

UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION IV

611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

REQUEST FOR TECHNICAL ASSISTANCE

DATE: September 28, 1992

TO: John E. Glenn, Chief, Medical, Academic, and Commercial
Use Safety Branch, NMSS

FROM: L. J. Callan, Director, Division of Radiation Safety and
Safeguards, Region IV

LICENSEE: Department of Veterans Affairs
John L. McClellan Memorial Veterans' Hospital
Little Rock, Arkansas

LICENSE NO.: 03-01082-01

PROBLEM/ISSUE: V.A. Little Rock has requested authorization to dispose of iron-59 and sulfur-35 after decay-in-storage for 5 half-lives instead of 10 half-lives.

ACTION REQUIRED: Review the submitted information and approve or deny the licensee's request to reduce storage time before disposal.

RECOMMENDED ALTERNATIVE: Approve the licensee's request, provided that a radiation survey cannot distinguish the waste from background.

ALTERNATIVES CONSIDERED: Authorize the licensee to hold sulfur-35 for decay-in-storage before disposal, provided the waste is held a minimum of 10 half-lives. The licensee is authorized to hold radioactive material with half-lives less than 65 days for decay-in-storage; therefore, no action would be required for disposing of iron-59 by this method.

REMARKS: The licensee has committed to segregate the material into 2-cu.ft. fiberboard drums containing maximum activities of 10 μ Ci of iron-59 and 100 μ Ci of sulfur-35 when placed in storage. After 5 half-lives, the decayed activity in a drum would not exceed 0.3 μ Ci of iron-59 or 3.0 μ Ci of sulfur-35, values that are about 1/30 the quantities specified in 10 CFR Part 20, Appendix C.

J/8



Department of Veterans Affairs
Little Rock, Arkansas

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Both nuclides are primarily beta emitters, except that iron-59 has two energetic gammas, 1.095 Mev (56%) and 1.292 Mev (44%). Sulfur-35 emits a lower energy beta than iron-59. The licensee has committed to survey the waste using a detector with window thickness of 1.7 mg/cm², which is capable of detecting the 0.167 Mev beta emitted by sulfur-35.

Region IV Reviewer: Vivian Campbell
Reviewer Code: T3
Reviewer Phone No.: 817-860-8143


L. J. Callan, Director
Division of Radiation Safety
and Safeguards



DEPARTMENT OF VETERANS AFFAIRS
 John L. McClellan Memorial Veterans Hospital
 4300 West 7th Street
 Little Rock AR 72205

Reciv Refer To: 598/115

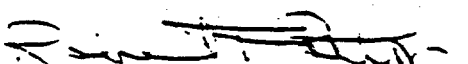
U.S. Nuclear Regulatory Commission
 Region IV
 Parkway Central Plaza Building
 611 Ryan Plaza Drive, Suite 1000
 Arlington, TX 76011

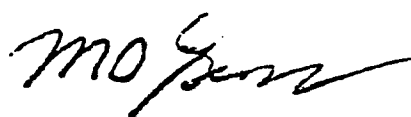
THRU: Director, Field Support Office (L33/141A5)
 Southern Region
 Department of Veterans Affairs
 810 Vermont Avenue, NW
 Washington, D. C. 20420

Gentlemen:

We request that our NRC License No. 03-01082-01 be amended to change condition 22 to read:

- 22. The licensee is authorized to hold radioactive material with a physical half-life less than 90 days for decay in storage before disposal in ordinary trash provided:
 - A. Radioactive waste to be disposed of in this manner shall be held for decay a minimum of five (5) half-lives.
 - B. Same.
 - C. Same.


 ROBERT T. PATTON
 Medical Center Director


 Director, Nuclear License Support Unit
 Veterans Health Services and
 Administration
 115 91

APR 24 1992

License: 03-01082-01
Docket: 030-01212
Control: 463975

Department of Veterans Affairs
ATTN: Robert T. Patton
Center Director
John L. McClellan Memorial
Veterans' Hospital
4300 West 7th Street
Little Rock, Arkansas 72205

Gentlemen:

We have reviewed your letter dated November 4, 1992, requesting an amendment to your byproduct material license to authorize disposal of byproduct materials with half-lives up to 90 days after storage of a minimum of 5 half-lives. Before further action can be taken, we will need the following additional information.

