RADIOWASTE HANDLING PROCEDURES
FOR
VA WADSWORTH MEDICAL CENTER

The waste disposal procedures outlined herein apply to anyone who uses or plans to use radioactive isotopes at this institution.

Table 1. The following physical states of radioactive waste are encountered at Wadsworth and are required to be kept separate:

Dry waste

Liquid waste(including droplets c̄ serum or other type vials)

Liquid scintillation counting vials (LSC)

Organic solvents

Animal carcasses

Table 2. Radiowaste segregation must be accomplished by separation according to increasing half-lives (see below). Do not mix items from separate columns, or mix beta with gamma:

Gamma radiowastes

Very short <1 day	Short <1 week	Medium <1 mo	Long >1 mo
Tc-99m	Tl-201	Cr-51	Fe-59
I-123	Ga-67	I-131	Co-57
	In-111		I-125
	Xe-133		Se-75
	Na-24		Sr-85
	Ca-47		Na-22

Beta radiowastes

Short <1 mo	Medium <1 yr	Long >1 yr
P-32	Ca-45	H-3
	S-35	C-14
		Cl-36
		Ni-63

SOLID WASTE - DRY

Definition: Waste such as paper, plastic, dry solids, glass, etc. Cannot include absorbed or solidified liquids, or serum vials or counting tubes containing any liquid

Lab handling:

Collect daily accumulations of waste in small plastic bags to form a package aproximately 8" x 12" (for compactor processing), tie neck of bag and store bag in laboratory radiowaste can until full.

Maintain log of isotope, amount and date, and label each disposal bag accordingly.

Segregate radioisotopes according to chart provided. Do not mix radioisotopes of short and long half-lives, or gamma with beta emitters.

Transport dry waste to Bldg. 340. Radiation Safety Officer, or designee, will arrange for final packaging.

Radiowaste storage facility - packaging instructions for radiation safety personnel:

When dry waste arrives at Bldg. 340, monitor for surface activity, and compress material in compactor. Obtain information from lab re isotope, amount, and dates generated.

Place compacted material in 55-gal barrel lined with 4 mil plastic drum liner. Record isotope, amount, date, and lab. After container is filled, seal plastic liner with a bag tie, or tape. Label barrel with radioactive white or yellow label, as appropriate for contents. Log contents and number the barrel. Monitor barrel and record findings.

...ASTE - AQUEOUS

...of supernatants, counting specimens, and diluting or ...k solutions. No organic solvent material is permitted.

...ling: Liquid wastes should be concentrated/reduced in volume prior to absorption on a suitable absorber (Pel-E-Cel), providing that there is no possibility of volatilization of the radioactive component during concentration. Segregate isotopes according to table provided. Do not mix short and long-lived radioisotopes, or gamma with beta emitters.

Store liquid wastes in lab in 1 qt, wide-mouth plastic jars with caps. Do not fill more than half full with Pel-E-Cel. Remember that one pint of Pel-E-Cel by volume is used to absorb one-half pint of liquid maximum. The remaining one pint space is for expansion.

Transport jars to Bldg. 346 for disposal packaging. Maintain a log for each jar, indicating isotope, amount, and date.

Radiowaste storage facility - packaging instructions for radiation safety personnel for absorbed liquids:

1. Container must be a DOT approved 17H drum, either 30 gallon or 55 gallon.
2. Container must be lined with a double 4 mil plastic liner and sealed at the top when container is packed.
3. Container must be filled with a two-to-one ratio of absorbent-to-liquid layered in approximately one-foot layers to ensure even dispersion.
4. Approved absorbents are:

Perlite (medium grade)
Diatomaceus earth (medium grade)
Pel-E-Cel
Super fine (Diatomite)
Speedi dry

applies to aqueous wastes only

WASTE LIQUID SCINTILLATION COUNTING VIALS

Definition: Consists of vials containing or having contained solutions used in liquid scintillation counters. Vials must not contain more than 30 uCi/ml of liquid if isotope is of transport Group III or IV (H-3 & I-125, for example).

