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CLEANUP SUMMARY REPORT

Tatum Dome Test Site
Mississippi

JUNE 1972

(Reprinted - April 1973)

UNITED STATES ATOMIC ENERGY COMMISSION
NEVADA OPERATIONS OFFICE
Las Vegas, Nevada

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I. CLEANUP EFFORT

Introduction

All Tatum Dome Test Site radiation dose levels which might be potentially hazardous to present and future human surface use have been reduced to the lowest practicable levels, consistent with the applicable guides. The "Radiological Safety Guide for Decontamination and Disposal of the Tatum Dome Site" was provided to the Nevada Operations Office by the Division of Operational Safety, AEC Headquarters (DOS/HQ) on May 26, 1971 (see Appendix B).

The cleanup was accomplished by (1) sampling and analyzing of soil, water, vegetation, and indigenous animal life from on-site work areas and contiguous off-site areas, (2) excavating and placing all contaminated soil and pumping all contaminated water and other accumulated contaminated fluids into the Tatum Salt Dome nuclear cavity, (3) sealing the cavity by plugging all drilled entry holes with cement, (4) transporting for disposal at NTS all remaining solids (including several types of material), equipment, debris, and other personal property either contaminated or suspected of contamination, and (5) demonstrating that the site has been decontaminated and restored so far as is practicable to provide reasonable assurance that unrestricted use of the site surface will cause no concern in respect to radiological considerations.

Surveillance to identify and define the contamination commenced May 1970 and was performed by REECo Environmental Sciences Division (REECo/ESD). The survey consisted of collecting soil, water, and vegetation samples

for analysis which was performed at REECo's laboratory in Mercury, Nevada. Portable instrument surveys were also completed at this time as well as surveys which had been performed on a quarterly basis since approximately 1965. With receipt of the criteria, a more detailed surveillance was instituted after arrival on site for the actual cleanup. Soil sampling by REECo/ESD was done in a very detailed manner which was made possible by on site sample analysis. Surveys with thin window instruments (7 mg/cm^2), GM portable instruments, portable scintillation meters and TLD's were accomplished during the cleanup program. Additional sampling of vegetation and animal life was completed by a combined effort of the Environmental Protection Agency's Western Environmental Research Laboratory (EPA/WERL) and REECo/ESD. These samples were analyzed in the respective Nevada laboratories.

Soil exceeding the cleanup criteria level of $1.0 \times 10^{-5} \text{ } \mu\text{Ci/g}$ for gamma emitters (natural background is in the $10^{-6} \text{ } \mu\text{Ci/g}$ range) was generally confined to six major areas at the site. These areas are generally identified as the E-6, E-14, Bleeddown Plant, Ground Zero, Drilling Storage Yard, and West Gate areas.

The major portion of the contaminated hardware removed and packaged for shipment to NTS came from the Bleeddown Plant area. Other miscellaneous hardware and debris either contaminated or suspected of being contaminated was removed from the Junk Yard, Cable Yard, and Warehouse.

As part of the cleanup operation, various drill holes and pits were either plugged and/or backfilled. The items of radiological interest are described below:

1. HT-2 Well

This well was used as a disposal well for radioactive liquid waste during earlier operations and has been abandoned by plugging back to the surface with cement. This plugging program was accomplished without any radiological incident.

2. Post-Shot No. 1 Slush Pit

Excavation in this area went into the water table and because of the very muddy conditions it became impractical to remove the liquid mud. Continuing to excavate to criteria levels would have made it necessary to obtain different equipment, creating a much larger hole. The muddy conditions prevented actual removal and made the operation one of continual mixing.

With the concentration ($1-3 \times 10^{-5} \mu\text{Ci/g}$) near criteria levels ($1 \times 10^{-5} \mu\text{Ci/g}$) and considering the above problems, relief was requested from DOS/HQ and was obtained (TWX, M. B. Biles/R. E. Miller, 12/17/71). Approval was given to backfill with clean material to near original grade. The radioactive material in the $1-3 \times 10^{-5} \mu\text{Ci/g}$ range was buried under approximately seven feet of clean fill dirt (see Figure 1).

3. Post-Shot No. 1 "Mouse Hole"

This narrow ($\sim 12"$ diameter) hole was excavated to 12 feet which was the limit of the equipment and penetrated the water table. To avoid a large excavation problem similar to that encountered in the slush pit, approval to backfill was requested from DOS/HQ (R. J. Catlin/D. W. Hendricks, 1/14/72) and received. The last contamination

TATUM DOME TEST SITE
GROUND ZERO-STA. 1A-POST SHOT HOLE NO. 1
PS#1 SLUSHPIT LOCATION
SCALE 1"=50'

PS#1 MOUSEHOLE COVER SLAB
SCALE 1"=6'

Figure 1.

analysis at the 12-foot level indicated GM readings (open shield) of ~ 0.15 mR/hr which corresponds to a concentration of approximately 3×10^{-3} $\mu\text{Ci/g}$.

The hole was backfilled with non-contaminated pieces of concrete (about 4-6" in diameter), on top of which was placed a horizontal concrete slab ($\sim 4' \times 2' \times 2'$) and a second slab ($\sim 4' \times 2' \times 2'$) standing vertically. This amounted to approximately 12' of concrete on top of the excavation end point. The remaining void was backfilled with clean soil and the monument slab expanded to cover the hole.

4. Nuclear Cavity

The Station 1-A Hole, Post-Shot Hole No. 1, and the Post-Shot Hole No. 2, all of which entered the nuclear cavity, have been plugged to the surface with concrete. See Figure 2. Before the Station 1-A casing was plugged, approximately 10,770 cubic yards of contaminated soil and 1,305,000 gallons of contaminated fluids and fresh water were disposed of into the nuclear cavity. The fresh water was used to slurry the soil and lubricate the casing wall and was injected simultaneously with the soil. From the recorded total volume of material it was calculated that the top of the cavity fill would be in the vicinity of 2705 feet below ground surface. The cavity dimensions used in the calculation and the accuracy of the recorded volumes of material were confirmed when the cavity fill was tagged at 2704 feet. The tag was made using a casing perforating gun run immediately below the collar

SOUTHWEST-NORTHEAST SECTION THROUGH TATUM DOME

locator logging tool which simultaneously recorded the casing collar locations to reduce the error in the stretch of the machine. The above volumes are estimated to occupy approximately 57% of the available cavity volume. A concrete slab, approximately 6' x 14' x 6" thick, was poured to cover the top of the casing of Station 1-A and Post-Shot Hole No. 1, as well as the Post-Shot No. 1 "Mouse Hole" mentioned above. A monument was erected on this slab and on the monument was mounted a plaque stating the restrictions on excavation, drilling, and removal of materials below mean sea level on the 1,470-acre tract comprising the test site. The text of this plaque is as stated in Appendix C.

