UNIVERSITY OF MISSOURI-COLUMBIA

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February 20, 1979

(34)
-20(43FR56677)

Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: Docketing and Services Branch

I am indicating an objection to the proposed amendment to Section 20.304 of the Code of Federal Regulations as reported in Volume 43 of the FEDERAL REGISTER on December 4, 1978. This proposal to delete the general provisions for disposal of low-level radioactive wastes by local land burial will affect universities and other research institutions. Radioactive waste disposal will become more expensive and perhaps less safe if all radioactive wastes from these institutions must be packaged and transported to commercial burial sites.

My objection to the proposed rule changes are threefold. 1) There was an inadequate study by the NRC on the present uses of local land burials and the resulting hazards presented by these land burials. 2) An alternate method for the safe and efficient disposal of radioactive wastes will not be available to institutions wishing to dispose of the extremely low-level solid wastes. 3) An increasing volume of radioactive wastes will be transported for burials to already overcrowded commercial sites.

The attached presentation of the operation of a radioactive waste site within the present provisions of 20.304 indicates the efficiency and safety of this method of radioactive waste disposal. I know other institutions would also furnish similar data if requested. It is suggested that you contact all licensees and audit their use of the land burial provisions. Any risks of such burials should be identified, unacceptable practices be determined, and criteria to be used for establishing unacceptable risk limits defined. It is not evident to me that the proposed amendment will contribute to the protection of public health by encouraging the shipment of even small quantities of wastes to commercial burial sites. Transportation accidents and risks at the commercial burial sites may off set any risks of local burial.

The Commission should reconsider their proposal to eliminate the provisions for local and burials of radioactive wastes. Local land burial should be allowed with the stipulations that it be on the licensee's property and that annual burial sites be inspected . the time of the regular license inspection. Further limitations of activities or quantities buried each year or for each burial would not be required.

I trust you will consider these personal comments on the proposed changes in 10 CFR 20 that w uld eliminate local burial of radioactive wastes.

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Philip K. Lee

Philip K. Lee, Ph.D.
Director

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MANAGEMENT AND SURVEILLANCE OF A UNIVERSITY RADIOACTIVE WASTE BURIAL SITE

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Abstract

A radioactive waste burial site is operated at the University of Missouri under the conditions of 10 CFR 20.304. Over 90% of the radioactive wastes generated by the laboratories and clinics, exclusive of the Research Reactor Facility, are economically disposed at this site. During the seven year operation about 200 cubic meters of low-level wastes containing about 1.5×10^{11} becquerels have been buried in 3.6 meter deep and 0.6 meter wide trenches. A radiation surveillance program confirms that radiation levels in the vicinity of the burial site are well within acceptable limits.

Discussion

All licensees of the Nuclear Regulatory Commission are permitted to dispose of small activities of radioactive wastes by local land burial. General provisions contained in Section 20.304 of Title 10 of the Code of Federal Regulations (10 CFR 20.304) stipulate allowable burial conditions such as nuclide activities, burial depths, and burial frequencies for the local land burials. Recently it has been announced that the provisions for generally permitted land disposals are under discussion and may be modified or withdrawn. Hopefully any changes in the regulations will not completely eliminate the opportunity for institutions to operate a local radioactive waste site for the efficient disposal of low-level solid wastes.

The University of Missouri has operated a radioactive burial site within the conditions of 10 CFR 20.304 for the past seven years. This designated burial site is a nine-tenth acre fenced plot on a University research farm located about five miles from the main portion of the Columbia Campus. A metal building at the site is used for temporary waste storage and for processing radioactive wastes scheduled for transfer to commercial firms for off-site disposal. This building is also used to a limited extent for the temporary storage of radioactive wastes and there is a freezer in the building for storing contaminated animal carcasses that are to be buried.

The soil at the site consists of a water permeable clay layer to a depth of about three meters. Below the surface soil layer is about one meter of water impermeable clay and then about a one-half meter layer of weathered limestone and clay over the limestone bedrock. Burial trenches which are about four meters deep may penetrate into the impermeable clay region but will not break through it. Surface water drains to the north across the site into a natural drainage ravine near the farm boundary about 200 meters from the north end of the burial site.