1. Enclosed is a copy of Information Notice 90-09 entitled, EXTENDED INTERIM STORAGE OR LOW-LEVEL RADIOACTIVE WASTE BY FUEL CYCLE AND MATERIALS LICENSEE. Attachment 1 of this notice identifies information that you will need to provide to NRC. Address each of the items. If you believe any of the items are not pertinent to your proposal, provide your justification.
2. Specifically identify the isotopes of interest with half-lives between 65 and 90 days, the maximum possession limit needed, and whether these isotopes are to be used in research or for medical applications as defined in 10 CFR Part 35. NRC policy requires your license to identify the isotopes with half-lives greater than 65 days that will be held for decay-in-storage.
3. Submit your survey procedures for monitoring waste before disposal. Also, specify for each radiation detection instrument used to survey the waste the manufacturer's name and model number, the type of radiation detected, the window thickness in mg/cm², and minimum detectable activity.
4. Submit a justification for the need to only hold byproduct material in storage for only 5 half-lives.

RIV:NMLS
VHCampbell
4/24/92

5. Provide assurance that waste will contain very little activity and always less than the quantity of radioactive material specified in 10 CFR Part 20, Appendix C per waste container when placed in storage. For multiple isotopes, use the "sum of the ratios" rule, as referenced in the Note in Appendix C, 10 CFR 20.1 - 20.601 and 20.1001 - 20.2401.
6. Specify the frequency of such disposals and the total activity per disposal.

To continue prompt review of your application, we request that you submit your response to this letter within 30 calendar days from the date of this letter. Please reply in duplicate and refer to the license, docket, and control numbers specified above. If you have questions or require clarification on any of the information stated above, we encourage you to contact us at (817) 860-8143.

Sincerely,

Original Signed By
Vivian H. Campbell
Vivian H. Campbell
Health Physicist
Nuclear Materials Licensing Section

Enclosure:
As stated

M/S # 16

T3



Department of
Veterans Affairs

MAY 28 1992

In Reply Refer to: 598/115

- U. S. Nuclear Regulatory Commission
Region IV
Parkway Central Plaza Building
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

MAY 29 1992

RE: Control No. 463975

Gentlemen:

Further information you requested in response to our amendment request
is enclosed.

ROBERT T. PATTON
Medical Center Director

463975

NRC Question 1.

Provide information relating to Attachment 1, IN 90-09.

This IN is in general not applicable since we are not asking for an extended storage period (actually a reduced storage period), an increase in possession limits or other changes in procedures. For those items which may be relevant and for purposes of clarification a response is provided.

Information Notice Item No.

1. a. None.

1. b. We will limit our request to S-35 and Fe-59. Estimates are as follows.

	Fe-59 -----	S-35 -----
Volume (max.)	200 ft ³	100 ft ³
Activity (max.)	10 mCi	10 mCi

1.c. (1) Class A - see above.

1.c. (2) Solid

1.c. (3) None

1.c. (4) None

1.d. Currently we are holding mainly I-125 RIA waste, and P-32, F-59 and S-35 biomedical research waste for DIS. Approximate quantities are: I-125, 100 ft³, 1 mCi; P-32, 100 ft³, < 10 mCi; S-35, 30 ft³, < 1mCi; Fe-59, 100 ft³, < 1 mCi. Much of the Fe-59 is slightly contaminated animal bedding, 2 - 3 x background. The other waste is laboratory dry waste, mainly absorbent paper, pipettes tips, etc.

1. e. N/A

2. (all items). N/A

3. a. The location where the radwaste will be stored is that which has been previously described (see Appendix 1). The mainly dry-form waste will be contained in 2 ft³ stackable, sturdy containers which are not prone to leakage, even if small amounts of liquid are present. Each container is labeled with nuclide, activity and date placed in storage. In addition, each container is identified on a summary log sheet (attached), with an entry made for each container. Containers are placed such that may be readily identified and removed.

3. b. Maximum volume: approx. 500 ft³. The total amount of waste generated exceeds this amount, but because of the short half-lives, disposal by decay is utilized. As a result, more pertinent is the equilibrium volume or percent of capacity. This is approx. 50 - 80% at all times - hence, the reason for this amendment request.

3. c.-h. See Appendix 1. This area is below grade and is a concrete structure with a brick outer wall. The structure has flame detectors, utilizes explosion-proof electrical outlets and fixtures

and is sprinkled. It contains its own A/C unit for temperature control. Ventilation is achieved by louvers in the outside wall which open for air circulation to the outside. The structure is in a low traffic area of the building and hence is not prone to industrial accidents. Flood damage probability is nil. Tornado damage is unlikely since the area is below grade. Security is achieved by limiting key access to Health Physics personnel, as the door to the radwaste area is kept locked.

