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DOCKET NO: 70-734

LICENSEE: GA Technologies, Inc. (GA)

FACILITY: Fuel Fabrication Facility, San Diego, California

SUBJECT: EVALUATION OF GA's PROPOSED DECONTAMINATION PLAN

Background

By letters dated November 16, December 6, December 21, 1984, and October 1, 1985, GA Technologies, Inc. (GA), informed the Nuclear Regulatory Commission (NRC) that GA had decided to decontaminate a portion of the plant so that it can be deleted from the license and released for unrestricted use. The principal areas to be released include the waste processing area, the associated canyon area, and raw land (mainly hillsides and canyons) surrounding these areas. In addition, GA plans to decontaminate the underground radioactive liquid storage tanks to an extent that they can be released for unrestricted use; however, the above areas are still within GA's current licensed operating area. Although these areas will be cleaned up to the criteria suitable for unrestricted release in the future, they will not be deleted from the GA license. In connection with the above activities, GA by letter dated October 1, 1985, submitted a revised decontamination plan reflecting the updated information from the original plan. The revised plan contains: (1) a description of areas to be decontaminated, (2) identification of areas where levels of radioactivity may exceed the regulatory levels for release to unrestricted use prior to decontamination, (3) criteria for release to unrestricted use, (4) methods to identify the quantity of radioactivity in these areas, and (5) decontamination schedule and procedure for detailed final survey (after decontamination) to demonstrate compliance with the criteria for unrestricted use.

Description of Areas to be Decontaminated

The following provides a general description on the various locations where decontamination activities are to be conducted. GA's objective is to cleanup these areas to the proposed criteria suitable for unrestricted use.

A. Underground Radioactive Liquid Waste Holding Tanks

1. Building 9

The Building 9 Tank is a 750-gallon, poured-in-place reinforced concrete tank. The tank was placed underground 28 years ago and is part of the Building 9 loading dock. The tank was originally used to dilute non-radioactive liquid waste. The liquid collected in

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the tank was contaminated with thorium and depleted uranium. At a later time, it was used to hold liquid contaminated with mixed fission and activation products. According to GA, the tank has no history of leakage.

2. Building 2/540

The Building 2/540 Tank is a 1,000-gallon, poured-in-place reinforced concrete tank. The tank was placed underground 28 years ago. The tank was used to hold liquid waste contaminated with natural uranium and thorium from metallurgical labs. No mixed fission or activation products were used in these laboratories. According to GA, the tank has no history of leakage.

3. Building 2/307

The Building 2/307 Tank is a 1,000-gallon, poured-in-place reinforced concrete tank. The tank was placed underground 28 years ago. The tank was used to hold liquid from a shielded research laboratory contaminated with Cs-137, Co-60, and Sr-90. According to GA, the tank has history of leakage.

4. Building 31

The Building 31 Tank is a 1,000-gallon steel tank. The tank was placed underground 23 years ago. The tank was used to hold hand wash water contaminated with enriched uranium, thorium, and activation products from the HTGR Critical Facility. According to GA, the tank has no history of leakage.

5. Building 21

The Building 21 Tank is a 1,000-gallon steel tank housed in a concrete cradle and surrounded by gravel. The tank was placed underground 28 years ago and originally served the TRIGA Reactor Facility. Until establishment of the Fuel Development and Research Laboratory (FDRL), there was little use for the tank. After establishment of the FDRL, the tank was used to hold liquid contaminated with mixed fission and activation products. According to GA, the tank has no history of leakage.

6. Building 37

The Building 37 Tanks are two 1,000-gallon steel tanks. The tanks were placed underground 20 years ago and serve the Building 37 Change Rooms. Only hand wash water contaminated with low levels of enriched uranium and thorium drains to the tanks. According to GA, the tanks have no history of leakage.

The locations of these underground tanks are shown on the site map in GA's submittal (Appendix A, Figure 1).

B. Waste Processing Area

1. Solar Evaporation Ponds

The Solar Evaporation Ponds consist of four sets of three 20' x 20' concrete ponds, one foot deep, designed to contain contaminated liquid which in turn is evaporated by solar energy. Three sets of ponds were used for liquid waste containing enriched uranium and thorium. The fourth pond contained liquid waste contaminated with mixed fission and activation products. Through the years, when there was a need to place additional liquid waste in the ponds, there was some cross contamination of the ponds if other ponds were full. Sludge was periodically removed, packaged, and shipped to a licensed radioactive waste disposal site.

2. Radioactive Waste Incinerator Site

The incinerator was located on a 20' x 20' concrete pad. The unit was placed in operation in 1963 and decommissioned and removed in 1980. Only the pad remains. The incinerator was used to burn solid waste contaminated with enriched uranium and was equipped with a particulate filter system. The ash was periodically removed from the incinerator and analyzed for U-235.

3. Waste Processing Facility

The Waste Processing Facility was constructed to process and package solid waste contaminated with primarily enriched uranium and thorium, small quantities of mixed fission and activiation products, and to process and solidify acid waste contaminated with uranium and thorium. The waste processing facility was placed into operation 28 years ago. The surface of the packaging area was asphalt and the solidification area concrete.

4. Upper Storage Yards

The upper storage yards were constructed 14 years ago with asphalt surfaces. Only equipment properly packaged for storage and solid waste packaged in accordance with appropriate regulations and awaiting disposal were stored in these areas.

5. Other Storage Areas

An underground storage facility was located at the east end of the Waste Processing Facility. The storage area was constructed by placing 10-inch diameter transite pipe underground. Slightly irradiated TRIGA fuel elements in capped, steel pipe containers were stored in the facility from 1960 to 1978. According to GA, at the time of removal, no measurable contamination was detected on the external surface of the pipe containers or inside the storage pipes. The yard was abandoned in 1979.

The Byproducts Storage Building is a metal "Butler" building located in the northwest corner of the Waste Processing Facility. Inside the building are:

a. Four storage wells 13 feet deep by 3 feet in diameter with removable shield plugs,

b. Six "lazy susans" located behind a shield wall. The "lazy susan" can be lowered into individual storage wells 12 feet deep, and;

c. Two levels of shielded shelf storage. Liquid cesium chloride was spilled in one of the storage wells several years ago.

A high-level storage bunker for 55-gallon drums reading 50 mr/hr or greater at the surface is located in the southeast end of the Waste Processing Facility. The Facility is a three-sided, open top enclosure constructed of burlap bags filled with a mixture of cement and sand and with an asphalt floor. The drums contained solid waste contaminated with mixed fission and activation products.

C. Canyon Area

The Canyon Area is a 1 acre area adjacent to the Solar Evaporation Ponds, Waste Processing Facility, and incinerator pad. According to GA, a spill in 1972 from the evaporation ponds contaminated part of this Canyon Area directly below the ponds with approximately 100 grams of enriched uranium and thorium. Water runoff from the Waste Processing Facility also enters the Canyon Area.

The locations of the above areas are shown in GA's submittal (Appendix A, Figures 1 and 2).

The principal area to be released for unrestricted use is shown on Figure III of Appendix A. This area includes the Waste Processing Area (Item B above), the associated Canyon Area (Item C above), and raw land (mainly hillsides and canyons) surrounding these areas.

Since the small localized storage tank areas are still within the plant's licensed operation, they will be decontaminated but not released at the present time for unrestricted use.

Evaluation of GA's Decontamination Plan

A. Decontamination Criteria for Unrestricted Releases

1. Facility and Equipment

The NRC has established guidelines for the decontamination of facilities and equipment prior to release for unrestricted use. The guidelines provide acceptable surface contamination levels for byproduct, source, or special nuclear materials. The guidelines which are applicable to GA's decontamination activites for facility and equipment, are shown in Table 1, Appendix A, of GA's submittal.

