

ENVIRONMENTAL SURVEYS OF THE  
URANIUM MILL TAILINGS PILE  
AND SURROUNDING AREAS  
SALT LAKE CITY, UTAH



U.S. ENVIRONMENTAL PROTECTION AGENCY

Office of Radiation Programs

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TAILINGS PILE AND SURROUNDING AREAS,  
SALT LAKE CITY, UTAH



DAVID L. DUNCAN  
GREGORY G. EADIE

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URANIUM MINING AND MILL TAILINGS PROJECT  
OFFICE OF RADIATION PROGRAMS--LAS VEGAS FACILITY  
U.S. ENVIRONMENTAL PROTECTION AGENCY  
LAS VEGAS, NEVADA

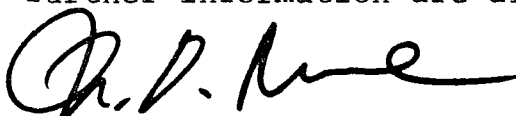
## FOREWORD

The Office of Radiation Programs of the Environmental Protection Agency carries out a national program designed to evaluate population exposure to ionizing and non-ionizing radiation, and to promote development of controls necessary to protect the public health and safety.

Within the Office of Radiation Programs, the Las Vegas Facility conducts in-depth field studies of various radiation sources (e.g., nuclear facilities, uranium mill tailings, and phosphate mills) to provide technical data for environmental impact statement review as well as needed information on source characteristics, environmental transport, critical pathways for population exposure, and dose model validation.

This report summarizes the results of several field studies conducted between 1967 and 1973 in Salt Lake City, Utah, at and around the inactive uranium mill tailings site formerly operated by the Vitro Corporation of America.

Readers of this report are encouraged to inform the Office of Radiation Programs of any omissions or errors. Comments or requests for further information are also invited.

A handwritten signature in black ink, appearing to read "W. D. Rowe". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

W. D. Rowe, Ph.D.  
*Deputy Assistant Administrator  
for Radiation Programs*

## ABSTRACT

At the request of EPA's Region VIII, environmental surveys have been conducted for the Utah State Division of Health's Occupational and Radiological Health Section at the former Vitro Corporation uranium mill and in the Salt Lake City, Utah, area. The surveys included measurement of external gamma radiation and airborne radioactivity. The results of the surveys indicated that: the external gamma radiation levels on the tailings area exceed recommended exposure limits for individuals in the general population; ambient levels of radon over the pile and in structures built immediately adjacent to the tailings pile are above the currently recommended concentration for the general population; the working level exposure in the adjacent buildings exceeds existing recommendations; tailings material has been removed from the Vitro site by persons and used around dwellings and businesses; and tailings material has become windborne and deposited against dwellings and structures in the vicinity. For general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels for the pile were not distinguishable from natural background levels and were found to be within current guides.

On June 7, 1974, the U.S. Environmental Protection Agency recommended to the State of Utah that:

1. The State of Utah establish the necessary regulations to effect the disposition and control of radioactive mill tailings. These should not rule out the possibility of some acceptable use for any given closed mill site.

2. The Vitro uranium mill tailings pile should be properly stabilized to prevent migration of the tailings into the environment and public ingress to the area should also be prevented. The pile should be graded,, covered, properly fenced, and controlled to prevent any migration of the tailings into the surrounding environs by wind, water erosion, or removal of tailings for unauthorized purposes.

3. The State of Utah consider possible remedial actions for the businesses located on the west side of the Vitro uranium mill tailings pile along South 900 West Street.

## ACKNOWLEDGMENTS

Grateful appreciation is expressed by the Environmental Protection Agency to the many individuals of the Utah State Division of Health; U.S. Atomic Energy Commission; Lucius Pitkin, Inc.; and EPA's Region VIII and National Environmental Research Center--Las Vegas. Without their help, these studies would not have been possible. Special thanks go to Messrs. Dennis Dalley, Louis Bunce, Blain Howard, Jeff Throckmorton, Paul Smith, Jon Yeagley, George Boysen, Charles Fitzsimmons, Dwayne Rozell, Robert Snelling, and Fred Johns and also to Mrs. Lynn Hughes and Ms. Daphne Prochaska.

## CONTENTS

	<u>Page</u>
FOREWORD.....	iii
ABSTRACT.....	v
ACKNOWLEDGMENTS.....	vii
LIST OF FIGURES.....	xi
PURPOSE.....	1
LOCATION AND DESCRIPTION.....	1
ENVIRONMENTAL SURVEYS.....	4
Sampling procedures.....	4
External gamma radiation.....	4
Field survey instruments.....	4
Thermoluminescent dosimeters (TLD's).....	4
Mobile unit gamma radiation scanning surveys.....	4
Field personnel gamma radiation screening surveys..	5
Air Sampling.....	6
Five minute radon in air sample.....	6
Integrated radon in air sample.....	8
Five minute radon progeny in air sample.....	8
Integrated radon progeny in air sample.....	8
Meteorology.....	10
Analytical procedures.....	10
Radon concentrations.....	10
Radon daughter concentrations.....	10
Integrated working levels.....	10
RESULTS--1967 to 1973.....	11
USPHS--1967 to 1968.....	11
USPHS Surveys--November 1970.....	11
EPA Gamma Scanning Surveys--April to September 1972....	16
EPA Gamma Screening Surveys--August to October 1972....	16
Radon and Radon Daughter Evaluation--May 1973.....	16

DISCUSSION OF RESULTS.....	33
Gamma Radiation Exposures on the Tailings Pile.....	33
Radon and Radon Daughter Concentrations.....	37
Gamma Radiation Exposures in the Salt Lake Valley.....	40
RECOMMENDATIONS.....	43
APPENDIXES.....	46
REFERENCES.....	120

## LIST OF FIGURES

	<u>Page</u>
FIGURE 1 Vitro Uranium Mill Tailings Piles: Salt Lake City, Utah	2
FIGURE 2 Indoor Radon Study--Gamma Screening Form	7
FIGURE 3 Radon and Radon Daughter Decay Scheme	9
FIGURE 4 Location of Radon Sampling Stations in Salt Lake City, Utah (1967-1968 PHS Study)	12
FIGURE 5 E-500B Gamma Radiation Measurement in mR/h: Salt Lake City, Utah: Vitro Uranium Mill Site: Southeast Tailings Pile (3 ft. reading/ground reading)	13
FIGURE 6 E-500B Gamma Radiation Measurement in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Southwest Tailings Pile (3 ft. reading/ground reading)	14
FIGURE 7 E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Northwest Tailings Pile (3 ft. reading/ground reading)	15
FIGURE 8 TLD Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Tailings Pile	17
FIGURE 9 Gamma Survey Map, Suburban Sewage Treatment Plant, Salt Lake City, Utah, November 1970 (NE-148A reading in $\mu$ R/h) Ground Floor Main Building	18
FIGURE 10 Gamma Survey Map, Suburban Sewage Treat- ment Plant, Basement Main Building, Salt Lake City, Utah, November 1970 (NE-148A readings in $\mu$ R/h)	19



# LIST OF FIGURES

	<u>Page</u>
FIGURE 11    Gamma Survey Map, Suburban Sewage Treatment Plant, West Digester, Salt Lake City, Utah, November 1970 (NE-148A readings in $\mu\text{R/h}$ )	20
FIGURE 12    Gamma Survey Map, Suburban Sewage Treatment Plant, East Digester, Salt Lake City, Utah, November 1970 (NE-148A reading in $\mu\text{R/h}$ )	21
FIGURE 13    Gamma Survey Map - Area Surrounding the Vitro Uranium Mill and Tailings Pile Site, Salt Lake City, Utah	22
FIGURE 14    Gamma Survey Map, Location 42325 (Vacant Lot) Salt Lake City, Utah	23
FIGURE 15    Gamma Survey Map, Location 42326, Salt Lake City, Utah	24
FIGURE 16    Gamma Survey Map, Location 42327, (Vacant Lot) Salt Lake City, Utah	25
FIGURE 17    Gamma Survey Map - Location 42328, Salt Lake City, Utah	26
FIGURE 18    Gamma Survey Map, Location 42329, Salt Lake City, Utah	27
FIGURE 19    Gamma Survey Map - Location 42330, Salt Lake City, Utah	28
FIGURE 20    Gamma Survey Map - Location 42331, (Vacant Land West of Tailings Pile) Salt Lake City, Utah	29
FIGURE 21    Gamma Survey Map - Location 42332 (Vacant Land North of Tailings Pile) Salt Lake City, Utah	30
FIGURE 22    Air Sampling Locations - May 1973 - Salt Lake City, Utah	32

## LIST OF FIGURES

		<u>Page</u>
FIGURE 23	TLD Integrated WL Exposure - Salt Lake City, Utah, May 1973	34
FIGURE 24	Radon and Radon Daughter Concentration (pCi/l), Salt Lake City, Utah, (Location 75001) - May 1973	35
FIGURE 25	Radon and Radon Daughter Concentration (pCi/l), Salt Lake City, Utah, (Location 75002) - May 1973	36

## PURPOSE

The following report summarizes the results of several environmental surveys conducted between 1967 and 1973 in Salt Lake City, Utah, at the inactive uranium mill site and in the surrounding area.

## LOCATION AND DESCRIPTION

The uranium mill in Salt Lake City, Utah, was operated by the Vitro Corporation of America from May 1951 to January 1964. As of July 1970, the inactive uranium mill tailings pile occupied about 107 acres of land, bordered on the north by Mill Creek, on the east by the railroad, on the south by 3300 South Street, and on the west by South 900 West Street. As shown in figure 1, the area of the mill site can be considered as a square with four quadrants. Three of the quadrants are covered with tailings material and the northeast quadrant is occupied by the Salt Lake City Suburban Sewage Treatment Plant (SSTP). A portion of the land between the railroad and the east boundary of the SSTP is also covered with tailings.

The original uranium mill was situated in the southeast section, but the buildings have now been completely demolished. All that remains of the old mill are some rubble and concrete foundations of the buildings and the old mill stack. As of May 1974, radioactive material has been spread over the old mill site and contaminated material has also been placed on what appears to be railroad right of way. It is estimated (1) that the Vitro uranium mill tailings piles contain 1,666,000 tons of material with an average radium-226 concentration of 1100 pCi per gram of tailings material (or about 1670 total curies of radium-226).

There is a narrow access road from 3300 South Street leading to the Suburban Sewage Treatment Plant and a shallow stream flows parallel to this road, thereby creating a boundary line between the southeast and the southwest sections of the tailings piles. There is no gate on this access road and it is through this open entranceway that most of the public access to the tailings piles is gained. The southern one-half of the southeast section of the tailings pile has been covered with about a foot of "clean" dirt as a result of road construction in the area.



Figure 1. Vitro Uranium Mill Tailings Piles: Salt Lake City, Utah

The southern one-half of the southwest section of the tailings piles has been covered with concrete, dirt, and asphalt road debris. Bordering the southwest section of the pile, on South 900 West Street, are four business buildings. These structures were built against, and possibly over, the tailings pile. An eight-foot-high chain link fence has been erected on the south side of the tailings pile (i.e., along 3300 South Street) and along a portion of the east and west sides of the tailings pile. The fence ends at the northernmost building on the west side of the piles; therefore, entry to the tailings piles area may also be gained at this point. Indeed, the abandoned tailings piles have become a motorbike and horse riding course for the area youngsters.

Most of the tailings piles surface remains uncovered and, as a result, a slick, muddy surface is formed after rain or snow storms. When the pile surface dries out, the tailings materials are subject to wind migration and the materials are easily spread to offsite areas surrounding the mill site. Grass cover or volunteer vegetation growth has not occurred over the entire tailings pile surface, although some of the dikes are covered with growth. It is also apparent that at times local inhabitants have removed portions of the tailings material for various uses around their private dwellings and buildings. Trash is also being discarded at the mill site.

In 1972-1973, construction was initiated in the upper half of the southwest section of the tailings pile for a proposed automobile racing track. An oval-shaped pit about 15 feet deep, 200 feet wide, and 500 feet long was dug out of the tailings material. The west end of the pit is about 100 feet from South 900 West Street, at the fence boundary of the Won-Door Corporation Assembly Building (Location #42330). The tailings material which was removed to create the pit was piled on the original pile surface to form hills from 10 to 20 feet in height, surrounding the pit. After a rain storm, the eastern portion of the pit floor is covered with several inches of water. The pit floor is at the level of the street; i.e., the original ground level before tailings material was placed on it.

A stream formed by the effluent discharged from the Suburban Sewage Treatment Plant flows between the southwest and northwest sections of the pile. Water flow is away from the tailings pile. In November 1970, the northern one-half of the southeast section of the tailings pile was covered

with water; and in May 1973, the northwest section of the pile was partially covered with water. This water was from operations at the Suburban Sewage Treatment Plant. Except for a few strands of barbed wire fence, there is no access control to the northwest section of the pile.

The Suburban Sewage Treatment Plant, which forms the northeast quadrant of the site, is entirely fenced and is a restricted access location, usually limited to SSTP operating personnel.

## ENVIRONMENTAL SURVEYS

### Sampling procedures

#### External gamma radiation

#### *Field survey instruments*

Gamma radiation exposure measurements were obtained using portable radiation detection instruments. Two types of survey meters were used at different times during the studies. An Eberline Instrument Corporation, Model E-500B, portable Geiger-Mueller survey meter was used and the gamma exposure rate was reported in units of mR/h. Also used for more sensitive gamma surveys was the NE-148A Baird Atomic Scintillometer and these results were reported in units of  $\mu$ R/h.

#### *Thermoluminescent dosimeters (TLD's)*

In addition to the portable survey instruments, TLD's were used in two studies (1967-1968 and 1970) to evaluate the external gamma exposure dose. EG&G, Model TL-12, TLD capsules were used and returned to the laboratory\* for analysis. The TLD results were reported in units of mR/h.

#### *Mobile unit gamma radiation scanning surveys*

The EPA provided a contract to the U.S. AEC to conduct a mobile gamma scanning survey in communities surrounding

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\*EPA, National Environmental Research Center--Las Vegas (NERC-LV) at Las Vegas, Nevada (formerly USPHS, Southwestern Radiological Health Laboratory).

uranium mill tailings sites in the Western United States. These scanning surveys were performed in Salt Lake City, Utah, starting in April 1972.

The mobile gamma scanning unit was equipped with two shielded four-inch by five-inch sodium iodide crystals. The signal from the crystals was recorded on a strip chart recorder and addresses or other notes were added to the chart by the operator. This chart was then sent to the Lucius Pitkin\* Office in Grand Junction, Colorado, where an anomaly report was prepared from the chart. An anomaly is defined as any location where the recorded counts per second (c/s) exceed the determined background c/s for that location by 50 or more c/s. The anomaly report was sent to ORP-LVF\*\* and, in turn, forwarded to the Utah State Division of Health.

#### *Field personnel gamma radiation screening surveys*

Survey teams, utilizing the gamma scanning report, performed field radiation surveys in Salt Lake City. These surveys were performed between August and October 1972.

The field teams were composed of two surveyors; each person was equipped with a NE-148A Baird Atomic Scintillometer. These instruments were calibrated with a National Bureau of Standards certified radium needle, and a five item field check was performed each day to determine if the instrument was functioning properly. If the instrument did not operate within preset ranges, it was not used.

The NE-148A contains a one-inch by one-and-one-half inch sodium iodide crystal; thus, the measurements obtained are not "true" exposure rates. Also, because of the size of the crystal, the meter indication represents only terrestrial radiation. The meter reading can be corrected to a true value (T) by  $T (\mu R/h) = S (\mu R/h) \times 0.56 + 0.9$ , where S = NE-148A meter reading.

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\* Lucius Pitkin, Inc., is a prime contractor for the U.S. AEC, Grand Junction Operations Office.

\*\*The EPA, Office of Radiation Programs, Las Vegas Facility (ORP-LVF) is a tenant organization located at the NERC-LV. The ORP-LVF now conducts the uranium mill tailings monitoring previously carried out by the NERC-LV.

Thus, a reported 60  $\mu\text{R/h}$  becomes a corrected 34.5  $\mu\text{R/h}$ , or a net corrected 24.5  $\mu\text{R/h}$  (assuming 10  $\mu\text{R/h}$  background). One can obtain a total exposure rate by adding the corrected value, in this case, 34.5  $\mu\text{R/h}$ , and a known or assumed cosmic rate. The previously mentioned TLD and E-500B readings in mR/h do not have to be corrected.

A survey was performed at a location only after permission was obtained from the owner or occupant of the property. If persons were present, but permission was not obtained, the location was listed as a refusal. Suspected tailings use might have been determined while approaching the property or structure to request permission and would be noted. Once permission to survey was obtained, one surveyor would survey inside the structures while his partner would survey the surrounding property. The high inside gamma instrument reading (HIG), high outside (HOG), and low outside (LOG) were recorded on the Indoor Radon Study-Gamma Screening Form. A copy of this form is included as figure 2. If tailings were found on the property, but more than 10 feet from a habitable structure, the location is called a tailings away or TA location. The tailings use code would be "2." If tailings were found within 10 feet of a habitable structure, it is a TU location (under or up against). In this case, the tailings use code would be "1" or "3." If instrument readings inside a TU structure exceeded 20  $\mu\text{R/h}$ , a gamma map was made. In many instances, a map was not required; but a sketch showing the location on the property of readings found above 20  $\mu\text{R/h}$  was made. This would be indicated by a "7" in the "Gamma-Map" block on the form (figure 2), and the sketch would be placed on the back of the survey form. If ore or other radioactive material was found, the reading from the material was not recorded as the HIG or HOG, but appeared in the "Free Punch Comment" on the survey form. The survey form was then checked by an EPA field supervisor, a specific location number was assigned to each location, and the form was sent to the ORP-LVF for card punch and data storage.

## Air Sampling

### *Five minute radon in air sample*

A radon gas sample was obtained by drawing filtered air into an evacuated glass flask (2 liter volume). The flask was sealed after about a five-minute collection period and returned to the laboratory for analysis of radon-222.