4. a. As stated above, waste material is generally held in sturdy 2 ft³ fiberboard drums. Since the material is mainly dry waste, experience has shown these drums to be satisfactory over the period of time they have been employed, both at the Kansas City VAMC and Little Rock VAMC. After the waste is decayed and appropriate surveys made, the drums are incinerated.

4. b. The storage area is physically inspected at least quarterly and periodically when additional waste is placed in storage.

4. c. Since the total radioactivity is minimal, only standard procedures for contamination control, e.g. disposable gloves worn, are employed.

5. a. External radiation surveys and contamination surveys of the area are conducted at least quarterly. The area is posted "Caution - RAM". All external readings to date are less than 0.5 mR/h and contamination results are background.

5. b. No changes.

5. c. Emergency situations that may occur are addressed in the Little Rock VA general emergency plan. A phone list is maintained in which appropriate individuals are contacted - Safety, Security, Fire Department, Radiological, etc. Employees are trained and available to assess the situation and contact outside resources as necessary. Contacts have previously been established with local agencies in order that assistance may be called upon as necessary depending upon the extent of the situation.

5. d. As stated previously, a log sheet is used for radwaste entry. After DIS, an additional entry is made on the DIS waste record (also attached).

6. Only Health Physics personnel (RSO and HP Tech) are involved in this operation.

7. N/A

8. N/A

NRC Question 2.

We are limiting our request to only S-35 ($T_{1/2} = 87.44$ da) and Fe-59 ($T_{1/2} = 44.5$ da). Both these nuclides are used in biomedical research.

NRC Question 3.

Our survey procedures for disposal after decay are taken from RG 10.8, Appendix R and are as given below.

PROCEDURE FOR DISPOSAL BY DECAY-IN-STORAGE (DIS)

Short-lived material may be disposed of by DIS. Material will be kept separated according to

half-life or nuclide.

1. The waste will be surveyed with all additional shielding removed.
2. When the container is full, it will be sealed with tape and identified by date sealed or placed in storage, nuclide(s) and activity, and then transferred to the DIS area.
3. The material will be decayed for at the appropriate amount of time - 10 half-lives for all nuclides except Fe-59 and S-35 ($5 T_{1/2}$).
4. Prior to disposal as in-house waste, each container will be monitored as follows:
 - a. Check radiation detection survey meter for proper operation;
 - b. Plan to monitor in a low-level (less than 0.05 millirem per hour) area;
 - c. Remove any shielding from around the container;
 - d. Monitor all surfaces of each individual container;
 - e. Discard as in-house waste only those containers that cannot be distinguished from background. Record the date on which the container was sealed, the disposal date, and type of material (e.g., paraphernalia, unused dosages). Check to be sure no radiation labels are visible.
 - f. Containers that can be distinguished from background radiation levels must be returned to the storage area for further decay or transferred for burial.

SURVEY INSTRUMENTS

We will use a Ludlum Model 3 with a 44-7 (thin-end window) or 44-9 (Pancake) beta-gamma GM detector. Both detectors have window thicknesses of 1.7 mg/cm^2 .

Minimum detectable activity:

By a common definition, $MDA = 3 \times \sigma_b$, where σ_b is the standard deviation of the background. For a ratemeter,

$$\sigma_b = (c/2RC)^{1/2} \quad (\text{Hendee}). \quad \text{Eq. 1.}$$

where c = countrate, and RC = time constant of meter.

For a GM survey meter, typical parameters are $c_b(\text{cps}) = .7$ and $RC = 6 \text{ sec}$. By substitution in equation 1 and use of the MDA definition, $MDA = .7 \text{ cps}$ or 40 cpm .

A typical efficiency for photon detection by GM detectors is 3×10^{-3} . Then the MDA is approx $40 \text{ cpm}/3 \times 10^{-3} \text{ cpm/dpm} = 14 \times 10^3 \text{ dpm}$.

The above analysis is probably conservative, since both Fe-59 and S-35 emit beta particles. The efficiency for beta detection is potentially much greater for beta particles, however, it is dependent upon geometry and interposed material.

NRC Question 4.

As stated previously, we are constantly at 50 - 80% of our disposal capacity for research waste. With the current climate regarding radioactive waste and the impending 1993 deadline, we felt it prudent to exercise as many options as possible to avoid the necessity to ship out radwaste. Also as pointed out, much of the waste is extremely low in activity (~ 2-3 x background), and thus presents minimal public health risks.