Most of the radioactive wastes generated at the University research and clinical laboratories consist of slightly contaminated paper trash, plastic vials, animal bedding, and animal carcasses. This high volume of low activity waste is well suited for shallow land burial disposal. The wastes are collected from the campus locations and accumulated in the waste storage areas on campus

burial would be approximately the same as preparing the waste for shipment. This time is estimated to be about 1.5 man days per burial. Packaging expenses would be greater for a commercial shipment because of the cost of the containers. Containment or packaging costs for local burial are minimal because certified shipping containers are not required.

The local shallow land burial site has proven to be an effective means for disposal of almost all of the low-level solid wastes generated by the University campus. It has been demonstrated that a low-level waste disposal site properly maintained and operated within the conditions of 10 CFR 20.304 is a safe, efficient, and economical disposal method for large quantities of low-level radioactive wastes. It is recommended that continued use of this type of burial sites be allowed for institutions willing to accept the responsibility for proper custodial maintenance.

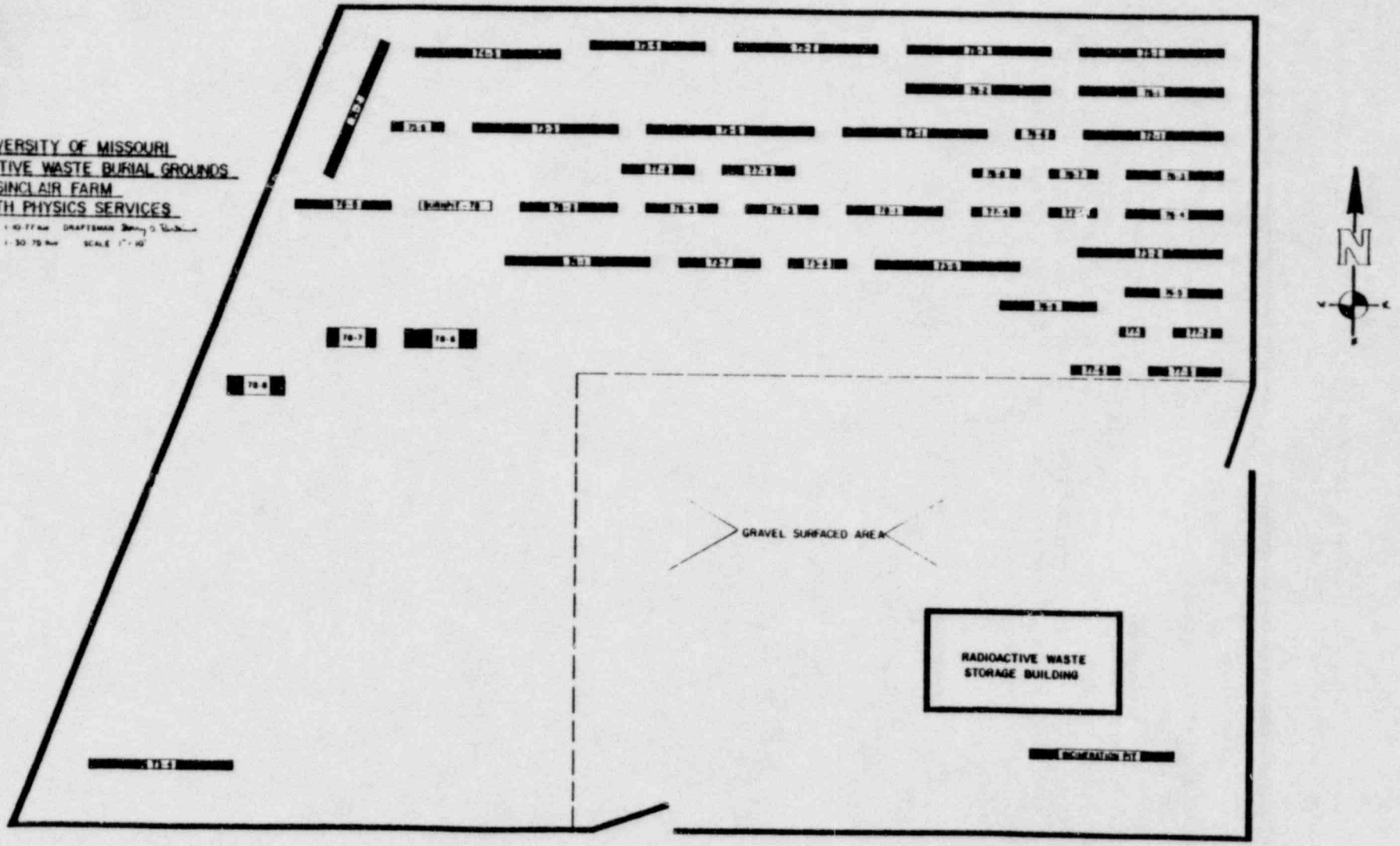
UNIVERSITY OF MISSOURI
RADIOACTIVE WASTE BURIAL GROUNDS
SINCLAIR FARM
HEALTH PHYSICS SERVICES
GRAVEL SURFACED AREA
RADIOACTIVE WASTE
STORAGE BUILDING
N