															DATE FORM COMPLETED			
CARD	LOCATION No.					CITY				COUNTY			STATE		MONTH		YEAR	
A																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

<u>ADDRESS</u>																				
NUMBER					DIR.	NAME														
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
(Last Name First - Initials for first and middle name-husband and wife)																				
OCCUPANTS NAME																				
		41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	
OWNERS NAME																				
		59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	
(Last Name First - Initials for first and middle name - husband and wife)																				

<u>CLASSIFICATION</u>	<u>GAMMA SCREEN</u>	(OWNERS ADDRESS _____)	
77	78	<u>TAILINGS USE</u>	<u>GAMMA MAP</u>
0. Vacant Lot 1. Residence single family 2. Multiple (<4 families) 3. Apartment (>4) 4. Motel, hotel, or hospital 5. Single business (in one unit) 6. Multiple business unit (connected) 7. School 8. Church 9. Other	0. None 1. Completed 2. Occupant refusal 3. No - ask owner 4. Owner refusal 5. No one to contact 6. No bad address 7. Outside only 8. Special scheduling 9. Other	<div style="text-align: center;">79</div> 0. None 1. Under 2. Away 3. Under-Away 4. Possible 9. Unknown	<div style="text-align: center;">80</div> 0. None 1. Yes 2. Occupant - No 3. No ask owner 4. Owner - No 5. No one to see 6. Not required

---

CARD	LOCATION NUMBER					CITY				COUNTY			STATE	
B														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

LOCATION CODE	Township	Section 1/4 Sec.	Block	Owner Number	Lot								
16	17	18	19	20	21	22	24	25	26	27	28	29	30

HOG	LOG	HIG	LOCATION HIG												
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

<u>TYPE OF HOUSE</u>	<u>NUMBER OF LEVELS</u>	<u>MATERIAL</u>	0. Bedroom 1. Living Room 2. Kitchen 3. Den - Family Rm. 4. Dining Room 5. Attached garage 6. Basement 7. Work shop 8. Other 9. More than one location
47	48	49	
1. Basement 2. Slab on grade 3. Crawl space 9. Unknown		1. Masonry 2. Non masonry	

<u>FREE PUNCH COMMENT</u>															
50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	

Figure 2. Indoor Radon Study-Gamma Screening Form

### *Integrated radon in air sample*

A continuous, low-volume sampling system was used to obtain an integrated radon sample. (2) This sampling technique consists of drawing filtered air through a small, low-volume pump (usually less than 10 ml/min sampling rate) into a 30-liter Mylar bag. Usually, a continuous 48-hour air sample was collected and returned to the laboratory for radon-222 analysis.

### *Five minute radon progeny in air sample*

The short-lived particulate radon daughter products (figure 3) were sampled by drawing air through an Acropor filter (Type AN-450, manufactured by the Gelman Instrument Corporation) having a  $0.45\text{ }\mu\text{m}$  pore size. Each sample was collected for five minutes at a flow rate of about one cfm. The particulate sample was collected separately from, but simultaneously with, the five-minute grab radon air sample in order to compute the percent equilibrium and the radon daughter to radon concentration ratios.

### *Integrated radon progeny in air sample*

Integrated radon progeny working levels were measured using the TLD-Type II Air Sampler. (3) The detector unit consists of a filter holder containing a membrane filter\* and two thermoluminescent dosimeters (TLD's).\*\* One TLD disc is supported above the membrane filter and is exposed to the combination of alpha, beta, and gamma radiations emitted by the radon progeny collected on the filter. The second TLD disc is separated from the first TLD disc by a stainless steel washer that absorbs the beta particles that pass through the first TLD disc. The second TLD disc, therefore, responds to external gamma radiation sources and hence is the radon progeny background subtraction correction. Calibration factors are used to convert the TLD readings (nanocoulombs) to working level (WL)† exposure.

All TLD's were returned to the ORP-LVF for read-out and data analysis.

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\* Millipore Corporation, DAWP01300 (13 mm dia)  $0.65\text{ }\mu\text{m}$  pore size.

\*\*Isotopes, Inc., Teflon disk impregnated with Harshaw  $\text{CaF}_2\text{:Dy}$  powder (30% by weight).

† Working Level, WL, is defined as any combination of short-lived radon daughters in one liter of air that will result in the ultimate emission of  $1.3 \times 10^5$  MeV of alpha energy by 8 decay to lead-210 (Pb).

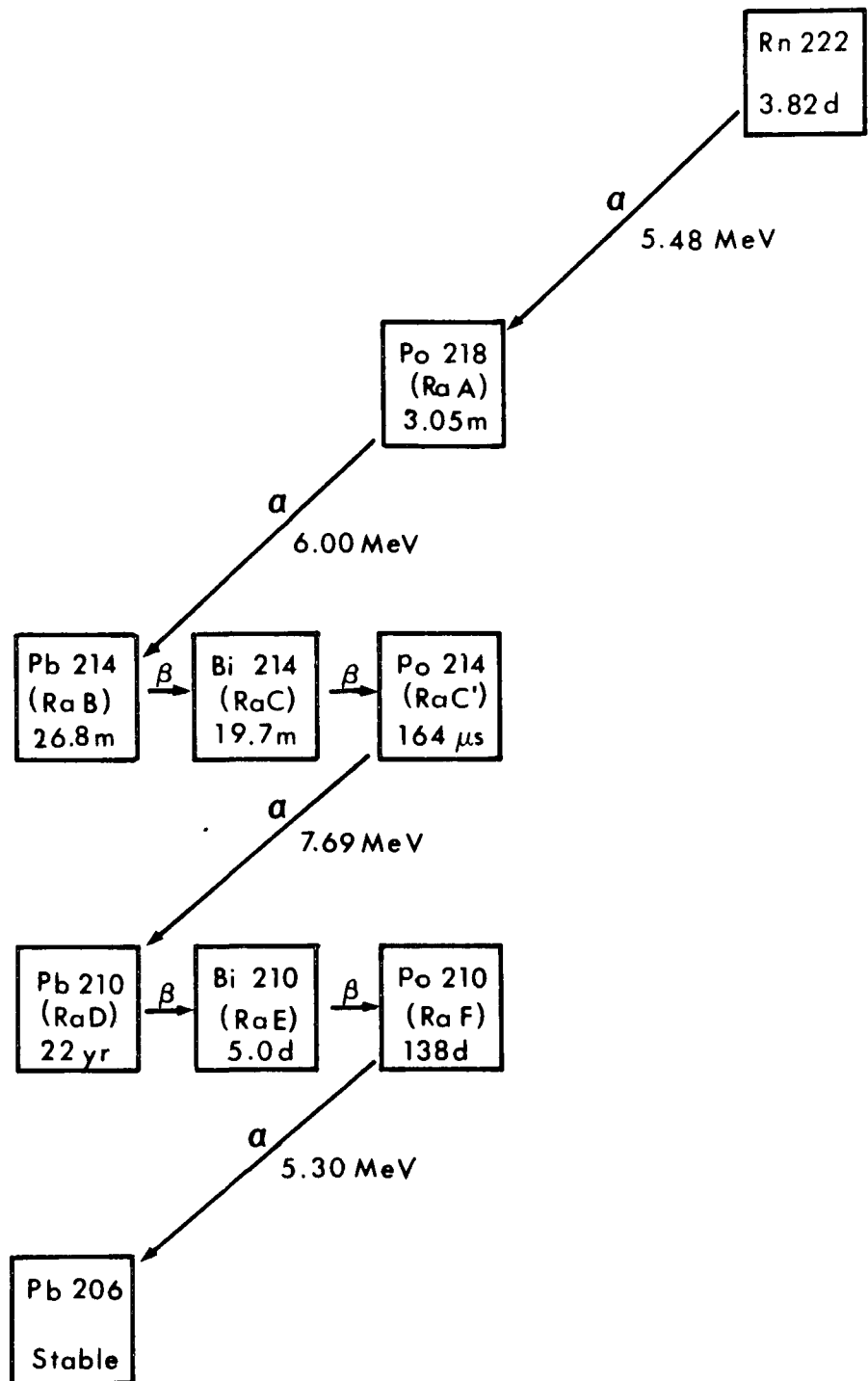


Figure 3. Radon and Radon Daughter Decay Scheme

## Meteorology

A mobile weather station having two separate meteorological data-gathering stations was used to obtain information on the wind speed, wind direction, and the ambient temperature. The meteorological trailer is powered by a propane generator and the data are automatically recorded on punch tape which is later read out to provide the meteorological information. Data were usually collected from two locations at 15-minute intervals during the study period. Barometric pressure changes were measured with a standard aircraft altimeter which was reset to a reference altitude.

## Analytical procedures

### Radon concentrations

The radon analysis was performed by cryogenic separation and subsequent alpha scintillation counting. In some cases, a scintillation cell was filled directly from the flask and counted.

The radon decay is calculated to the midpoint of the sample collection period and the radon results are reported in units of picocuries per liter (pCi/l). The decay calculations are performed by a computer program designed for a CDC-6400.

### Radon daughter concentrations

The particulate air filter sample was immediately gross alpha counted in the field utilizing a specially designed alpha scintillation counter. The dpm/cpm for the counter is obtained from certified sources. The radon daughter concentrations and the working level is then calculated using the Thomas equations for the modified Tsivoglou technique. (4) These equations have been incorporated in programs for both the Wang 320K and 362E calculators.

### Integrated working levels

The WL exposure measured by the Radon Progeny Integrating Sampling Unit (3) is determined by the nanocoulomb readout from the TLD's. This measurement of stored charge is obtained with a Harshaw model 2000 reader. The nanocoulomb readout is converted to a WL value by utilizing a working level liter-per-nanocoulomb conversion factor ( $WL = 1/nC$ ) which is obtained by sampling in a known WL atmosphere. The known WL atmosphere is calculated using an alpha spectroscopy system.

## RESULTS--1967 TO 1973

### USPHS--1967 to 1968

From October 27, 1967, through October 9, 1968, a joint study between the U.S. Public Health Service (USPHS) and the U.S. Atomic Energy Commission (AEC) was performed in cooperation with the Utah State Division of Health (UDH). Environmental surveys were conducted during the project to evaluate the public health aspects of atmospheric concentrations of radon-222 in the vicinity of the Vitro uranium mill tailings pile site. The results of this study were reported in "Evaluation of Radon-222 Near Uranium Tailings Piles," U.S. Department of Health, Education, and Welfare, Public Health Service, Report DER 69-1, March 1969. (Figure 4 and tables I through III have been taken from the DER 69-1 report.)

Figure 4 shows the locations of the radon sampling stations used in the 1967-1968 PHS Study. Table I contains the radon concentrations determined for the 48-hour integrated air samples during various sampling periods. The yearly average concentrations for each sampling location are provided in table II. Table III contains the results of the thermoluminescent dosimeters (TL-12's) used to evaluate the external gamma radiation exposure rate.

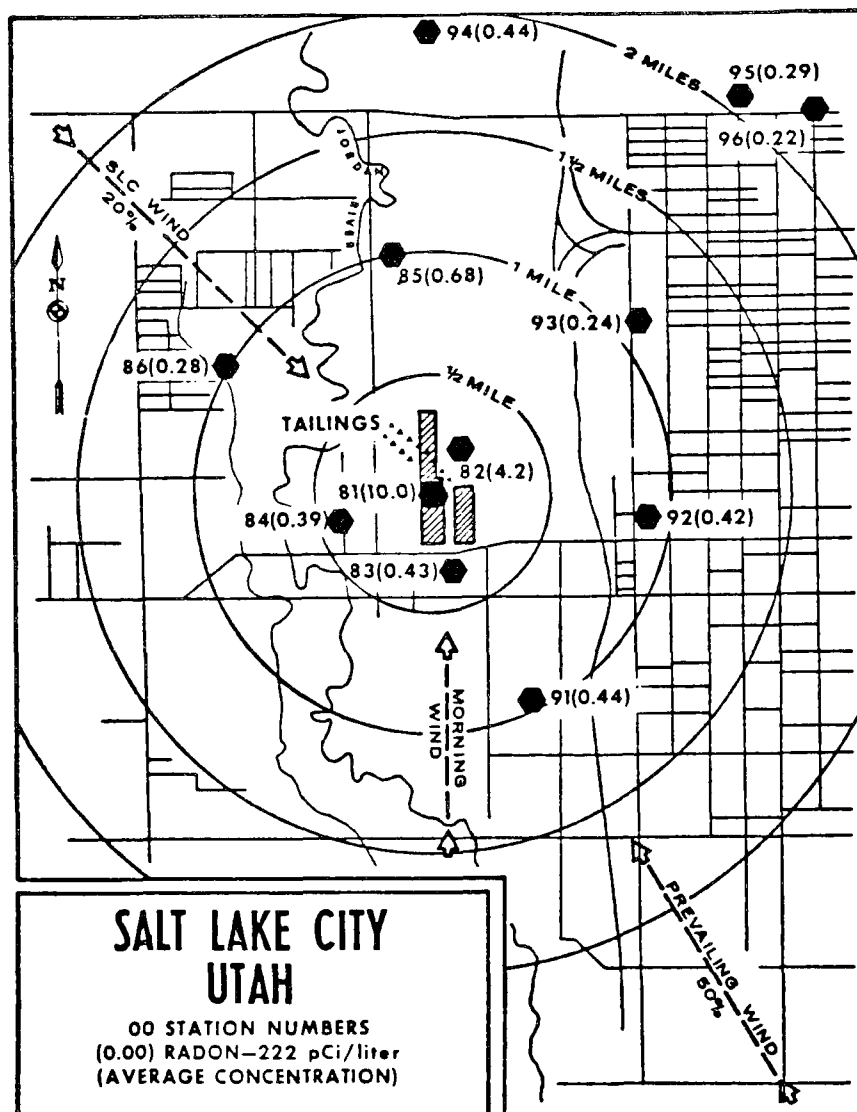
### USPHS Surveys--November 1970

In November 1970, personnel from the National Environmental Research Center--Las Vegas (NERC-LV) conducted a comprehensive gamma survey of the entire uranium mill tailings pile site and the Suburban Sewage Treatment Plant site. A grid system survey, using both portable gamma survey meters\* and thermoluminescent dosimeters (TL-12's), was completed. This study was initiated in order to record the gamma exposure rates over the tailings material before covering the piles with "clean" dirt from the proposed widening of 3300 South Street. The cover work has not been completed to our knowledge; thus, the second (post stabilization) part of the survey has not been performed.

The results of the November 1970 gamma surveys are shown in figures 5 through 7. The portable instrument measurements are given for three feet above ground surface and at the

---

\*Eberline Instrument Corporation, Model E-500B.



- |    |   |
|----|---|
| 81 | Center of tailings (700 West 3300 South).   |
| 82 | Sewage Plant, 650 West 3300 South.  |
| 83 | American Smelting & Refining Company, Hygiene & Research Department, 3422 South 7th West. |
| 84 | D. B. Harmon, 1080 West 3300 South.   |
| 85 | Bonneville News Company, 965 Beardsley Place.   |
| 86 | J. A. Skogg, 1501 West Claybourne Avenue.   |
| 91 | D. Bolton, 570 West 3740 South.   |
| 92 | Chris Body and Paint Shop Inc., 3152 South 2d West.                                       |
| 93 | Tuloma Gas Products Co., 201 West 27th South.   |
| 94 | Aluminum Manufacturing & Supply Co., 1809 South 8th West.                                 |
| 95 | A. H. Higham, 105 Westwood Avenue.  |
| 96 | Salt Lake City Health Department, 610 South 2d East.                                      |

Figure 4. Location of Radon Sampling Stations in Salt Lake City, Utah (1967-1968 PHS Study)

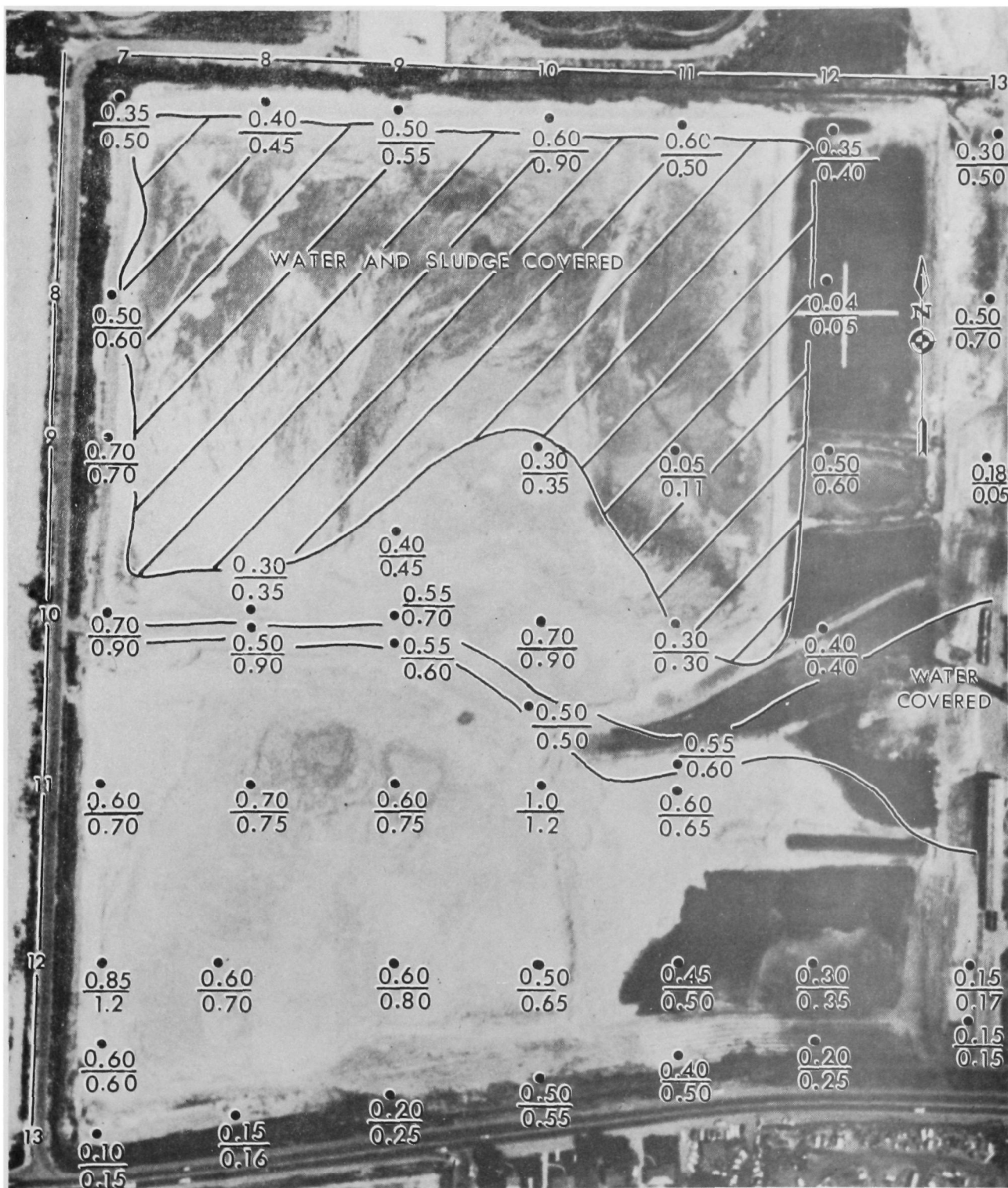


Figure 5. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Southeast Tailings Pile (3 ft. reading/ground reading)