II. RADIOLOGICAL SURVEY RESULTS

This section summarizes the results of the various radiological surveys performed during and after the cleanup efforts at the Tatum Dome Test Site. These results, which are representative of several thousand radiological surveys and samples obtained during cleanup operations, indicate the extent of decontamination efforts at this facility. A more comprehensive report will be published soon after all the data has been compiled and prepared for presentation.

All operations experiences and records were reviewed in order to identify potentially contaminated areas of the site. Additionally, preliminary radiological surveys including soil, water and vegetation samples were obtained to attempt delineation of the general extent of contamination. A summary of these results is included in tables

in Appendix A.

Concurrent with actual cleanup operations, comprehensive radiological surveys and sampling were performed. Limited qualitative and quantitative radiological measurements were performed off-site, as well, to distinguish background radiation levels, i.e., those nuclides of natural origin or from atmospheric fallout. Detailed surveys of soil and surface waters, including vertical distribution of contaminated soil, were performed in all locations where measured radioactivity levels exceeded 10 times the average background levels for the site. The specific radionuclides comprising the contamination found on site were identified by laboratory analysis of extensive samples from each contaminated area on site.

All contaminated areas of the site were decontaminated and cleaned up to the lowest practicable levels by:

- (1) removing the contaminated soil and water and injecting it into the explosion cavity;
- (2) segregation and removal of all contaminated solids including several types of scrap, equipment and debris by packaging for shipment to the NTS for burial as contaminated waste.

Following delineation of the radiological condition, decontamination, and cleanup of the TDTS, the post-cleanup radiological status of the site was determined as follows:

Contaminated surface waters in excess of the applicable guides were injected into the explosion cavity. Sampling

of remaining surface water sources, such as streams, ponds, wells, and intermittent pools, using one-liter "grab" samples, indicated that all these sources were at background levels. Background levels were generally 5.4×10^{-6} $\mu\text{Ci/cc}$ $^3\text{H}^*$, 5.5×10^{-8} $\mu\text{Ci/cc}$ gross gamma, 2×10^{-7} $\mu\text{Ci/cc}$ gross beta, and 7.1×10^{-11} $\mu\text{Ci/cc}$ ^{239}Pu .

Residual contamination levels on buildings, equipment, scrap, and other materials released to the public or transferred for use by other agencies were measured at background levels. There was no detectable contamination on any such material released. All materials, equipment, and scrap containing measurable contamination were segregated, packaged and held for shipment to the Nevada Test Site for final disposal. Those items for which comprehensive radiation monitoring could not be adequately performed (i.e., interior of plumbing, etc.) were assumed to be contaminated and included in the material to be shipped to the NTS. Monitoring techniques and equipment used were in accordance with the applicable guides and included both portable instrument surveys as well as swipe samples for laboratory analysis.

Soil throughout the Tatum Dome Test Site above the water table (a depth of 2-9 feet depending on weather and location) was extensively sampled for radiological analysis. All contaminated soil was placed in the explosion cavity in accordance with applicable guides.

Soil Sampling

Soil samples collected from decontaminated areas of the Tatum Dome Test

*Minimum detectable level

Site were of two kinds. Surface samples consisted of soil averaged to a depth of not more than one inch for a total volume per sample of one pint. Core samples were collected using a coring tool having a cylindrical volume of three inches by eight inches from which an approximate volume of one pint was extracted. Core samples were collected at six-inch intervals to a depth of four feet in most cases. However, the sampling depth was extended up to nine feet in some areas.

Soil sample locations were selected generally using a grid system of 15-foot squares in areas such as the E-6 Decontamination Pad and Swamp. In the Ground Zero area, a 10-foot grid was used, and in special cases where the contaminated area was quite localized, smaller grids were employed.

Soil samples collected from more remote, non-activity areas, whose history indicated little potential for contamination, were obtained using a 1,000-foot grid system supplemented by random samples. These samples were mostly collected during May 1970 before cleanup operation commenced. The samples consisted of surface soil approximately six inches square and less than one inch deep. Core samples were obtained using a four-inch diameter core tool to sample at four-foot depths, generally. A one-pint aliquot was obtained from each core for analysis.

Isotopic analyses were run on selected soil samples for ^{239}Pu , ^{90}Sr , ^3H , and gross beta. All soil samples were analyzed for gamma contributors. It was determined that no significant plutonium or strontium contamination was present. The controlling isotope was determined to be

^{125}Sb in all cases.

After cleanup, soil sample results generally ranged from 1×10^{-5} $\mu\text{Ci/g}$, ^{125}Sb down to background levels. The majority of the samples averaged about 2×10^{-6} $\mu\text{Ci/g}$, ^{125}Sb for all areas except two. A slush pit, uncovered at the south end of the GZ area was determined to have local spots containing levels of ^{125}Sb up to 3.0×10^{-5} $\mu\text{Ci/g}$ at depths of 7-9 feet below grade as explained in Station 1. Since this depth is at or below the water table and the volume of soil estimated for completed decontamination to criteria levels was large, further decontamination was not attempted. This area was backfilled with clean soil.

The Post-Shot No. 1 "Mouse Hole" was also found to be above criteria levels ($\sim 3.0 \times 10^{-3}$ $\mu\text{Ci/g}$) after excavation to 12 feet. For the reasons given elsewhere, HQ permission was given to backfill.

Portable instrument surveys of all decontaminated areas indicated no radioactivity levels exceeding 0.05 mrad/hr measured at one centimeter above the ground with an instrument whose detector window was less than 7 mg/cm^2 .

After decontamination and cleanup of the Tatum Dome Test Site, additional evaluations were made to identify any residual potential radiological health problems.