Lab handling: Store vials in original shipping trays in shipping cartons. Do not accumulate more than 2 cartons (1,000 vials) in the lab at any time. Label and log radioisotope, amount, and date.

Transport to Bldg. 346 for disposal.

<u>Radiowaste storage facility</u> - handling instructions for radiation safety personnel for packaging of scintillation vials

1. Container must be DOT approved 17H drum, either 30 gallon or 55 gallon.

2. Container must be lined with double 4 mil plastic liner and sealed at the top when container is packed.

3. Place approximately 3" of absorbent at the bottom of the container. Vials and absorbent must be placed in the container in layers not exceeding 6" in depth. Between each layer, at least 1" of absorbent must be placed. The top layer must be approximately 3" of absorbent.

4. The vials are <u>not</u> to be opened.

5. The container must be filled with a two-to-one ratio of absorbent to liquid in the vials.

6. Approved absorbents are:

   Perlite (medium grade)

   Diatomaceus earth (medium grade)

   Super Fine (Diatomite)

   Speedi Dry

LIQUID WASTES - ORGANIC

Definition: Consists of solvents such as toluene, alcohol, etc., or mixtures with water. Disposal of this type of waste is under continuous investigation. There have been many rule changes.

Lab handling:

It is suggested that labs refrain from production of such wastes until the situation can be resolved. It may be possible to evaporate organic phases, if the possibility of entrainment of the radioactive component can be overcome.

Diatomaceous earths can be used under certain circumstances.

Contact Radiation Safety Officer if you are planning to produce radiowaste of this nature.

Radiowaste storage facility - handling instructions for radiation safety personnel

Waste of this nature will not be accepted in Bldg. 346 without authorization from the Radiation Safety Officer.

BIOLOGICAL RADIOACTIVE WASTE

Definition: Consists of animal matter, limited to carcasses and excreta. As of this date (11-26-79), no waste repository is accepting this type of waste.

Lab handling: It is suggested that labs refrain from production of such wastes until packaging, transportation, and disposal procedures are approved.*

Radiowaste storage facility - handling instructions for radiation safety personnel

Waste of this nature will not be accepted in Bldg. 346 without the approval of the Radiation Safety Officer.

* In the event that national waste repositories re-open, it is expected that carcasses will be packaged according to the following protocol:

1. Container must be a DOT approved double wall 30 gallon size inside 55 gallon.

2. Line 30 gallon drum with 4 mil plastic liner.

3. Place animal carcasses into 30 gallon drum with absorbent and lime.

   Ratio: One part lime to 10 parts absorbent.

4. Seal plastic liner and 30 gallon drum.

5. Place inside 55 gallon drum.

6. Place absorbent between walls of 30 gallon drum and 55 gallon drum.

7. Seal 55 gallon drum.

8. Approved absorbents are:

   Perlite (medium grade)

   Diatomaceous earth (medium grade)

   Super Fine (Diatomite)

   Speedi Dry

WHAT NEEDS TO BE DONE BEFORE SAFETY OR HAZARD OF BRENTWOOD DUMP CAN BE ADEQUATELY ASSESSED

1. Get from Wetterau detailed maps of exactly where the material he buried was buried (not just the general area, but the location of each hole). If he has no such maps (and he was using some records in leading the NRC around), he should point them out to the scientific panel at the site itself.

2. Find out from VA how to contact J.O. Erickson, Wetterau's predecessor, to determine from him whether burials took place prior to 1960, and if so, precisely where, what, how much, and when. (The 1960 Erickson records imply prior routine burials).

3. Determine (from Wetterau or Wetterau's records) whether the 3-foot in diameter circles (in which vegetation is not growing in the areas indicated by Wetterau on the map he previously provided as containing the waste dump holes) ~~xxxxxxxxxxxxx~~ correspond to dumping locations. If so, what explanation does he have why vegetation is lush all around the holes and why little or nothing grows on top of them.