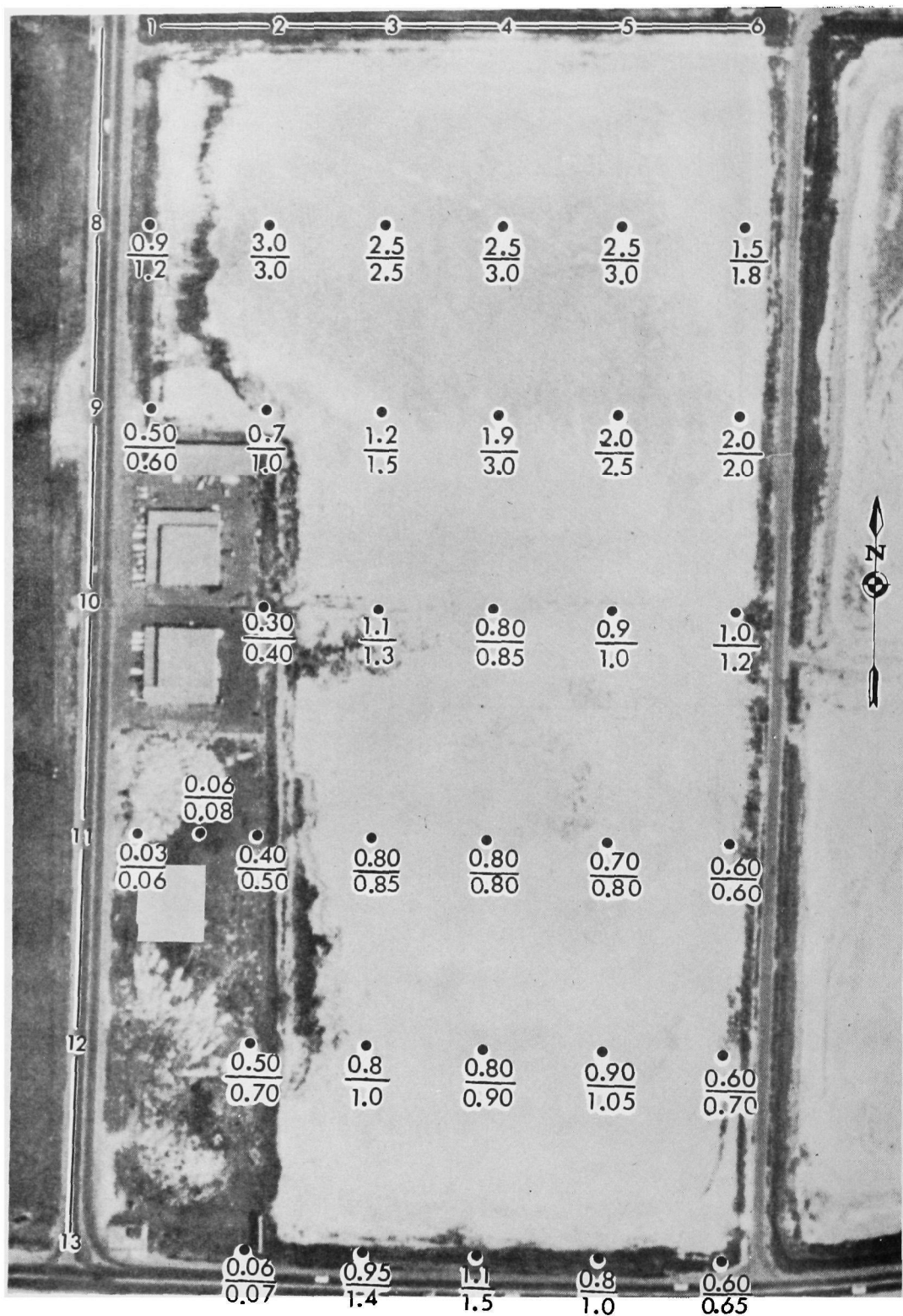


Figure 6. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Southwest Tailings Pile (3 ft. reading/ground reading)



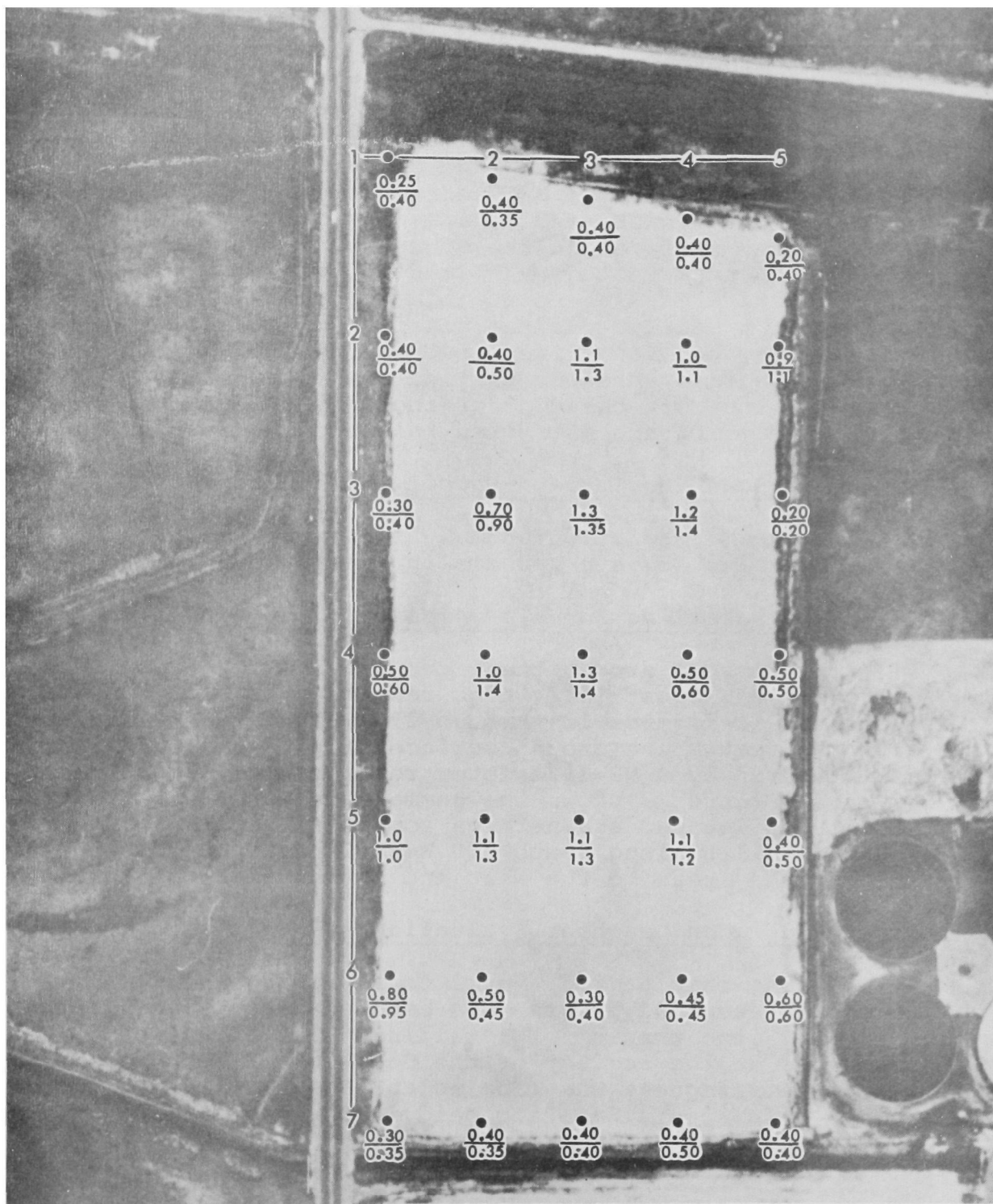


Figure 7. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Northwest Tailings Pile (3 ft. reading/ground reading)

ground surface. All units are reported in mR/h.\* Figure 8 shows the results of the TLD-gamma exposure rate measurements; all units reported in mR/h.\*

Also, in November 1970, a gamma survey was completed at the Suburban Sewage Treatment Plant to determine if tailings had been used in the plant construction. The gamma survey maps for several SSTP structures are shown in figures 9 through 12. These results are also given for three feet above ground surface and the ground surface; all units are reported in uncorrected  $\mu\text{R/h}$  (meter indication)\*\* since the more sensitive NE-148A scintillometer was used for these surveys. In addition to the detailed gamma surveys conducted at the SSTP, both the five-minute radon air sample and the five-minute radon progeny particulate filter sample was collected in the main building of the SSTP. The results of the air sampling are presented in table IV.

#### EPA Gamma Scanning Surveys--April to September 1972

The gamma radiation anomaly list prepared from the Mobile Gamma Scanning Surveys appears in appendix B.

#### EPA Gamma Screening Surveys--August to October 1972

The surveys around the Vitro uranium mill site were performed in August 1972. The results of these field surveys are shown in figures 13 through 21. The gamma measurements at three feet above ground surface and at the ground surface, as indicated by a NE-148A meter reading, are reported in " $\mu\text{R/h}$ ." Figure 13 shows the gamma surveys of the four business areas located against the southwest section of the tailings piles along South 900 West Street. Figures 20 and 21 show the areas to the west and north of the mill site.

#### Radon and Radon Daughter Evaluation--May 1973

During this period, May 2 to 22, 1973, an extensive radon air sampling program was conducted at the site of the inactive Vitro uranium mill tailings pile. This study was conducted at the request of the Governor of the State of Utah. This request was made to an EPA Region VIII representative at a special meeting held in the Governor's office on April 11, 1973. The Governor wanted additional data to

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\* These measurements do not need to be corrected.

\*\*True  $\mu\text{R/h}$  = Reported  $\mu\text{R/h}$  x 0.56 + 0.9.