Thermoluminescent dosimeters were emplaced throughout the test site and off-site at selected locations for about one month to determine the ambient radiation levels compared to background. Evaluation of

these dosimeters indicates an average projected level of approximately 56 mrem/yr on-site for continuous occupation. The average background level of radiation measured in communities and farms around the site was essentially the same value.

Resuspension

Migration of radionuclides to man through resuspension in air and water was determined to be negligible. Twenty-four hour air samples collected after decontamination over a total of 7-14 days from several locations on-site indicated no significant activity above background levels, i.e., 10^{-15} - 10^{-14} $\mu\text{Ci/cc}$ gamma, 10^{-15} - 10^{-14} $\mu\text{Ci/cc}$ beta, 10^{-17} - 10^{-15} $\mu\text{Ci/cc}$ ^{90}Sr , and 10^{-18} - 10^{-17} $\mu\text{Ci/cc}$ ^{239}Pu . Similarly, water sample results, as mentioned earlier were also background, i.e., $<5.5 \times 10^{-8}$ $\mu\text{Ci/cc}$ gamma, $<2 \times 10^{-7}$ $\mu\text{Ci/cc}$ beta, $<5.4 \times 10^{-6}$ $\mu\text{Ci/cc}$ ^3H , and $<7.1 \times 10^{-11}$ $\mu\text{Ci/cc}$ ^{239}Pu .

Environmental samples from man's food web were collected from the Tatum Dome Test Site in January-February, 1972 and analyzed for radionuclides by the Environmental Protection Agency and Reynolds Electrical and Engineering Co., Inc. Samples consisted of both terrestrial and aquatic biota including animals used by man for food in the local area: rabbit, squirrel and quail. Analyses indicated the presence of antimony-125 in four species of vegetation, however, the levels reported are less than that for the cleanup criteria for soil (no criteria exists for vegetation) and in all probability the activity measured was surface contamination.

Additional samples of garden produce (turnips, radishes, rutabaga, mustard greens, onions), chicken, eggs, pecans, and white-tailed deer from areas on the periphery of the site were collected and analyzed. No movement of antimony-125 from the site area was revealed by these analyses. Other radioisotopic levels reported in these samples are commensurate with worldwide fallout data.

Results of the environmental samples discussed above show that future authorized use of the site under any circumstances will result in no dose to man through his food web.

The residual radiation levels remaining at the Tatum Dome Test Site will be further reduced in the future by action of natural processes. The chief factors will involve dispersion, percolation, and fixation by climatic conditions and radioactive decay. Since the primary contaminant is ^{125}Sb , the radioactive half-life of 2.7 years will insure continuing rapid reduction of ambient radiation levels where measurable.

Considering all factors, no further cleanup efforts are deemed warranted. Post-cleanup radioactivity levels in the environment are unlikely to exceed a few percent of the applicable limits for non-occupational radiation exposure.

III. PHYSICAL AND LEGAL MEASURES TO PREVENT DEEP DRILLING AND MINING, AND OTHER RESTRICTIONS

Agreement with Tatum Dome Landowners

1. The Federal Government will retain exclusive right to regulate and

control access to the subsurface of the real property, whether by drilling or excavation; and the right to prevent removal of any materials, whether solid, gaseous, or fluid from the real property below the depth of mean sea level.

2. For a period of 10 years, and with the option to renew such rights for an additional 10 years, the Government shall have full right to take soil and water samples therefrom and to operate, maintain, and monitor certain wells located thereon.
3. The land leases will expire by their terms on June 30, 1972 or will be terminated earlier should the Government requirement for the land be completed.

IV. ARRANGEMENTS FOR LONG-TERM HYDROLOGIC MONITORING

Because of strict compliance with site disposal criteria, approved by AEC/HQ for this site, no contamination in excess thereof remains at the site, on or near the land surface. The only possible way for contamination remaining far below the land surface to be redistributed is through the action of ground water. Therefore, only hydrologic monitoring is considered appropriate for a long-term monitoring program. Samples of well, spring, and surface waters will be collected and analyzed primarily from down the hydrologic gradient from the event site. Samples of water from local domestic and municipal use points will also be collected and analyzed.

Analyses to be performed include: general chemical (initial run only); tritium, radiochemical for gross beta and gross alpha; and a gamma spectral scan.

Sampling locations are as follows:

1. Aquifers

<u>Aquifer</u>	<u>Location</u>
local	HT-2c
1	HT-4
2a	HT-5
2b	HT-5
3	HT-1
4* }	HT-2m
}	
5 }	
caprock	E-7

2. Shallow Holes

<u>USGS Designation</u>	<u>Location</u>
F-35-1	North of Dome
J-16-12	West of Dome
K-17-2	East of Dome
J-34-1	South of Dome (near Baxterville)

* Casing at the aquifer 4 level is not presently perforated in order to prevent the contaminated #5 aquifer from polluting #4. If contamination is encountered in #5 then #4 would be sampled either by perforation of this well casing or by drilling a new monitoring well.

3. Streams

<u>Name</u>	<u>Location</u>
Half Moon Creek	At the loop adjacent to the site access road
Lower Little Creek	Just above its junction with Pittman Creek

4. Municipal Water Supplies

Baxterville, Mississippi

Purvis, Mississippi

Columbia, Mississippi

Lumberton, Mississippi

Frequency of the sampling will be once per year in the early
spring, weather permitting.

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APPENDIX A

SUMMARY OF MONITORING RESULTS

TABLE I

PORTABLE SURVEY METER READINGS

<u>Area Location</u>	<u>Scintillator Detector*</u>	<u>Pancake Probe**</u>
E-6	0.005 mR/hr	0.03 mrad/hr
Bleeddown Plant	0.008 mR/hr	0.03 mrad/hr
East Parking Lot	0.008 mR/hr	0.03 mrad/hr
East Road	0.007 mR/hr	0.03 mrad/hr
South Road	0.005 mR/hr	0.02 mrad/hr
East G-Z Swamp	0.006 mR/hr	0.02 mrad/hr
E-14	0.006 mR/hr	0.02 mrad/hr
Pipe Yard	0.005 mR/hr	0.02 mrad/hr
West Gate	0.005 mR/hr	0.02 mrad/hr
G-Z	0.008 mR/hr	0.03 mrad/hr

* All data shown is the maximum gamma exposure rate for the area.
 All readings obtained at approximately one inch from the surface
 and at the intercepts of a grid pattern comprised of ten-foot
 squares.
 Background for this instrument is approximately 0.005 mR/hr.
 Surveyed on 12/15/71.