NRC Question 5.

We confirm that the limits for exercise of the 5 T_{1/2} option will be limited to 10 uCi for Fe-59 and 100 uCi for S-35, when placed in storage.

NRC Question 6.

Approximately 10 ft³/mo and 0.1 mCi/month, for both nuclides. *ac*

Additional Subjects

We further request that this amendment request be made retroactive to January 1, 1989.

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Precision of Ratemeter Measurements

The precision of a ratemeter reading is improved if the pulse rate from the detector is averaged over a longer interval of time. The estimated standard deviation $\hat{\sigma}_c$ of a ratemeter reading c in counts per second is

$$\hat{\sigma}_c = \sqrt{\frac{c}{2(RC)}} \quad (\text{Eqn 18-10})$$

where RC is the time constant of the ratemeter in seconds. The percent estimated fractional standard deviation $\% \hat{\sigma}_c$ is

$$\% \hat{\sigma}_c = 100 \sqrt{\frac{1}{2c(RC)}}$$

Example 18-10. A ratemeter with a time constant of 2 sec displays an equilibrium count rate of 1000 cpm. What are the estimated standard deviation $\hat{\sigma}_c$ and the percent estimated fractional standard deviation $\% \hat{\sigma}_c$?

$$\begin{aligned} \hat{\sigma}_c &= \sqrt{\frac{c}{2(RC)}} \\ &= \sqrt{\frac{(1000/60)}{2(2 \text{ sec})}} \\ &= 2 \text{ cps} \\ &= 100 \sqrt{\frac{1}{2(1000/60)(2 \text{ sec})}} \\ \% \hat{\sigma}_c &= 100 \sqrt{\frac{1}{2c(RC)}} \\ \% \hat{\sigma}_c &= 12 \end{aligned}$$

Determinate Errors in Measurements of Radioactivity

The count rate measured for a radioactive sample reflects the rate of decay of atoms in the sample. However, the influence of a number of determinate errors must be known before the activity of the sample can be determined from the measured count rate. The influence of these errors must be included in an expression for the relationship between the rate of decay dN/dt and the measured count rate $(c)_{t+s}$ (Eqn 18-11).

$$\frac{dN}{dt} = \frac{(c)_{t+s}}{\{[1 - (c)_{t+s}] \tau\} E f G B f_c f_w f_s} - (c)_b \quad (\text{Eqn 18-11})$$

- $(c)_{t+s}$ = (sample plus background) count rate in counts per minute
- $(c)_b$ = background count rate in counts per minute
- τ = resolving time in minutes
- E = detector efficiency
- f = fractional emission of source

APPENDIX 1

Description of radioactive waste storage area.



May 2, 1990

In Reply Refer To:

U.S. Nuclear Regulatory Commission
Region IV
Parkway Central Plaza Building
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

ATTN: Jack E. Whitten

Dear Mr. Whitten:

We request that our NRC License No. 03-01082-01 be amended to allow an additional radioactive waste storage area to be used. Additional information is enclosed. This action has been approved by the Radiation Safety Committee and by Nuclear Medicine VACO (FTS 373-3195).

We respectfully request that this matter be expedited. This action will allow the movement of radioactive waste presently stored in researcher's labs to this new area. Our present amount of radioactive waste storage has been severely limited for an extended period of time.

Robert T. Patton
Medical Center Director

Enclosure

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PROPOSAL: ADDITIONAL RADIOACTIVE WASTE STORAGE AREA

1. Description

The following information is provided regarding our proposed additional radwaste storage area at the Little Rock Division. This location of use was not described in our original license application. The attached plot plan shows that the location is near the research labs described in our application.