2. Contaminated Soil

The NRC issued a Branch Technical Position setting forth soil decontamination limits for unrestrictive releases of soil contaminated with uranium or thorium[1]. These soil limits shall be applied to the GA site. However, there is other radionuclide contamination involving fission product or activated products at the GA site. The staff provided GA with cleanup criteria using the dose limits established in Option 1 in the Branch Technical Position for all radionuclides involved. The staff has evaluated the derived soil limits for various radionuclides as summarized in the Tables of GA's submittal (see Appendix A) and found that they are acceptable.

B. Decontamination Plan

In Appendix A, GA has outlined the procedures for the proposed decontamination activities. This includes characterization of the decontaminated areas, proposed waste disposal to meet released criteria, decontamination schedule, radiological survey plan during cleanup and after cleanup, method to demonstrate compliance with the criteria for unrestrictive release, and the quality assurance plan. The staff has evaluated the above procedures and found that they are acceptable.

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1 W. J. Dircks, Executive Director of Operations, NRC, memorandum to the Commissioners, "Disposal or Onsite Storage of Residual Thorium or Uranium from Past Operations" presented as a Branch Technical Position from the Uranium Fuel Licensing Branch, October 5, 1981.

Conclusion

For the proposed GA decontamination activities, GA has provided acceptable criteria for the decontamination of some portion of their site such that they can be released for unrestricted use. The staff has evaluated the overall decontamination plan submitted by GA and found it acceptable. Therefore, the staff recommends that the GA plan be approved.

Original Signed By:
E. Y. Shum

E. Y. Shum
Uranium Process Licensing Section
Uranium Fuel Licensing Branch
Division of Fuel Cycle and
Material Safety, NMSS

Approved by: G A Deegan
for W. T. Crow, Acting Chief

Enclosure: Appendix A (GA Technologies ltd dtd 10/01/85)

OFFICE	FCUF	FCUF	FCUF				
SURNAME	EYShum/ks	VLHarpe	WTCrow				
DATE	11/19/85	11/19/85	11/20/85				

K5,A2-7

APPENDIX A

GA's DECONTAMINATION PLAN SUBMITTED ON OCTOBER 1, 1985

70-734

GA Technologies

In Reply
Refer To: 696-8023

GA Technologies Inc.
P.O. BOX 85608
SAN DIEGO, CALIFORNIA 92138
(619) 455-3000

1 October 1985

Mr. William T. Crow
Office of Nuclear Material
Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Docket 70-734: Plan for Obtaining Release of Certain Areas to Unrestricted Use. (8 copies)

Reference: (a) GA letter #696-6077 dated 11/16/84.
(b) GA letter #696-6085 dated 12/6/84.
(c) GA letter #696-6092 dated 12/21/84.

Dear Mr. Crow:

Enclosed are eight (8) copies of a plan prepared by GA Technologies Inc. (GA) for obtaining approval to release certain portions of its site to unrestricted use. This plan is a revised version of a previously submitted plan and supporting information (References a, b and c). It has been modified in response to recommendations contained in an NRC draft evaluation of the original plan as well as to reflect GA's current strategy for obtaining release following discussions with Messrs. Thomas and B. Brock of Region V. Further, the enclosed plan includes an updated schedule.

Your early approval of our criteria and plan are respectfully requested. Thank you for your timely support in this regard. If you have any questions or comments, please contact me at (619) 455-2823.

Very truly yours,

Keith E. Asmussen

Keith E. Asmussen
Licensing Administrator

KEA:hc

Enclosure:
Plan for Obtaining Approval to Release
Discrete Areas to Unrestricted Use.

cc: Mr. John B. Martin, NRC, Region V (1 copy)
Department of Health, State of California
(Attn: Ben Kapel) (1 copy)

25855

PLAN FOR OBTAINING APPROVAL TO RELEASE DISCRETE AREAS TO UNRESTRICTED USE

I. Objectives

The objectives of this plan are to provide:

1. a description of sites to be released to unrestricted use

2. identification of areas where levels of radioactivity approximate or exceed the regulatory levels for release to unrestricted use (prior to decontamination)

3. methods to identify and quantify levels of radioactivity in these areas

4. criteria for release to unrestricted use

5. a procedure for a detailed final survey (after decontamination) to demonstrate that radioactivity levels in the areas meet the criteria for unrestricted release.

II. Summary of Plan

Our plan for releasing the sites to unrestricted use is as follows:

1. Identify the activities and their site location, and for each site provide·

   a. a brief history of the activity;

   b. a characterization of any residual radioactive materials, including a listing of the principal nuclides, and estimates of their concentrations, and total quantity;

   c. proposed disposition of contaminated materials;

   d. schedule proposed dates for clean-up, survey and release to unrestricted use.

2. Decontaminate any such location to:

   a. meet the license criteria for release of a facility or equipment to unrestricted use (Table 1) and/or

   b. remove any contaminated soil and/or vegetation until the residuals meet the NRC policy (SECY 81-576) Option 1 criteria. This option assures that no individual is likely to receive an external radiation exposure at a rate greater than 10 μR/hr above background measured at one (1) meter above the surface or 20 millirem/yr to the lung or 60 millirem/yr to the bone. See Table 2.

3. Provide NRC with the results of our final surveys and request NRC confirmatory surveys to independently verify that the specified sites and their environs have been appropriately decontaminated.

4. Request NRC confirmation(s) that soils surrounding the removed underground radioactive material storage tanks listed above have been decontaminated to acceptable levels for release to unrestricted use. This confirmation will be used as evidence the locations need not be reconsidered at the time of future decommissioning activity.

5. Request and obtain a license amendment indicating that the several acres which contained and surrounded the waste pond area, incinerator area, waste processing and storage areas and the adjacent canyon areas have been appropriately cleaned up and may be released to unrestricted use.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
nat, U-235, U-238, and sociated decay products	5,000 dpm α/100 cm²	15,000 dpm α/100 cm²	1,000 dpm α/100 cm²
nsuranics, Ra-226, Ra-228, 230, Th-228, Pa-231, 227, I-125, I-129	100 dpm/100 cm²	300 dpm/100 cm²	20 dpm/100 cm²
nat, Th-232, Sr-90, 223, Ra-224, U-232, I-126, 131, I-133	1000 dpm/100 cm²	3000 dpm/100 cm²	200 dpm/100 cm²
ta-gamma emitters (nuclides th decay modes other than pha emission or spontaneous ssion) except Sr-90 and ers noted above.	5000 dpm βγ/100 cm²	15,000 dpm βγ/100 cm²	1000 dpm βγ/100 cm²

here surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nclides should apply independently.

s used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the unts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

asurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average could be derived for each such object.

e maximum contamination level applies to an area of not more than 100 cm².

e amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft sorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

e average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of tal absorber.

TABLE 2

Criteria for Soil Decontamination at the GA Site

Exposure Pathway	Target Criteria	Other Existing Criteria or Guidance
External Radiation (whole body)	10 µr/hr (35 mrem/yr)[a]	20 µr/hr indoor[b] -EPA cleanup standard for Inactive Uranium Processing Site; 500 mrem/yr-10 CFR 20; 170 mrem/yr-FRC Guidance; 400-900 mrem/yr-Surgeon General's Guidance for indoor exposure; 25 mrem/yr-40 CFR 190.
Inhalation of Particulates (lung, bone)	1 mrad/yr (lung) (20 mrem/yr)[c] 3 mrad/yr (bone) (60 mrem/yr)	1500 mrem/yr-10 CFR 20[d] 25 mrem/yr-40 CFR 190 1 mrad/yr (lung), 3mrad (bone) EPA Transuranic Guidance

(a) This value does not include background, the 35 mrem/yr (realistic dose) includes shielding factor of 0.5 from building a residential home for general population and residence time 80 percent.