** All data shown is the maximum beta-gamma exposure rate for the area.
 All readings obtained at approximately one centimeter from the
 surface and at the intercepts of a grid pattern comprised of ten-
 foot squares.
 Background for this instrument is approximately 0.02 mrad/hr through
 a 7 mg/cm² window.
 Surveyed on 1/8/72.

TABLE II

AIR SAMPLE RESULTS ($\mu\text{Ci/cc}$)

<u>Map Location Number and Description</u>	<u>Sample Collection Period</u>	<u>Gross Beta</u>	<u>Gross Gamma</u>	<u>^{89}Sr</u>	<u>^{90}Sr</u>	<u>^{239}Pu</u>	<u>^3H</u>
1 Drill Yard	01-13-72	Max. 6.59×10^{-14}	2.83×10^{-14}	$*8.78 \times 10^{-14}$	$*1.69 \times 10^{-14}$	$*1.7 \times 10^{-16}$	
	02-01-72	Min. 6.13×10^{-14}	$*3.9 \times 10^{-14}$	2.57×10^{-15}	1.26×10^{-15}	$*3.6 \times 10^{-17}$	
2 Bleeddown Plant	01-20-72	Max. 6.00×10^{-14}	7.96×10^{-14}	$*2.81 \times 10^{-14}$	2.85×10^{-15}	$*1.2 \times 10^{-16}$	
	01-28-72	Min. 1.04×10^{-14}	$*7.9 \times 10^{-14}$	3.13×10^{-15}	1.52×10^{-15}	$*1.1 \times 10^{-16}$	
3 E-6 Area	12-23-71	Max. 7.42×10^{-15}	8.67×10^{-15}	5.31×10^{-16}	1.77×10^{-16}	$*1.4 \times 10^{-17}$	
	01-07-72	*Min. 4.7×10^{-16}	$*5.40 \times 10^{-15}$	$*5.88 \times 10^{-17}$	$*2.94 \times 10^{-17}$	$*9.1 \times 10^{-18}$	
A-2 4 Sta. 1A(GZ)	02-08-72	**Max. 7.68×10^{-14}	$*7.7 \times 10^{-14}$	2.63×10^{-15}	2.33×10^{-15}	$*1.7 \times 10^{-16}$	$*+5.2 \times 10^{-11}$
	02-16-72	**Min. 5.79×10^{-14}	$*7.7 \times 10^{-14}$	$*2.57 \times 10^{-15}$	1.60×10^{-15}	$*7.3 \times 10^{-17}$	$*+3.1 \times 10^{-12}$
5 AEC Warehouse	12-23-71	Max. 2.9×10^{-15}	3.92×10^{-15}	4.67×10^{-16}	$*1.34 \times 10^{-15}$	$*3.6 \times 10^{-17}$	
	01-13-72	Min. 4.12×10^{-16}	$*3.80 \times 10^{-15}$	1.71×10^{-16}	$*7.61 \times 10^{-17}$	$*8.2 \times 10^{-18}$	

* These values are at the detection limit. The variance is because of sample volume and type of analysis.

** These elevated values are probably attributable to fresh fallout from the Republic of China atmospheric detonation of 01/07/72.

+ Tritium samples collected during downhole operations.

In general, the air samples were collected post soil cleanup.

TABLE III

PRE-EXCAVATION SOIL SAMPLE RESULTS*

<u>Map Location Number and Description</u>	<u>¹²⁵Sb Concentrations in $\mu\text{Ci/g}$</u>		
	<u>Date Maximum Collected</u>	<u>Maximum</u>	<u>Minimum</u>
1 E-6	07-08-71	3.38×10^{-4}	1.69×10^{-6}
2 E-14	07-15-71	1.36×10^{-4}	1.10×10^{-6}
3 South Road	08-05-71	2.70×10^{-5}	5.60×10^{-7}
4 Mud Pond	12-27-71	3.64×10^{-4}	1.20×10^{-6}
5 East Road	08-11-71	2.78×10^{-5}	8.76×10^{-7}
6 West Road	08-18-71	4.83×10^{-6}	4.54×10^{-7}
7 HT-2 Disposal Well (See inserts on map)	08-20-71	6.38×10^{-6}	1.02×10^{-6}
8 West Gate	08-25-71	3.72×10^{-5}	8.08×10^{-7}
9 Bleeddown Plant	10-13-71	5.06×10^{-3}	9.65×10^{-7}
10 East Parking Lot	09-09-71	5.38×10^{-5}	1.17×10^{-6}
11 Pipe Yard	10-05-71	6.67×10^{-3}	1.64×10^{-6}
12 South Road Swamp	10-04-71	2.92×10^{-5}	1.73×10^{-6}
13 East Parking Lot Swamp	10-04-71	1.81×10^{-5}	1.56×10^{-6}
14 East Road Swamp	10-14-71	1.31×10^{-5}	2.06×10^{-6}
15 Slush Pit	11-15-71	2.36×10^{-4}	2.08×10^{-6}
16 East GZ Swamp	12-10-71	1.82×10^{-5}	1.03×10^{-6}
17 Cable Yard	11-17-71	4.23×10^{-6}	2.93×10^{-6}
18 Scrap Yard	11-17-71	5.60×10^{-6}	2.21×10^{-6}
19 GZ Area	01-14-72	3.02×10^{-3}	8.25×10^{-7}

*All post-excavation results are less than $1 \times 10^{-5} \mu\text{Ci/g}$

TABLE IV

VEGETATION SAMPLE RESULTS

<u>Map Location Number and Description</u>	<u>Activity* ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
1 200 Feet West of GZ	1.13×10^{-5} 1.6×10^{-6}	^3H γ
2 Edge of Gator Pond	2.0×10^{-7} 1.5×10^{-6}	^3H γ
3 200 Feet South of Gator Pond	6.35×10^{-7} 2.1×10^{-6}	^3H γ
4 South Fence of Decontamination Pad (E-6 Area)	2.8×10^{-7} 3.2×10^{-6}	^3H γ
5 20 Feet South of Decontamination Pad Fence (E-6 Area)	1.5×10^{-7} 1.45×10^{-6}	^3H γ
6 50 Feet South of Decontamination Pad Fence (E-6 Area)	2.9×10^{-7} 2.02×10^{-6}	^3H γ
7 100 Feet South of Decontamination Pad Fence (E-6 Area)	2.5×10^{-7} 1.92×10^{-6}	^3H γ
8 200 Feet South of Decontamination Pad Fence (E-6 area)	1.7×10^{-7} 5.11×10^{-6}	^3H γ

* Efficiency based on 661 keV ^{137}Cs photopeak; most samples were at or near the instrument detection limit.

