance was posted with a radiation warning sign. This study, however, indicated that the sign is unwarranted and should be removed. It should be noted that all of these mines are in poor repair, and represent conventional safety hazards that should be appropriately fenced and posted to prevent an accident. The shafts are easily accessible and some are hidden from view by underbrush, enhancing the possibility of somebody stumbling into them unknowingly.

The KAFB maps also identified 6 dirt mounds that were listed as 'possible burial sites'. As mentioned, one of these sites turned out to be an old burn test site with 3 pits, labeled DM-3 on map C1.1a. One of these pits was locally contaminated with ceramic thorium thermocouple insulation debris from a burn test. This debris was confined to within one pit, and SNL Health Physics has cleaned up this site and disposed of the debris. Survey and grab samples of the surrounding area and the

How? ↗

other pits show no other contamination present. Two other mounds in the same general area, labeled as DM-1 and DM-2, were also surveyed. Radiation spectra at these mounds show nothing unusual, and the dirt mounds are not high enough to significantly shield any sources. These sites are fenced with two sets of signs posted. The older, faded signs label the area as an explosive test area, and the newer signs label the area as a radiation area. These sites are most likely disposal sites for old explosive ordnance removed from the area, and are believed to be clean of radioactive contamination. The remaining 3 sites, DM-4, 5, and 6, are located in the Lawrence Canyon area. These sites are actually located roughly 600 meters east of their recorded positions on the base maps. These mounds line up directly with the old 155mm gun site north of their location, and were used as targets when that facility was in operation. Radiation spectra show nothing unusual at these mounds, and they are believed to be clean also. How about old roundels?

The 'area 5' location reported in the EG&G helicopter survey was also investigated. The site was found to be a natural lava mound formed by an uprising of a brown lava rock. Apparently as the brown rock cooled it fractured, and a darker metallic lava was pushed up through the fissures and cooled in place. Radiation levels in the area were found to be roughly twice the normal background. Since no man-made source could be found, the rocks were analyzed, and the metallic rock was found to contain natural uranium at levels roughly four times the concentrations in the brown lava. This is a completely natural occurrence and not caused by any practices of KAFB or SNL personnel, therefore cleanup of the site would be both impractical and unnecessary. There may well be other similar occurrences in the area, although none were positively identified. The presence of natural uranium deposits probably explains why the helicopter survey indicated slightly higher background levels in and around the mountainous areas than those observed on the mesa.

The next site surveyed was the Pendulum Site. Several years ago penetration tests were performed inside an earth covered bunker built into the side of a small hill using devices with depleted uranium loadings. The last test resulted in an explosion that blew the roof off the bunker and destroyed the facility. This area was studied for possible uranium contamination with a series of soil samples. Out of 8 samples, only one showed any signs of contamination, and only at a level of 60 pCi/g, compared to the natural uranium average background concentration of 0.9 pCi/g reported in the SNL environmental monitoring program (ref. 5). The contaminated area was a small pile of vermiculite, and was cleaned up easily. This site is now believed to be clean of contamination.

One other site was also found through the interviews, a series of 3 filled trenches east of Pennsylvania Road across from the NATO Evaluation Site, near a small arroyo. This site is on Air Force land, and is vaguely posted as a radiation area, although the signs are roughly 60 meters away from the trenches. (It is not clear whether the never heard of this one. Not being sure that is one of SNL's. It is on KAFB land.)

signs are intended for the trenches or for a USAF training area further to the east of the site, known to be contaminated with thorium ore.) The trenches are marked with two wooden stakes, apparently indicating the trench ends, and with a yellow metal post in roughly the center of the trenches (this posting corresponds with a 'dated' method for identifying radioactive waste burial areas). There are no other markings or signs, and inquiries to the Air Force have yielded no information. Radiation spectra acquired above the trenches indicate nothing above background; however, the depth of the trenches could severely limit the detection capabilities of the spectrometer due to the amount of cover soil. The trenches are on KAFB property, and the military has been notified of their condition. As a minimum precaution the trenches should be better identified.