4. Determine (from Wetterau or Wetterau's records) as closely as possible how much toluene (in gallons) and how much dioxane were buried. Confirm whether the records are correct in indicating that gallons of the material were just poured into 4-8 feet holes. Determine whether any chemicals besides toluene and dioxane were buried (by checking records and asking Erickson and Wetterau directly).

5. Request of UCLA it's records for the fifties and sixties regarding disposal of radioactive materials. We know some UCLA material was buried in the VA dump during the sixties. The records should indicate whether any more dangerous materials were buried in the fifties.

6. Determine from Wetterau or Wetterau's records (or Erickson) whether any other radioactive materials besides those recorded were disposed of, and if so, through what means? If nothing radioactive was disposed of during that period except through burial or by dumping down the drain, check radioactive inventory records of incoming materials to see if materials other than those listed in burial records were on site and what was the disposition of them.

7. Monitor water wells downstream for tritium, carbon-14, toluene, dioxane, and if possible, strontium, iodine, cesium, and plutonium.

8. Arrange for regular and routine monitoring in the future, preferably for at least tritium, carbon-14, toluene, and dioxane.

9. Take in the range of 20 soil samples, from top six inches or so, of dump hole locations and areas where vegetation won't grow, plus from streambed down below; monitor for as many of the substances listed in 7 as possible (at least dioxane and toluene--bare minimum).

10. Take about the same number of vegetation samples for monitoring, including roots (of grasses) from dump hole locations and particularly from the circular areas where little vegetation except stunted grasses grows.

11. After the above has been done, depending on the information received, determine whether some coring is needed.

SUMMARY OF WHAT IS KNOWN

1. Of the more dangerous isotopes recorded as buried (e.g. I-131), virtually complete decay should have taken place by now.

2. Of the long-lived material recorded as buried (i.e. tritium and carbon-14), the quantities listed as buried indicate a relatively small hazard because the materials are weak internal emitters and the quantity stated to be buried there is small.

3. A relatively large volume of toluene is recorded as having been buried at the site (in the hundreds of gallons), and at least some of the toluene is recorded to have been merely poured out of cans directly into the bottom of holes dug 4-8 feet deep and then covered over.

4. A less certain volume of dioxane was also buried; one receives the impression of less than 10% as much as the toluene.

5. Toluene is a highly toxic material; estimated lethal dose to a 150 pound person is one teaspoon to one ounce (a child proportionately smaller lethal dose.)

6. Dioxane is suspected of being a highly potent carcinogen.

7. One geologist on the technical committee says that he feels the primary means of transport would be upward migration, in part through capillary action, in part through vegetation roots, in part through rain followed by warming conditions evaporating the water that has sunk a few feet in the ground rising again.

8. The lack of vegetation, aside from stunted grasses, in 3-foot-diameter circles in the area marked on Wetterau's map as disposal areas, is, according to a couple members of the technical committee, worrisome indication of possible upward migration and potent effect.

9. The streambed so close to the disposal area provides a potentially worrisome means of transport of materials; although there may be a self-cleaning tendency also and the stream may not connect with ground water.

10. UCLA did, despite initial denials, bury material at the VA during the 60s. The VA, despite initial denials, did dispose of radioactive materials in the ocean.

WHAT IS NOT KNOWN

1. What if anything was buried prior to 1960? If material was buried prior to 1960, where was it buried?

2. Did UCLA bury material there prior to 1960?

3. How accurate are the records provided to date?

4. What migration of materials has taken place?

SUMMARY OF WHAT NEEDS TO BE DONE

1. Determine if there are either any records or personal recollections by the people involved which indicate one way or the other whether materials other than those listed on Wetterau's inventory were ever buried at the VA. In particular, determine (through Wetterau, his predecessor, NRC personnel, and UCLA radiation personnel) whether there were any burials prior to 1960, when his records begin.

2. Determine precise location of dump holes and whether they correspond to areas where vegetation doesn't grow; if so, has upward migration of the material made the soil toxic to plant life.