NOTE: All the above samples collected on 05-18-70.

γ refers to gross gamma.

TABLE IV-A

<u>Map Location Number and Description</u>	<u>Activity ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
9 East of GZ (Slough Grass Site)	$2.56 \times 10^{-6*}$	γ
	3.3×10^{-6}	^{144}Ce
	4.6×10^{-6}	^{125}Sb
	$2.6 \times 10^{-2**}$	^{40}K
10 East of GZ (Grass Site)	$3.36 \times 10^{-6*}$	γ
	3.1×10^{-6}	^{144}Ce
	1.2×10^{-6}	^{125}Sb
	1.7×10^{-7}	^{106}Ru
	1.3×10^{-6}	^{137}Cs
	3.0×10^{-7}	^{95}Zr
	$1.0 \times 10^{-2**}$	^{40}K
11 Southwest of GZ (Moss and Soil)	$3.30 \times 10^{-6*}$	γ
	1.6×10^{-6}	^{137}Cs
	$1.4 \times 10^{-3**}$	^{40}K
12 Northwest of GZ (Lichens)	$3.6 \times 10^{-6*}$	γ
	1.9×10^{-6}	^{144}Ce
	5.7×10^{-7}	^{125}Sb
	1.6×10^{-6}	^{137}Cs
	3.4×10^{-7}	^{95}Zr
	$3.9 \times 10^{-3**}$	^{40}K
13 One Mile North of TDTS Boundary - (Cornstalks not shown on maps)	$1.44 \times 10^{-6*}$	γ
	2.8×10^{-6}	^{106}Ru
	2.5×10^{-6}	^{137}Cs
	$2.7 \times 10^{-3**}$	^{40}K

* Efficiency based on 661 keV ^{137}Cs photopeak.

** ^{40}K results are in grams of K per gram of sample.

NOTE: All the above samples were collected on 01-13-72.

γ refers to gross gamma.

TABLE IV-B

<u>Type of Vegetation</u>	<u>Sample Results</u>	<u>Radionuclide</u>
Turnips	3.4×10^{-3} gK/g	$^{40}\text{K}^+$
Radishes	4.3×10^{-3} gK/g	^{40}K
Rutabaga	3.83×10^{-3} gK/g	^{40}K
Mustard Greens	5.3×10^{-3} gK/g	^{40}K
Onions	4.7×10^{-3} gK/g	^{40}K
Swamp Greens	3.9×10^{-3} gK/g	^{40}K
Parsley	NA	NA
Blackberry Vine	NA	NA
Pecans*	3.6×10^{-3} gK/g	^{40}K
Aquatic - Gator Pond** [See location (2) Table 4]	2.8×10^{-3} gK/g	^{40}K
Tree Fungus** [See location (12) Table IV-A]	8.1×10^{-7} $\mu\text{Ci/g}$ 6.7×10^{-7} $\mu\text{Ci/g}$ 2.0×10^{-2} gK/g	^{125}Sb ^{137}Cs ^{40}K

* Sample taken near Lumberton.

** Samples taken on the TDTS.

+ All K results are in grams of K per gram of sample.

NOTE: The above samples were collected on January 13, 1972, at a farm one mile north of the TDTS (see Map 3). Three samples, identified above, were collected on the TDTS at the sites indicated.

NA - No activity above normal background

TABLE V
WATER SAMPLE RESULTS

<u>Map Location Number and Description</u>	<u>Activity* ($\mu\text{Ci/cc}$)</u>	<u>Radionuclide</u>
1 Decontamination Pad Swamp	5.94×10^{-6} 5.60×10^{-8} 2.10×10^{-11}	$^3\text{H}^{**}$ γ ^{239}Pu
2 GZ Pond	3.18×10^{-4} 5.60×10^{-8} 1.60×10^{-10}	$^3\text{H}^{**}$ γ ^{239}Pu
3 Decontamination Pad Pond	5.40×10^{-6} 1.59×10^{-7} 3.39×10^{-10}	$^3\text{H}^{**}$ γ ^{239}Pu
4 Gator Creek	5.2×10^{-6} 5.5×10^{-8} 7.1×10^{-11}	$^3\text{H}^{**}$ γ ^{239}Pu
5 Swamp Fence North of Holding Area	6.4×10^{-6} 2.88×10^{-7} 1.02×10^{-7}	$^3\text{H}^{**}$ β γ
6 Half Moon Creek	5.1×10^{-6} 1.89×10^{-9} 5.6×10^{-8}	$^3\text{H}^{**}$ β γ
7 E-3 Swamp	5.0×10^{-6} 6.78×10^{-9} 5.6×10^{-8}	$^3\text{H}^{**}$ β γ
8 Swamp Near HT-1 (see map inserts)	5.1×10^{-6} 2.64×10^{-9} 5.6×10^{-8}	$^3\text{H}^{**}$ β γ
9 Culvert on West Road	5.2×10^{-6} 2.94×10^{-9} 7.53×10^{-8}	$^3\text{H}^{**}$ β γ
10 Swamp 200 feet North of LLL "F" Building	5.0×10^{-6} 1.3×10^{-9} 5.6×10^{-8}	$^3\text{H}^{**}$ β γ
11 200 feet South of Storage Yard	5.0×10^{-6} 4.91×10^{-9} 5.6×10^{-8}	$^3\text{H}^{**}$ β γ