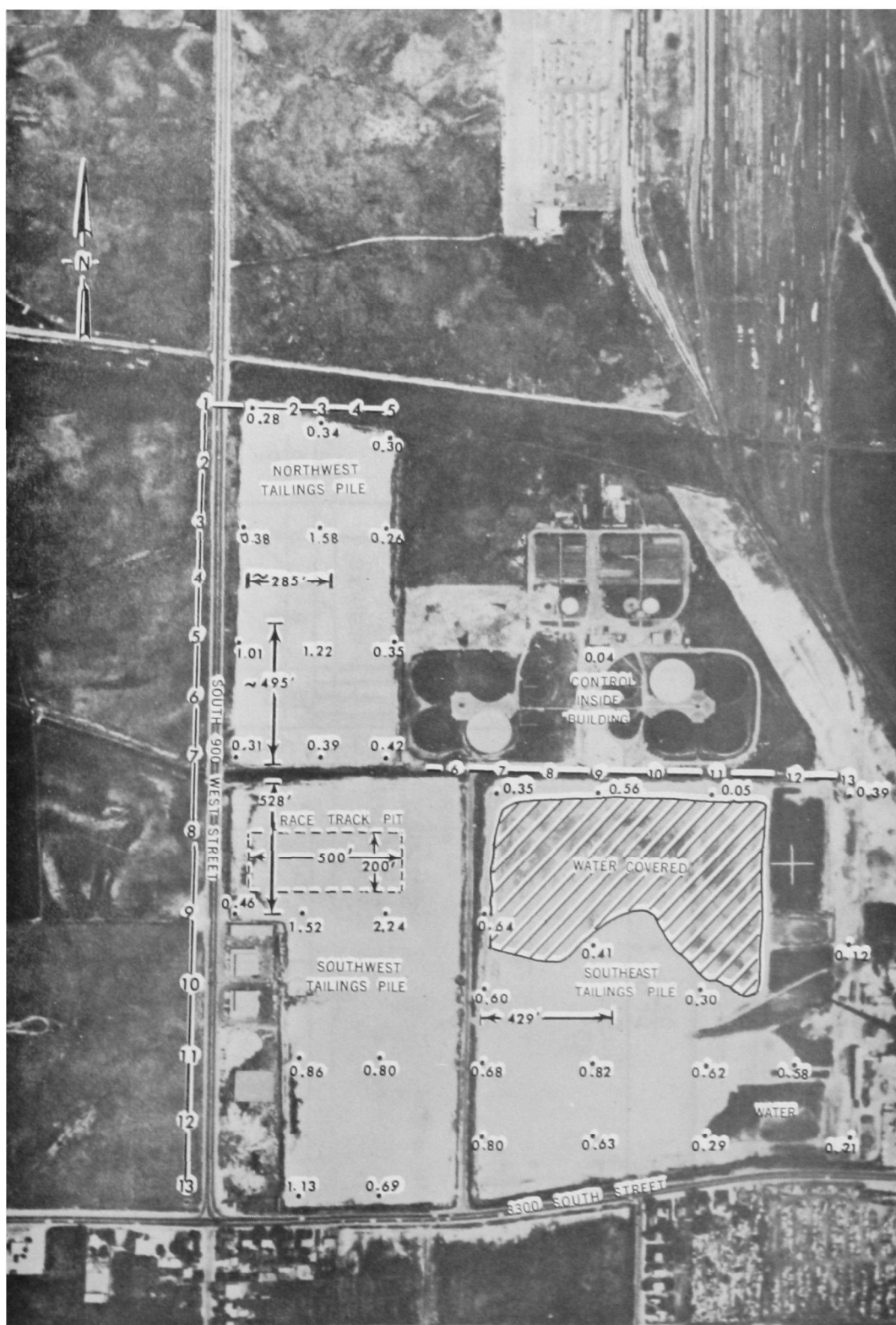


Figure 8. TLD Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Tailings Pile

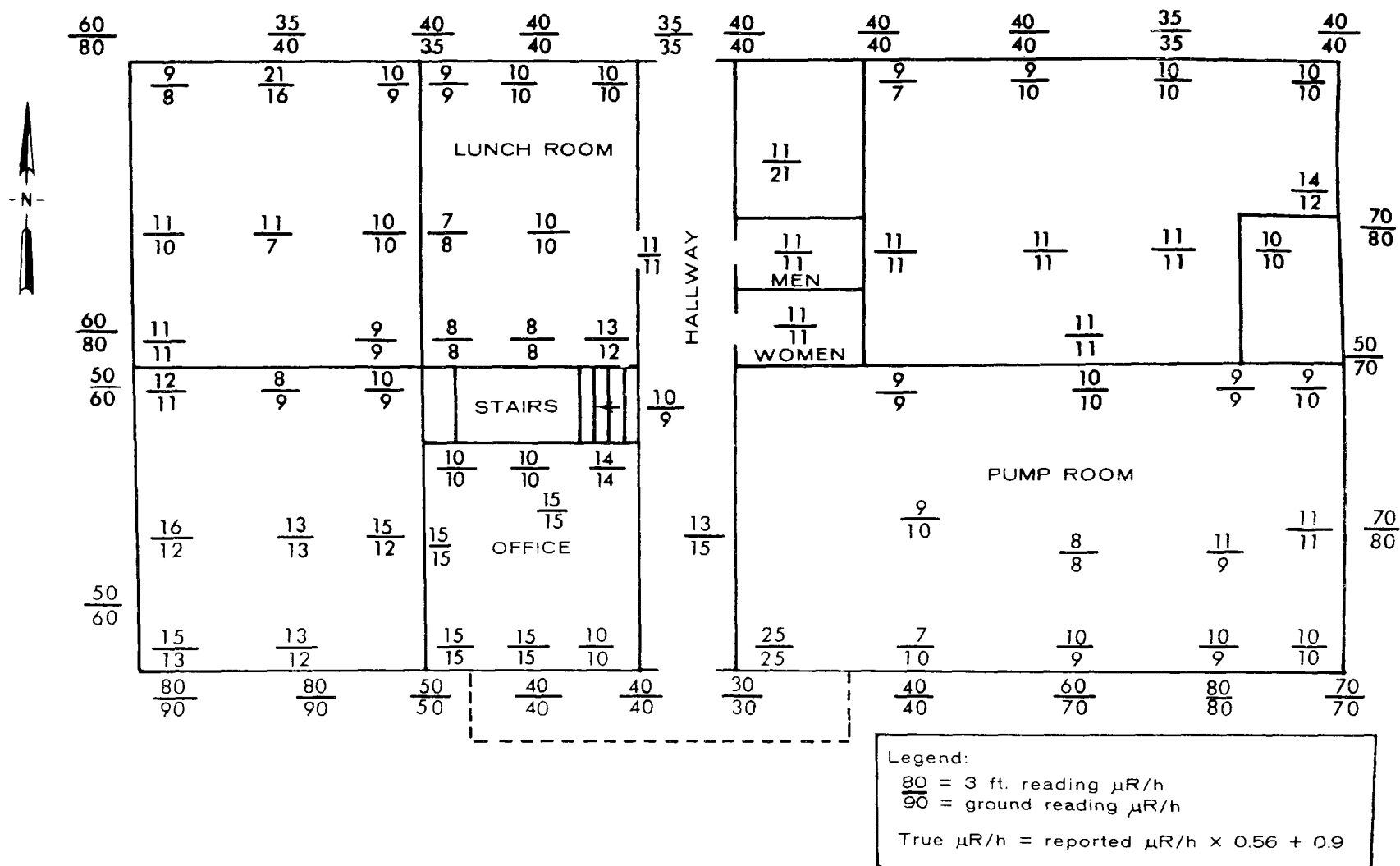
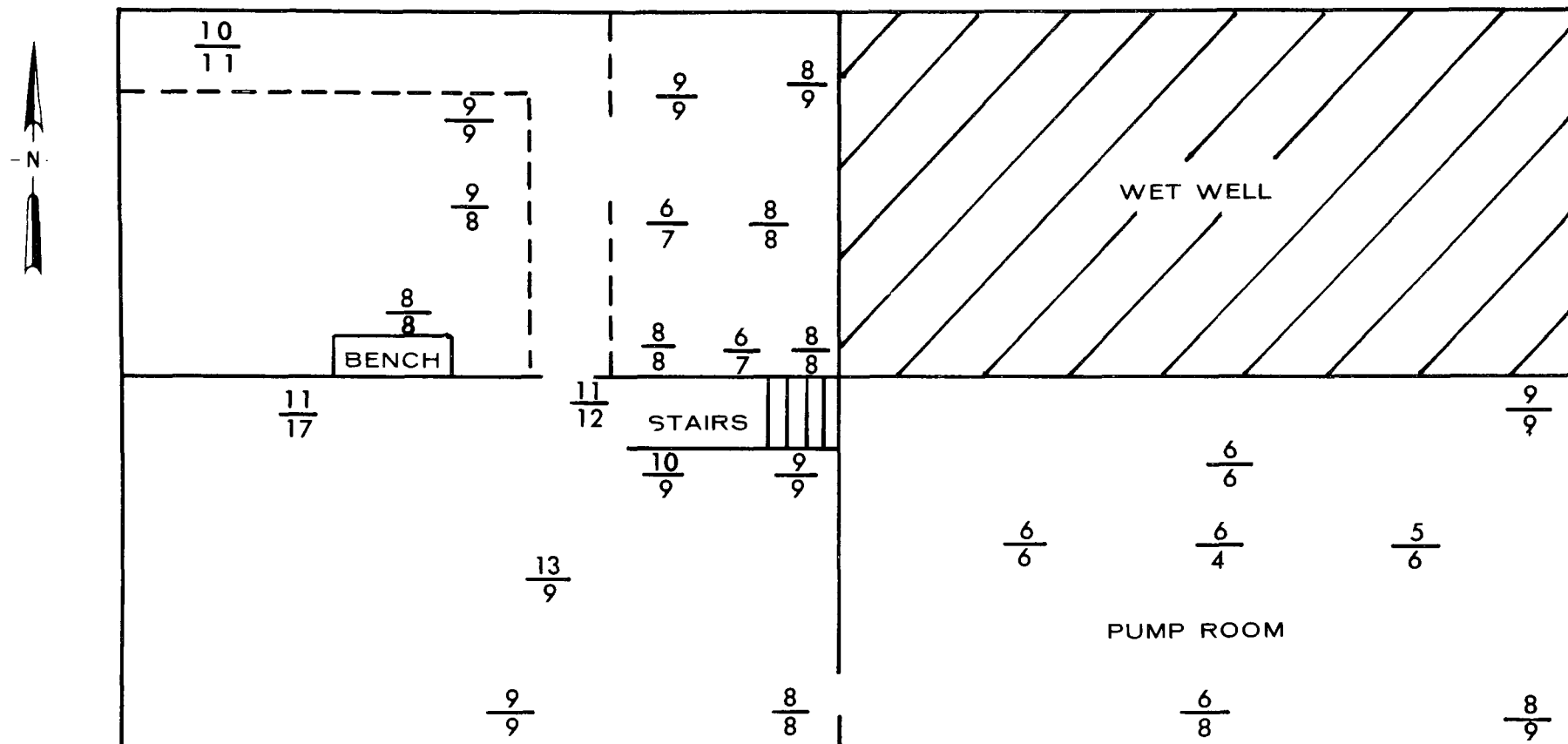


Figure 9. Gamma Survey Map, Suburban Sewage Treatment Plant, Salt Lake City, Utah, November 1970 (NE-148A readings in  $\mu\text{R/h}$ ) Ground Floor Main Building



Legend:

$\frac{10}{11}$  = 3 ft. reading  $\mu\text{R/h}$   
 $\frac{11}{11}$  = ground reading  $\mu\text{R/h}$

True  $\mu\text{R/h}$  = reported  $\mu\text{R/h} \times 0.56 + 0.9$

Figure 10. Gamma Survey Map, Suburban Sewage Treatment Plant, Basement Main Building, Salt Lake City, Utah, November 1970 (NE-148A readings in  $\mu\text{R/h}$ )

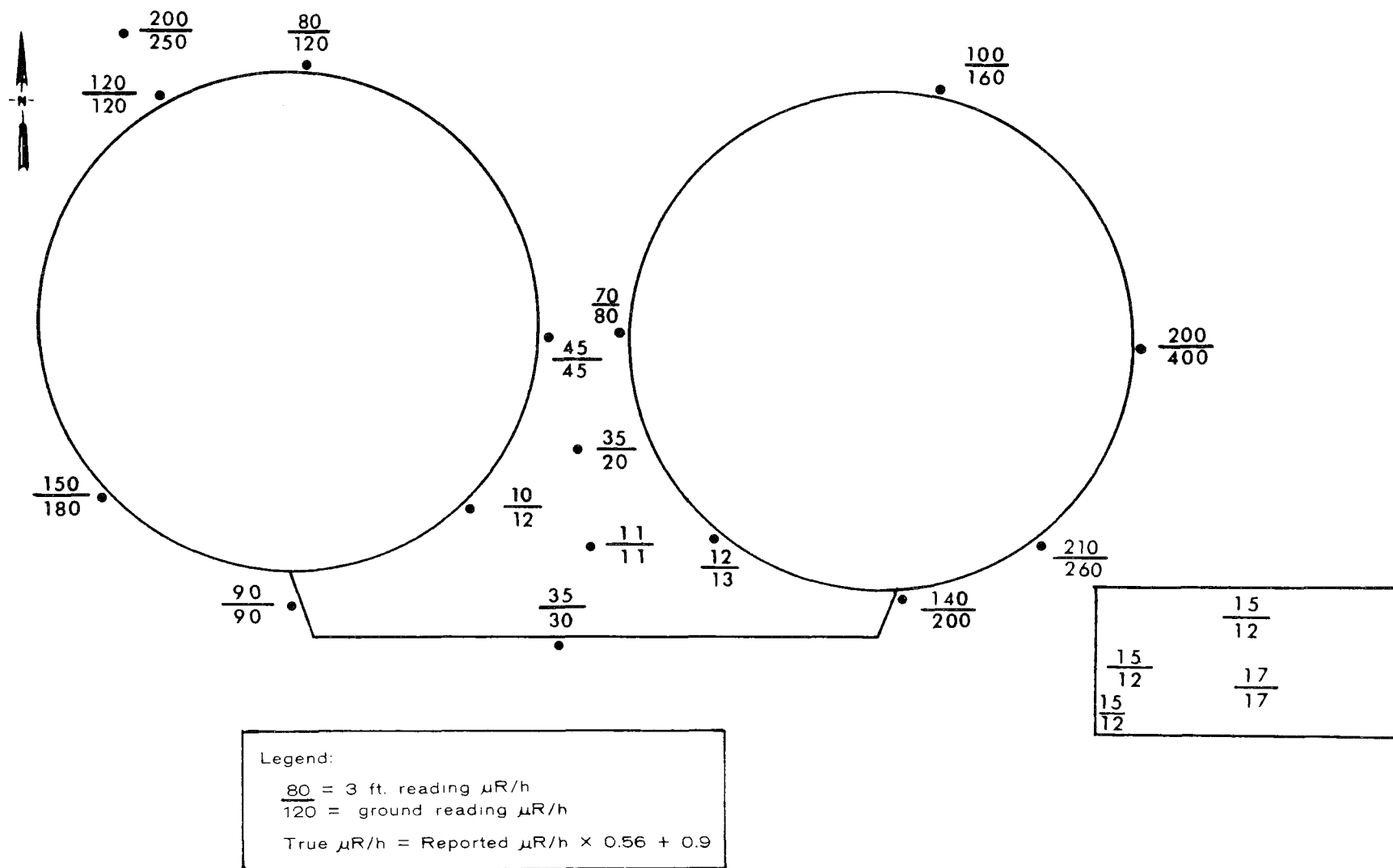


Figure 11. Gamma Survey Map, Suburban Sewage Treatment Plant, West Digester, Salt Lake City, Utah, November 1970 (NE-148A readings in  $\mu R/h$ )

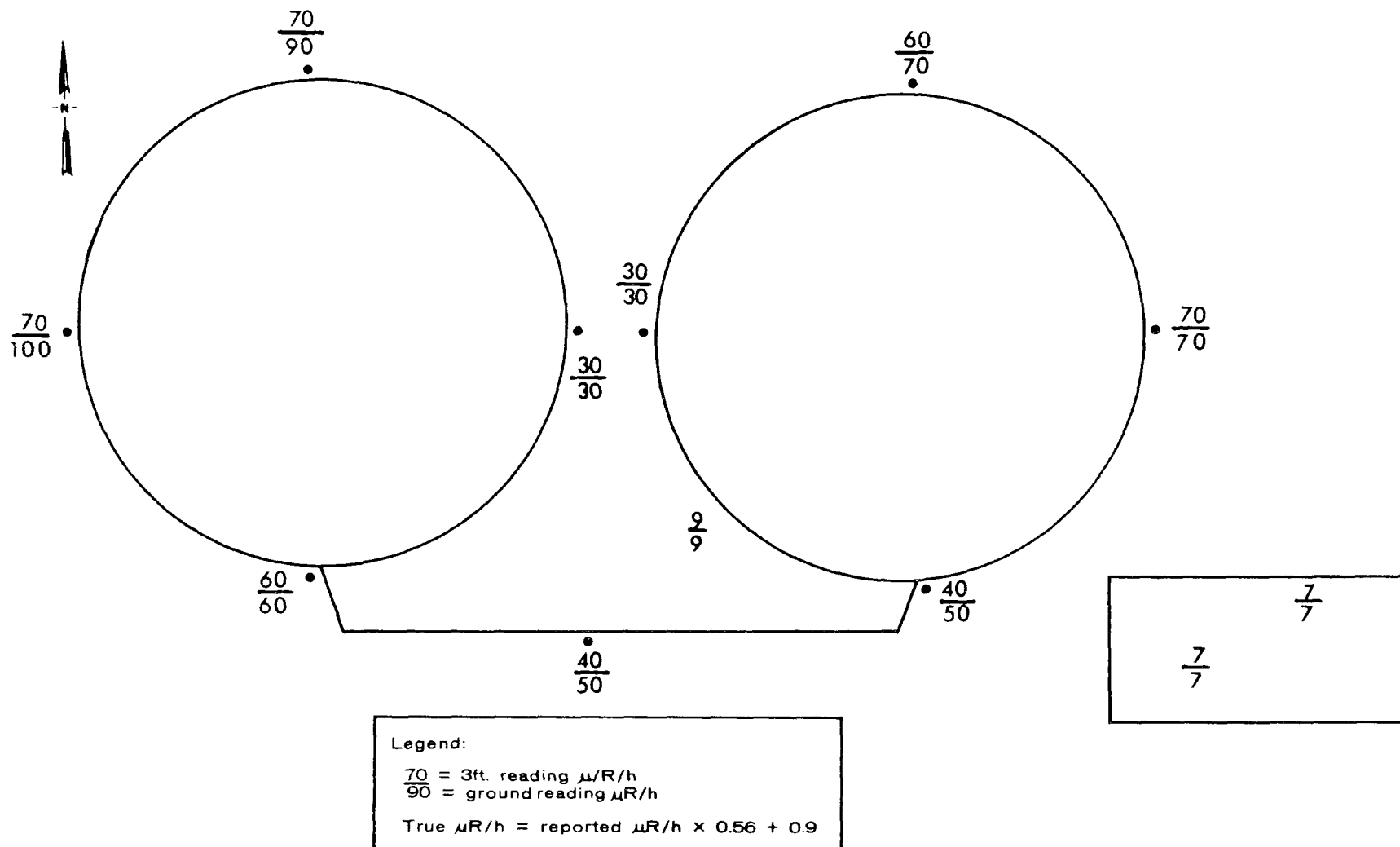


Figure 12. Gamma Survey Map, Suburban Sewage Treatment Plant, East Digester, Salt Lake City, Utah, November 1970 (NE-148A reading in  $\mu R/h$ )

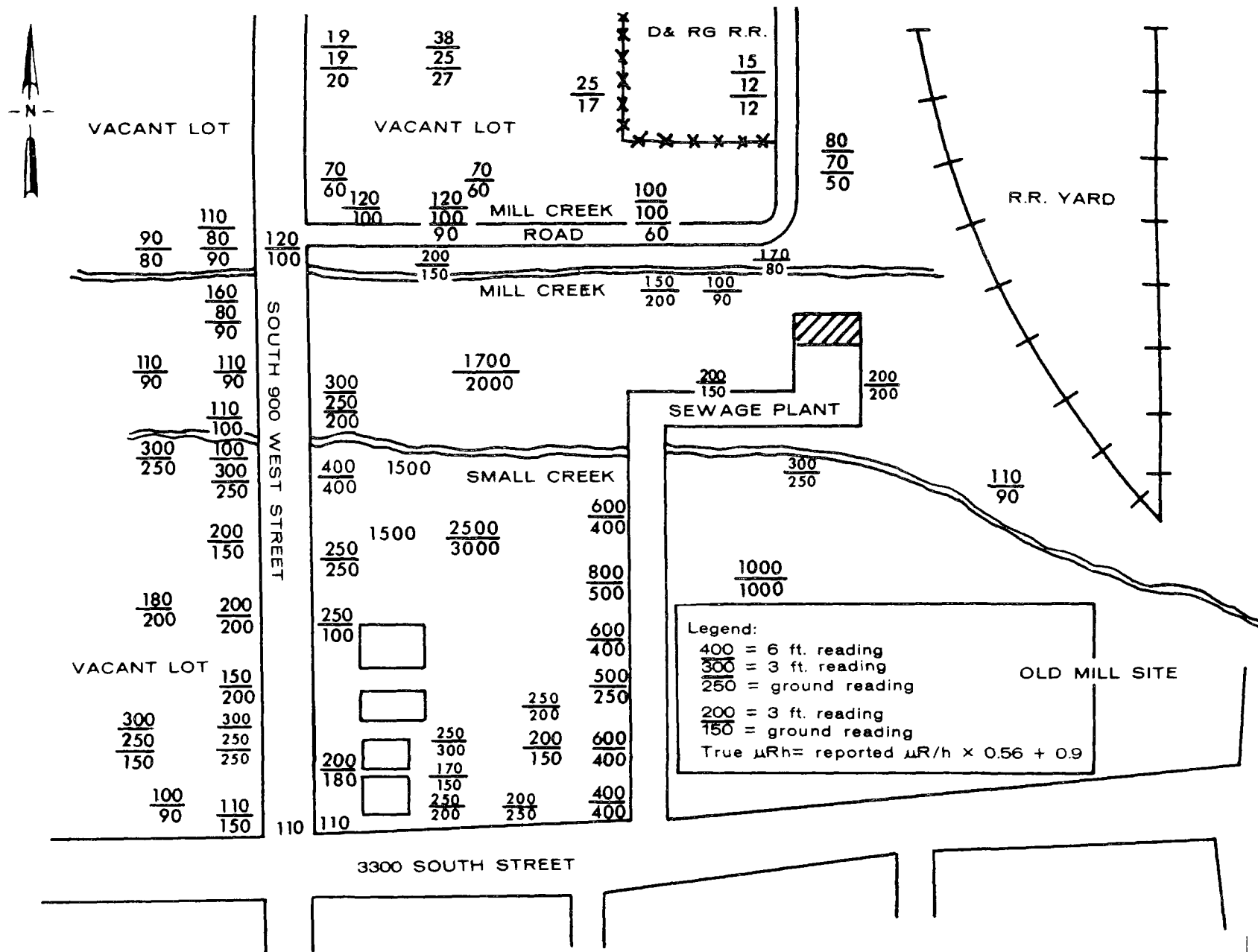


Figure 13. Gamma Survey Map - Area Surrounding the Vitro Uranium Mill and Tailings Pile Site, Salt Lake City, Utah