CONCLUSIONS

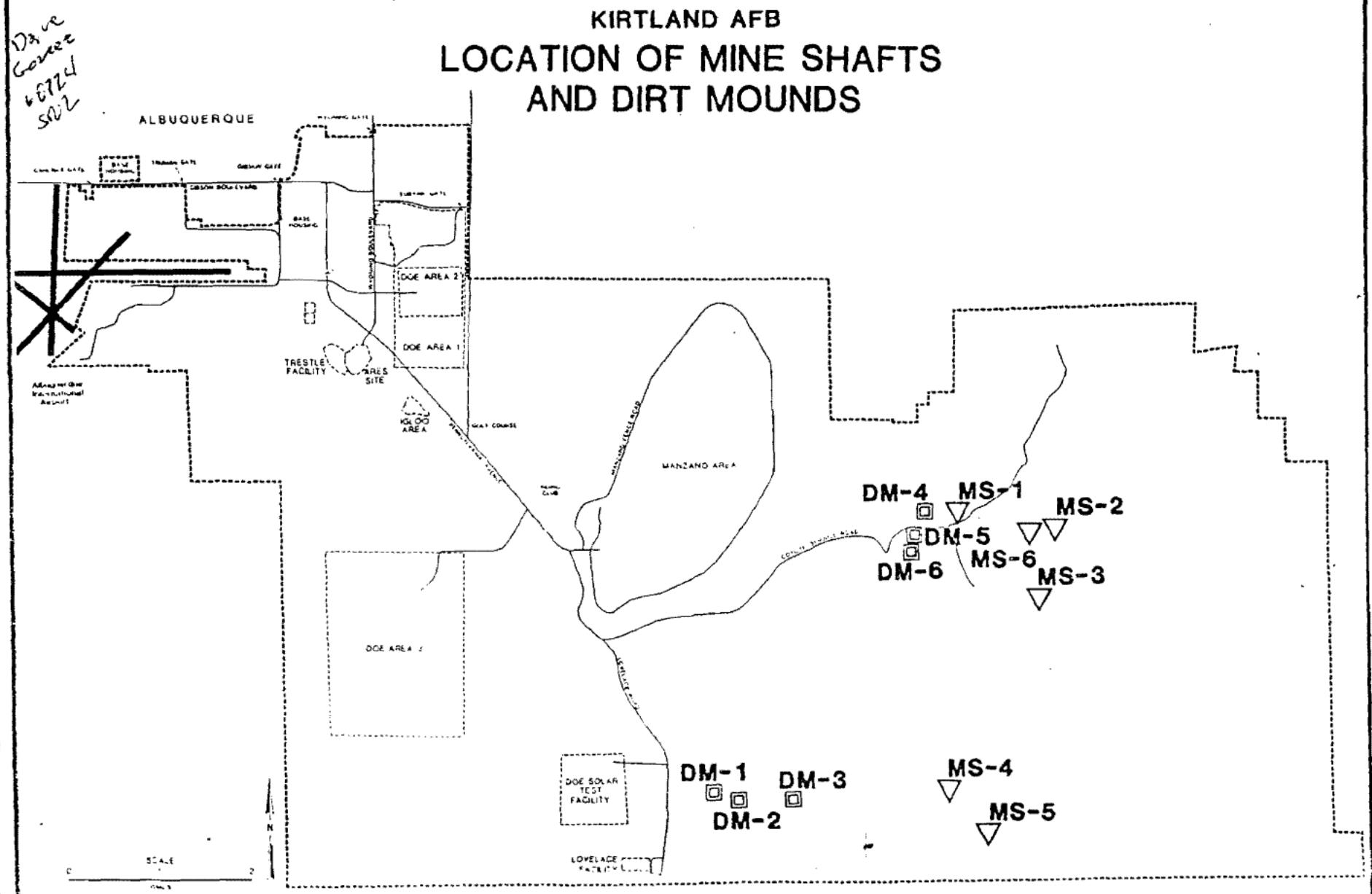
With the exception of the trenches across from the NATO Site, and the two sites that have since been cleaned up, nothing unusual was found at any of the sites. These sites should be considered clean of any radioactive contamination and removed from the maps, including the old burn site and the Pendulum site, since they have been cleaned up as required. All radiation signs should be removed to avoid confusion, and the two mounds believed to be explosives disposals should be either cleaned up or reposted as such. It is further recommended that the mine shafts be sealed off and labeled to reduce the hazardous conditions that exist at these sites.

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 2. "Installation Restoration Program, Phase I Records Search, Hazardous Materials Disposal Sites, KAFB", performed by Engineering-Science, 57 Executive Park South, NE, Suite 590, Atlanta, GA, 30329 (Draft report only).
 3. "Radioactive Contaminated Sites, Kirtland Air Force Base", a base map, tab # Cl.1a, revised to 9/30/82.
 4. "An Aerial Radiological Survey of the United States Department of Energy's Sandia National Laboratories and Inhalation Toxicology Research Institute, Albuquerque, New Mexico", P. K. Boyns, project scientist; date of survey, April, 1981; The Remote Sensing Laboratory operated for the U.S. DOE by EG&G Energy Measurements Group.
 5. "1982 Environmental Monitoring Report, Sandia National Laboratories, Albuquerque, New Mexico", Gloria Chavez Millard, Charles E. Gray, Theodore N. Simmons, Bill L. O'Neal. SAND83-0789, printed April 1983.

AFB Library

KIRTLAND AFB
LOCATION OF MINE SHAFTS
AND DIRT MOUNDS



memorandum

DATE: JUL 26 1989

REPLY TO

ATTN OF: MSD:ESHB:BHY

SUBJECT: Radiological Survey Reports on the Frustration and No-Name Abandoned Mine Sites.

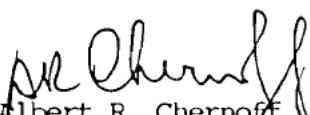
TO: P. M. Stanford, Controller, 0100, SNLA

It is the Department of Energy's (DOE) understanding that Sandia National Laboratories (SNL) completed radiological surveys of the above areas around two-years ago. The old mine sites were used as SNL experimental stations. It is also our understanding that reports were written on the results of the surveys and the areas are clean of radioactive materials and contamination. Due to proposed land use changes in that area, it is paramount that the mine areas be officially cleared, since both sites are still posted with radioactive area signs.

We need copies of the previous radiological reports. DOE conducted a new survey on the sites due to changing survey requirements, but having previous reports will substantiate any new information.

Please contact Bennett H. Young of my staff at 846-8211, regarding the status of these much needed radiological reports by August 1, 1989.

Sincerely,


Albert R. Chernoff
Director, Management
Support Division

CC:

G. Tucker, 3312, SNLA
J. Phelan, 3314, SNLE,
H. Davidson, 1606 ABW/DEEU
B. Dow, 1606 ABW/DEEU
B. Young, MSD
P. Boehme, MSD

Memo for Record

7 October 1980

Subject: Radiological Survey of Possible Radioactive Burial Sites

1. I conducted a radiological survey of the possible radioactive burial sites on 2 Oct 80 with TSgt Jones and A1C O'Toole.
2. Areas marked DM-1 and DM-2 were fenced off and radiation caution signs were posted. Two of the signs were badly weather-beaten and need to be replaced. Also, sections of the fence need repair. Radiation levels were equal to or less than background.
3. Area marked DM-3 was fenced with radiation caution signs. Explosive testing signs were also posted. These signs should be removed. Also, the fence is in need of repair. Radiation levels were equal to or less than background.
4. Four mine shafts were also surveyed, MS-A, MS-B, MS-D and MS-E. Of these four only MS-B had a radiation caution sign posted at the entrance to the mine. Radiation levels were no higher than background with the Fidler detector.
Reference report RSS 80-180.