TABLE V (cont'd)
Water Sample Results

<u>Map Location Number and Description</u>	<u>Activity* (μCi/cc)</u>	<u>Radionuclide</u>
12 Pond South of GZ	1.7x10 ⁻⁵ 1.01x10 ⁻⁸ 5.5x10 ⁻⁸	3H ** β γ
13 E-6 Swamp	5.2x10 ⁻⁶ 8.80x10 ⁻⁹ 9.39x10 ⁻⁸	3H ** β γ
14 Swamp NW of GZ Near E-14	4.1x10 ⁻⁵ 4.71x10 ⁻⁹ 5.6x10 ⁻⁶	3H ** β γ
15 Swamp Near E-5 (E-5 is located 500 feet northwest of point shown on map)	5.1x10 ⁻⁶ 1.76x10 ⁻⁹ 5.6x10 ⁻⁸	3H ** β γ

*Efficiency based on 661 keV ¹³⁷Cs photopeak

NOTE: All samples collected on 05/18/70

γ refers to gross gamma

β refers to gross beta

** Samples at detection limit

TABLE VI

TLD RESULTS (mR/month)

	<u>Minimum</u>	<u>Maximum</u>	<u>Average</u>	<u>Projected mR/yr</u>
Off-site	3.4	6.6	4.6	55
On-site	1.7	6.9	4.7	56

TABLE VII
ANIMAL TISSUE

<u>Description</u>	<u>Activity ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
Catfish I		
Intestine	$3.2 \times 10^{-2+}$	^{40}K
Muscle	$3.1 \times 10^{-3+}$	^{40}K
Catfish II		
Intestine	NA	--
Muscle	$5.1 \times 10^{-3+}$	^{40}K
Large Shiner		
Muscle	NA	--
Intestine	NA	--
Sunfish I		
Intestine	$4.3 \times 10^{-6*}$	γ , DL
Flesh and Skin	$1.6 \times 10^{-6*}$	γ , DL
Muscle	5.2×10^{-7}	^{137}Cs
	$2.1 \times 10^{-3+}$	^{40}K
Sunfish II		
Intestine	$1.5 \times 10^{-5*}$	γ , DL
Flesh and Skin	$2.0 \times 10^{-6*}$	γ , DL
Muscle	$4.3 \times 10^{-3+}$	^{40}K

TABLE VII (cont'd)
Animal Tissue

<u>Description</u>	<u>Activity ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
Bass I		
Intestine	$8.5 \times 10^{-7*}$	γ , DL
Flesh and Skin	$2.5 \times 10^{-7*}$	^{137}Cs
Muscle	3.8×10^{-7}	^{137}Cs
	$3.8 \times 10^{-3+}$	^{40}K
Bass II		
Intestine	$1.0 \times 10^{-6*}$	^{137}Cs
Flesh and Skin	$2.6 \times 10^{-7*}$	^{137}Cs
Muscle	4.1×10^{-7}	^{137}Cs
	$5.1 \times 10^{-3+}$	^{40}K
Turtle Flesh	$6.8 \times 10^{-7*}$	^{137}Cs
Liver	NA	—
Muscle	7.9×10^{-7}	^{137}Cs
	$4.3 \times 10^{-3+}$	^{40}K
Rabbit I		
Skin	$4.6 \times 10^{-7*}$	γ , DL
Muscle	$3.0 \times 10^{-7*}$	^{137}Cs
Intestine	$2.5 \times 10^{-7*}$	γ , DL
Rabbit II		
Skin	$3.7 \times 10^{-7*}$	γ , DL
Muscle	$2.2 \times 10^{-7*}$	^{137}Cs
	1.8×10^{-7}	^{137}Cs
	$3.6 \times 10^{-3+}$	^{40}K

TABLE VII (cont'd)
Animal Tissue

<u>Description</u>	<u>Activity ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
Rabbit II (cont'd)		
Intestine	$2.3 \times 10^{-3+}$	^{40}K
Intestine Contents	2.2×10^{-7}	^{137}Cs
	$2.2 \times 10^{-3+}$	^{40}K
Liver	NA	--
Kidney	NA	--
Thyroid	NA	--
Lung	NA	--
Rabbit III		
Liver	NA	--
Muscle	9.3×10^{-7}	^{137}Cs
	$5.7 \times 10^{-3+}$	^{40}K
Kidney	NA	--
Lung	NA	--
Intestine Contents	7.6×10^{-7}	^{137}Cs
	$3.9 \times 10^{-3+}$	^{40}K
Skin	5.3×10^{-7}	^{137}Cs
	$1.8 \times 10^{-3+}$	^{40}K
Raccoon I		
Thyroid	NA	--
Muscle	6.6×10^{-7}	^{137}Cs
	3.9×10^{-3}	^{40}K

TABLE VII (cont'd)
Animal Tissue

<u>Description</u>	<u>Activity ($\mu\text{Ci/g}$)</u>	<u>Radionuclide</u>
Raccoon I (cont'd)		
Liver	4.2×10^{-7}	^{137}Cs
	$2.9 \times 10^{-3+}$	^{40}K
Lung	NA	--
Kidney	1.5×10^{-6}	^{137}Cs
Skin	6.8×10^{-7}	^{137}Cs
Intestine	1.0×10^{-6}	^{137}Cs
	$7.6 \times 10^{-3+}$	^{40}K
Intestine Contents	2.7×10^{-6}	^{137}Cs
	$4.1 \times 10^{-3+}$	^{40}K

*Environmental Sciences data; all other data from EPA.

+K results are total grams of K per gram of sample.

γ Refers to gross gamma.

DL refers to sample detection limit.

NA-no activity above normal background.

Note: All the above samples collected on February 9, 1972
from the Gator Pond and vicinity.