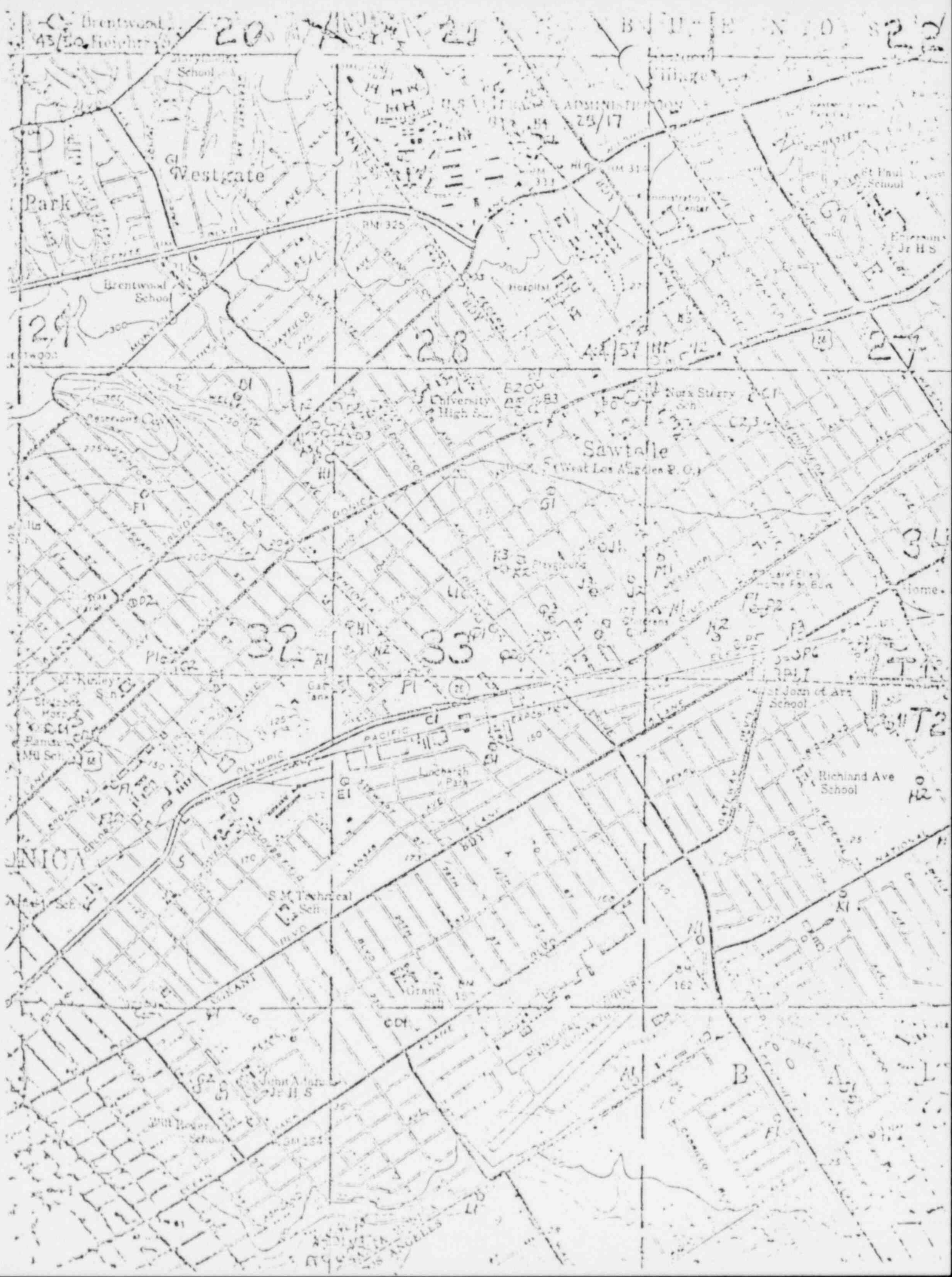
3. Take a few soil and vegetation samples from near the surface of these dumping and dead areas.