DAVID HUNTER, Captain, USAF, BSC
Chief, Radiological Health/RPO

DEPARTMENT OF THE AIR FORCE
USAF DISPENSARY, KIRTLAND (AFSC)
KIRTLAND AFB, NEW MEXICO 87117

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AFSWC (SGPR)

27 April 1972

Radioactive Waste/Contamination Survey Report

AFSC (SG/Maj Caldwell)
AFLC (SGPR/Maj Furtado)
AFSWC (SG/RadSafe Committee)

FCDNA (FCCOM)
AFSWC (CC)

AFSWC (SE)
4900TH ABGp (CC)

Attached is the final report of the radioactive waste/contamination survey of the former Sandia Base range areas.

Marshall Silberman

for T. A. SILBERMAN, Lt Col, USAF, MC
Director of Base Medical Services

1 Atch
as

DEPARTMENT OF THE AIR FORCE
USAF DISPENSARY, KIRTLAND (AFSC)
KIRTLAND AFB, NEW MEXICO 87117

AFSWC (SGPR)

27 April 1972

Radioactive Waste/Contamination Survey Report

AFSC (SG/Maj Caldwell)
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PCDNA (FCCOM)
AFSWC (CC)

AFSWC (SE)
4900TH ABGp (CC)

Attached is the final report of the radioactive waste/contamination survey of the former Sandia Base range areas.

SIGNED

I. A. SILBERMAN, Lt Col, USAF, MC
Director of Base Medical Services 1 Atch
 as

SURVEY REPORT

I GENERAL:

In early 1971, a survey of radioactive waste disposal sites and contaminated areas located on what was then Sandia Base was initiated by Field Command, DASA. The report of this survey was published on 16 Aug 1971, and addressed all known disposal sites and radioactive areas on the base. During the conduct of this survey, some personnel contacted intimated that additional areas of the base might be either contaminated or contain radioactive waste and be unmarked and undocumented. As a result, the survey report recommended the survey be continued to determine the extent of radioactive waste/contamination on the base and that this further study be conducted under the direction of the Director of Base Medical Services. In response to this recommendation, a survey of suspected areas was initiated in the fall of 1971, by the Radiological Health Section, USAF Dispensary, KAFB. During the conduct of the survey, additional assistance and support was provided by Det 3, 42d Aerospace Rescue and Recovery Sqdn (MAC); AFWL Nuclear Safety Div, Nuclear Power Systems Br.; and the Nuclear Operations and Training Division, Nuclear Weapons School, FCDNA.

II AREAS OF STUDY & METHODOLOGY:

Since the suspected areas were not documented as to waste disposal or contamination, a physical survey was necessary. The areas which were suspected to contain radioactive material were several abandoned mines and the general area formerly used for tests involving devices or components containing radioactive material. Specific areas were determined by conversation with AEC and Sandia Laboratories personnel in addition to the personnel who conducted the earlier study. From these conversations, mines located at CJ 690741, 691741, and 693685 were surveyed using fidler probes and an E500 beta-gamma meter. The fidler probe was set to locate the Pu decay series. The former test area located between CJ 640680, 640705, 663680, and 662705 and the Lurance Canyon and Arroyo del Coyote areas generally from CJ 660742 to 700741 were checked using these same instruments for the area survey, the initial surveys were made from an HH 43F at an altitude of approximately 20 to 50 ft

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and a speed of about 60 knots. Following the aerial survey, locations which showed levels of 1½-2 times background were marked for ground survey. Ground surveys were then made first from a vehicle and then on foot if levels of 1½-2 times background were observed.

A. Area Survey:

Prior to flights being made over suspected or known areas of activity, a determination of background was made by flying over a known clean area. A background value of 8-10,000 cpm was obtained. Initial survey flights were then made over one of the thorium sludge seeded training areas and over the Co 60 source to determine the capability of the fidler and beta-gamma probes to detect radioactive material from an aerial platform. Both instruments responded significantly while in the vicinity of these sources. Following this, the flight into the Arroyo del Coyote area was made. On this flight, increases to approximately 1½ times background were noted in the vicinity of the abandoned ranch house at CJ 689741. A ground survey followed which resulted in a value of approximately 25,000 cpm being obtained at the top of a dirt mound located near the ranch house. The area in general, including two more mounds in the vicinity, showed no significant increase over background. Subsequent flights were made over the large area east and south of the airfield at CJ 640710 using legs approximately 100 yards apart. Several locations of increased activity were noted and marked for ground survey. None of the locations checked on the ground in this area showed significant activity. Some increase in levels were noted in the vicinity of dry stream beds located in the area. This is felt to be a sign of leaching of natural radioactive material. A check was also made of the mounds in the vicinity of the road junction at CJ 636694 and one of these mounds showed a reading of approximately 25,000 cpm.

B. Mine Survey:

The mines noted above were checked by personnel entering them with the fidler and beta-gamma probes. In each case, the fidler indicated levels of approximately 20,000-25,000 cpm.

III RESULTS AND CONCLUSIONS:

As noted above, with only a couple of exceptions, no readings were observed which were significantly above background. In the case of the two mounds and the four mines, the readings, although generally two to three times background, are not sufficiently high to pose a health problem. Since no records indicate what might be covered by the mounds, no indication can be obtained as to levels that might occur if the mounds were excavated. Based on the absence of any major indications of radioactivity, it is felt that the former test areas do not contain hazardous amounts of radioactive material.

IV RECOMMENDATIONS:

The following actions are recommended to eliminate the possible exposure of personnel to even the relatively low levels of radiation observed:

- A. Fence and post the mounds to eliminate their possible excavation and thus the possibility of exposure to unknown levels of radiation.
- B. Close the four mines by filling in the vertical shafts and dropping the entrance to the horizontal shafts by the use of explosives.

June 18 '83
Don

SGPBR (844-0598)

15 July 1983

Mr. Don Silva
Science Applications, Inc.
505 Marquette Ave., NW
Albuquerque, NM 87102

Dear Mr. Silva:

We surveyed the core samples removed from radioactive burial site No. 11 on 6 Jun 83. The instrument we used was a Ludlum Model 19 Micro R Meter, Serial No. 21540, calibrated 2 Feb 83. The Ludlum Micro R instrument detects low energy X and gamma radiation. Normal background readings are 20 μ R/hr or .02 mR/hr.