(b) 40 CFR Part 192 - Federal Register, April 22, 1980.

(c) Based on quality factor of 20 as originally intended for alpha emitted from the transuranic elements.

(d) Designated in or derived from 10 CFR 20.

III. Sites to be Released to Unrestricted Use

The portions of GA's roughly 430 acre site to be released to unrestricted use are several small localized areas plus a relatively large area associated with and surrounding the old waste processing area. Their locations are shown in Figures I, II, III and IV.

The underground tanks being deactivated range from 750 gallons to 1000 gallons capacity. These tanks served as holdup for radioactive liquid effluents from licensed fuel facilities and laboratories utilizing radioactive materials. Where needed, alternative above ground effluent storage is being provided to eliminate the underground tank monitoring and potential soil contamination problems. Each of the tank sites are being treated as a potential highly localized discrete source area. (Reference Fig. I)

The Waste Processing Area (WPA) is an approximately six acre complex of discrete areas; an incinerator site, solar evaporation ponds, waste processing facility, associated storage yards, and other storage facilities. Their locations are shown in Figure II.

The canyons below the WPA are a discrete area occupying approximately one acre through which run-off from the WPA goes.

Figure III shows the specific areas associated with and surrounding the Waste Processing Area. This relatively large portion of the GA site (~80 acres) is the principal area to be released for unrestricted use. Figure IV shows this area in more detail and identifies the affected areas.

A brief description of each of the above is given below:

A. UNDERGROUND RADIOACTIVE LIQUID WASTE HOLDING TANKS

1. Building 9

The Building 9 Tank is a 750 gallon poured-in-place reinforced concrete tank. The tank was placed under ground 28 years ago and is part of the Building 9 loading dock. The tank was originally used to dilute non-radioactive acid wastes from a metal plating operation and was later converted to a radioactive liquid waste holding tank. The liquid collected in the tank was contaminated with thorium and depleted uranium. At a later time it was used to holdup liquid contaminated with mixed fission and activation products. The tank has no history of leakage.

2. Building 2/540

The Building 2/540 Tank is a 1,000 gallon poured-in-place reinforced concrete tank. The tank was placed underground 28 years ago. The tank was used to hold-up liquid waste contaminated with natural uranium and thorium from metallurgical labs. No mixed fission or activation products were used in these laboratories. The tank has no history of leakage.

3. Building 2/307

The Building 2/307 Tank is a 1,000 gallon, poured-in-place, reinforced concrete tank. The tank was placed under ground 28 years ago. The tank was used to hold-up liquid from a shielded research laboratory contaminated with Cs-137, Co-60 and Sr-90. The tank has a history of leakage.

4. Building 31

The Building 31 Tank is a 1,000 gallon steel tank. The tank was placed under ground 23 years ago. The tank was used to hold-up hand wash water contaminated with enriched uranium, thorium, and activation products from the HTGR Critical Facility. The tank has no history of leakage.

5. Building 21

The Building 21 Tank is a 1000 gallon steel tank housed in a concrete cradle and surrounded by gravel. The tank was placed under ground 28 years ago and originally served the TRIGA Reactor Facility. Until establishment of the Fuel Development and Research Laboratory (FDRL), the tank saw little use. After establishment of the FDRL the tank was used to hold-up liquid contaminated with mixed fission and activation products. The tank has no history of leakage.

6. Building 37

The Building 37 Tanks are two one-thousand gallon steel tanks. The tanks were placed underground 20 years ago and serve the Building 37 Change Rooms. Only hand wash water contaminated with low levels of enriched uranium and thorium drains to the tanks. The tanks have no history of leakage.

B. Waste Processing Area:

1. Solar Evaporation Ponds

The Solar Evaporation Ponds consists of four sets of three 20' x 20' concrete ponds one foot deep designed to contain contaminated liquid which in turn is evaporated by solar energy. Three sets of ponds were used for liquid waste containing enriched uranium and thorium. The fourth pond contained liquid waste contaminated with mixed fission and activation products. Through the years there was some cross contamination of the ponds necessitated by one or the other set of ponds being full when there was a need to place additional liquid waste in the ponds. Sludge was periodically removed, packaged and disposed of to a licensed radioactive waste disposal site.

2. Radioactive Waste Incinerator Site

The incinerator was located on a 20' x 20' concrete pad. The unit was placed in operation in 1963 and decommissioned and removed in 1980. Only the pad now remains. The incinerator was used to burn solid waste contaminated with enriched uranium. The incinerator was equipped with a particulate filter system. The ash was periodically removed from the incinerator and analyzed for U-235.

3. Waste Processing Facility

The Waste Processing Facility was constructed to process and package solid waste contaminated with enriched uranium and thorium primarily, and small quantities of mixed fission and activation products, and to process and solidify acid waste contaminated with uranium and thorium. The waste processing facility was placed into operation twenty-eight years ago. The surface of the packaging area was asphalt and the solidification area concrete.

4. Upper Storage Yards

The upper storage yards were constructed fourteen years ago with asphalted surfaces. Only equipment properly packaged for storage, and solid waste packaged in accordance with appropriate regulations and awaiting disposal was stored in these areas.

5. Other Storage Areas

An underground storage facility was located at the east end of the Waste Processing Facility. The storage area was constructed by placing 10 inch diameter transite pipe underground. Slightly irradiated TRIGA fuel elements in capped and gasketed steel pipe containers were stored in the facility from 1960 to 1982. At the time of removal no measurable contamination was detected on the external surface of the pipe containers nor inside the storage pipes.

The Byproducts Storage Building is a metal "Butler" building located in the Northwest corner of the Waste Processing Facility. Inside the building are:

a. 4 storage wells 13 feet deep by 3 feet in diameter with removable shield plugs,

b. 6 "lazy susans" located behind a shield wall. The "lazy susan" can be lowered into individual storage wells 12 feet deep, and

c. two levels of shielded shelf storage. Liquid cesium chloride was spilled in one of the storage wells several years ago.

A high level storage bunker for 55 gallon drums reading 50 mR/hr or greater at the surface is located in the south east end of the Waste Processing facility. The facility is a three sided open top enclosure constructed of burlap bags filled with a mixture of cement and sand and has an asphalt floor. The drums contained solid waste contaminated with mixed fission and activation products.

C. Canyon Area

The canyon area is a one acre area adjacent to the solar evaporation ponds, Waste Processing Facility and incinerator pad. A spill in 1972 from the evaporation ponds contaminated part of this canyon area directly below the ponds with approximately 100 gms of enriched uranium along with thorium, Cs-134, Cs-137, Co-60 and Sr-90. Water runoff from the Waste Processing Facility also enters the canyon area.

D. Principal Area to Be Released to Unrestricted Use

The principal area to be released is shown on Figure III. This area includes the Waste Processing Area (Item B above), the associated canyon area (Item C above), and areas of raw land (mainly hillsides and canyons) surrounding these areas.

IV. Survey and Sampling Plan for Each Site

A. Underground Tank Removal, Survey and Sampling Plan

Prior to removal of any tank, the tank will be pumped and the contents sampled and analyzed. The inlet lines will be capped, placarded as appropriate, and a site map marked to indicate the location of the drain lines.

The flow chart for the removal of the tank, the surveys to determine contamination levels, if any, as well as decontamination and disposition is shown on the decision tree in Figure V. The isotopic content for any contamination inside or outside of the tank will be determined. The total quantities will be made from dose rate measurements utilizing information from the measured isotopic content.

After removal of the tank, the hole will be surveyed with an appropriate instrument and if no measurable activity above background levels is detected, permission will be requested from the USNRC to backfill the hole. The decision tree for the activity associated with any contamination within the tank pit is also given on Figure V.