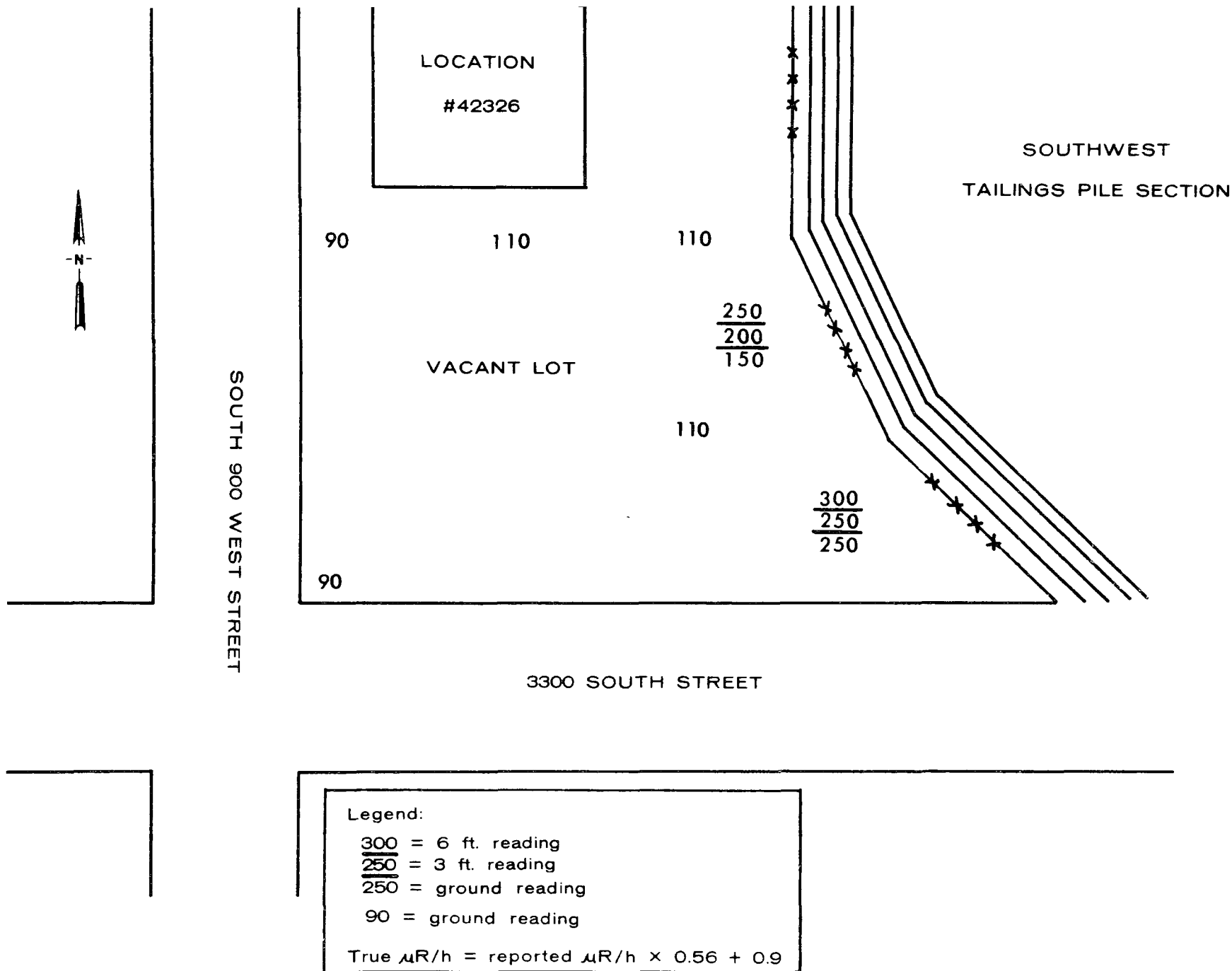
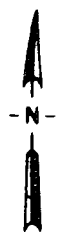


Figure 14. Gamma Survey Map, Location 42325 (Vacant Lot) Salt Lake City, Utah



SOUTH 900 WEST STREET

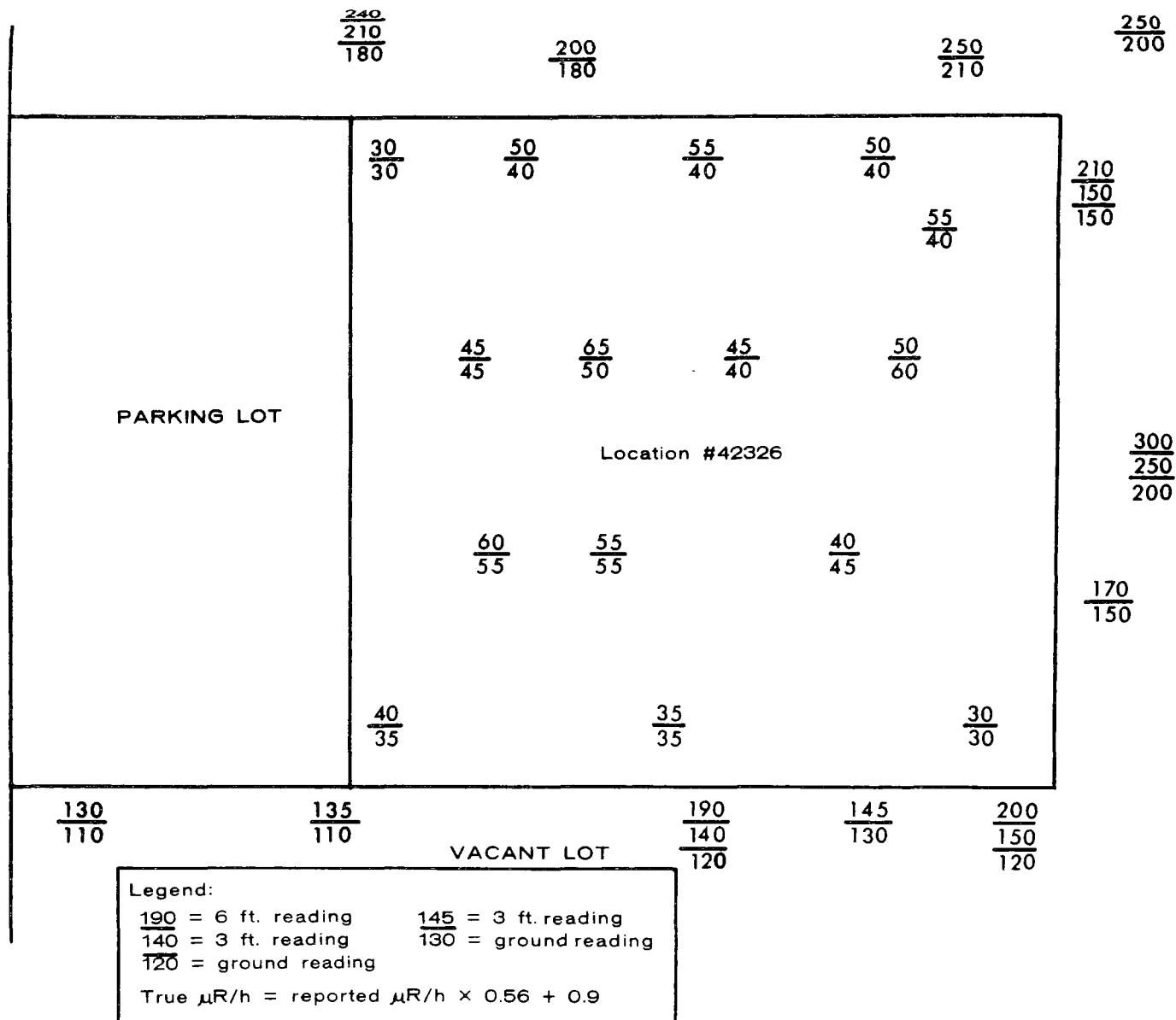


Figure 15. Gamma Survey Map, Location 42326, Salt Lake City, Utah

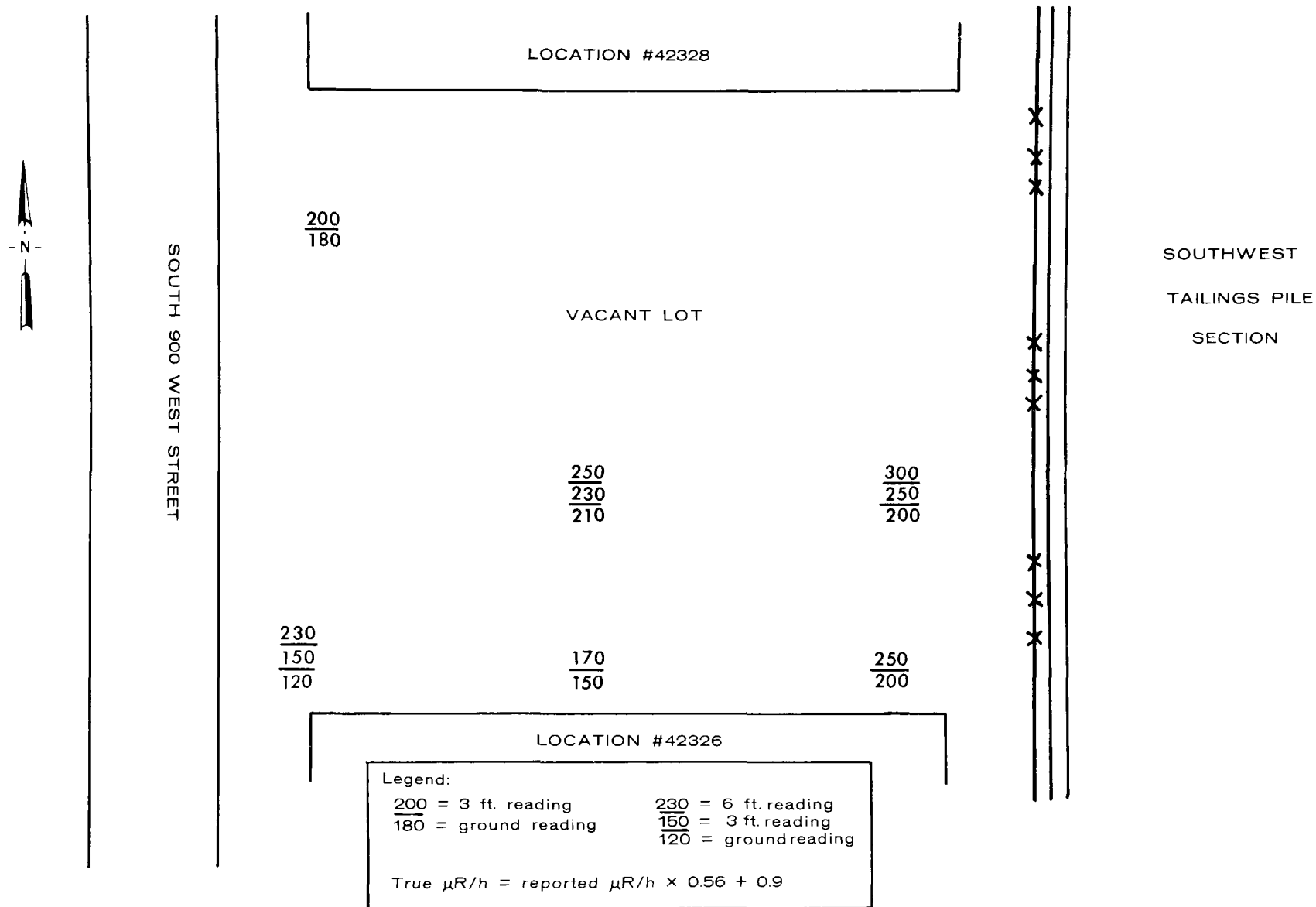


Figure 16. Gamma Survey Map, Location 42327 (Vacant Lot) Salt Lake City, Utah

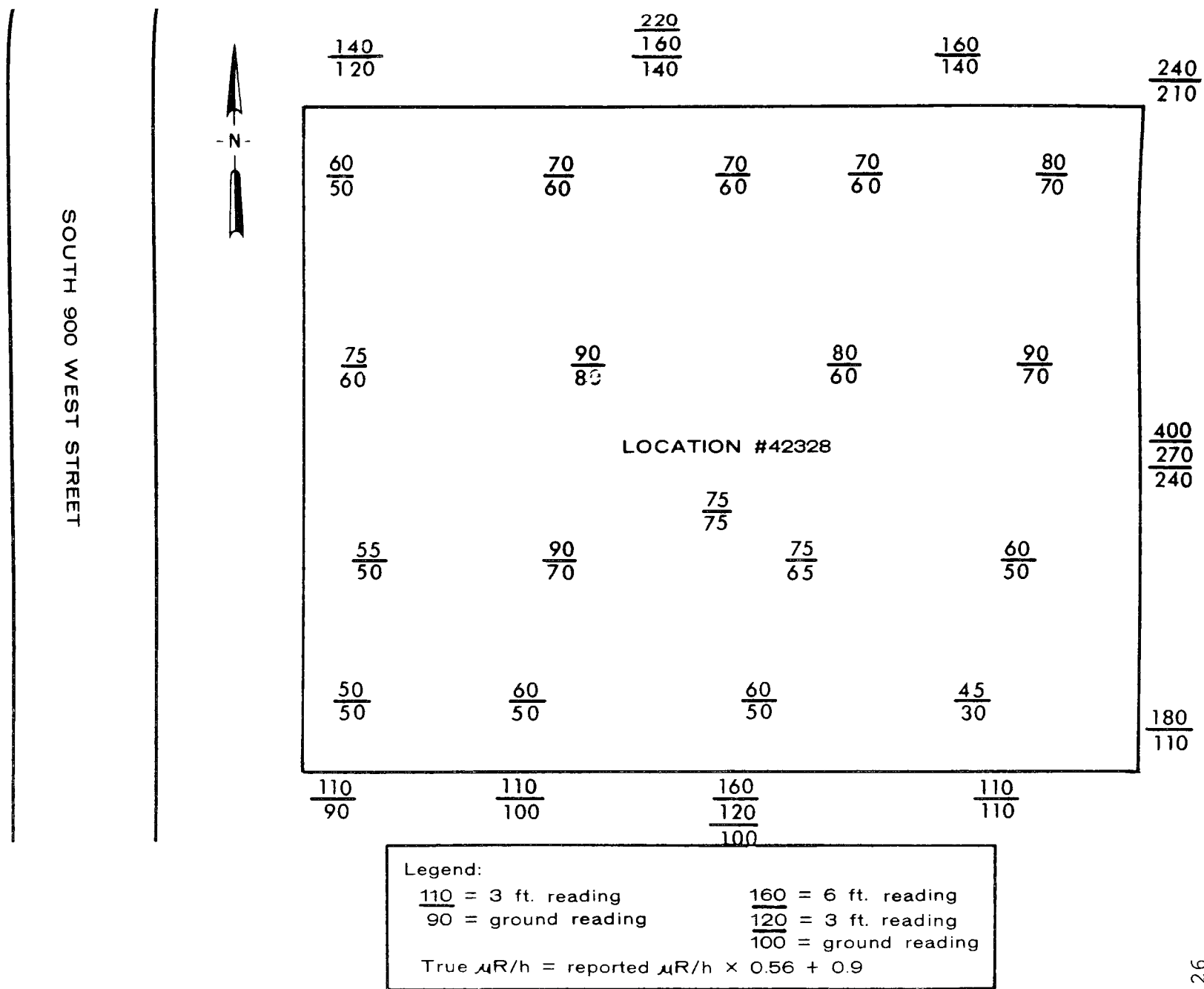
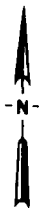