FIGURE 1

or in the storage building at the waste site. Burials are scheduled with respect to weather conditions and the amounts of accumulated wastes.

Burial trenches are dug to a depth of about four meters by a University operated backhoe. The width and length of an individual burial trench is dependent upon the volume and types of wastes to be buried. Usually the trenches are about sixty centimeters wide and four meters long; however, trenches double this normal width are convenient for burial of large animal carcasses. The location and size of a particular burial trench is recorded on the map of the burial site as shown in figure 1 and referenced by a number code giving the calendar year and burial number for that year, such that the number 78-6 would indicate the sixth burial at the site in 1978.

Each item placed in the burial trench, whether a bag of laboratory trash, animal carcasses, or container of animal bedding, is identified according to the contaminating nuclide and activity. Records for each burial indicate the activities of all radioisotopes, total volume of uncompacted wastes, numbers of items buried and the fraction of an allowable burial in reference to the allowable activity limits defined in 10 CFR 20.304. Other waste records can be used, if required, to trace an item buried to its source laboratory. Following burial the wastes are covered with at least 1.2 meter of dirt and the burial located and coded on the site map.

There have been 40 burials at the waste site as of the end of 1978. These burials represent over 95% of the solid radioactive wastes generated at the Columbia Campus over the past seven years. The present waste site should accommodate the University for the next fifteen years; however, the area can be expanded if needed.

A total of 1.4×10^{11} Bq (3.87×10^{3} mCi) have been disposed by land burial in the 40 burials over the past seven years. The uncompacted volume of the disposed wastes is estimated to be 199 m^3 (7027 ft^3). Each burial is distinctively different but an average burial would be 3.58×10^{9} Bq (99.9 mCi) with a volume of 4.96 m^3 (175 ft^3) and would represent 47.4% of an allowable burial as defined in 10 CFR 20.304. A summary of the annual burial totals is given in table 1.

The volume of waste buried each year has been fairly consistant ranging from about 11 m^3 to 39 m^3 for the calendar year as shown in figure 2. However, there has been a decrease in the activities from about 4.8×10^{10} Bq being disposed in 1973 to only 4×10^{9} to 9×10^{9} Bq being disposed in each of the past three years as shown in figure 3. One of the reasons for the decrease in disposed activity is that labeling procedures requiring relatively large amounts of tritium are not being performed by campus users to the extent of several years ago.

The residual activity of previously buried wastes is continuously being reduced by radioactive decay. A computer program calculates this decay reduction and indicates the radioisotope inventories in the site. Residual activities have reached a plateau over the past two years due to decreased levels of activities per burial and the decay of the previously disposed radionuclides. The variation in residual activity over the past seven years is indicated by figure 4. At the end of 1978 the total activity of the buried wastes was calculated as being 1.11×10^{11} Bq (3.0 Ci). Of the total activity

tritium accounted for 97.4% and carbon-14 accounted for 2.49%. Other radionuclides which were minor contributors to the residual activity include scandium-46 at 0.04%, iodine-125 at 0.03%, calcium-45 at 0.02% and strontium-85 at 0.02%. Twenty-three other radionuclides are identified by the disposal records as being represented at very low activites in the burial site. The total activities of the different radioisotopes in the burial site at the end of 1978 are listed in table 2.

Radiation surveys and environmental samplings have been conducted in the waste site area to confirm that radiation levels are maintained within acceptable limits. After the backfill of each burial, the surface exposure rate is measured with a portable survey meter. There was only one measurement above normal background recorded during a post burial survey. This elevated reading was due to some items that had not been properly covered by the backfill operation. The materials were collected and were properly disposed in a later burial.