We took readings from the core samples at depths of 5, 10, 15, 25, 30, 40, and 50 feet. We monitored the samples below 50 feet as one unit. The readings at all depths did not exceed the normal background reading.

If you have any questions regarding this survey, please call us at 844-0598.

Thank you,

P.L.

C. DAVID LOVELL, 2Lt, USAF, BSC
OIC, Radiological Health/RPO
USAF Hospital Kirtland

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SGPER (4-0697)

20 September 1982

Radioactive Waste Burial Sites

SGA (Maj Killanek)

1. Radiological Health personnel conducted a survey of the possible burial sites listed on CE reservation map dated 1 Jan 1976, Tab No. C1, 1a.
2. The suspected radioactive burial sites were:

DM-1	MS-C
DM-2	MS-D
DM-3	MS-E
MS-A	MS-F
MS-B	

From the nine sites that were examined, only DM 1-3 and MS-B were properly posted with the sign "Caution Radioactive Material." A FIDLER detection system was used to identify any gamma radiation levels above background, but yielded only negative results.

3. If you have any questions, please feel free to call me.

DAVID HUNTER, Capt, USAF, BSC
Chief, Radiological Health/RPO
USAF Hospital Kirtland

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OK
Frank

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SPECIAL WEAPONS CENTER (AFSC)
KIRTLAND AIR FORCE BASE, NEW MEXICO 87117

SGAR

9 AUG 1971

Survey of Radioactive Waste and Hazardous Areas

H. C. Donnelly, Manager
Albuquerque Operations Office
U.S. Atomic Energy Commission
P. O. Box 5400
Albuquerque, New Mexico 87115

1. References:

- a. Letter, FCJ3, Field Command, DASA, subject as above, dated 18 May 1971.
- b. Letter, AEC, ALOO, dated 19 May 1971 (response to reference 1.a. above).
2. By reference 1.a., Commander, Field Command, DASA requested cooperation in conducting a survey of radiological waste and hazardous areas at Sandia Base. As a result of the recent consolidation of bases, the responsibility for the former Sandia Base area has become that of this command.
3. The survey referred to in the referenced correspondence is to be continued and expanded. The Radiological Health Services Section of Base Medical Services is to be responsible for this action. Specifically, Major Edwin N. Dodd, Jr. will be the officer conducting the survey.
4. Based on the cooperation received from both AEC and AEC prime contractor personnel during the survey to date, it is requested this cooperation be extended to this command in order to facilitate a complete compilation of radioactive

waste and hazardous areas located on the Kirtland AFB complex.

signed

Colonel A. G. Swan
Commander
Air Force Special Weapons Center

-1-

DEPARTMENT OF THE AIR FORCE
USAF DISPENSARY, KIRTLAND (AFSC)
KIRTLAND AFB, NEW MEXICO 87117



REPLY TO
ATTN OF: SGAR

4 August 1971

SUBJECT: Survey of Radioactive Waste and Hazardous Areas

TO: AFSWC (CC)

1. A survey of documentation and other data available regarding radioactive waste and hazardous areas at the former Sandia Base was initiated in Jan 1971 by the Commander, Field Command, DASA. This survey has been completed.
2. A continuation of this survey to physically locate and monitor all radioactive waste and hazardous areas has been initiated. Purpose of this survey is to provide a complete compilation of all radioactively contaminated or hazardous areas on the Kirtland AFB complex.
3. Request the attached letter be signed and dispatched in order to obtain the necessary cooperation of AEC and AEC contractor facilities located on Kirtland AFB.

I. A. Silberman
I. A. SILBERMAN, Lt Col, USAF, MC
Director of Base Medical Services

1 Atch
a/s

FCSU

4 May 1971

MEMORANDUM FOR RECORD

SUBJECT: Radioactive Waste Disposal

1. On 29 - 30 Apr 71 this office was engaged in protracted discussions with Cpt. Jones, FCJ3 about radioactive waste disposal sites on Sandia Base. Cpt. Jones is compiling a listing of all such sites and attempting to determine the type and quantity of material buried. A major problem exists because of the lack of accurate records and the dispersal of any existing records throughout the Command.
2. This office will become actively engaged in the remainder of the study with emphasis placed on insuring that all contaminated areas are located. In addition, a study will be made to determine the amount of drift and contamination.

RMS
R.M.S.

157-0103-324
162-0103-325
163-0103-326
164-0103-327

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DEPARTMENT OF THE ARMY
AMENDMENT
OF PERMIT TO OTHER FEDERAL GOVERNMENT DEPARTMENT OR AGENCY
TO USE PROPERTY ON SANDIA BASE
NEW MEXICO

Amendment No. 1
CONTRACT NO. DA-29005-Eng-5251

WHEREAS, the Department of the Air Force was granted a permit on 18 February 1966, for a term of Five (5) years beginning 19 March 1966 and ending 18 March 1971, but revocable at will by the Secretary of the Army, to occupy and install certain facilities on an area of Sandia Base which is described as follows:

A portion of the East half (E½) of Section Sixteen (16), Township Nine (9) North, Range Four (4) East of the New Mexico Principal Meridian, Bernalillo County, State of New Mexico, containing 75 acres, more or less; and

WHEREAS, the Permittee has requested that the permit be amended to allow burial of radioactive waste materials generated at the Kirtland Ionization Radiation Annex; and

WHEREAS, it has been determined that such use is permissible, subject to the terms and conditions hereinafter provided for.

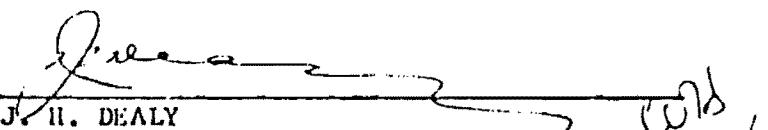
NOW, THEREFORE, the permit, bearing Contract No. DA-29005-Eng-5251, is amended by adding the following provisions:

1. The burial of radioactive waste materials within the area hereinabove described shall be permitted in accordance with the procedures contained in Exhibit "A" attached hereto.