Figure 17. Gamma Survey Map - Location 42328, Salt Lake City, Utah



SOUTH 900 WEST STREET

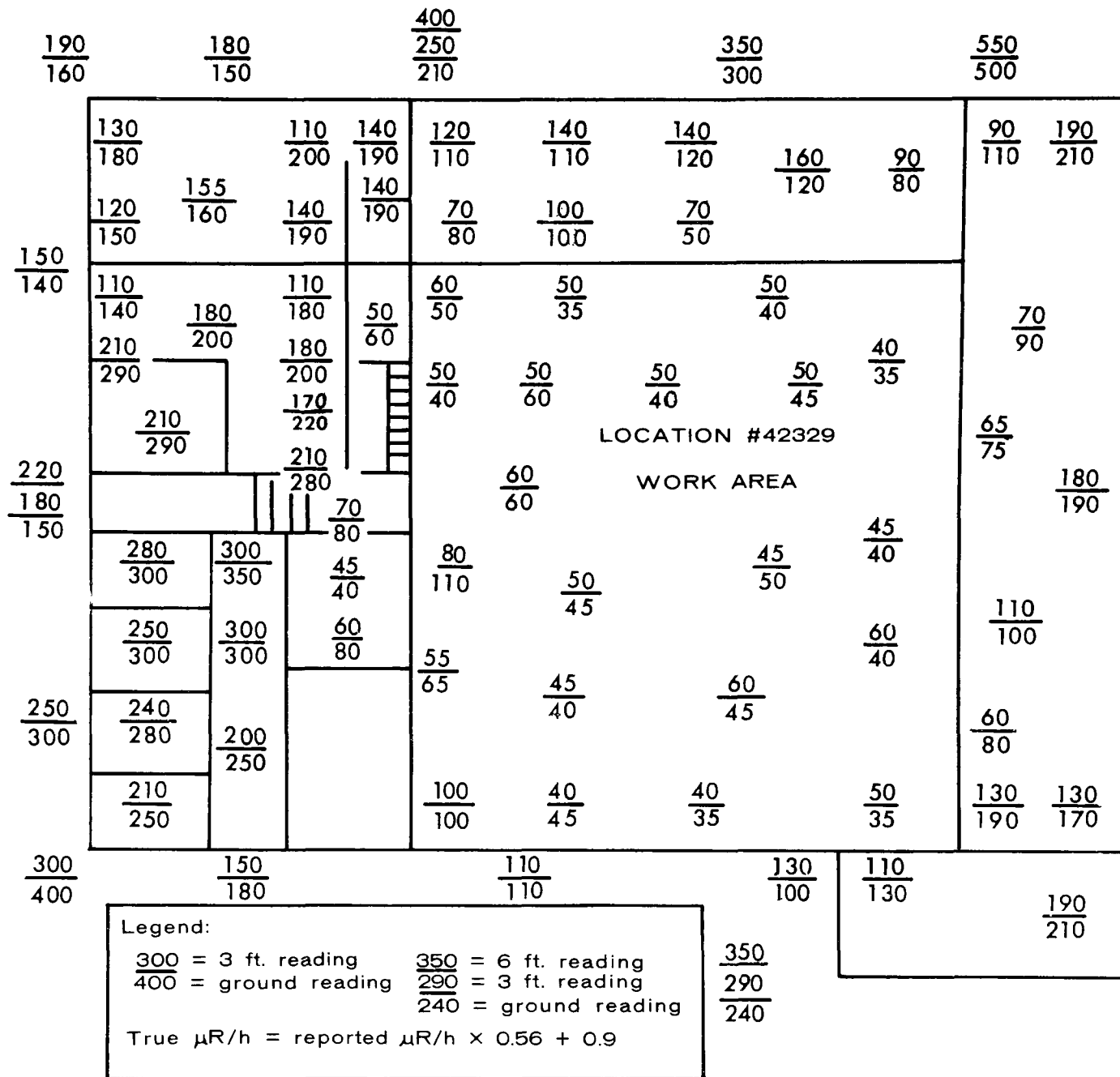


Figure 18. Gamma Survey Map, Location 42329, Salt Lake City, Utah



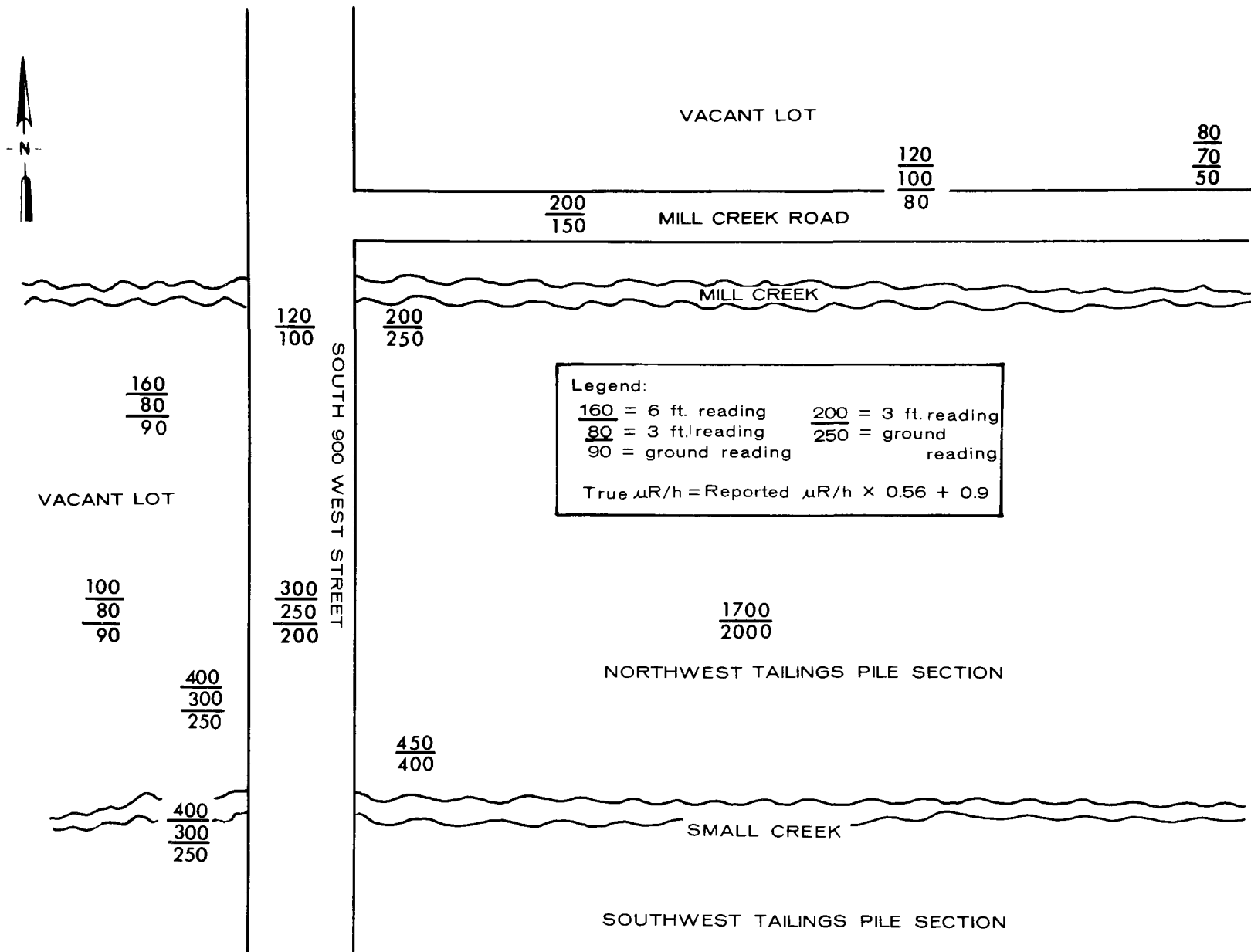


Figure 20. Gamma Survey Map - Location 42331 (Vacant Land West of Tailings Pile) Salt Lake City, Utah

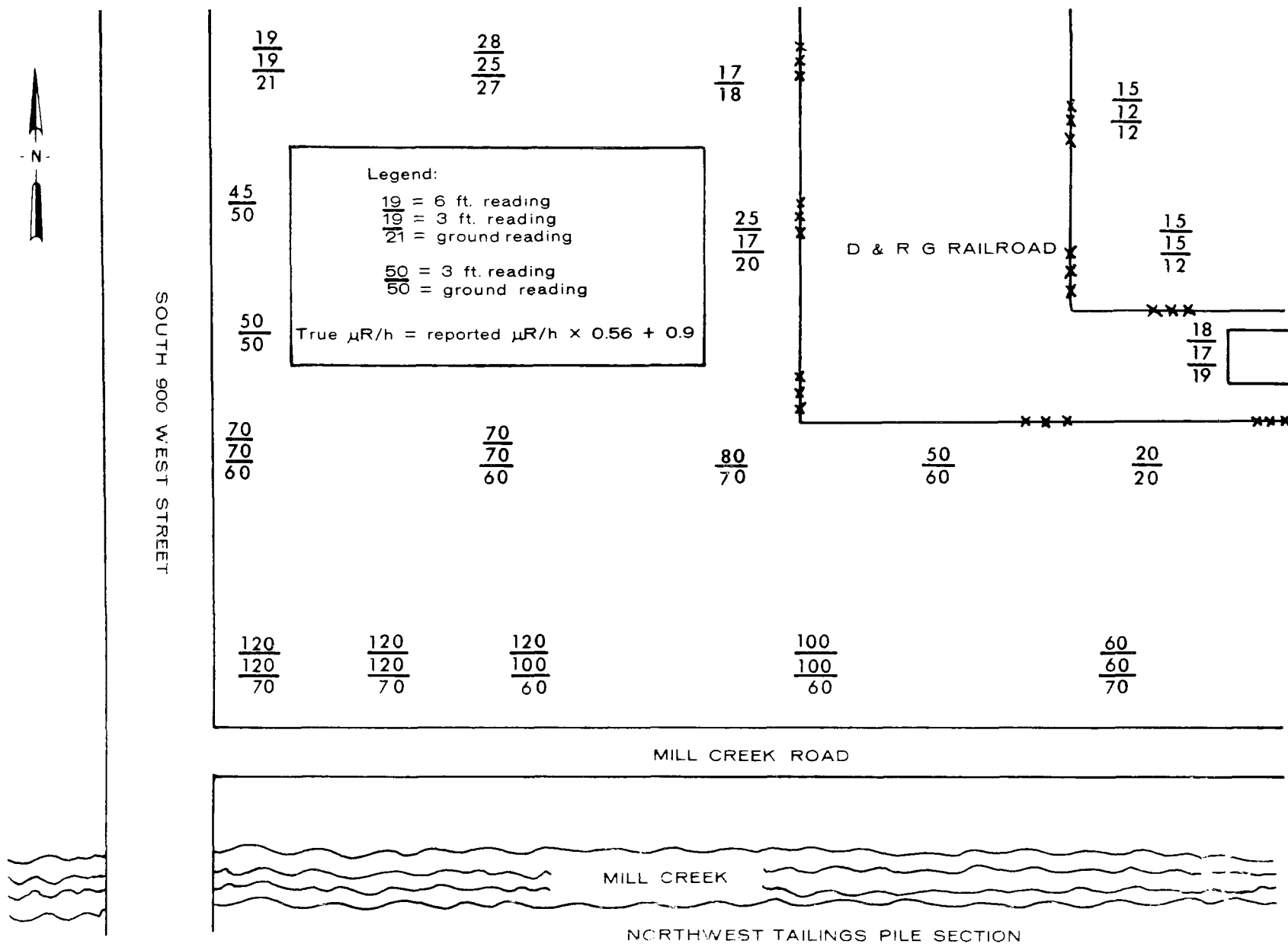


Figure 21. Gamma Survey Map - Location 42332 (Vacant Land North of Tailings Pile)  
Salt Lake City, Utah



evaluate the potential radiological hazards associated with the operation of an automobile race track proposed for the southwest section of the tailings pile. As described earlier, by April 1973, a pit had been dug out of the tailings pile, resulting in an excavation about 15 feet deep, 200 feet wide, and 500 feet long. The tailings material removed from the pit was piled on the surrounding pile to form hills about 10 to 20 feet high. This study was completed by EPA, ORP-LVF, with the assistance of the Utah State Division of Health and EPA, Region VIII personnel. Included were radon and radon daughter evaluations at the tailings pile, the Suburban Sewage Treatment Plant, and in the four business buildings on South 900 West Street.

Figure 22 shows the air sampling locations selected for this study. Location #75001 was the station setup on the floor of the race track pit dug out of the tailings pile. This station was located about 50 feet away from the wall of the pit. The pit was approximately 15 feet deep at this point. Portions of the pit floor were covered with from one to six inches of water during the sampling period. Location #75002 was an indoor station in the "lunch room" of the Suburban Sewage Treatment Plant. The SSTP is surrounded by the tailings pile on its south and west boundaries, but none of the habitable SSTP buildings appear to have been constructed over uranium mill tailings. Location #75003 was the station setup on the southwest section of the tailings pile. Most of the area surrounding Location #75003 was covered by dirt, concrete, and asphalt road debris. Location #75004 was the station setup at the perimeter fence between the Won-Door Corporation and the tailings pile at the southwest end of the excavated pile.

Four stations were located indoors at the business buildings on South 900 West Street. Location #42326 was an office reception area of the Sierra Corporation at 3275 South 900 West Street. Location #42328 was the main stock room of Inventory Sales at 3227 South 900 West Street. Location #42329 was the main assembly room of the Won-Door Corporation at 3215 South 900 West Street. Location #42330 was the rear assembly area of the Won-Door Corporation at 3195 South 900 West Street.

Several different radon air sampling methods were used at the various locations. A TLD-Type II air sampler was installed at each of the locations to measure the integrated radon progeny working level. An integrating air sampler for the determination of  $^{222}\text{Rn}$  was used at locations #75001,

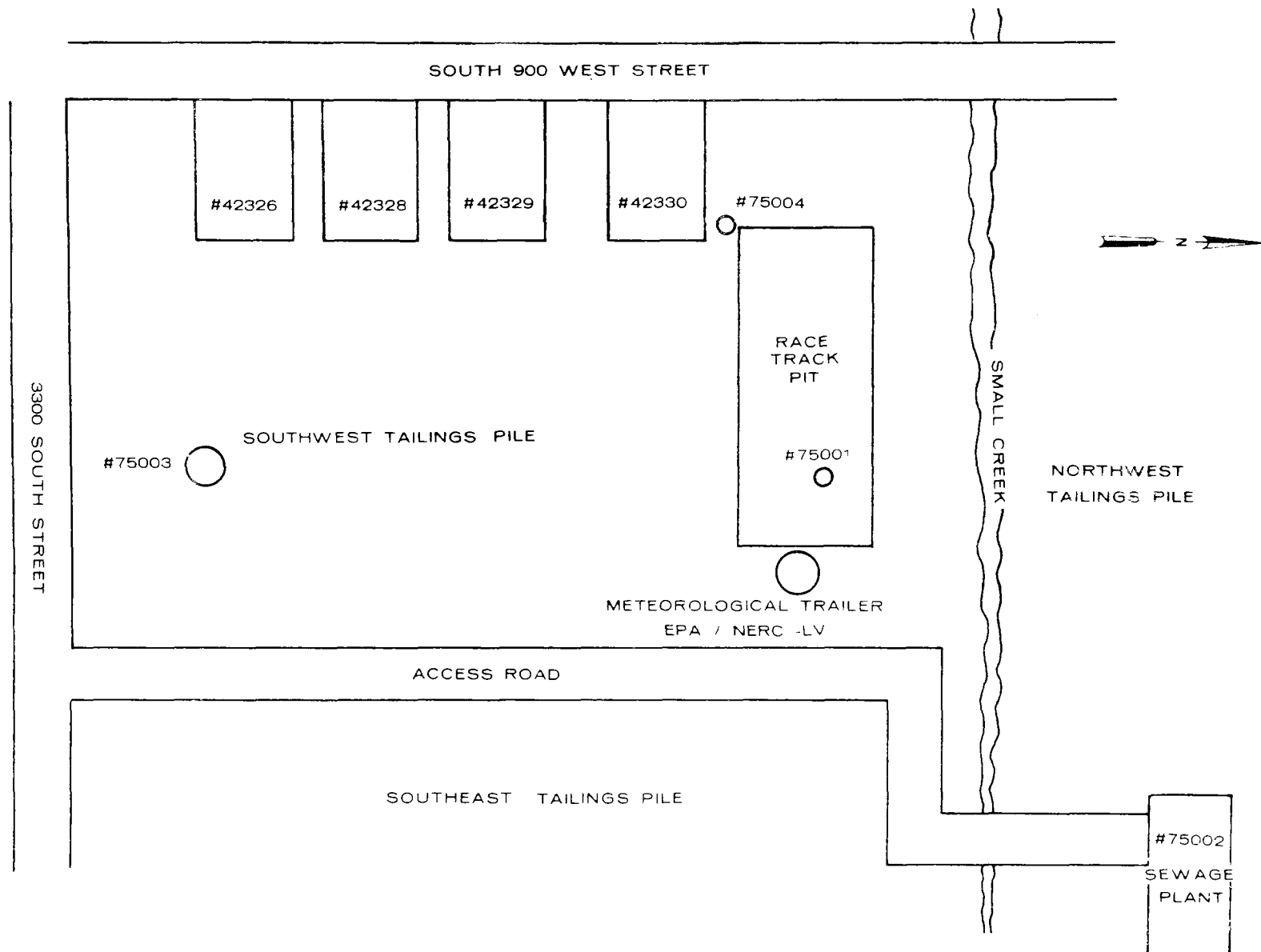


Figure 22. Air Sampling Locations - May 1973 - Salt Lake City, Utah

#75002, #75003, and #75004. A "grab" radon sample was collected for five minutes by drawing filtered air into an evacuated glass flask (2-liter volume) at locations #75001, #75002, #42326, #42328, #42329, and #42330. Simultaneously with the radon grab sample, short-lived radon progeny concentrations were determined by collecting a five-minute particulate air sample. The working level exposure was then determined by using the Thomas equations for the modified Tsivoglou method.

The results of the various air sampling methods for each of the locations are shown in tables V through XII and in figures 23 through 25.

Tables XIII and XIV show the comparisons between the various radon sampling methods for locations #75001 and #75002.

## DISCUSSION OF RESULTS

### Gamma Radiation Exposures on the Tailings Pile

The gamma radiation measurements which have been made on the pile are provided in table III and figures 5 through 8. The average TLD measurement for the 1967-68 on-pile sampling station was 1.1 mR/h. A grid system was established in 1970 with 13 stations from west to east, which were about 150 feet apart; 13 stations were also established from north to south, which were about 250 feet apart (figure 8). E-500B measurements were taken at each grid intersection and TLD's were placed at alternating grid intersections. As table XV shows, there is very good agreement between the TLD measurement (TLD mounted on a stake three feet above the surface) and the E-500B measurement (number in parentheses) at the same location; thus, the E-500B measurements do not require correction. The average for the northwest pile at the 12 locations where TLD and E-500B measurements were made (table XV) was 0.57 mR/h (TLD) and 0.53 mR/h (E-500B). The average of all 35 E-500B (three-foot) measurements (figure 7) was 0.63 mR/h. Similarly, the southwest pile (table XV) showed 1.1 mR/h (TLD) and 0.99 (E-500B) with a 1.12 mR/h for all 32 (three-foot) E-500B measurements (figure 6); and the southeast pile (table XV) had an average of 0.47 mR/h (TLD) and 0.45 mR/h (E-500B) with 0.45 mR/h for all 46 (three-foot) E-500B measurements (figure 5). Fulltime occupancy in these areas would result in whole body gamma exposures

