

BURIAL OF RADIOACTIVE WASTE IN THE USAF

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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. Stencil. 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

safer 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
Carwell 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 AFB
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 AFB
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
Hornestead AFB	Taipei AS
Howard AFB	Thule AB
Kadena AB	Tan Son Nhut Afd
Kingsley Field	Tyndall AFB
Korat AB	Ubon Afd
K. L. Sawyer AFB	Udorn Afd
Kunsan AB	USAF Academy
Lages Field	Vance AFB
Langley AFB	Webb AFB
Laughlin AFB	Wurtsmith AFB

Note: No individual responses from USAFE.

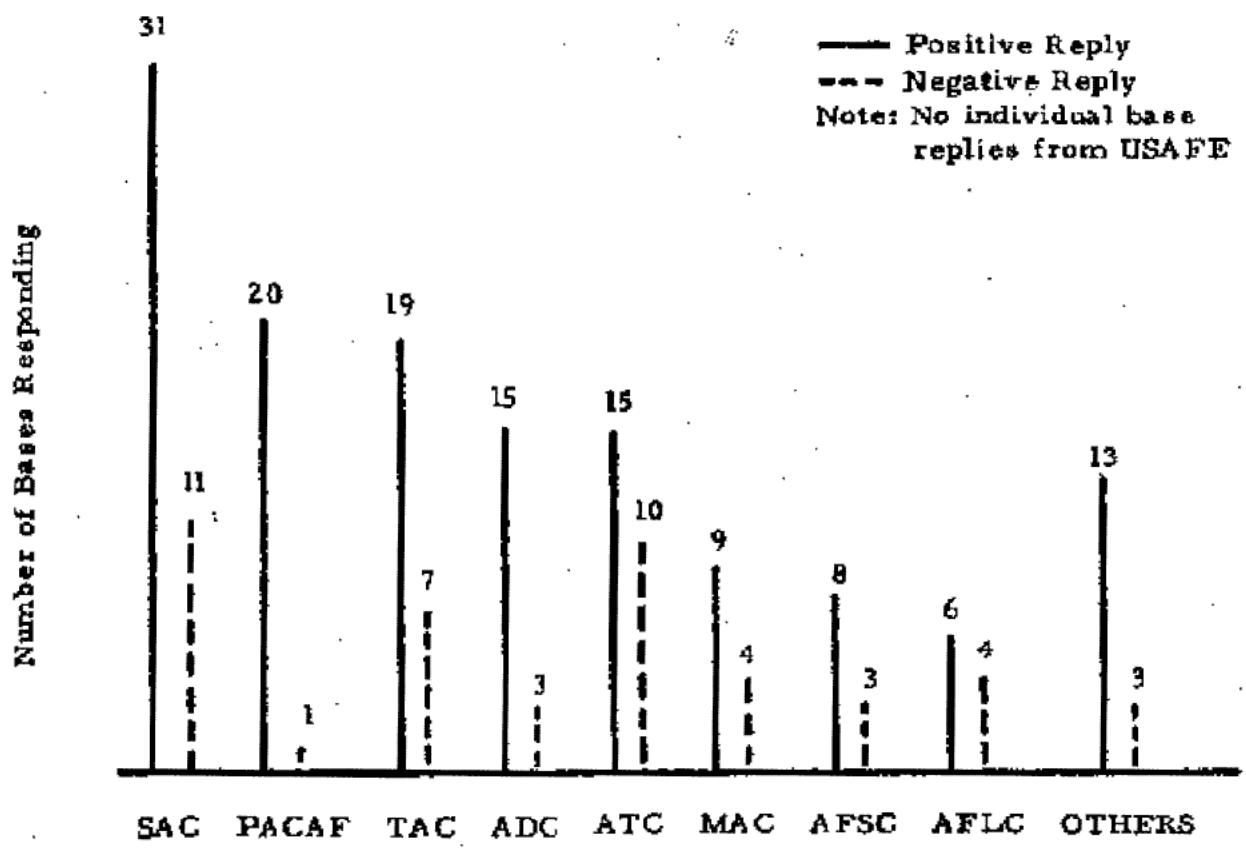


FIGURE I: Distribution of Replies, By Major Command

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/PRES 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/SGFAAP.

### 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.

### 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/SGPAA P.

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/SGPAA P.

### McCody 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 (half-life is 28 days) and 21 microcuries of tritium (half-life 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.

#### Ferrin 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 FM-1 nuclear power plant. Complete details are available in Hq ADC report, "Final Inspection of the FM-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>	<u>Precise Location</u>	<u>Sign(s)</u>	<u>Fenced</u>	<u>Master Plan (Tab-C)</u>	<u>Brief 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
Columbus 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

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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. Wastes 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.

Appendix A

(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.

## 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.

Appendix D