2. The Permittee shall maintain accurate records which must contain adequate information of the dates, quantities and type of radioactive waste material buried, and such records shall be made available upon request to representatives of Headquarters, Army Materiel Command.

3. The original permit, as amended hereby, shall remain in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand by authority of
the Secretary of the Army this 31st day of October 1966.


J. H. DEALY
Acting Chief, Real Estate Division
Office of the District Engineer, C. of E. 14-1-66
Albuquerque, New Mexico

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DEPARTMENT OF THE AIR FORCE
AIR FORCE WEAPONS LABORATORY (AFSC)
KIRTLAND AIR FORCE BASE, NEW MEXICO 87117



REPLY TO
ATTN OF: WLAS

13 May 1966

SUBJECT: Permit 091-RLEG-68, Department of the Air Force, Sandia Base, New Mexico

TO: SWC

1. The permit for approximately 70 acres of Sandia Base property occupied by the Radiobiology Laboratory, Biophysics Branch, Air Force Weapons Laboratory, was recently renewed for the five-year period of 19 March 1966 to 19 March 1971. We wish to have this permit amended to allow for land burial of radioactive wastes.
2. Basically, land burial of radioactive wastes would be made in accordance with the provisions of Title 10, Code of Federal Regulations, Part 20 and the provisions of the lessee's license from the Atomic Energy Commission. Proposed procedures for radioactive waste disposal are shown in Attachment 1. These procedures are subject to final approval by the USAF Radioisotopes Committee and the USAEC. We intend to make them a part of the Air Force Special Weapons Center Byproduct Material License No. 30-3110-2. Approval of the responsible property custodian for such burials is needed prior to the approval by the aforementioned agencies.
3. At this time, we have an unofficial verbal agreement from the USAEC that the proposed procedures will be acceptable to them. In addition, Mr. David J. Hayes, Chief, Materials Section, DCSLOG, PEMA, Execution Division, DA, Washington, D.C. has been contacted on this matter and made aware of the proposed procedures. His approval may be required in accordance with Air 700-52, "Licensing and Control of Sources of Ionizing Radiation", 4 February 1966.
4. We request this matter receive the most expeditious handling. If there are any questions, please contact me or Captain Connolly at Extension 2810 or 3820.

Noah M. Shoppenn

NOAH M. SHOPPENN
Health Physicist
Radiation Protection Officer

1 Atch
a/s

Cys to: WLRB (Col Max M. Nold)
DCSLOG, PEMA, Execution Div (Mr. D. J. Hayes)
AFLC (MCD/Capt R. G. Conrad)

PROCEDURES FOR THE DISPOSAL OF RADIOACTIVE WASTES*

1. Past History:

The Radiobiology Laboratory, Biophysics Branch, Air Force Weapons Laboratory (AFWL), physically located on Sandia Base has maintained a radioactive waste disposal facility for the past several years. The procedures for disposal were established in previous amendments to the Air Force Special Weapons Center (AFSWC) Broad Byproducts License #30-3110-2; however, the proposals for waste disposal which follow will replace any existing procedures.

Since the initiation of waste disposal procedures on site at the Radiobiology laboratory (WLRB-2), four (4) waste disposal pits 9 feet deep by 2 feet wide and about 50 feet long have been utilized in full and covered with a minimum of 4 feet of earth. Two of the pits have been surfaced with asphalt while the other two have only a compacted earth cover. These four pits have been enclosed in an area fenced by barbed wire and signs posted on the fencing to indicate that radioactive waste materials have been buried within these boundaries. The WLRB-2 complex itself occupies approximately 70 acres and is enclosed by chainlinked fencing.

Since the institution of the waste pits and utilization of isotopes at WLRB-2, radioactive wastes in the form of animal carcasses, animal excreta, contaminated solid wastes, etc. have been placed in the pits. Most of the contaminated solid wastes were placed in steel drums prior to burial although some of these wastes were buried after having been sealed in only double plastic bags. Animal carcasses have been buried both by sealing in steel drums and by burial without any container. High-level wastes and most liquid wastes have been disposed of through appropriate Air Force channels.

In some instances, records regarding type and quantities of activity disposed of in these four pits are sketchy or not available. Based on this, the utilization records of all isotopes received by WLRB-2 since early 1959 have been checked and compared with the stock levels of isotopes now on hand. A comparison study was also made of all the existing waste disposal records, and where the waste disposal records did not indicate that an isotope had been disposed of through other channels, it has been assumed that the isotope eventually was disposed of in the pits in the form of animal carcasses, solid wastes, animal excreta, etc. Therefore, the probable maximum activity of these four pits, allowing for decay, is:

<u>ISOTOPE</u>	<u>PRESENT ACTIVITY (MICROCURIES) AS OF 31 AUG 64</u>	<u>ISOTOPE</u>	<u>PRESENT ACTIVITY (MICROCURIES) AS OF 31 AUG 64</u>
Au-198	Less than 1	Ra-226	1
BaLa-140	Less than 1	Ru-103	Less than 1

* Proposed Amendment No. 14 to AFSC Byproduct Material Lic #30-3110-2

Ca-45	25	Ru-106	249
Ge-111	Less than 1	Sr-85	Less than 1
GePr-144	4261	Sr-90	Less than 1
Co-57	Less than 1	Sr-90	2273
Cr-51	Less than 1	Y-90	Less than 1
Cs-137	3243	Y-91	6
Fe-59	437	Zn-65	378
Hg-203	31	ZrNb-95	10
T-131	Less than 1	MFP	Less than 1
Kr-85	66	Pu-239	Trace (From Animal Carcasses from Operation Roller-coaster)

2. Location of Waste Disposal Pits:

The present radioactive waste disposal pits are approximately 100 feet long by 6 feet wide by 20 feet deep. The waste pits are enclosed in a fenced area which has been appropriately marked with radiation warning signs. These pits will be covered with a minimum of 4 feet of compacted earth cover when they have been utilized in full and included in the area pending the old waste pits.