If levels above the acceptable criteria are detected, soil samples will be collected, analyzed and evaluated. If the levels are in excess of the release criteria for the identified isotope, the soil will be removed, packaged and shipped to a licensed land burial facility for disposal. In the event the quantity is economically not removable, the profile and total quantity of radioactive material will be determined and a disposition scenario proposed to the USNRC.

B. Waste Processing Area

1. Survey Plan

In the waste processing area the first part of a survey will be a "walkover" survey. This will consist of random readings taken in the areas with a calibrated meter. This effort will locate any "hot" spots. Readings from this survey will be recorded for any area exceeding 10 µR/hr above background at one meter above the surface.

Upon completion of the "walkover" survey and with "hot" spots removed, the grid survey will be inaugurated. A grid survey will be accomplished by using a 10' x 10' grid in the designated contaminated areas and a 30' x 30' grid in all other affected areas. Measurements at each grid intersection at a distance of one meter above the surface will be made using a MicroR meter. If the readings do <u>not</u> exceed 10 µR/hr above the background at one meter above the surface, the surveyor shall move to the next grid intersection. If the reading exceeds 20 µR/hr above background at

one meter above the surface, a surface reading shall also be taken.

With a reading of 20 μR/hr or greater at one meter above the surface, and the surrounding 4 grid area average exceeding the 10 μR/hr above background at one meter above the surface, that point shall be considered for soil sampling. See section on Soil Sample Plan for details.

Survey each of the affected areas as noted below;

Solar Evaporation Ponds	10' X 10' grid
Radioactive Waste Incinerator Site	10' X 10' grid
Waste Processing Facility	10' X 10' grid
Upper Storage Yards	10' X 10' grid
Other Storage Areas	10' X 10' grid

C. Canyon Area

1. Survey Plan

The canyon area is defined as that area adjacent to and below the solar evaporation ponds, Waste Processing facility and incinerator pad. This area is shown in Figure IV.

Because of the activities previously described for the waste processing areas, it is anticipated that there are several locations at which some contamination is expected.

As was done in Waste Processing Area, the first part of the canyon survey will be a walkover survey. It will be done in an identical manner as that described for the Waste Processing Area. Upon completion of this survey and its associated decontamination, a grid survey will be performed. It will be performed in the same manner as the Waste Processing area, except that the grid description is as follows:

Spill area below ponds	10' x 10' grid
Other affected areas	10' x 10' grid
Canyon floor	30' lengthwise along central axis
	10' lateral, parallel to central axis

D. Land Surrounding Waste Processing and Canyon Areas

Land surrounding the affected areas described above in Sections B and C but within the boundaries of the principal area for release to unrestricted use, shall be surveyed for external radiation by a "walkover" survey at 30 foot intervals. Grids will not be staked out unless readings >10 μR/hr above background at 1 meter above the surface are detected. If this level is exceeded, the location will be identified as an affected area and characterized.

E. Soil Sample Plan

1. Prior to Clean-up

After the contaminated (affected) areas have been identified, soil samples will be taken to characterize the site. Core samples will be obtained in the Solar Evaporation Ponds, the spill area below the ponds, the canyon floor and the radioactive waste incinerator site and other specific areas where there is a high potential for contamination to migrate downward into the soil strata or transport into the soil by erosion.

o Collection

a. The surface vegetation (brush and weeds) will be removed by cutting off at ground level, not uprotted.

b. Surface samples (0-1") will be collected; approximately 2 kilograms of soil sample.

c. A composite soil sample 1"-6" or 1"-12" will be collected based on the area and estimated depth of contamination.

d. If subsurface soil contamination is found, then additional samples (e.g. core samples) will be taken at sufficient depths to provide an estimate of the extent of contamination.

o Preparation

a. The soil samples will be free of vegetation and rocks.

b. The samples will be dried to remove moisture.

c. The sample will be ground to a fine powder with no "clumping" (clumping would be due to excess moisture), or

if it can be demonstrated with adequate data that there is no significant difference between the results obtained with samples that have been ground to a fine powder and samples that have not been ground, then subsequent analyses will not require samples to be ground. Samples that are not ground to a fine powder will be crushed and mixed to eliminate clumping and to homogenize.

- Analysis

  The samples will be analyzed by gamma ray spectroscopy, gross alpha, gross beta, DNAA or chemical analyses performed to written procedures. The option to log the core hole, identify and quantify the nuclides present in-situ with a gamma spectrometer and NaI detector or equivalent instrument may be used in lieu of counting the core samples.

2. During Clean-up

During the decontamination phase (removal of soil with contamination above Option 1 target criteria) soil samples will be collected and the locations will be marked and identified on a map. The first foot of soil will be prepared, and analyzed as described above to:

a. Verify correlation between the microR/hr readings and the soil radionuclide concentrations or

b. Check compliance with the inhalation criteria in areas where correlation may not exist.

If results indicate contamination levels above the Option 1 criteria, additional decontamination will be conducted in order to meet the target criteria (see Section V).

3. After Clean-up

Upon completion of required decontamination, soil samples will be collected as follows:

a. In areas where the microR/hour readings are the controlling criterion (i.e., where a correlation between μR meter readings and the results of soil sample analyses has established that both the inhalation and direct radiation pathway limits are met when using the direct reading), random sampling of 5% of the 30' x 30' grids will be conducted.

b. In all other affected areas, samples will be taken as follows:

   Representative soil samples shall be collected at each grid (30' x 30') from the first inch (1") of soil.

The samples will be prepared and analyzed as described above.

V. Target Criteria for Unrestricted Release

A. Facility & Equipment

Table 1 is taken from USNRC's criteria for releasing facilities and equipment to unrestricted use. It has been incorporated into our SNM-696 license. This table will be used for releasing process equipment or buildings to unrestricted use. Ponds, tanks, etc. will be treated as process equipment. The above criteria will not be utilized for soils.

B. Direct Radiation

External radiation (gamma dose rate in air one meter above ground level) shall not exceed 10 μR/hr above background for a diffuse source area (a contaminated area greater than 30' x 30') and shall not exceed 20 μR/hr above background for a discrete area (a contaminated area smaller than 30' x 30').

C. Inhalation Pathway

Table 3 contains values of soil contamination (pCi/gm) which if residing on the surface and could be inhaled would not lead to an exposure exceeding the Option I acceptability limit. Soil contaminations above these Table 3 values may be acceptable under unusual circumstances but only if a specifically analyzed intrusion scenario shows that any individual will not be exposed to radiation levels greater than those appropriate for NRC/EPA Option I.

D. Ingestion Pathway

The GA site is located within a semi arid region zoned for light industry and Research and Development. The area is not, nor will likely be, allowed any residential or agricultural land usage. There is no potable water on the site or its environs. A brackish water table is approximately 275-300 ft deep at about the same level as the nearby salt water backwater and marshes. Therefore the pathway for ingestion of any residual contamination via any food or water is highly improbable.

However, vegetation (brush, weeds, etc) removed from the GA site for unrestricted disposal could possibly enter the ingestion pathway. Therefore the contamination levels of such vegetation must satisfy the target criteria for ingestion exposure (as well as the target criteria for direct radiation and inhalation exposure).

The target criteria for food ingestion exposure is 30 mrem/year to the bone (NRC Policy Issue SECY-81-576). The dose commitment resulting from ingestion (vegetation, beef, milk) of radionuclides from contaminated vegetation are shown in Table 4. These values are based upon a unit concentration of 1 pCi/gram of each radionuclide in the vegetation.

E. Summary of Limiting Concentrations for Direct Radiation and Inhalation Dose Limits

Table 5 summarizes the derived limiting concentrations of various groups of radionuclides for the compliance of the direct radiation and inhalation dose limits. Meeting the target criteria in Table 5 will indicate that the residuals satisfy the Option I acceptability criteria.