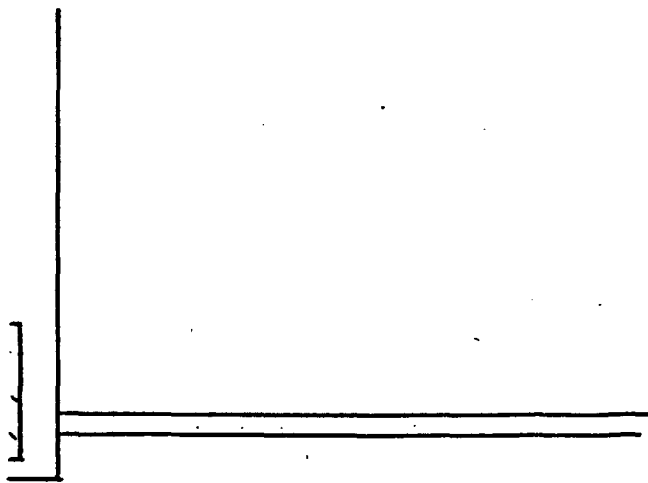
2. Radiation Safety

Our maximum volume of waste to be stored is anticipated to be less than 1000 ft³. The majority of this will be dry waste, stored in fiberboard drums. The radionuclides will be primarily ³H, ¹⁴C, and ³²P, which are pure beta emitters; the shielding requirements and external dose rates are minimal. External dose rate measurements and contamination surveys will be made to assure compliance with regulations as described in our original application.

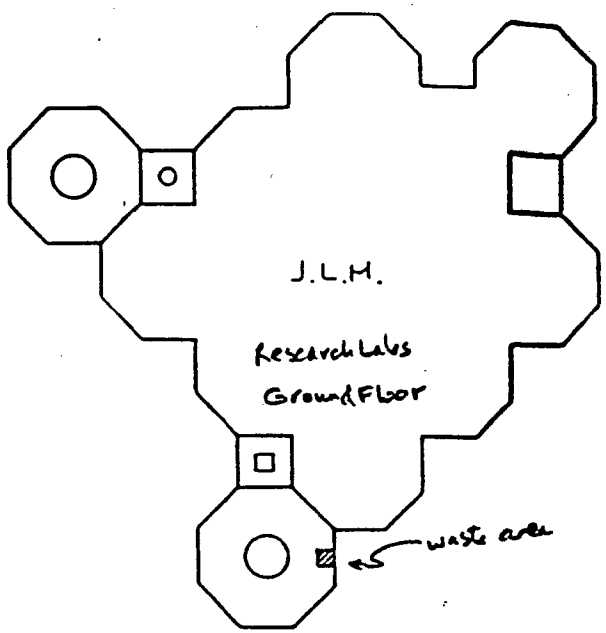
3. Security

The area is contained in the hazardous waste storage area. However, the area will be physically separated from the hazardous waste by means of a fence. Access to the area will only be allowed by radiation safety personnel or trained safety hospital personnel.