Surveys are also taken monthly at fifteen identified locations around the site boundary and in the waste storage building. Elevated exposure rates in and around the waste storage building are produced by radioactive wastes stored in the building. These wastes are primarily from the Research Reactor Facility and are being stored and processed before transfer to a commercial waste disposal vendor. Exposure rates within the building range up to 40 mR/h while the exposure rates at the site boundary nearest to the building have been as high as 0.15 mR/h when the building is full of stored wastes. Other survey points beyond the influence of the radioactive material in the storage building are at normal background levels of less than 0.05 mR/h. Thermoluminescent dosimeters positioned at the monitoring locations for extended time periods confirm the exposure rate measurements.

Soil and grass samples were obtained in 1978 at nine of the monitoring locations at the site and analyzed for radioactivity. No activity was observed above 1 Bq/g of gamma activity or above 1 Bq/g of beta activity on any of the samples. Soil samples from depths ranging to three meters were also taken at the middle of the north boundary of the waste site. These soil samples, taken in 1977, were also below 1 Bq/g of beta activity. The environmental sample measurements confirm that the soil and vegetation have not been contaminated with radionuclides from the burial site.

Water samples taken from the surface of the waste site and in the drainage area below the site showed neither gamma nor beta activity above background levels nor any tritium activity above the 400 Bq/ℓ detection level. Ground water samples from three meter deep sample holes at the north edge of the site did show slight positive tritium activity in 1977 when heavy rains probably flushed the tritium from the burial pit near the sample point. Concentrations of 10^4 Bq/ℓ of tritium were observed in the ground water from the site at that time.

Operating costs of the waste site are minimal. The major expense is the digging and backfilling charges from the University service furnishing the backhoe equipment. These charges average about $40 per burial which are small in comparison to the approximate $800 expense of having the wastes removed by a commercial disposal firm. Personnel time and efforts for a local

FIGURE 2

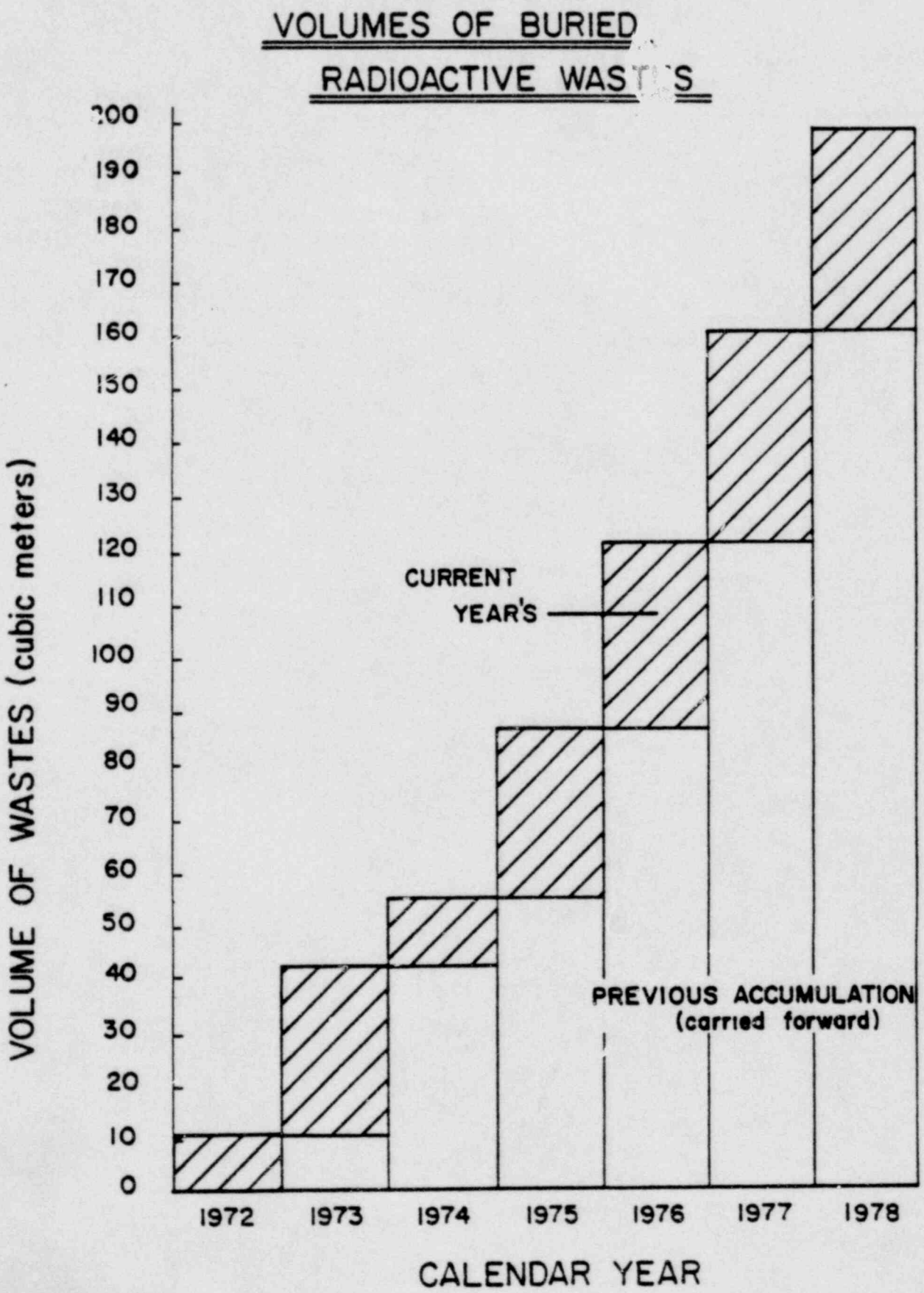
VOLUMES OF BURIED
RADIOACTIVE WASTES
VOLUME OF WASTES (cubic meters)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
CURRENT
YEAR'S
PREVIOUS ACCUMULATION
(carried forward)
1972
1973
1974
1975
1976
1977
1978
CALENDAR YEAR