As of the end of 1965, one of these disposal pits, designated burial pit No. 5, contained approximately one-fourth of the allowable annual activity permitted under 10 CFR 20.304 exclusive of any activity in animal carcasses due to neutron activation.

The radioactive waste disposal pits are located approximately 250 yards to the southeast of the WLRB-2 buildings. About one mile up-gradient to the east is located Manzano Base. Approximately one mile southwest is located the Sandia Corporation reactor area. One mile to the northwest is located a small radio-receiving station. The beginning of the occupied area of the Sandia-Kirtland complex is about four miles to the north and northwest.

The major water supply to these facilities is obtained from the Sandia Base well located approximately four miles to the north and northwest. The Sandia Corporation reactor area receives their water supply from a well located within the reactor area. Manzano Base receives their water supply from the Sandia Base wells but maintains a reserve well located about one-half mile up-gradient to WLRB-2. The water table is about 490 feet below the surface. Details regarding the topography and geology, hydrology and meteorology of the site area are included in Exhibits 14-A-1, 14-A-2 and 14-A-3 to this section. The hydrological, meteorological, topographical and geological data pertaining to WLRB-2 has been extracted from previous amendments to the ANGUS Broad Byproducts license. This information was obtained from the Sandia Base "Master Plan - Analysis of Existing Facilities," dated 1 February 1960 and from the geological survey of the area performed by the Department of the Interior - "Geology and Hydrology with Respect to

"Contamination Hazard at Proposed Reactor Site, Albuquerque, New Mexico" by B. W. Maxwell, dated April 1957.

3. Classification of Radioactive Wastes:

Radioactive wastes generated at the Air Force Special Weapons Center and the Air Force Weapons Laboratory shall be classified as follows:

Liquid Wastes -

Shall include any radioactive waste in liquid form.

Solid Wastes -

Shall mean contaminated solid waste such as contaminated scrap metal, ion exchange resins, obsolete mechanical equipment, air filters, laboratory glassware, empty isotope containers, contaminated paper products, protective clothing, and other items routinely discarded from a laboratory facility. Certain biological wastes shall be included.

Biological Wastes -

Shall include animal carcasses, biological tissues, feces and dried blood. Biological fluids such as urine, mammary secretions and whole blood shall be treated as liquid wastes.

Low-level Wastes -

Shall consist of wastes which contain not more than 25 microcuries per unit volume of activity. A unit volume shall mean one (1) liter for liquid wastes and one (1) cubic foot for solid wastes.

High-level Wastes -

Shall consist of wastes which contain more than 25 microcuries per unit volume of activity. A unit volume shall mean one (1) liter for liquid wastes and one (1) cubic foot for solid wastes.

Each of the three basic types of radioactive wastes - liquid, solid and biological - may be sub-classified further into levels of half-life and activity. The disposal procedures outlined below for each classification of waste material shall apply to all units of AFSGC and AFLW. Furthermore, the organization generating radioactive waste will provide all containers (plastic bags, metal drums, bottles, etc.) and will accomplish the actual burial or transport of the waste under the supervision of Health Physics.

4. Liquid Wastes:

Each laboratory which generates radioactive liquid wastes will contain the wastes in glass or polyethylene bottles, preferably the latter. When glass bottles are used, they will not be larger than one (1) gallon in size and will be positioned in another container where all the contents of the bottle will be retained should the bottle be broken. Liquid waste containers will be provided with caps that will not leak or come loose when the container is turned on its side.

Each laboratory will have one liquid waste container for low-level isotopes. A record will be kept of the activity placed in each container. Liquid waste containers will be removed from service whenever they become full or whenever the dose rate from the container exceeds the storage limits specified below. Whenever a liquid waste container is ready for disposal action, the Health Physics Section will be notified and they will arrange for disposal.

Low-level liquid wastes will be held for decay prior to disposal action through the sanitary sewerage systems in accordance with the limits of activity prescribed by 10 CFR 20.303. If the liquid wastes cannot be disposed of in accordance with 10 CFR 20.303, disposal action through appropriate Air Force channels will be taken.

High-level activities of both will receive special handling; i.e., whenever a laboratory anticipates generating high-level liquid wastes, the Health Physics Section will be notified and will arrange for proper disposal action either in accordance with 10 CFR 20.303 or through Air Force channels.

LIQUID RADIOACTIVE WASTES WILL NOT BE DISPOSED OF THROUGH THE SANITARY SEWERAGE SYSTEMS WITHOUT AUTHORITY OF THE HEALTH PHYSICS SECTION.

5. Solid Wastes:

Each laboratory which generates radioactive solid wastes will contain the wastes in covered steel drums or cans lined with two plastic bags or a 5-gallon "ice cream" carton. Each laboratory will have a solid waste container for low-level isotopes. Waste will be disposed of whenever the container becomes full or whenever the dose rate from the container exceeds the storage limits specified below. The Health Physics Section will be notified when a container is ready for disposal.

All low-level activity will be disposed of in the waste pits at the Radiobiology Laboratory site by sealing each plastic bag or "ice cream" carton with tape and labeling the plastic bags or "ice cream" cartons as prescribed below. Steel drums or cans may be used for the final disposal of the low-level solid wastes. Disposal of low-level solid wastes in the WIRB-2 waste pits will be made in accordance with 10 CFR 20.304 in so far as levels of activity and number of burials per year. Burial will be at a minimum depth of four feet. Because of the type trench used for waste

disposal at the WLBB-2 complex, successive burials need not be separated by distances of six feet.

High-level activities will receive special handling; i.e., whenever a laboratory anticipates generating high-level solid wastes, the Health Physics Section will be notified and will arrange for proper disposal action. The disposal of this type material will be in accordance with 10 CFR 20.304 or T.O. 00-110N-2: "Radioactive Waste Disposal".