TABLE VII-A
ANIMAL TISSUE

<u>Description</u>	<u>Sample Date</u>	<u>Sample Results</u>	<u>Radionuclide</u>
Quail I (Off-site)			
Feathers	01/11/72	NA	--
Muscle	01/11/72	7.4×10^{-3} gK/g	^{40}K
Intestine	01/11/72	6.6×10^{-3} gK/g	^{40}K
Quail II (On-site)			
Feathers	01/12/72	2.1×10^{-2} gK/g	^{40}K
Muscle	01/12/72	5.2×10^{-3} gK/g	^{40}K
		3.3×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
Intestine	01/12/72	6.4×10^{-3} gK/g	^{40}K
		2.7×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
White Tail Deer I			
Rumen	01/12/72	1.2×10^{-6} $\mu\text{Ci/g}$	^{144}Ce
		6.9×10^{-7} $\mu\text{Ci/g}$	^{106}Ru
		3.5×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		2.1×10^{-3} gK/g	^{40}K
		5.0×10^{-7} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		2.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		3.0×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)

TABLE VII-A (cont'd)
Animal Tissue

<u>Description</u>	<u>Sample Date</u>	<u>Sample Results</u>	<u>Radionuclide</u>
White Tail Deer I (cont'd)			
Liver	01/12/72	5.2×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		3.7×10^{-3} gK/g	^{40}K
		2.0×10^{-8} $\mu\text{Ci/l}$	^3H (Water)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^3H (ASH)
		8.0×10^{-7} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		3.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		4.0×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Lungs	01/12/72	5.2×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		3.6×10^{-3} gK/g	^{40}K
		6.0×10^{-7} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		2.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		3.0×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Bone	01/12/72	0.5×10^{-5} $\mu\text{Ci/kg}$	^{89}Sr (ASH)
		9.9×10^{-4} $\mu\text{Ci/kg}$	^{89}Sr (WET)
		3.7×10^{-5} $\mu\text{Ci/kg}$	^{90}Sr (ASH)
		7.1×10^{-3} $\mu\text{Ci/kg}$	^{90}Sr (WET)
		5.0×10^{-7} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		3.0×10^{-9} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		2×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1×10^{-9} $\mu\text{Ci/kg}$	^{239}Pu (ASH)

TABLE VII-A (cont'd)
Animal Tissue

<u>Description</u>	<u>Sample Date</u>	<u>Sample Results</u>	<u>Radionuclide</u>
White Tail Deer I (cont'd)			
Muscle	01/12/72	2.3×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		4.8×10^{-3} gK/g	^{40}K
		$1.38 \times 10^{-6*}$ $\mu\text{Ci/g}$	^{137}Cs
Kidney	01/12/72	1.6×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		3.5×10^{-3} gK/g	^{40}K
Thyroid	01/12/72	NA	--
White Tail Deer II			
Rumen	01/26/72	3.5×10^{-7} $\mu\text{Ci/g}$	^{144}Ce
		5.0×10^{-7} $\mu\text{Ci/g}$	^{106}Ru
		1.8×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		2.6×10^{-3} gK/g	^{40}K
		4.0×10^{-7} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		2.0×10^{-9} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		2.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-9} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Kidney	01/26/72	2.2×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		2.0×10^{-3} gK/g	^{40}K
		2.2×10^{-4} $\mu\text{Ci/l}$	^3H (Water)
		1.8×10^{-4} $\mu\text{Ci/kg}$	^3H (ASH)

TABLE VII-A (cont'd)
Animal Tissue

<u>Description</u>	<u>Sample Date</u>	<u>Sample Results</u>	<u>Radionuclide</u>
White Tail Deer II (cont'd)			
Liver	01/26/72	6.8×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		2.8×10^{-3} gK/g	^{40}K
		1.0×10^{-6} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		2.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		6.0×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Lung	01/26/72	5.4×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		3.4×10^{-3} gK/g	^{40}K
		2.0×10^{-6} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		4.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		5.0×10^{-7} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Muscle	01/26/72	3.1×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		3.7×10^{-3} gK/g	^{40}K
		1.0×10^{-6} $\mu\text{Ci/kg}$	^{238}Pu (WET)
		3.0×10^{-8} $\mu\text{Ci/kg}$	^{238}Pu (ASH)
		5.0×10^{-6} $\mu\text{Ci/kg}$	^{239}Pu (WET)
		1.0×10^{-8} $\mu\text{Ci/kg}$	^{239}Pu (ASH)
Chicken			
Eggs	01/13/72	1.6×10^{-3} gK/g	^{40}K
Feathers	01/14/72	7.6×10^{-2} gK/g	^{40}K
Muscle	01/14/72	6.0×10^{-3} gK/g	^{40}K

TABLE VII-A (cont'd)
Animal Tissue

<u>Description</u>	<u>Sample Date</u>	<u>Sample Results</u>	<u>Radionuclide</u>
Chicken (cont'd)			
Intestine	01/14/72	2.6×10^{-3} gK/g	^{40}K
Rabbit			
Muscle	01/12/72	2.3×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		3.1×10^{-2} gK/g	^{40}K
		4.88×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
Skin	01/12/72	1.4×10^{-7} $\mu\text{Ci/g}$	^{137}Cs
		3.0×10^{-3} gK/g	^{40}K
Intestine	01/12/72	4.8×10^{-7} $\mu\text{Ci/g}$	^{125}Sb
		2.5×10^{-2} gK/g	^{40}K
		$6.09 \times 10^{-7*}$ $\mu\text{Ci/g}$	^{137}Cs
Squirrel			
Skin	01/12/72	3.8×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
Muscle	01/12/72	3.2×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		4.0×10^{-3} gK/g	^{40}K
		$3.92 \times 10^{-6*}$ $\mu\text{Ci/g}$	^{137}Cs
Intestine	01/12/72	4.6×10^{-6} $\mu\text{Ci/g}$	^{137}Cs
		5.2×10^{-3} gK/g	^{40}K
		$2.97 \times 10^{-6*}$ $\mu\text{Ci/g}$	^{137}Cs

*Indicates REECo/ESD results; all other data are EPA's analyses.

TATUM DOME TEST SITE

LEGEND - Sampling Sites

- △ Soil
- Vegetation
- Water
- ⬡ Air
- ⊙ Animals 1-Rabbits, 2-Squirrels, 3-Quail

WEST GATE AREA

USGS OBSERVATION HOLE AREA

MAP 2

STATION IA, BDP & E6 AREAS

MAP 3

APPENDIX B

RADIOLOGICAL SAFETY GUIDE
FOR DECONTAMINATION AND DISPOSAL
OF THE TATUM DOME SITE

MAY 25, 1971

fallout. Detailed surveys shall be made for soil and surface waters

the explosion cavity or by some other means approved by AEC Headquarters when these levels exceed 10^{-6} $\mu\text{Ci/g}$ for alpha decay modes or 10^{-5} $\mu\text{Ci/g}$ for beta gamma decay modes (except tritium) above background (including atmospheric fallout levels). In determining concentration gradients in soil, samples taken at the surface may be averaged to a depth of one inch. Subsurface samples may be averaged over two-inch depth increments for analytical purposes, but subsurface soil samples need not necessarily be taken for every two-inch depth interval.