TABLE 3

Individual Concentration in Soil Resulting in an Annual Inhalation Dose of 20 mrem to the Lung[1] and 60 mrem to the Bone[2]

Radionuclide	Solubility Classification	Derived Concentration (pCi/g) Lung (20 mrem)	Bone (60 mrem)
U-238	Y	35[5]	1.2×10^{4}
U-238	W	3.2×10^{2}	3.9×10^{3}
U-238	D	1.9×10^{4}	1.2×10^{3}
U-235	Y	35	1.2×10^{4}
U-235	W	3.2×10^{2}	3.9×10^{3}
U-235	D	1.9×10^{4}	1.2×10^{3}
U-234	Y	30	1.0×10^{4}
U-234	W	2.8×10^{2}	3.6×10^{3}
U-234	D	1.7×10^{4}	1.1×10^{3}
Th-232	Y	35	2.6×10^{2}
Th-232	W	3.3×10^{2}	1.0×10^{2}
Ra-228	W	3.3×10^{3}	2.9×10^{3}
Th-228[3]	Y	20	1.8×10^{3}
Th-228	W	1.3×10^{2}	3.3×10^{2}
Co-60[4]	Y	1.2×10^{4}	1.6×10^{6}
Co-60	W	1.2×10^{5}	5.8×10^{6}
Cs-137[4]	D	9.6×10^{5}	1.8×10^{6}
Sr-90[4]	Y	1.8×10^{3}	2.6×10^{5}
Sr-90	D	1.6×10^{6}	2.8×10^{4}

---

(1) Pulmonary lung (570 gm); consistent with EPA's Transuranics Guidance.

(2) Bone means osseous tissue, (5,000 gm); consistent with EPA's Transuranic Guidance.

(3) The daughters of Th-228 and Ac-228 do not contribute significantly to the inhalation dose because of their comparatively short half-lives.

(4) Solubility classifications are based on ICRP-30.

TABLE 4[1]

Dose Commitment Resulting from Ingestion (Vegetation, Beef, Milk) of Radionuclides from Contaminated Vegetation (brush, weeds, etc.). Figures Based on a Unit Concentration of 1 pCi/g of Each Nuclide in the Vegetation.

Radionuclides	Bone Dose (mrem/yr)
U-238	1.9E-0
U-235	1.9E-0
U-234	2.2E-0
Th-232	2.1E-0
Th-230	2.0E-0
Th-228	4.0E-1
Ra-228	4.5E-0
Ra-226	8.9E-0
Sr-90	6.1E-0
Cs-137	2.3E-1
Pu-239	5.6E-2

(1) Reference: NRC's Docket No. 70-820 - United Nuclear Corporation Resources Company "Soil Decontamination Criteria for the Decommissioning of the UNC's Facility." Scrap Recovery Junction, Rhode Island.

TABLE 5

Derived Limiting Concentrations For Various Groups of Radionuclides

Radionuclide	Derived Limiting Concentration (pCi/gm)		
	Inhalation		Direct Radiation (1)
	Lung (20 mrem)	Bone (60 mrem)	(10 μR/hr)
Depleted uranium			
U-238, U-234 (Y)	35	—	--
U-238, U-234 (W)	3.2×10^2	--	--
U-238, U-234 (D)	--	--	8.0×10^2
High-enriched uranium			
U-234, U-235 (Y)	30	—	--
U-234, U-235 (W)	2.8×10^2	--	--
U-234, U-235 (D)	--	--	8.0×10^2
Natural Thorium			
Th-232, Th-228 (Y)	--	--	10
Th-232, Th-228 (W)	--	--	10
Cobalt			
Co-60 (Y)	--	—	8
Co-60 (W)	--	--	8
Cesium			
Cs-137 (D)	--	—	15
Strontium			
Sr-90 (Y)	1.8×10^3	--	--
Sr-90 (D)	--	2.8×10^4	--

(1) GA prefers to use an instrument (microRmeter) to demonstrate compliance of 10 μ R/hour above background at one meter for diffuse areas.

VI. Compliance With the Target Criteria

Given below are the target criteria for direct radiation and inhalation pathways. Both criteria must be met prior to release of the area for unrestricted use.

A. Direct Radiation

The direct radiation level of 10 μR/hr above background is intended as a target criterion for open land cleanup. The dose limit will be measured using calibrated micro R meters accurate enough to differentiate background.

Upon completion of any required decontamination, a final survey will be made of the waste processing and canyon areas. The purpose of this survey is to verify all significant contamination has been removed and the area meets the target criteria.

To demonstrate compliance with the direct radiation limit, the affected areas will be divided into grids about 30' x 30' for surveying purposes. In order to meet the target criterion, the following conditions have to be met:

> External radiation (gamma dose rate in air one meter above ground level) shall not exceed 10 μR/hr above background for a diffuse source area (a contaminated area greater than 30' x 30') and shall not exceed 20 μR/hr above background for a discrete area (a contaminated area smaller than 30' x 30').

Land surrounding the affected areas but within the boundaries of the principal area for release to unrestricted use shall be surveyed for external radiation by a "walkover" survey at 30 foot intervals.

B. Inhalation of Particulates

Table 3 summarizes the derived soil contamination limits for each inhaled radionuclide, which results in a committed dose of 20 mrem/yr to the lung and 60 mrem/yr to the bone. It is noted that Table 3 soil limits are for individual radionuclides. If a mixture of these radionuclides exists in soil, the following formula will be applied to show compliance:

the sum of $Ci/Li \leq 1$
where Ci = the average soil concentration of radionuclide i, and
Li = the derived maximum soil limit for radionuclide i (from Table 3).

To demonstrate compliance with the dose limits established for the inhalation pathway, the following has to be met:

> Representative soil samples shall be collected at each grid (30' x 30') from the first inch (1") of soil and analyzed for the various isotopes. The concentrations of isotopes can be averaged by any four adjacent grids to demonstrate compliance with the target criteria given in Table 3.

The derived concentrations in Table 3 also apply to subsurface soil contamination. Therefore, subsurface* soil samples will also be collected. After decontamination has resulted in the above condition being met for surface soil, compliance with the subsurface requirement will be demonstrated by analyzing a random 5% of the subsurface soil samples.

If a subsurface random sample exceeds the limit, the four adjacent 30' x 30' subsurface samples will be analyzed and the results averaged. If the average is below the limits, the inhalation dose target criteria will have been met. If the averaged result is above the limits, further decontamination will be conducted.

In these affected areas where it can be demonstrated with adequate data that meeting the 10 μR/hr above background limit will also meet the inhalation dose limit, direct radiation measurements will be used to demonstrate compliance for both pathways. In this case, soil samples of five (5) percent of the grids will be randomly collected and analyzed to confirm compliance.

C. Ingestion of Vegetation (Brush, weeds, etc.)

Table 4 summarizes the derived vegetation contamination limits for each ingested radionuclide which results in a committed dose of 30 mrem/year to the bone. The vegetation contamination limits given in Table 4 are for individual radionuclides. If a mixture of these radionuclides are present in vegetation, the following formula will be applied to demonstrate compliance:

$$\text{the sum of } Ci/Li \leq 1.0$$

where Ci = average concentration of radionuclide i in vegetation

Li = derived limit for radionuclide i in vegetation (from Table 4)

*"subsurface soil sample" refers to a soil sample taken starting at a depth of 1" and extending to a depth of 6" or 1' depending on the area and estimated depth of contamination.

VII. Disposition of contaminated Soil and Vegetation

Soil

Soil with contamination levels above the Option 1 target criteria will be appropriately packaged and shipped to an authorized radioactive waste disposal facility.

Vegetation

Vegetation (brush, weeds, etc.) with contamination levels above the target criteria for external radiation or inhalation exposure or ingestion exposure (See Sections V and VI) will be appropriately packaged and shipped to an authorized radioactive waste disposal facility.