TABLE 1

Summary of Radioactive Burials

University of Missouri

Year (Calendar)	Burials (Number)	Volume (Cubic Meters)	Activity (Becquerels)
1972	1	11.5	1.23×10^{9}
1973	6	30.6	4.84×10^{10}
1974	3	13.4	3.37×10^{10}
1975	6	31.2	4.08×10^{10}
1976	9	35.2	4.76×10^{9}
1977	8	39.1	5.65×10^{9}
1978	7	37.5	8.84×10^{9}
Totals	40	198.5	1.43×10^{11}

TABLE 2

Residual Activities at Burial Site
(December 29, 1978)

Radioisotope	Activity (becquerels)
Hydrogen-3	1.08×10^{11}
Carbon-14	2.77×10^{9}
Sodium-22	4.51×10^{5}
Phosphorus-32	1.01×10^{7}
Sulphur-35	9.51×10^{6}
Chlorine-36	6.99×10^{6}
Calcium-45	2.64×10^{7}
Scandium-46	4.96×10^{7}
Chromium-51	7.20×10^{6}
Magnesium-54	1.33×10^{4}
Iron-55	5.40×10^{5}
Iron-59	$<1.0\times10^{2}$
Cobalt-57	3.96×10^{2}
Cobalt-60	2.82×10^{6}
Zinc-65	4.44×10^{5}
Selenium-75	2.96×10^{5}
Arsenic-76	$<1.0\times10^{2}$
Strontium-85	2.36×10^{7}
Rubidium-86	$<1.0\times10^{2}$
Molybdenum-99	$<1.0\times10^{2}$
Technetium-99m	$<1.0\times10^{2}$
Cadmium-109	2.02×10^{5}
Iodine-125	3.06×10^{7}
Iodine-131	2.07×10^{6}
Cerium-144	7.40×10^{6}
Terbium-160	7.10×10^{5}
Mercury-203	$<1.0\times10^{2}$
Lead-210	$<1.0\times10^{2}$
Unknown Beta Emitters	1.11×10^{5}
Totals	1.11×10^{11}