- 3.4 After decontamination and the removal of debris, an evaluation shall be made of the remaining (residual) areas of radioactive contamination. Any residual potential radiological health problems shall be identified. Consideration should be given to (1) external radiation levels, (2) migration of radionuclides to man through resuspension in air, movement in water, or passage through food chains, (3) unrestricted property use, immediately and potential, (4) decay and other removal processes tending to reduce potential exposure to man, and (5) the feasibility, cost, and relative effectiveness of further decontamination activities. Further decontamination and cleanup shall be effected when warranted, on balance, after consideration by NV of the preceding factors. The cleanup shall be continued until potential future exposures to man are not likely to exceed a few percent of the limits specified in AECM Appendix 0524, Part II A.

4. Numerical guidance provided herein are preliminary and flexible to the extent that different values may be approved by Headquarters on a case-by-case basis. Higher values may be approved if it can be demonstrated

that it is impracticable to attain the stated values and potential radiological consequences of the higher values are limited to a small fraction of applicable dose limits. Lower values may be specified if it appears practicable to attain them.

5. A final site survey shall be performed prior to release of the site and copies of a report of the cleanup effort and survey results shall be transmitted to AEC Headquarters/AGMO, MA, BM, WSM, and OS in accordance with the requirement of the AGMO (Ref. TWX Erlewine to AEC Manager, AL, dated November 6, 1970). The report on the site cleanup operation shall include a description of the physical and legal measures taken to prevent deep drilling, mining, or other restrictions on use of the site. Agreements or arrangements for subsequent monitoring should also be described.
6. Effective site cleanup should eliminate the need for periodic terrestrial and bioenvironmental surveys and only annual surface and ground water samples should be required for a period of about five years or until there is reasonable assurance that no transport problems exist. Reports of the annual surveys shall be sent to AEC Headquarters/AGMO, MA, BM, WSM, and OS.

TABLE I

<u>Isotope</u> ^{2/}	<u>Surface Contamination Levels</u> ^{1/}	
	<u>Removable</u> ^{3/}	<u>Total</u> ^{4/} ^{5/}
U nat, U-235, U-238, Th nat, Th-232, and associated decay products	1,000 dpm or 450 pCi alpha on any 100 cm ²	10,000 dpm or 4,500 pCi alpha on any 100 cm ²
Other isotopes which decay by alpha emission or by spontaneous fission	100 dpm or 45 pCi alpha on any 100 cm ²	1,000 dpm or 450 pCi alpha on any 100 cm ²
Beta-gamma emitters (isotopes with decay modes other than alpha emission or spontaneous fission)	1,000 dpm or 450 pCi beta-gamma on any 100 cm ²	0.4 mrad/hr ^{6/} at 1 cm from the surface

- 1/ As used in this table, dpm (disintegrations per minute) or pCi (picocurie) means the rate of decay by radioactive material as determined by correcting the counts per minute observed by an appropriate detector and count rate meter, for background, efficiency, and geometric factors associated with the instrumentation and survey procedures.
- 2/ Where surface contamination by both alpha and beta-gamma emitting isotopes exists, the limits established for alpha and beta-gamma emitting isotopes shall apply independently.
- 3/ The amount of removable radioactive material on any 100 cm² of surface area may be determined by wiping that area with dry filter or soft absorbent paper and with the application of moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known background, efficiency and geometry. In determining removable contamination on objects of surface area less than 100 cm², the pertinent levels shall be reduced proportionately, and the entire surface shall be wiped. Alternately, it may be assumed that all of the radioactive material remaining on a surface may be removable, and that amount of radioactive material may be determined by direct measurement with survey instrumentation of sufficient sensitivity to detect levels equivalent to these limits.
- 4/ Alternatively, for total contamination one may elect to use an average level one-half of that listed in this column, provided that:
- (a) The average shall be taken over the total area or 10 square meters, whichever is the lesser; and
 - (b) At no location shall the maximum exceed 2.5 times the level listed in this column.
- 5/ It is assumed that measurements of total contamination are made with instruments having a sensitive cross sectional area of 100 cm². Measurements made with instruments having more or less than 100 cm² of sensitive area may be related to levels proportionately adjusted, or additional

measurements may be made on contiguous areas totaling 100 cm² and the findings added for comparison with the specified levels.

6/ Measured through not more than a total of 7 milligrams per square centimeter of absorbing material.

APPENDIX C

TEXT OF MONUMENT PLAQUES

APPENDIX C

TEXT OF MONUMENT PLAQUES

* * * * *

UNITED STATES

DEPARTMENT OF DEFENSE

ADVANCE RESEARCH PROJECTS AGENCY

DR. E. RECTIN DIRECTOR

PROJECTS DRIBBLE AND MIRACLE PLAY

Experiments in the Vela Uniform Program sponsored jointly by the Department of Defense and the Atomic Energy Commission were conducted below this spot at a depth of 2700 and 2715 feet in salt. A 5.3 kiloton nuclear device was detonated on October 22, 1964, known as the Salmon Event which was the first of the Dribble Series to evaluate the decoupling principle and to study seismic wave propagation in the southeast United States. A 380-ton nuclear device was detonated on December 3, 1966, known as the Sterling Event. Objective of this experiment was to determine the extent of decoupling of a cavity in salt and the accuracy of decoupling calculations.

The Miracle Play Series consisted of two gas explosions which were conducted in the cavity on February 2, 1969, and April 19, 1970. The objectives of these experiments were to determine the decoupling effect of explosions in an open cavity and the reduction in decoupling caused by overdriving a cavity.

* * * * *

NO EXCAVATION, DRILLING AND/OR REMOVAL OF MATERIALS IS PERMITTED
WITHOUT U.S. GOVERNMENT PERMISSION TO PENETRATE BELOW MEAN SEA
LEVEL ON THE 1470 ACRE TRACT SITUATED WITHIN SECTIONS 11, 12, 13,
AND 14, T2N, R16W, ST. STEPHENS MERIDIAN, MISSISSIPPI.