6. Biological Wastes:

Small items of biological wastes, such as small animal carcasses (rodents, guinea pigs, etc.), small sections of tissue, etc. may be treated as solid wastes and disposed of accordingly within the limitations specified in paragraph 5 above. The problem of biological waste disposal for large animal carcasses (sheep, burros, etc.) will be divided into two groups, carcasses containing isotopes injected into the animals and carcasses which contain radioactive materials due to activation by neutron, electromagnetic or particle irradiation.

Carcasses which contain radioisotopes that had been injected into the animal shall be limited to not more than 2.5 millicuries of activity per animal of either short-lived or long-lived isotopes. Burial of these carcasses shall be limited such that not more than 375 millicuries of activity is buried in this manner in any one year. The basis for 375 millicuries is determined from using approximately 150 animals for these type experiments in any one year. These type burials will be made as required without being limited by 12 burials per year as specified in 10 CFR 20.304, i.e., the number of burials per year shall be unlimited within the yearly activity level of 375 millicuries. Burials will be at a minimum depth of four feet and because of the type trench used for waste disposal at the WLBB-2 complex, successive burials need not be separated by distances of six feet. Animal carcasses containing isotopes with half-lives less than or equal to 1 year may be buried directly into the waste pits at WLBB-2, while those with isotopes having half-lives greater than 1 year will be sealed in a steel drum prior to burial.

Large animals, such as sheep, which are exposed to the Sandia Pulsed Reactor Facility (SPRF), will contain activation products. It has been determined by gamma spectroscopy that the only significant isotope present in sheep at approximately five (5) hours post-exposure in the SPRF is Sodium-24 (Na-24). This determination was accomplished with a 5 x 7 inch, well type, sodium iodide, thallium-activated, scintillation crystal and a 256-channel analyzer. Analyses of the data obtained by gamma spectroscopy showed that activation at T=0 is equal to approximately 5.5 picocuries of Na-24 per rad of neutron dose. Depending upon the type experiment being performed, neutron doses of about 1800 rads could be delivered to any one sheep. This 1800 rad neutron dose would induce an activity of approximately 10,000 picocuries of Na-24 activity. At the present time, 10 CFR 20.304 allows 10,000 microcuries of Na-24 per burial. The 10,000 picocurie of Na-24 activity present in a sheep at T=0 would represent 0.0001% of the allowable Na-24 burial limit. Therefore, because Na-24 has a very short half-life of 15.0 hours, any burials of animal carcasses containing Na-24

activation products will be considered as a sanitary burial if burial occurs at 15 hours post-exposure. The Na-24 activity would be about 5,000 picocuries or 0.00005% of the allowable Na-24 activity at T + 15 hours based on an original activity of 10,000 picocuries at T-0. Burials which occur at times prior to 15 hours post-exposure will be considered as radioactive burials. Such burials will not be limited by 12 burials per year and will not be separated by distances of at least six (6) feet.

Records of all radioactive burials of animal carcasses will be maintained whether they be carcasses containing injected isotopes or activation products.

7. Storage of Radioactive Wastes:

Radioactive waste material may be maintained under normal storage provided that the intensity at one (1) foot from the surface of the container does not exceed one (1) milliroentgen per hour (mR/hr) and the container is appropriately labeled as specified below. (Ref. T. O. 00-110N-3, para 3a)

Radioactive waste material containers which exceed 1 mR/hr at one foot must be stored in marked areas, storeroom, or buildings. The area shall be controlled to prevent entry of unauthorized personnel. The exterior of the area will be posted with the appropriate radiation warning sign and the dose rate at one foot from the exterior of such storage area shall not exceed 1 mR/hr. (Ref. T. O. 00-110N-2, para 5a(5))

8. References:

AFR 160-132, "Control of Radiological Health Hazards", 15 October 1958.

T.O. 00-110N-2, "Radioactive Waste Disposal", 1 September 1960.

T.O. 00-110N-3, "Requisition, Handling, Storing and Identification of Radioactive and Radioactively Contaminated Material", 1 October 1962.

Title 10, Code of Federal Regulations, Part 20.

AFWLR 161-1, "Safety-Health Physics AFWL Health Physics Program", dated 28 Jan 65.

3 Atchs

1. Exhibit 14-A-1
2. Exhibit 14-A-2
3. Exhibit 14-A-3

TOPOGRAPHY AND GEOLOGY

The Radiobiology Group Laboratory consists of a seventy acre fenced area located at a remote site on the Sandia-Kirtland complex. The site is on an alluvial apron in the Rio Grande Valley about 3 miles west of the base of the Manzanita Mountains and about 8 miles east of the Rio Grande River. The site is at an elevation of about 5,450 feet above mean sea level and slopes downward in a north-westerly direction from a maximum elevation of about 5,460 feet to a minimum elevation of about 5,440 feet. Surface drainage is northwestward toward the Coyote Arroyo and thence westward toward the Rio Grande; however, there are no perennial streams in the area.

The site is about 130 feet higher than the confluence of the Coyote and Tijeras Arroyos, 2.5 miles to the north.

The site is underlain by formations of the Santa Fe group of Quaternary and Tertiary age. The Santa Fe group is in turn underlain by formations of Permian, Pennsylvanian, and Precambrian age. These older rocks crop out in the mountains to the east. Thin deposits of alluvium of Recent age occur in arroyos in the area.

The alluvium is thin (15 to 20 feet maximum thickness) and consists of unconsolidated sand, gravel, and silt. This material is largely derived from the granite and metamorphosed rocks of Precambrian age which are exposed to the east. Generally, the porosity and permeability of this alluvial material are high, which allows relatively free movement of water.

The Santa Fe group comprises material similar to the alluvium but much of the material has come into the area from the north and there is a slightly greater degree of consolidation of some of the beds. The Santa Fe group was deposited by streams and consequently there are rapid lateral and vertical changes in character of the sediments. Individual beds are generally lenticular but some extend for considerable distances as channel deposits. These long narrow channel deposits are generally oriented in a northeast-southwest direction. The thickness of the Santa Fe group beneath the site is not known but is probably more than 500 feet as indicated by the well dug for Sandia Base. The porosity and permeability of the Santa Fe group as a unit in this general area is generally high; however, the permeability of individual beds of silt or clay is quite low.