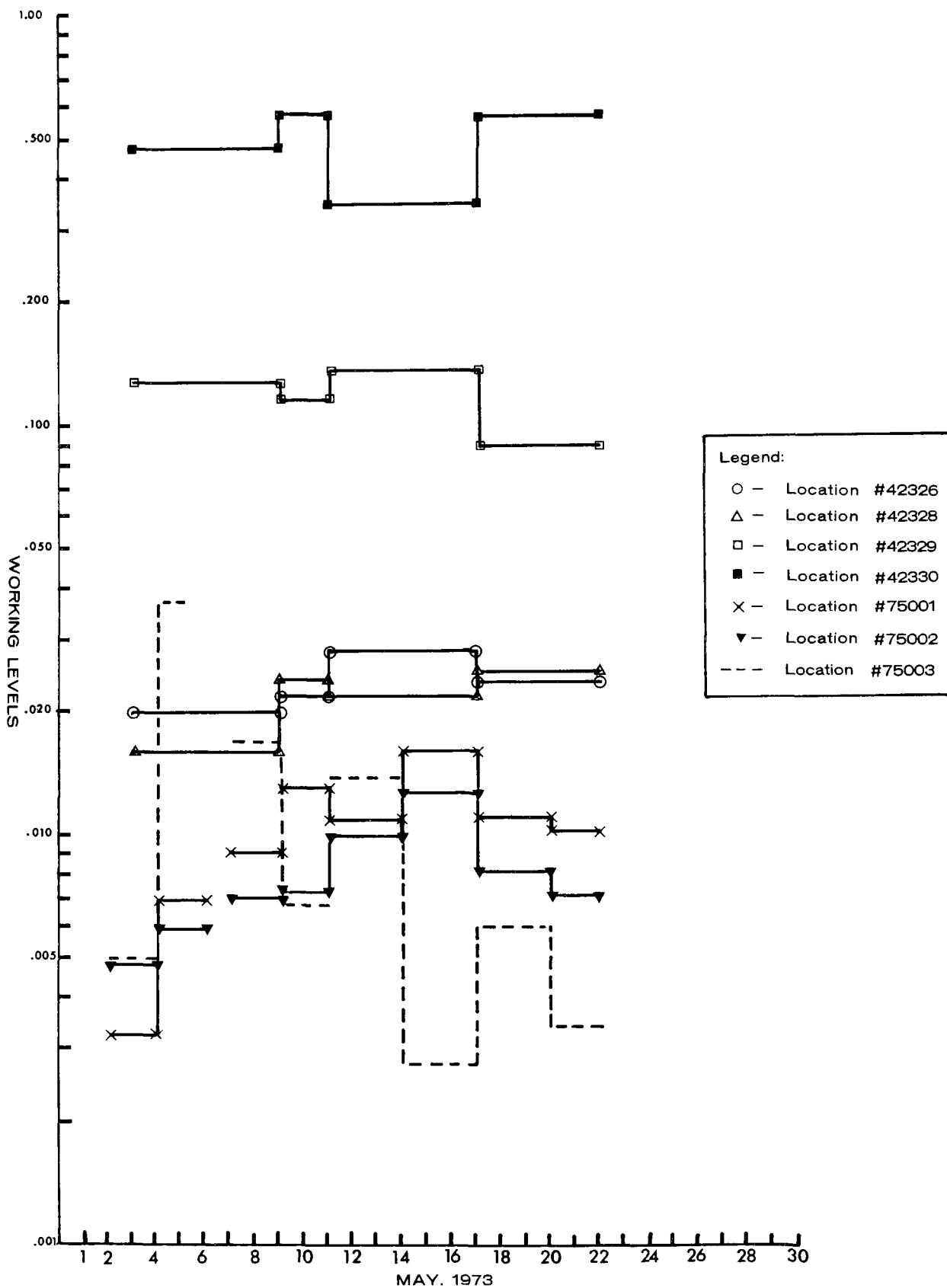


Figure 23. TLD Integrated WL Exposure - Salt Lake City, Utah  
May 1973

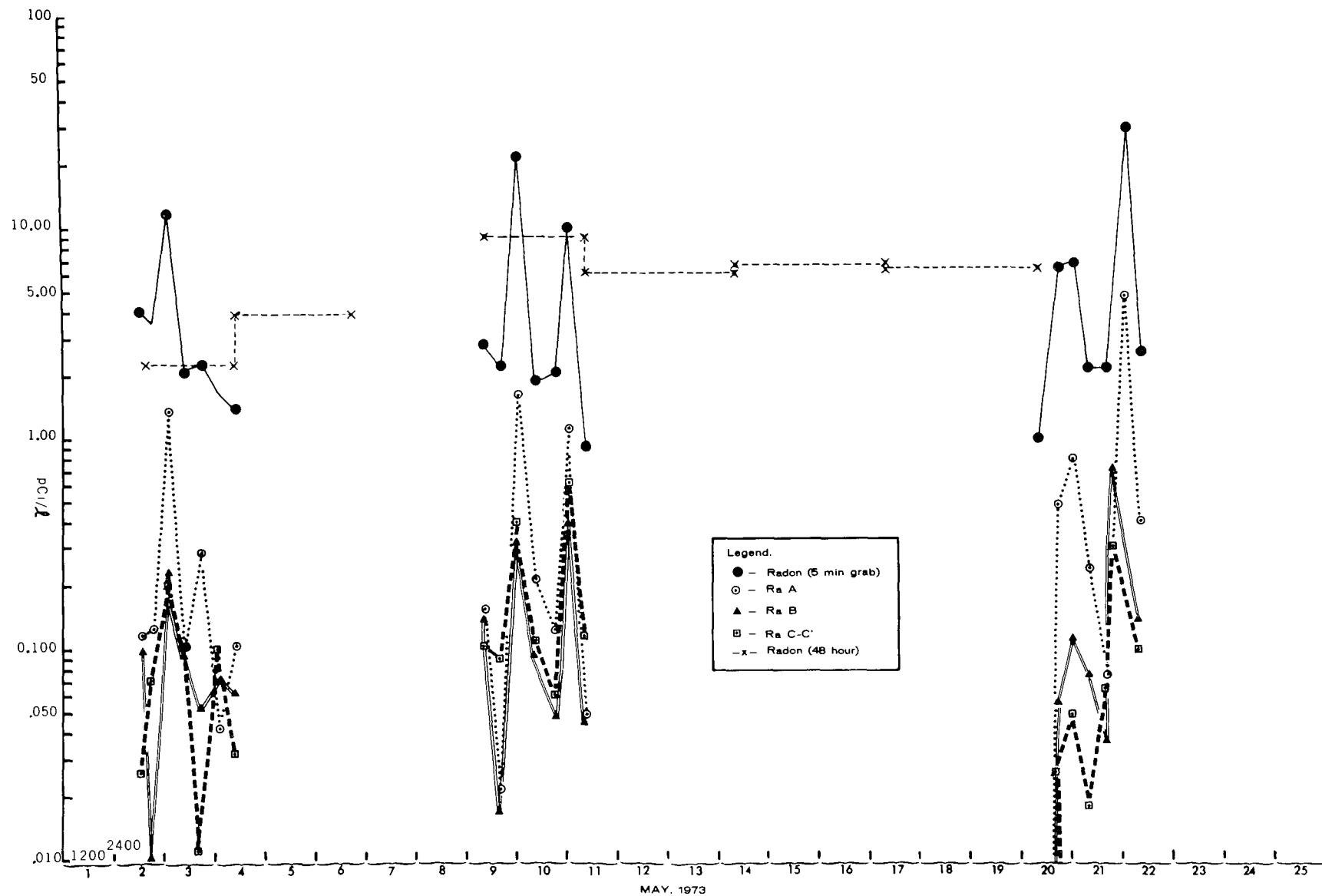


Figure 24. Radon and Radon Daughter Concentration (pCi/l) Salt Lake City, Utah (Location #75001) - May 1973

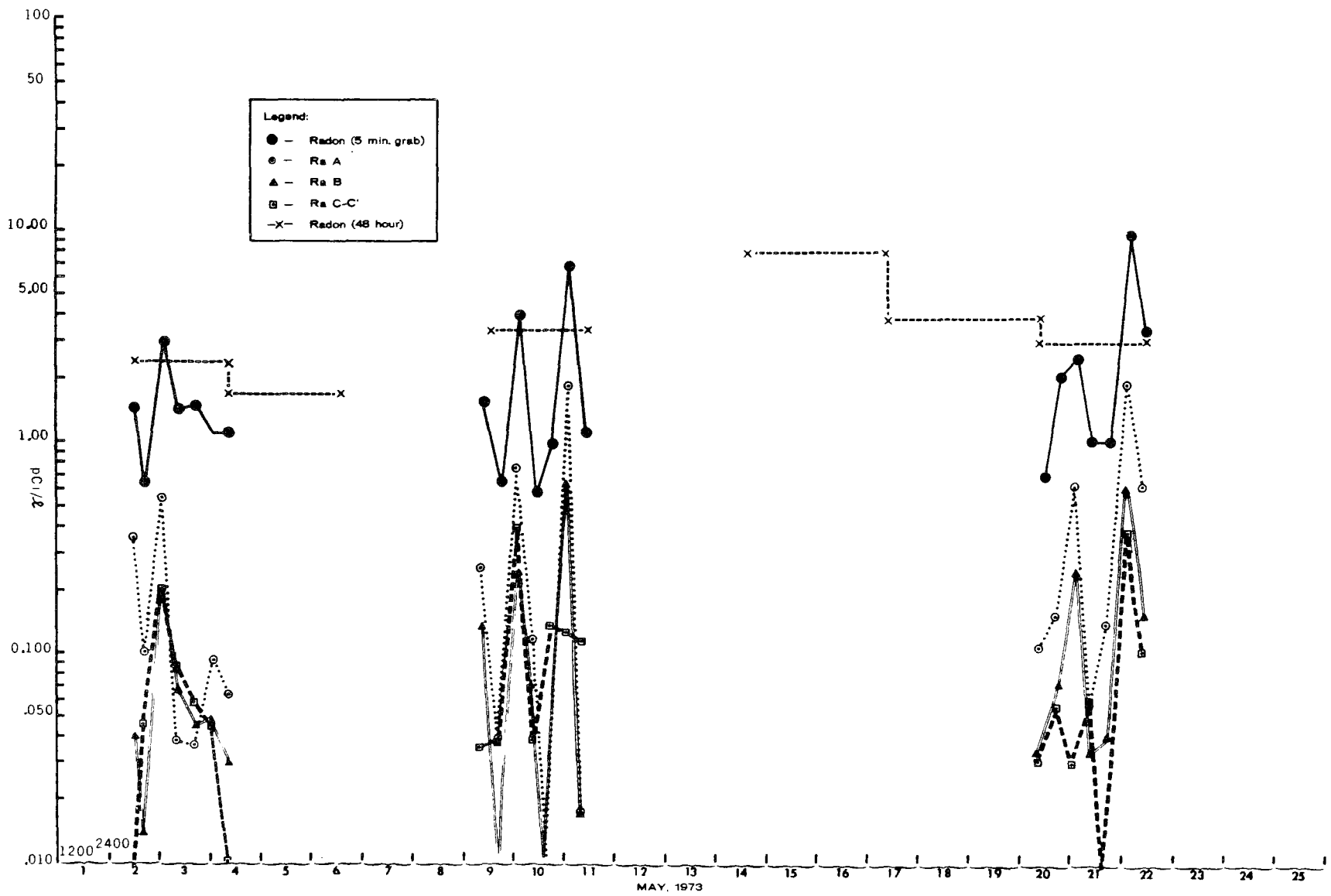


Figure 25. Radon and Radon Daughter Concentration (pCi/l) Salt Lake City, Utah (Location #75002) - May 1973

of about 100 times above background. The exposures received by children using the area as a playground are not beneficial and the exposures are received unknowingly.

### Radon and Radon Daughter Concentrations

Radium decays to radon, a chemically inert gas. Radon is capable of diffusing through most materials. The radon, in turn, decays to several short-lived particulate radon daughters (figure 3). When inhaled these particles can remain in the air pathways long enough for the alpha decay energy from the radon daughters, which represents the principal dose received, to be absorbed by the cells lining the tracheobronchial passages.

The biological effect of excess exposure to radon daughters can be a form of lung cancer, considered to be 100 percent fatal. It is, therefore, unfortunate that there is only a limited amount of experimental evidence or clinical documentation available regarding the consequence of chronic low-level exposures.

During the 1967-1968 PHS Study, only radon measurements were made to determine if the Vitro uranium mill pile had any effect on the surrounding community. The guidance used for comparison of the sample values is found in 10CFR20. (5) This guidance states that at the perimeter of a site the radon concentration should not be above 3 pCi/l ( $3 \times 10^{-9}$   $\mu$ Ci/ml); except, if a significant population group can be exposed, it should not exceed 1 pCi/l. Since measured community values did not exceed 1 pCi  $^{222}\text{Rn}/\text{l}$ , nothing more was done at that time. This is because of the mechanics of the WL. (If radon is in equilibrium with its daughters and 100 pCi/l of radon is present, the decay energy of the daughters will produce  $1.3 \times 10^5$  MeV of alpha energy or one WL.) Thus, the less than 1 pCi/l radon measurements obtained (in the surrounding community) indicated that less than 0.01 WL would be present. Actually, a much lower WL would be present since radon would not be in equilibrium with its daughters because of the constant air movement. The presence of less than 1 pCi/l of radon led to the conclusion presented in DER 69-1 that there was no hazard created in the surrounding community (beyond one-half mile). Field data collected to date indicates that for general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels from the pile were not distinguishable from natural background levels and were found to be within current guides.

There is, at present, no general guidance for public exposures to radon or radon daughters. In general, an applicable occupational exposure guide is divided by ten to obtain an exposure guide applicable to an individual in the general population. The current occupational limit for uranium miners is 0.3 working level months (WLM) or four WLM per year. (If a person works in an atmosphere containing 0.3 WL for one working month, 170 hours, he has received 0.3 WLM.)

Because of the previous practice of using uranium mill tailings in the construction of homes, the Surgeon General of the USPHS was requested to furnish guidance to the State of Colorado. This guidance, which includes guidance for exposure to gamma radiation as well as radon daughters, was provided in August 1970. The working level value, 0.05 WL, is based on the time necessary (50y) for a person, continually in that atmosphere, to accumulate 120 WLM which is considered to be the dose necessary to double one's risk of contracting lung cancer; however, because of the many uncertainties and unknowns, the 0.01 WL value is being used as a remedial action level. (6)

The radon and radon daughter measurements made at the Vitro site in May 1973 were made to determine if the surface of the pile could be developed and, at the same time, to prevent any increase in public exposure to ionizing radiation. In the case of the race track proposal, any public exposure to ionizing radiation is considered unacceptable by EPA because the exposure would be non-beneficial and it would be received unknowingly by persons attending the racing events.

The integrated radon measurement obtained (table IX) from May 2 to May 20, 1973, indicated an average of 5.9 pCi/l at the pile with an average WL of 0.010 (table V). Thus, the radon daughters had reached 16.9 percent of equilibrium\* with the radon.

Five-minute radon and particulate filter samples were also collected and the WL calculated. These samples were collected over three 48-hour periods from May 2 to 4, May 9 to 11, and May 20 to 22, 1973. The average values

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\*100 pCi  $^{222}\text{Rn}$ /l in 100% equilibrium with the radon daughter products is equal to 1 WL.



for these periods appear in tables VI, VII, and VIII; and although the average radon concentration was 5.7 pCi/l, the average working level was 0.002 which indicated the radon daughters had reached only three percent of equilibrium. The five-minute grab sample allows one to obtain radon daughter to radon ratios, but the answer obtained is valid only for the five minutes during which the sample was collected. Thus, the integrated values (table IX) provide a better estimate of the WL exposure.

In the open, on the surface of the pile, the measured working level was 0.010 WL. The average at the other two locations on the surface of the pile (locations #75003 and #75004), as shown in table V, was 0.006 WL and 0.008 WL, respectively. Thus, the gamma exposure rate existing on the surface of the pile is unacceptable for public exposure, but the less than 0.01 WL's detected in the open would not cause undue concern. However, if an enclosure of any type is placed on or against the surface of the pile, the results are very different, as shown in table V for locations #42326, #42328, #42329, and #42330.

In general, the radon concentration inside a building will come into equilibrium with the radon concentration that exists outside the building, but the longer air-residence time inside the building will cause the radon daughters and radon to have a higher percent equilibrium and hence a higher WL.

One five-minute grab air sample was obtained in each of the four business buildings adjoining the west side of the tailings piles. Integrated WL measurements were also made in the buildings from May 3 to 22, 1973. The calculated percent equilibrium is higher for all of the buildings than the outside measurements and indicates the amount of ventilation present in the buildings at the time the grab sample was taken; i.e., there were no doors open in locations #42326 or #42328 but freight loading doors were open in locations #42329 and #42330.

The integrated WL's reported for the preceding four locations are 0.023 WL, 0.021 WL, 0.12 WL, and 0.47 WL, respectively. The yearly WL exposure would be estimated to be higher because during the cold months the buildings would not be open as much as during the warm months; i.e., May values.

The Suburban Sewage Treatment Plant is about one-quarter mile from the north edge of the tailings pile and the average integrated radon concentration was 3.67 pCi/l (table X), an average integrated WL (table V) of 0.008 WL, and 21.0 percent equilibrium. The grab sample values for the same period were 2.14 pCi/l radon, 0.001 WL, and 6.4 percent equilibrium (table VII). These values (table VII) appear to indicate what would be expected when compared to the values obtained in November 1970 (table IV). That is, the relative percent equilibrium is higher during November than during May indicating a longer air-residence time in November because the building is not open as much. Based on these values, an employee of the SSTP would not be expected to receive a working level overexposure during an eight-hour working day at the Suburban Sewage Treatment Plant.

#### Gamma Radiation Exposures in the Salt Lake Valley

The mobile gamma scanning unit scanned 39,301 structures in the Salt Lake Valley and reported 272 gamma radiation anomalies. Twenty-seven of these were reported in Magna, Utah, but none were determined to be tailings locations. The remaining 245 anomalies were also investigated, resulting in the preparation of 226 Indoor Radon Study-Gamma Screening Forms, as shown in table XVI. (Fifteen locations were duplicated in the Mobile Gamma Scanning Unit Reports; two locations were screened which were not reported by the mobile unit; and six anomalies, previously surveyed in 1970, were reported by the mobile unit, but no screening form was completed. Also, two locations were duplicates, but two forms were filled out for each.) The location numbers assigned to the screening forms for the Salt Lake Valley are #42295 to #42476 and #42511 to #42554.

The causes of the anomalies (as listed in table XVIII) in the Salt Lake Valley are shown in table XIX. There are 64 anomalies reported in table XIX where nothing could be found or a refusal was obtained: 17 were bad address reports; seven were refusals; and at 40 locations, nothing could be detected on the property to indicate a reason for the reported anomaly. Fifteen anomalies were caused by radioactive materials, and 71 were determined to be tailings locations: 20 possible tailings use; 13 tailings away locations; 35 tailings under (up against) and away; two tailings under; and one was the Vitro uranium mill tailings pile. In addition, it was determined that at 36 of the 71 locations, the tailings were windblown from the tailings pile. It appeared that tailings

had actually been hauled onto the property at the remaining 34 locations (excluding the tailings pile). Of these, 18 locations are tailings away and 16 locations are tailings under and away.

Radium dial clocks were found at Location #42410, a drug store. Associated gamma measurements were 50  $\mu$ R/h.

At four locations, #42312, #42313, #42346, and #42411, the reported anomalies were determined to be due to "shine" from sources reported at another location, but not located on the involved property.

The gamma measurements obtained at the locations where natural radioactive materials were found are typical of the two-to-three times background measurements associated with comparable material.

Twenty locations were determined to be possible tailings use locations. All of the anomalies were apparently caused by windblown material from the tailings pile. Structures are involved at eight of the locations and the remaining locations (12) are vacant lots. Gamma measurements to 400  $\mu$ R/h were recorded at these locations. These locations have a "4" recorded under "Use" on the screening forms and in the attached computer printouts (appendix D).

Thirteen properties designated by a "2" recorded under "Use" were determined to be tailings away (tailings more than ten feet from a habitable structure) locations. At four of the locations, #42309, #42319, #42335, and #42413, the tailings were found on property which contained structures. Seven involved vacant lots with gamma measurements to 1,000  $\mu$ R/h and two were inactive tailings ponds at the Vitro mill site.