Vegetation with contamination levels below the target criteria for external radiation, inhalation exposure and ingestion exposure may be removed from the GA site for unrestricted disposal, e.g. sent to a local land fill facility.

VIII. Protective Measures and Survey Equipment

1. Work performed in controlled areas will be done using proper protective measures to comply with 10 CFR 20 and accepted health physics practices.

   Safety equipment on site that will be available for use at the work location includes but is not limited to:

   a. Anti-contamination clothing
   b. Personnel monitoring devices
   c. Respiratory protection equipment (supplied air hoods)
   d. Air samplers
   e. High Efficiency Particulate Air (HEPA) filtered vacuum cleaners.
   f. Calibration standards for instrumentation.
   g. Health Physics Instrumentation

      - o MicroR/hr meters (Ludlum mod 19 or equivalent)
      - o GM meters (Ludlum mod 3 with a Model 44-9 pancake probe or equivalent)
      - o Alpha survey meters (Eberline PAC 1-SA or equivalent)
      - o Gas proportional sample counters (Ludlum mod 2200 or equivalent)
      - o Gamma analyzers with NaI and Ge(Li) detectors (Davidson pulse Height Analyzer mod. 4106 or equivalent)

   Personnel will be surveyed upon exiting a controlled area. Equipment will be surveyed and decontaminated if required prior to removal from the controlled area.

   The project will be performed in such a manner to minimize radiation exposure and comply with the "As Low As Reasonably Achievable" (ALARA) philosophy.

   Soil samples will be analyzed for uranium content and the results will be the basis for an evaluation/analysis to verify criticality safety is assured.

IX. Schedule for Release to Unrestricted Use

The schedule of activities leading to the release of contaminated sites are shown on Tables 6, 7, and 8.

A. Underground Tanks

Table 6 lists underground tanks, the status/date of tank removal, status of any surrounding soil contamination, the dates of Region V verification, the release date authorizing backfill and final survey of environs of the tank site. Where the USNRC staff can be on site during or immediately after tank removal, they will verify absence of soil contamination and sample soils. The pits will be backfilled immediately thereafter if contamination levels are below the criteria for release.

B. Principal Area to be Released to Unrestricted Use

Contaminated soil removed during decontamination efforts will temporarily be piled in staging areas within the boundaries of the area to be released to unrestricted use. A meaningful survey cannot be completed for the entire area to be released prior to removal of this contaminated soil. Inasmuch as the packaging and shipment of the contaminated soil will be time consuming tasks, and because of the need to prepare (e.g. grade and seed) certain areas (where contaminated soil has been removed) in order to control soil erosion, the NRC confirmatory surveys of the total area to be released will be performed in two phases. The areas associated with Phase I and Phase II are identified on Figure IV. The first phase will involve a NRC confirmatory survey of essentially the entire area except those areas occupied by or influenced by the piles of contaminated soil and one small area containing buried asphalt. Following the NRC confirmatory surveys demonstrating that the Phase I area meets the target criteria for release, this area may be regraded.

After the contaminated soil has been removed from areas associated with Phase II, NRC will be requested to perform the final confirmatory survey.

Table 7 lists the schedule for equipment removal and appropriate cleanup. Table 8 gives the target schedule for completion of soil and surface surveys and for Region V/ORAU independent verification surveys.

TABLE 6

SCHEDULE FOR UNDERGROUND RADIOACTIVE WASTE HOLDING TANKS

Area	Removal Date	Clean-up	GA Survey	Projected USNRC Confirmatory Survey	Backfill Release Date
1. Building 9	10/8/84	NR	10/8/84	Open	10/18/84
2. Building 2/540	7/26/84	NR	7/26/84	10/5/84	10/5/84
3. Building 31	8/13/84	NR	8/13/84	Open	11/16/84
4. Building 2/307	6/28/84	6/28/84 7/23/84 8/14-15/84	6/28/84 7/24/84 8/18/84 8/23/84 9/12/84	10/5/84	12/6/85
5. Byproducts Storage Bldg. (storage pits)	11/16/84	11/17/84	11/19/84	Open	2/85
6. Building 2	11/14/84	NR	11/14/84	Open	11/15/84
7. Building 37	1/8/85	NR	1/8/85	Open	1/9/85

NR - None required.

TABLE 7

SCHEDULE FOR DECONTAMINATION OF PRINCIPAL AREA TO BE RELEASED

	Remove Equipment	Complete Clean-up*
1. Waste Processing Areas		
a. Solar Evaporation Ponds	8/31/84	10/15/85
b. Incinerator Site	N/A	11/85
c. Waste Processing Facility	11/84 11/85	3/86
d. Upper Storage Yards	11/15/84	3/86
2. Canyon	N/A	11/85
3. Surrounding raw land	N/A	N/A

*tentative, subject to change due to weather conditions, etc.

TABLE 8

Schedule for Final Surveys of Area to Be Released to Unrestricted Use

	GA Survey*	Final Report*	Request USNRC Confirmatory Survey**
Phase I Area(s)	10/24/85	11/15/85	11/15/85
Phase II Area(s)	3/1/86	4/1/86	4/1/85

*Dates are tentative, subject to weather conditions.

**Tentative target dates for requesting NRC confirmatory survey. It is anticipated NRC confirmatory survey would commence about two weeks after request.

X. Background Levels

The background for the general area was established by taking soil samples from five (5) selected locations (Figure I) agreed to by GA Technologies Inc. (GA) and the U.S. Nuclear Regulatory Commission (USNRC). Surface samples (0-1") and composite samples from between 1' to 2' depth were taken from each of the five locations.

Samples were assayed by gamma ray spectroscopy by GA, the USNRC and Oak Ridge Associated Universities. The results were compared and the following background levels will be utilized.

Isotope	Conc pCi/gm
K-40	21.81
Co-60	0.003
Cs-137	0.09
U-238	1.5
U-235	0.09
U-232	1.50
Th-228	1.32
Ra-226	0.84
Ra-228	1.37

Background external radiation levels will be established for the work site by taking readings in the adjacent non-contaminated areas and averaging them to obtain an overall background reading for the area.

APPENDIX A

QA PLAN

1.0 Purpose

The purpose of the QA Plan is to establish an acceptance plan for the survey, evaluation and release of descrete locations on GA Technologies property in order to meet the U.S. Nuclear Regulatory Commission regulations for release to unrestricted use.

2.0 Scope

The scope will include examination and review of; statistics and procedures, instrumentations and calibration, data and evaluation documentation and verification.