The pre-Tertiary rocks that underlie the Santa Fe group consist of sandstones, siltstones, limestones, and metamorphosed sediments lying on top of granite. These rocks are well consolidated and less porous and permeable than the rocks of the Santa Fe group. The thickness of these rocks is not known with certainty but it appears to be at least 22,000 feet.

The soils of the area are generally alkaline, calcareous loams low in organic matter, somewhat compacted, and underlaid with soft caliche from 8 to 30 inches deep. The surface 3-inches are essentially lime free, becoming increasingly calcareous and developing into soft caliche at about 18 inches. The vegetation on this semi-desert site is dominantly short grasses interspersed with Yucca.

HYDROLOGY

The Santa Fe group of sediments, which underlies the site, is the aquifer from which the City of Albuquerque, Kirtland Air Force Base, Sandia Base, and some farmers in the valley derive their water supplies. Most of the recharge to this aquifer in the vicinity of the site is from flood flow in the arroyos and underflow from cracks, joints, and weathered zones in the pre-Tertiary rocks to the east. Because the pre-Tertiary rocks are dense and relatively impermeable and precipitation is small, it seems probable that most, if not essentially all, the water in the aquifer near the Radiobiology Group Laboratory is from infiltration of flood flow in the arroyos.

The water-table elevation at the site is approximately 4,980 feet which is approximately 490 feet below the surface. From the site, the water table slopes generally westward toward the Rio Grande, indicating that ground water beneath the site moves from east to west toward the Rio Grande.

The material underlying the site ranges in grain size from clay to gravel. The unsaturated part of this material, above the water-table, probably ranges from damp near the water-table to dry near the surface. There may be variation of moisture content from bed to bed due to variation in grain sizes. Generally, it may be assumed that the maximum moisture content of the material above the water-table does not exceed the specific retention...the amount of moisture that will be retained against the force of gravity. The specific retention is approximated by the moisture equivalent, expressed as percentage by volume, which is the moisture content, by volume of the soil after being subjected to a centrifugal force of 1,000 times gravity for one hour. U.S. Geological Survey Water-Supply Paper 887 lists moisture equivalents ranging from 1.4 percent for a sandy gravel to 49.5 percent for an argillaceous silt.

In surveying the alluvial plane for the reactor site located approximately 1.5 miles to the southwest of the Radiobiology Group Laboratory, the problem of a hypothetical release of 12,000 gallons of contaminated liquid was investigated. The reactor site and the Radiobiology Group Laboratory are located on the same alluvial plane and have the same geological characteristics. It is assumed that the results would be the same for any release of large volumes of liquid on the Radiobiology Group Laboratory site.

If a circular area of only 30 feet in diameter were flooded and the material were to retain water equal to only 0.8 percent of its volume (thus allowing for moisture which might already be present), no water would get below 280 feet. Because of the silt and clay lenses present in the subsurface, the individual beds would retain more moisture, and the water would be spread over a larger area as it migrated downward, resulting in less depth of penetration. The actual depth of penetration would depend upon

the moisture content of the material below the site. It is difficult to predict the rate of movement of water through unsaturated material; however, if it is assumed that no water is necessary to make up for the soil-moisture deficiency, it would take from several days to several years (probably the latter) for water to move downward to the water-table. If some water did reach the water-table, it would move westward. Even though water reached the water table, the high ion-exchange characteristics of the deposits appear to preclude the possibility of contamination of ground water.

Assuming a slope of the water-table of 10 feet per mile and a porosity of the formation of 10 percent, an average velocity of the ground water of about 500 feet per year is indicated.

The nearest used well down gradient from the site is the reactor well located approximately 1.5 miles to the southwest. At the rate of about 500 feet per year, water in the aquifer would require about 16 years to move this distance without allowing for a lag in transmission of waste material due to absorption. The ion-exchange characteristics of the material through which the waste would pass have been determined and range from 1.0 to 19.0 milliequivalents per 100 grams, or approximately 0.5 to 10 equivalents per cubic foot of material.

In order to determine the greatest possible hazard of contamination of ground water, the most extreme conditions consistent with available data were assumed. The velocity of ground water is proportional to the hydraulic gradient and to the permeability of the material through which it moves and inversely proportional to the porosity of the material through which it moves. Therefore, larger values for permeability and hydraulic gradient and a smaller value for porosity were assumed than those which are believed to exist in the formations. Thus the velocity of about 500 feet per year is probably higher than actually exists. If the absorptive character of the materials underlying the site were equal to those of the least absorptive material tested, all the radioactive cations would be absorbed before traveling far and probably before penetrating to the water-table.

METEOROLOGY

The average annual rainfall in the Sandia-Kirtland complex is about 8.4 inches. The average monthly precipitation is 1/3 inch during the winter months of November through March to over 1 $\frac{1}{2}$ inches during the summer months of July through September. A considerable portion of this meager winter precipitation falls in the form of snow. The monthly average never exceeds 2 inches and normally only four days a year have as much as one inch of snow occurring. The snow usually doesn't remain more than twenty-four hours.

The months of July through September furnish half of the annual moisture with most of the rain falling in the form of brief but at times rather heavy thunderstorms. Prolonged rainy spells are practically unknown.

The winter temperatures in the area are generally mild with an average minimum of 22.2 degrees F. The average winter temperature is near 50 degrees F. with only 3 days on which the temperature doesn't rise above the freezing mark. Maximum summer temperatures average 89.7 degrees F. in July.

The relative humidity during the summer months is about 30 percent, while 15 to 25 percent is common during the rest of the year. The average amount of sunshine per year is approximately 80 percent.

High winds of 42 miles per hour and gusts exceeding 70 miles per hour prevail during the months of March and April, causing severe dust and sand storms. The average velocity for the year is approximately 7.5 miles per hour.