4. Determine whether Wetterau's map given to the technical committee, showing the dumping done at the side of the proposed lease area, is accurate, or whether the area he led the NRC through (middle of proposed lease area) is the correct location.

5. Visually inspect area to see if other circular no-vegetation areas exist outside of the known dump area as an indication of possible past dumping.

6. Monitor downstream water routinely for at least a couple radionuclides and toluene and dioxane.

7. Based on results of the above, determine whether some coring is needed (much easier than previously thought because the actual dump holes are apparently easy to find visually where we previously thought it would be trial and error.)



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REMOVAL OF I-125 FROM LIQUID RADIOASSAY WASTE AND CONVERSION TO SOLID WASTE.

Thomas R. Custer, Anne-Line Jansholt, Kenneth A. Krohn, University of California Davis Medical Center, Sacramento, CA.

Past closures of the three radiation waste disposal sites in the United States have created severe inconveniences for the nuclear medicine community. Although reopened, none will currently accept liquid waste. The limited number of sites, their distance from many users, and the complicated regulations regarding packaging and shipping make disposal of radioactive waste a costly endeavor for any institution. The goal of this work was to remove I-125 from liquid waste and convert it to a solid so the liquid could be disposed of in public sewage without dilution.

Approximately one-half gallon of waste per week is generated in our laboratory in the course of performing 1000 routine assays monthly. Preliminary experiments showed that >90% of the I-125 could be removed by mixing 0.15 g/ml of AG1X-2 anion exchange resin with the liquid waste. The remaining activity was still about 50 times higher than legal disposal limits which are 4 X 10^{-5} μCi/ml or 88.8 dpm/ml. When proteins were precipitated with 70% perchloric acid and filtered prior to anion exchange only 1728 dpm/ml remained in the liquid, about 20 times greater than allowable for sewage disposal. The remaining activity was allowed to soak in activated charcoal commonly used for aquarium filtration. With a concentration of 0.67 g of charcoal per ml of waste, only 30 minutes was required to reduce the activity in the liquid to 38 dpm/ml. After an overnight soak in the charcoal the remaining activity was equivalent to background. The above method was utilized five additional times on separate 200 ml aliquots of liquid waste. There was no difference between background; $\bar{X}$=641±25 SEM dpm, and the activity in the purified liquid; $\bar{X}$=657±26 SEM dpm/ml. A typical processing is shown in the table below, with a comparison resulting from boiling the precipitated waste.

While the anion exchange occurs instantly, charcoal adsorption does not. A concentration of 0.15 g/ml of charcoal can reduce activity to background levels in only 30 minutes when mixed with a magnetic stirring bar. The charcoal became saturated in 60 minutes after removing 2.6 μCi from 400 ml of waste. Alternately 0.67 g/ml of charcoal can reduce the remaining activity to legal disposal limits in 30 minutes when the adsorption takes place in a charcoal column, but overnight soaking is required to reduce the activity to background levels.

This purification and conversion method requires no more time or expertise than a routine radioassay.

	Without Boiling		With Boiling	
	dpm/ml	μCi/ml	dpm/ml	μCi/ml
Starting Activity	23,126	1.0 X 10^{-2}	24,326	1.0 X 10^{-2}
After Acid Precip.	10,964	4.9 X 10^{-3}	10,920	4.9 X 10^{-3}
After Boiling	———	———	14,035	6.0 X 10^{-3}
After Anion Exchange	1,282	5.7 X 10^{-4}	1,779	8.0 X 10^{-4}
5 Min in Charcoal	170	7.7 X 10^{-5}	178	8.0 X 10^{-5}
30 Min in Cahrcoal	30	1.4 X 10^{-5}	76	3.4 X 10^{-5}
Overnight in Charcoal	0		12	5.0 X 10^{-6}

PHS – Licensing

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U. S. Nuclear Regulatory Commission
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MATERIALS SECTION

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	Grayson	
✓	Pang	
✓	Riedlinger	BAR
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Some very nice words for Region V. Many thanks to all who participated in this effort.

HEB

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File: VA Hosp, Los Angeles