3.0 Statistics and Procedures

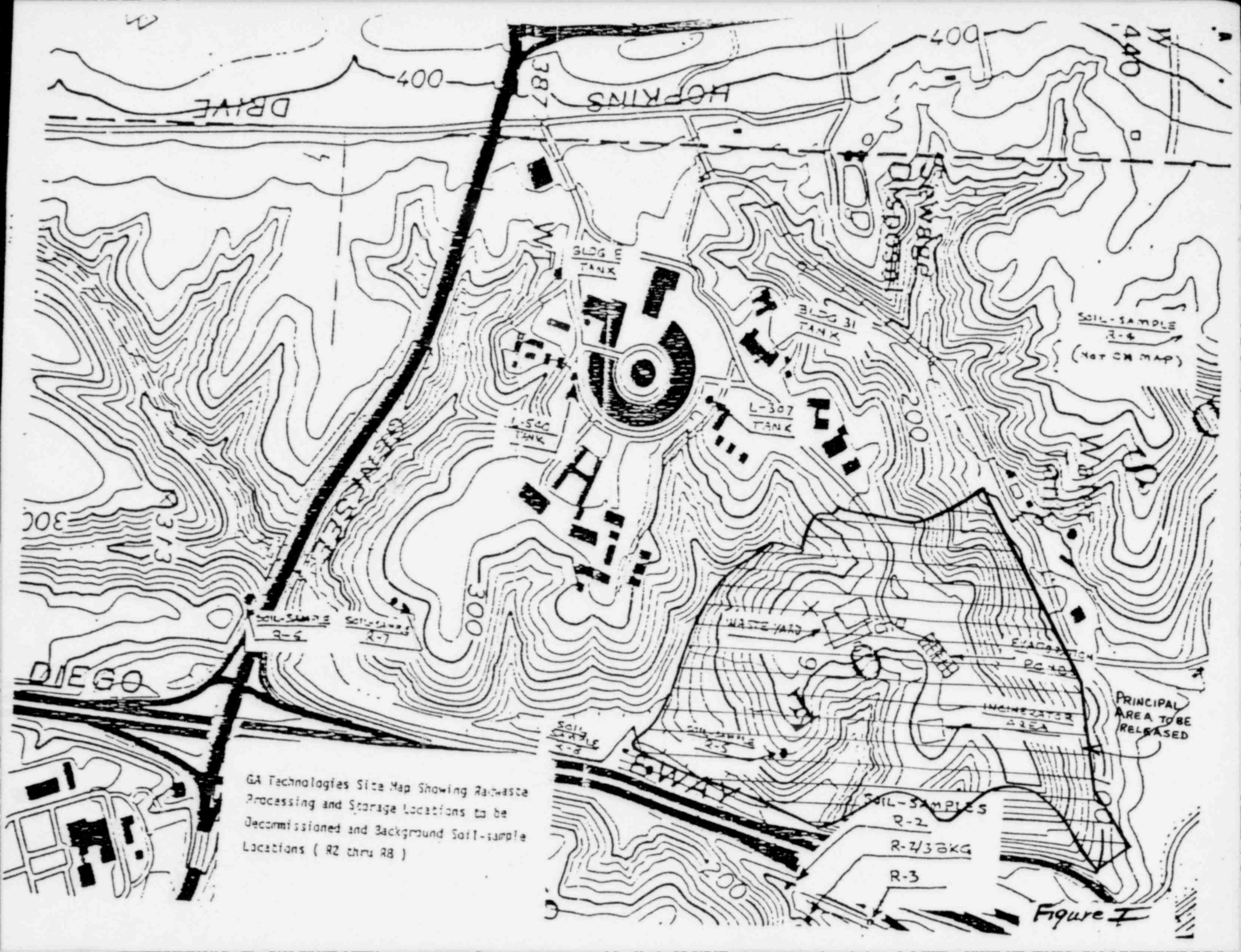
Statistics that are used shall be checked for accuracy and applicability. The procedure used shall be current.

4.0 Instrumentation and Calibration

All instruments shall be mechanically and electronically stable. The calibration shall be with applicable standards and be traceable to NBS Standards.

5.0 Data, Evaluation, Documentation and Verification

All data and its documentation shall be maintained as to be retrievable and traceable.



GA Technologies Site Map Showing Radwaste Processing and Storage Locations to be Decommissioned and Background Soil-sample Locations (R2 thru R8)