FIGURE 3

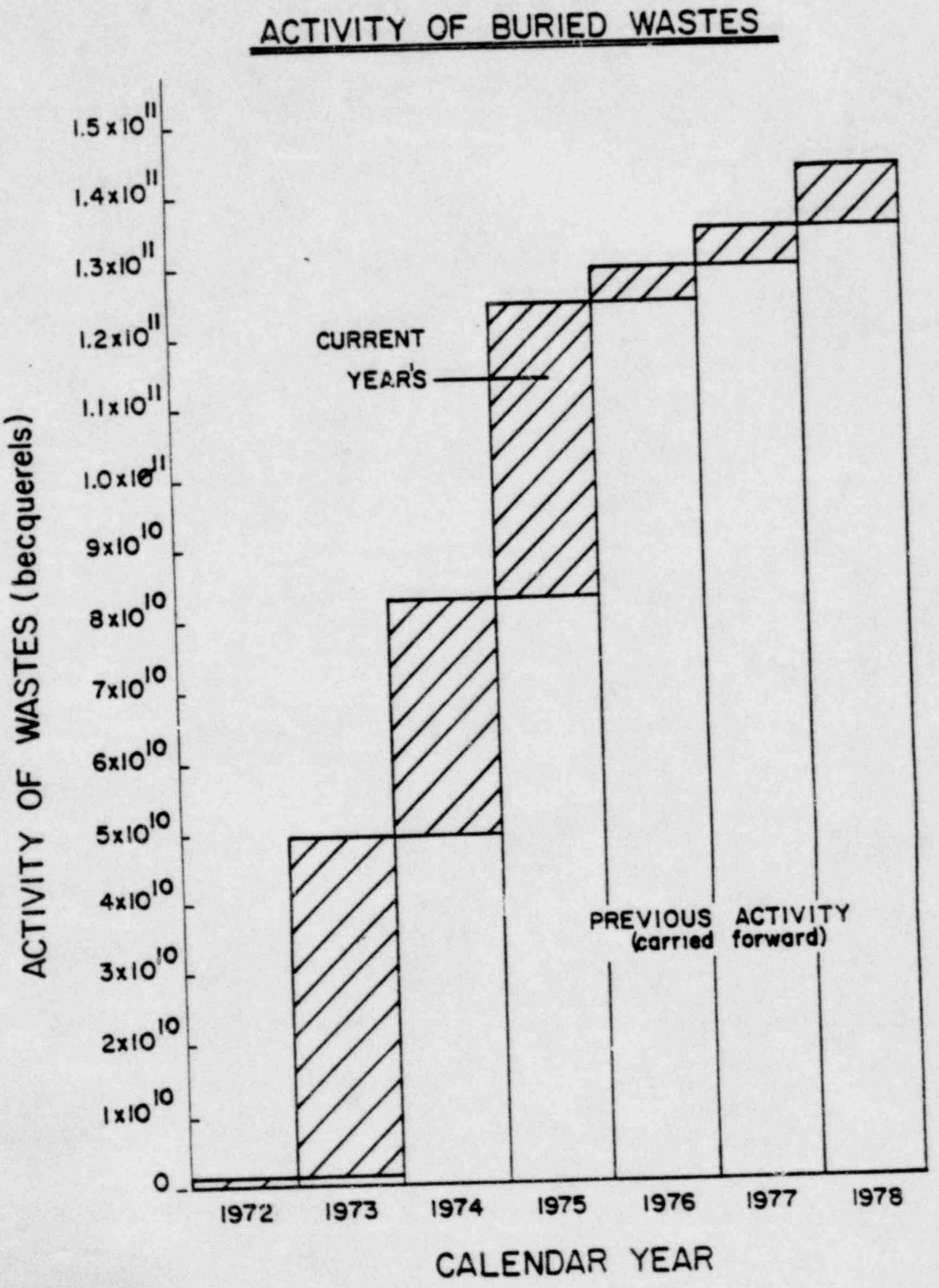
ACTIVITY OF BURIED WASTES
ACTIVITY OF WASTES (becquerels)
1.5 x 10^11
1.4 x 10^11
1.3 x 10^11
1.2 x 10^11
1.1 x 10^11
1.0 x 10^11
9 x 10^10
8 x 10^10
7 x 10^10
6 x 10^10
5 x 10^10
4 x 10^10
3 x 10^10
2 x 10^10
1 x 10^10
0
CURRENT YEAR'S
PREVIOUS ACTIVITY (carried forward)
1972
1973
1974
1975
1976
1977
1978
CALENDAR YEAR

FIGURE 4

RESIDUAL RADIOACTIVITY OF BURIED WASTES