MAY 23 1992



ENTRANCE DRIVE

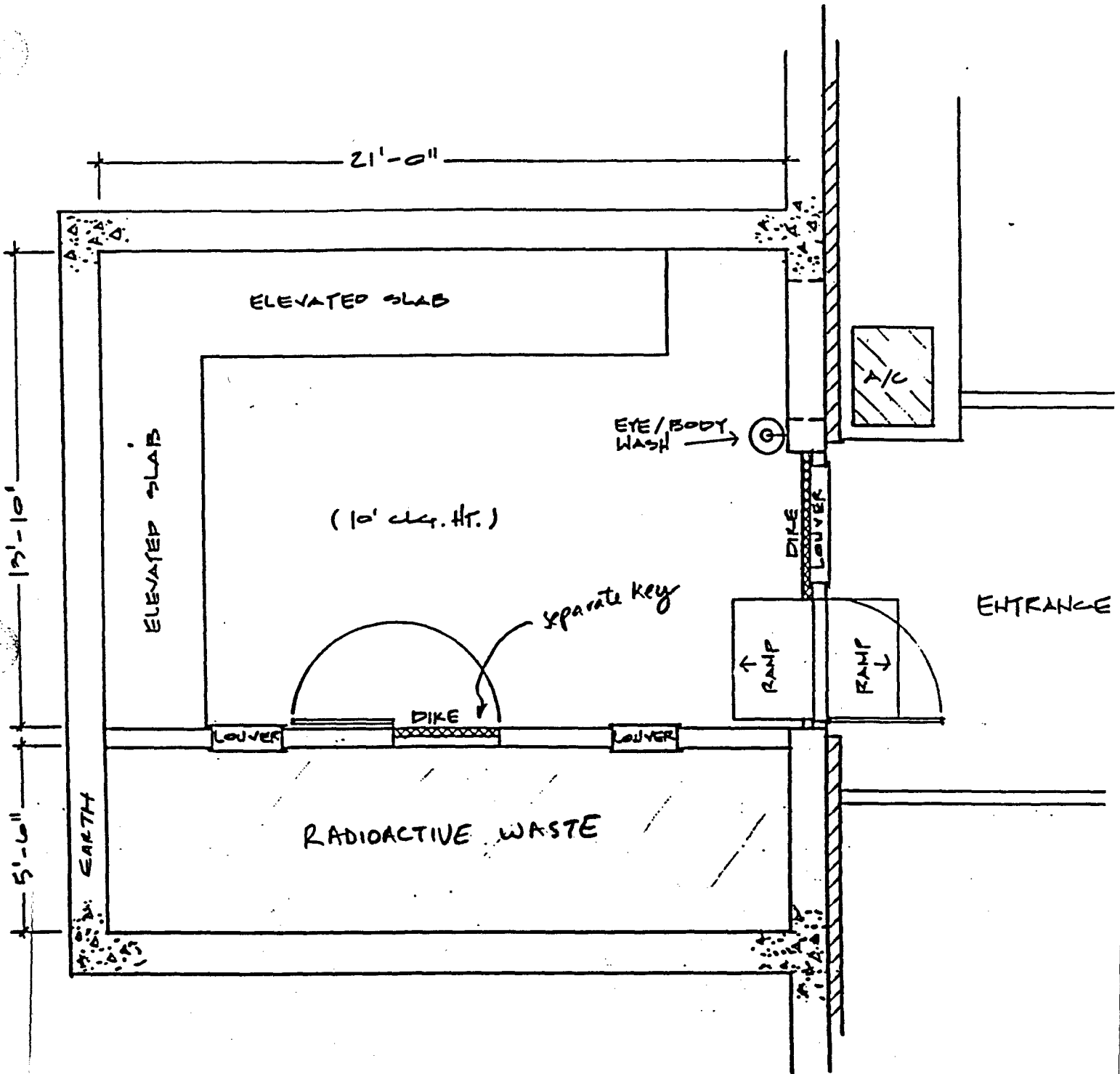


KEY PLAN



Notes : 1) waste area is into grade, below circular concrete drive (> 3' concrete)

HAZARDOUS WASTE STORAGE FACILITY @ V.A.M.C. LR. 1, ARKANSAS



FLOOR PLAN

1/4" SCALE

DEPARTMENT OF VETERANS AFFAIRS
Medical Center
4300 W. 7th Street
Little Rock AR 72205

In Reply Refer To: 598/115

June 30, 1992

Vivian Campbell
Health Physicist
US Nuclear Regulatory Commission
Region IV
Parkway Central Plaza Building
611 Ryan Plaza Drive, Suite 1000
Arlington TX 76011

Dear Ms. Campbell:

This is reference to our phone conversation today in which we discussed our recent license amendment request pertaining to holding certain nuclides five half-lives for DIS.

As you indicated, some points of clarification should be made.

1. Surveys and frequency.

Although the large majority of waste in this area is research waste, we may periodically store some Nuclear Medicine waste in this area. This will be limited to perhaps bulk type waste from I-131 therapy patients - linens, contaminated objects, etc. We therefore wish to commit to a survey frequency of weekly rather than quarterly.

2. Mixing of 5 $T_{1/2}$ waste with 10 $T_{1/2}$ waste.

All containers of waste are clearly individually marked with nuclide, activity, date placed in storage and date when it may be removed from DIS. A log is kept of each container to provide periodic reports of quantity and type of material in storage. These measures along with careful attention to detail should preclude the possibility of inadvertent disposal prior to its allowed time.

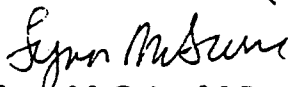
3. Request for retroactive applicability.

We requested that this amendment be made retroactive to January 1, 1989 without explanation. The request was made in order that S-35 radwaste generated prior to the amendment date in particular could be disposed of, since there is no present provision to DIS S-35 waste (87 da $T_{1/2}$). Additionally, other Fe-59 waste (perhaps our largest volume component and the only nuclide we currently transfer for burial) could also be disposed to reduce the current volume further. The reason for this request was the implication that if the disposal may be appropriate in the future then it should have been appropriate previously. There is obviously no significant public dose commitment from this radionuclide waste stream. There was no intention, nor should one be surmised, of this request being made in order to apply to actions that have already taken place. We fully understand that no actions are authorized until if and when an amendment is issued. We

further emphasize that we are now and have been previously in compliance with the 10 T_{1/2}, < 65 da T_{1/2} provision of our current license.

I apologize for any misunderstanding that may have occurred and appreciate the opportunity to perhaps clarify any of these issues.

Sincerely yours,



Lynn McGuire, M.S.
Radiation Safety Officer