Figure I

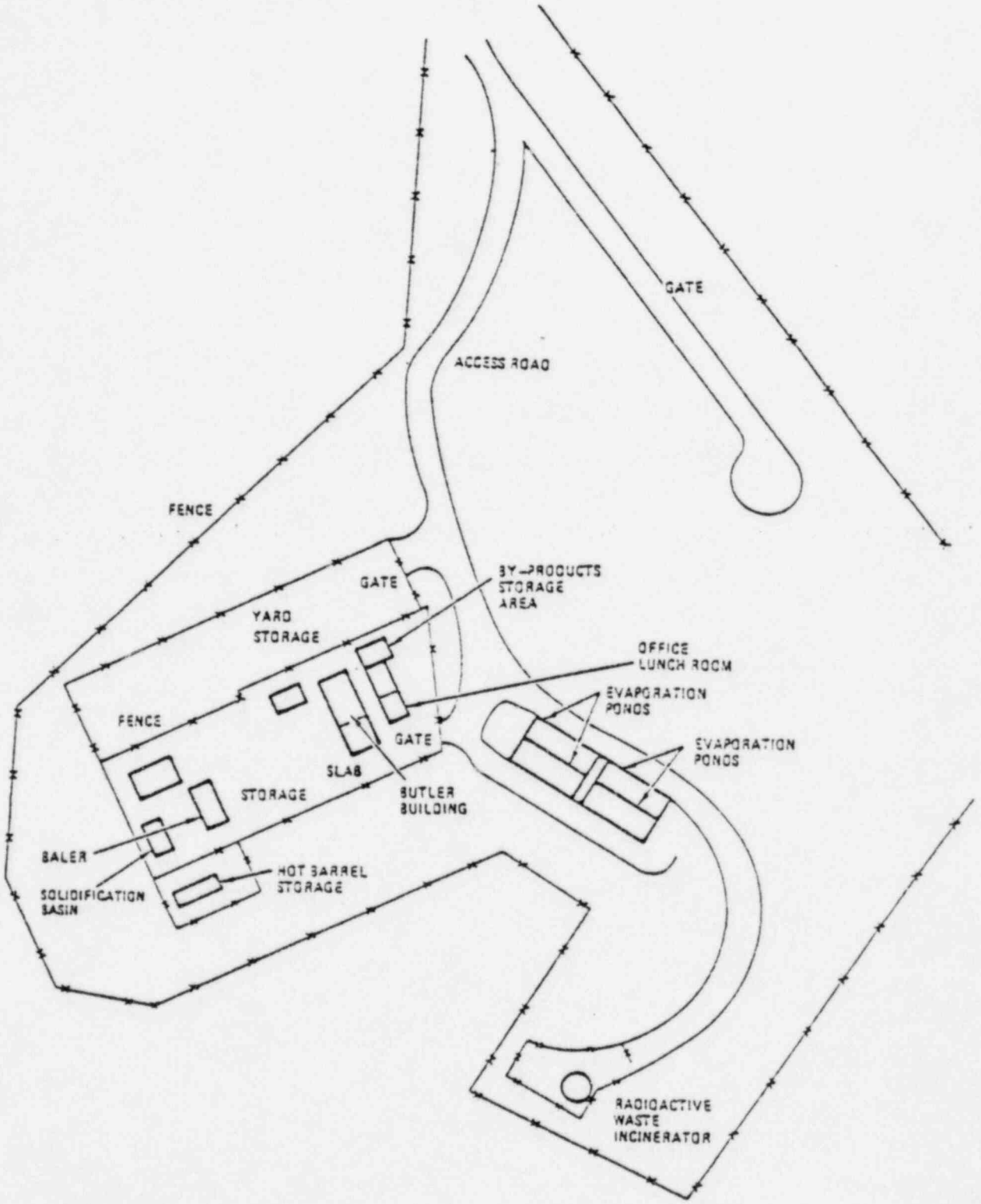


Fig. II Waste Yard and Adjacent Facilities

COUNTY OF SAN DIEGO

-LEGEND-

FIGURE III. P

DENOTES BOU
UNRESTRICTED

Boundary Segment

SURVEY SECTION
Department of Transportation

4-21-77
INLAND AERIAL SURVEYS

4-21-77
INLAND AERIAL SURVEYS

MAPPING SECTION
Department of Transportation

NATIONAL MAP ACCURACY STANDARDS

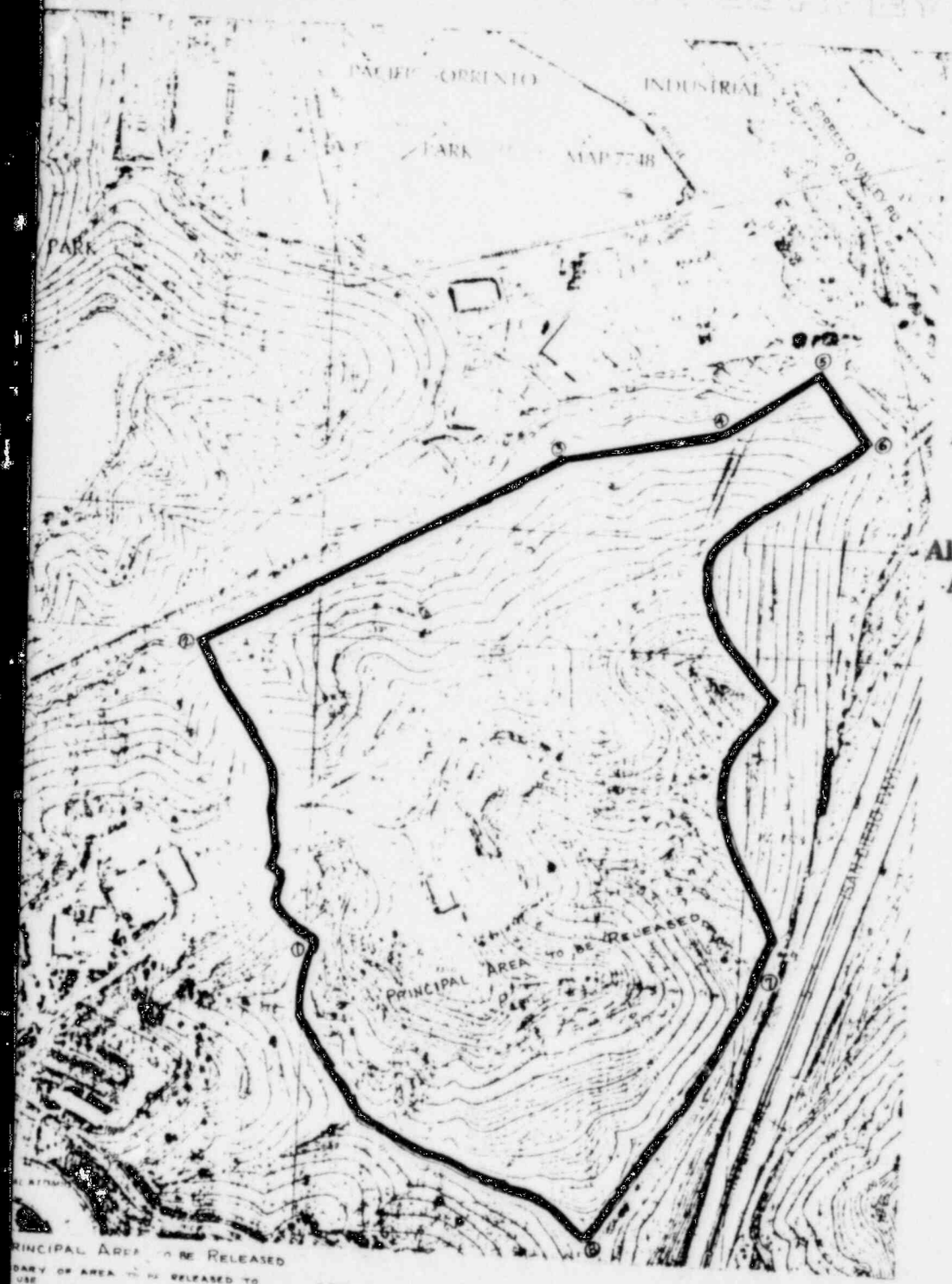


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FIGURE IV. PRINCIPAL AREA TO BE RELEASED - SHOWING PHASE II AREAS AND "AFFECTED" AREAS.

Figure V. Decision Tree Associated with Underground Tank Removal, Determination of Contamination, and Subsequent Disposition

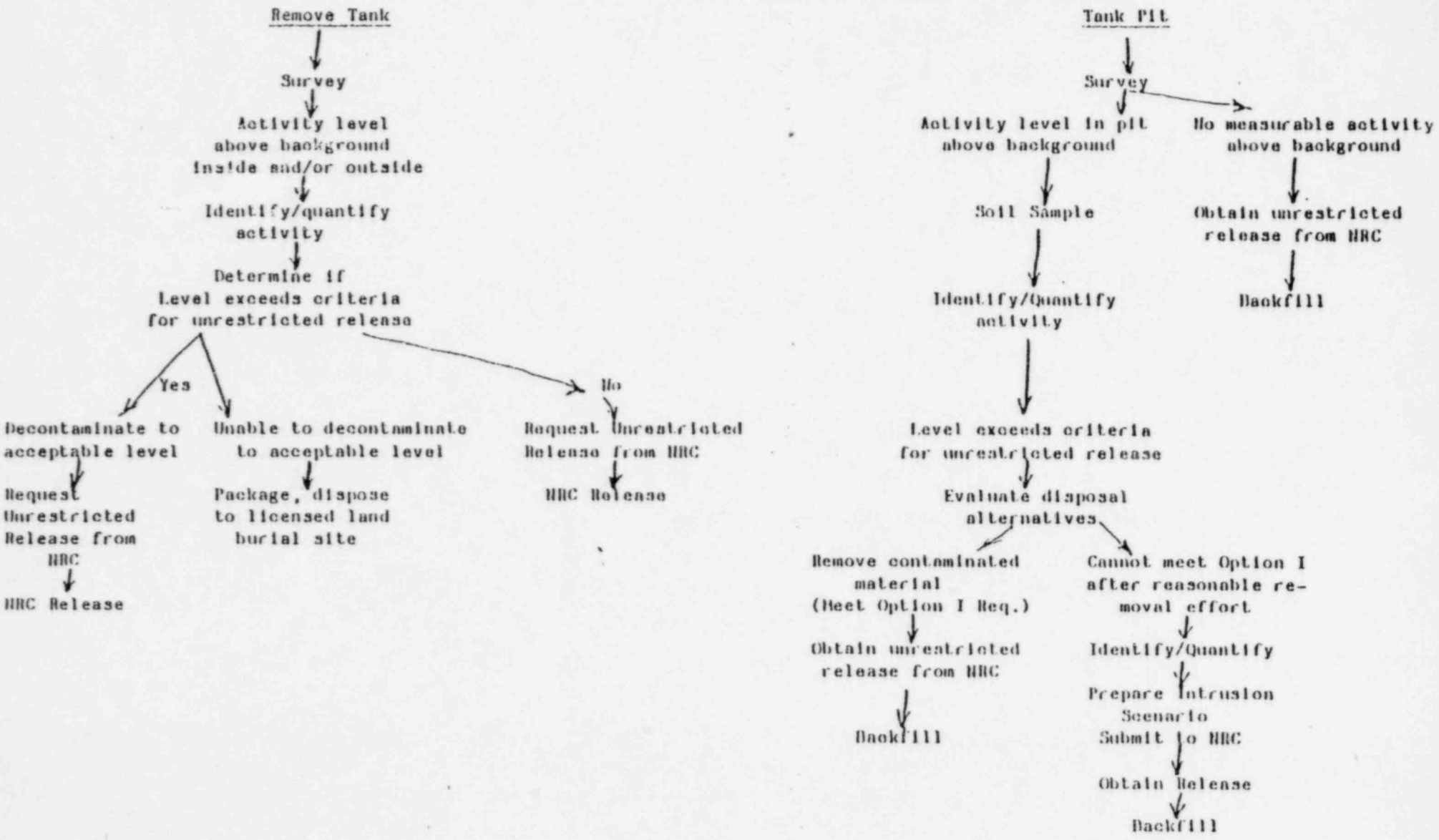

FIGURE VI

Flow Chart Associated with Contaminated Areas in Waste Processing and Canyon Areas