Thirty-six properties were determined to be tailings up against and away locations. At 16 of these, where the tailings material has apparently blown from the tailings pile onto the property and up against the structures, gamma measurements to 110  $\mu$ R/h were recorded (#42301, #42302, #42304, #42305, #42306, #42307, #42315, #42316, #42317, #42318, #42347, #42349, #42350, #42352, #42355, and #42357). At the remaining 10 locations where similar measurements were obtained, the tailings material appeared to have been hauled onto the property (#42349, #42351, #42359, #42393, #42396, #42403, #42412, #42511, #42514, and #42546).

Tailings were determined to be under or under and away at six business locations. At Location #42311, with gamma measurements to 60  $\mu\text{R/h}$  inside and 100  $\mu\text{R/h}$  outside, the tailings are located under the floor slab. At Location #42329, with gamma measurements of 350  $\mu\text{R/h}$  inside and 550  $\mu\text{R/h}$  outside, the tailings were found over the entire property. At Location #42330, tailings were also found over the entire property; and gamma measurements of 500  $\mu\text{R/h}$  inside and 2,500  $\mu\text{R/h}$  outside were recorded. At Location #42363, where the entire floor slab is involved, 150  $\mu\text{R/h}$  inside and 50  $\mu\text{R/h}$  outside gamma measurements were recorded. Location #42394 is a Salt Lake City fire station with tailings over the entire area and gamma measurements recorded inside were 110  $\mu\text{R/h}$  and 400  $\mu\text{R/h}$  outside. At Location #42408, gamma measurements of 190  $\mu\text{R/h}$  were observed in the display area with the associated outside measurements of 1,000  $\mu\text{R/h}$ .

Three residential properties are tailings under locations. Location #42321 is a single family residence and the tailings were determined to be under the floor slab. The high inside gamma measurement (HIG) was made in the living room and 60  $\mu\text{R/h}$  was recorded. Associated outside gamma measurements to 30  $\mu\text{R/h}$  were recorded. At Location #42462, where tailings were found under the south section of a vacant trailer house, the associated gamma measurements were 100  $\mu\text{R/h}$ . Gamma measurements to 130  $\mu\text{R/h}$  were recorded in the utility room at Location #42528. Tailings were also found in the lawn and a flower bed with gamma measurements to 500  $\mu\text{R/h}$ .

The screening form assigned Location #42295 was prepared for the former Vitro uranium mill site. The buildings at this site have been dismantled and removed since the time of the survey. There were no measurements obtained inside the mill buildings during the survey, but gamma measurements greater than 3,000  $\mu\text{R/h}$  were obtained outside at the site.

In conclusion, there is not any one simple solution to the environmental problems associated with the radon emanations from uranium mill tailings. If the property now covered by the tailings is to be developed and structures placed on it, the stabilization will be very difficult and expensive. Various estimates have been made of the depth of soil necessary to significantly reduce radon emanation. (7) However, to date, there have been no attempts to cover tailings piles with sufficient material to eliminate or significantly reduce radon emanation. Removal of the tailings to another location

would be a possible, but costly, solution. An estimate made for another site was \$6 million to move one and one-half million tons 16 miles by truck (25¢/ton-mile mileage rate).

The EPA will continue to provide assistance to the State of Utah, subject to our resource limitations, to find a workable solution to the mineral tailings site problems.

#### RECOMMENDATIONS

The exposures received by children and others using the tailings pile area as a playground or recreation area are not beneficial and the exposures are received unknowingly. The Vitro uranium mill site and tailings pile should be immediately fenced and locked to prevent all unauthorized access. This action will not only prevent radiation exposure, but will also prevent the possibility of any further use of the tailings material in construction.

As a result of various environmental studies in Salt Lake City and at the Vitro tailings piles, recommendations have been provided to the State of Utah by the PHS and EPA. In general, the recommendations have stated that all inactive uranium mill tailings piles should be temporarily stabilized by grading the surface and by covering the surface with "clean" material. This temporary stabilization is to prevent the migration of the tailings material into the surrounding environment by wind or water erosion. The temporary stabilization requires that routine maintenance of the cover be performed indefinitely or until a final solution is achieved.

After the community gamma survey reports were submitted to the State of Utah, the EPA provided general guidance to the State to utilize in determining if remedial action was desired for any surveyed locations. The EPA provided general guidance rather than a case-by-case interpretation because it is EPA's belief that the state agency responsible for radiation programs is in a much better position to weigh the various factors involved in the remedial action decision. In general, the EPA recommendations which are attached as appendix E are based on guidance submitted by the Surgeon General of the USPHS to the State of Colorado in August 1970 (appendix C). The Surgeon General's guidelines were developed to apply specifically to the situation in Grand Junction, Colorado. In the absence of

any other available guidance at the present time, the application of this guidance to the Salt Lake City area may be used with limitations. The limitations must specifically address differences in site conditions, i.e., a case-by-case evaluation is absolutely necessary for the involved properties.

Subsequent to the May 1973 Study at the Vitro site, recommendations (appendix F) were provided by the EPA. These were presented to the Governor of the State of Utah on June 7, 1973. The EPA considered the following facts in preparing these recommendations:

1. The U.S. Atomic Energy Commission, in dealing with new uranium mill license applications, requires as a prerequisite to the issuance of a license, that the applicant submit its procedures for stabilization and long-term maintenance and control of tailings. Mill owners must also provide assurance that funds will be available for reclamation of the tailings area when mill activities are terminated. In addition, the AEC requires the licensee to subject the land on which the tailings are stored to the following restrictions:

- a. The owner may not permit the exposure and release of the tailings material to the surrounding area.

- b. No structures which men or animals can occupy may be built on the covered surface.

- c. The covered surface may not be subdivided.

- d. No private roads, trails, or rights of way may be established across the covered surface.

These restrictions are to be binding on the licensee while it owns the land, and on successive owners thereafter, for a period of 50 years or until such time prior to the expiration of the 50-year period as regulations are promulgated to control disposition of uranium mill tailings. (8)

2. The AEC has required one licensee of an inactive uranium mill to submit an Environmental Impact Statement (EIS) before the company's application for license termination is considered.

3. Because of the use of the uranium mill tailings in construction in Grand Junction, Colorado, the Congress of the United States authorized the expenditure of \$5 million in Federal funds, matched by \$1.6 million of State of Colorado

funds, to correct the overexposure to radiation occurring in that community. Tailings use in construction in Utah has also been determined, but the State has no regulations to control the further use of tailings. As evidenced by the construction work that has occurred on the surface of the Vitro tailings pile, unauthorized use of the tailings can still occur.

The EPA realizes that the AEC policy for new mill operators and the one EIS requirement for a uranium mill license termination would not be binding on the present owners of the inactive and delicensed Vitro facility; however, the EPA believes that the intent of these new policies should apply to proposals for new uses of land covered by a tailings pile or the land which is within one-half mile of a tailings pile.

Until regulations are available for the permanent control of the tailings, including, but not limited to, the first proposed use, any use of the tailings material or the tailings pile site and its immediate vicinity is not recommended.

The EPA further recommends that, because uranium mill tailings material has been found in the Salt Lake Valley, no new or remodeling construction be allowed at locations where tailings materials were found until a radiation survey of the site has been performed by a person or firm with competency in radiological health, as defined by the State's laws or statutes related to ionizing radiation. (Guidance levels that may be used for decontamination are discussed in appendix E.)

## APPENDIXES

		<u>Page</u>
Appendix A		49
Table I	Concentrations of Radon-222 found in 48-Hour Integrated Air Samples from Salt Lake City, Utah (1967-1968 PHS Study)	50
Table II	Average Concentrations of Radon-222 for Salt Lake City, Utah (1967-1968 PHS Study)	55
Table III	Thermoluminescent Dosimeter Results (1967-1968 PHS Study)	56
Table IV	Air Sampling Results (Location #75002) Sewage Treatment Plant (Indoor) Salt Lake City, Utah (1970)	57
Table V	Integrated Working Levels--Salt Lake City, Utah, Sampling Stations	58
Table VI	Air Sampling Results (Location #75001) Tailings Pile, Floor of Pit, Salt Lake City, Utah (1973)	59
Table VII	Air Sampling Results (Location #75002) Sewage Treatment Plant, Salt Lake City, Utah (1973)	62
Table VIII	Air Sampling Results, Business Buildings (Indoor) Salt Lake City, Utah (1973)	65
Table IX	Integrating Radon Air Sampling Results, Salt Lake City, Utah (Location #75001) Tailings Pile, Floor of Pit (1973)	66
Table X	Integrating Radon Air Sampling Results, Salt Lake City, Utah (Location #75002) Sewage Treatment Plant (1973)	66



		<u>Page</u>
Table XI	Integrating Radon Air Sampling Results, Salt Lake City, Utah, Location #75003, South Side of Tailings Pile, 1973	67
Table XII	Integrating Radon Air Sampling Results, Salt Lake City, Utah, Location #75004, West Side of Tailings Pile, 1973	67
Table XIII	Radon Sampling Method Comparison, Loca- tion #75001, Salt Lake City, Utah, May 1973	68
Table XIV	Radon Sampling Method Comparison, Loca- tion #75002, Salt Lake City, Utah, May 1973	69
Table XV	Comparison of TLD and E-500B Gamma Radiation Exposure Rates, Vitro Uranium Mill Tailings Pile, Salt Lake City, Utah	70
Table XVI	Community Gamma Scanning and Screening Results	71
Table XVII	Computer Codes and Location Numbers Used	71
Table XVIII	Determined Cause of Reported Scanning Anomalies, Salt Lake City, Utah	72
Table XIX	Anomaly Occurrence in Surveyed Communities	74
Appendix B	Mobile Gamma Scanning Report, Salt Lake Valley, Utah	75
Appendix C	Recommendations of Action for Radiation Exposure Levels in Dwellings Constructed on or with Uranium Mill Tailings--Surgeon General, Public Health Service	97
Appendix D	Computer Printout--Utah Comprehensive by City, Street Address, Salt Lake City, Utah	104

		<u>Page</u>
Appendix E	U.S. Environmental Protection Agency's Informal Guidance for Assessment of the Need for Remedial Action Based on the Follow-up Gamma Survey Reports for Communities which are Located near Uran- ium Mills	116
Appendix F	U.S. Environmental Protection Agency's Recommendation for the Vitro Tailings Pile in Salt Lake City, Utah (June 7, 1973)	118

## APPENDIX A

### TABLES I - XIX

TABLE I

Concentrations of Radon 222 Found  
In 48-hour Integrated Air Samples  
From Salt Lake City, Utah  
( 1967-1968 PHS Study)

Sta- tion	Midpoint of sampling time		Concentration of radon 222 (pCi/liter)			
	no.	hour day	USAEC		SWRHL	
81	1458	10-31-67	18.3	± 0.1		
	1035	11-7-67	17.6	± 0.2		
	1115	11-28-67			16.66	
	1600	1-4-68			5.70	
	1100	1-16-68	4.24	± 0.05		
	1330	2-14-68			9.69	
	1135	3-6-68			6.92	
	1030	3-20-68			1.62	
	1115	4-17-68	2.55	± 0.05		
	1100	5-1-68	11.5	± 0.1		
	1145	5-28-68	7.8	± 0.1		
	1505	7-11-68	16.2	± 0.1	17.5	± 0.1
	1052	7-31-68	7.44	± 0.08		
	1050	8-21-68	5.67	± 0.08		
	1240	9-11-68			5.11	
	1005	10-3-68	22.1	± 0.2	21.8	± 0.1
82	1245	10-27-67	5.9	± 0.1	6.49	7.09
	1115	11-16-67	5.1	± 0.1	7.42	7.34
	1025	12-27-67	4.4	± 0.1		
	1120	12-5-67			2.26	
	1400	1-23-68			4.55	
	0740	2-7-68			3.49	4.39
	1110	2-28-68			2.49	
	1035	3-20-68			4.38	
	1050	5-7-68	4.17	± 0.06		
	1115	4-9-68			2.97	
	1130	5-28-68	3.13	± 0.08		
	1220	6-19-68			3.70	
	1100	7-24-68	6.39	± 0.09		
	1205	8-7-68			5.20	
	1105	9-5-68			3.07	
83	0830	11-1-67			1.30	
	1035	11-21-67	0.39	± 0.03		
	1115	12-12-67			0.50	
	1415	1-11-68	0.50	± 0.02	0.26	
	1250	1-30-68			0.12	
	1340	2-20-68			0.39	
	1120	3-13-68	0.30	± 0.02		
	1105	4-3-68	0.31	± 0.02		
	1010	4-24-68	0.21	± 0.01		
	1145	5-14-68	0.17	± 0.01		

TABLE I (CONT)

Sta- tion no.	Midpoint of sampling time		Concentration of radon 222 (pCi/liter)		
	hour	day	USAEC	SWRHL	
83	1140	6-5-68		0.63	
	1125	6-25-68		0.48	
	1000	7-18-68		0.60	
	1110	8-14-68		0.42	
	1100	8-28-68	0.71 ± 0.03		
	1530	9-18-68		0.09	
84	1200	10-29-67		0.76	
	1040	11-28-67	0.44 ± 0.02	0.38	
	1100	11-7-67		0.23	
	0945	12-20-67	0.42 ± 0.03		
	1040	1-16-68		0.85	
	1125	3-6-68	0.21 ± 0.02		
	1045	3-20-68	0.25 ± 0.02		
	1140	4-17-68		0.27	
	1110	5-1-68		0.31	
	1125	5-21-68		0.43	
	1130	6-11-68	0.21 ± 0.01		
	1040	7-31-68		0.28	
	1110	8-21-68		0.24	
	1255	9-11-68		0.39	
	1235	9-25-68	0.68 ± 0.02	0.53 ± 0.02	0.60
	1020	10-9-68		1.23	1.05
85	1122	10-29-67	0.60 ± 0.02		
	1050	11-16-67		0.63	0.58
	1130	12-5-67		0.36	0.33
	1155	1-23-68	0.98 ± 0.04		
	0755	2-7-68	0.83 ± 0.04	1.00 ± 0.04	
	1135	3-6-68	0.23 ± 0.02		
	1015	3-27-68	0.58 ± 0.02		
	1100	4-9-68	0.81 ± 0.02		
	1030	5-7-68	0.82 ± 0.03		
	1120	5-28-68	0.47 ± 0.03		
	1055	6-19-68	0.51 ± 0.02		
	1150	7-24-68		0.62	
	1020	10-3-68	1.30 ± 0.03	1.44 ± 0.05	1.4
86	1315	10-29-67		0.50	
	1045	11-21-67	0.44 ± 0.02		
	1125	12-12-67		0.15	
	1547	1-3-68	0.54 ± 0.03		

TABLE I (CONT)

Sta- tion no.	Midpoint of sampling time		Concentration of radon 222 (pCi/liter)	
	hour	day	USAEC	SWRHL
86	1305	1-30-68		0.11
	1310	2-20-68	0.23 ± 0.01	
	1045	3-13-68		0.31
	1120	4-3-68		0.28
	1050	4-24-68		0.17
	1100	5-21-68	0.30 ± 0.02	
	1130	6-5-68	0.15 ± 0.02	0.17 ± 0.01
	1110	6-25-68	0.29 ± 0.02	
	1030	7-18-68	0.51 ± 0.04	0.32
	1305	8-14-68		0.17
	1100	8-28-68	0.20 ± 0.01	0.19 ± 0.02
91	1117	10-27-67	0.38 ± 0.02	
	1025	11-7-67		0.17
	1105	11-28-67		0.99
	1005	12-20-67		0.48
	1110	1-16-68	0.69 ± 0.04	0.73 ± 0.05
	1255	2-14-68		0.61
	1155	3-6-68		0.27
	1100	3-20-68		0.80
	1045	4-17-68	0.18 ± 0.02	0.17 ± 0.01
	1040	5-1-68		0.24
	1150	5-21-68		0.26
	1125	6-11-68		0.24
	1105	7-8-68	0.99 ± 0.04	
	1045	8-21-68		0.15
	1220	9-11-68	0.22 ± 0.01	0.20 ± 0.02
92	1550	10-31-67		0.42
	1025	11-14-67		0.82
	1105	12-5-67	0.21 ± 0.01	0.26 ± 0.01
	1055	12-27-67		0.84
	1415	1-23-68		0.85
	1110	2-28-68		0.42
	1100	3-27-68	0.26 ± 0.01	
	1020	4-9-68	0.23 ± 0.01	
	1120	5-7-68		0.29
	1230	5-28-68		0.22
	1215	6-19-68	0.40 ± 0.02	
	1130	8-7-68	0.30 ± 0.01	0.22 ± 0.02
	1150	9-5-68	0.40 ± 0.02	0.45 ± 0.03
	1530	9-18-68		0.17
	0945	10-3-68		0.26

TABLE I (CONT)

Sta- tion no.	Midpoint of sampling time		Concentration of radon 222 (pCi/liter)	
	hour	day	USAEC	SWRHL
93	1450	10-31-67	$0.55 \pm 0.02$	
	1045	12-12-67	$0.25 \pm 0.02$	
	1335	1-11-68	$0.25 \pm 0.02$	
	1335	1-30-68	$0.19 \pm 0.02$	
	1335	2-20-68	$0.16 \pm 0.01$	
	1115	3-13-68		0.22
	1005	4-24-68		0.06
	1100	4-3-68		0.25
	1145	5-14-68		0.07
	1120	6-5-68		0.20
	1045	6-25-68	$0.30 \pm 0.02$	
	1000	7-18-68	$0.38 \pm 0.02$	$0.42 \pm 0.02$
	1115	7-31-68	$0.20 \pm 0.01$	
	1045	8-28-68		0.26
	0900	10-5-68		0.54
94	1427	10-27-67	$0.58 \pm 0.03$	$0.60 \pm 0.02$
	1000	11-7-67	$0.83 \pm 0.03$	$0.95 \pm 0.04$
	1122	11-28-67	$0.57 \pm 0.03$	
	1010	1-16-68		0.94
	1225	2-14-68	$0.60 \pm 0.03$	
	1045	3-13-68	$0.17 \pm 0.02$	
	1135	3-20-68		0.46
	0945	4-17-68		0.13
	1125	5-1-68	$0.29 \pm 0.02$	
	1035	5-21-68	$0.07 \pm 0.01$	
	1040	6-11-68	$0.24 \pm 0.01$	
	1050	7-2-68		0.50
	1025	7-31-68		0.37
	1000	8-21-68	$0.14 \pm 0.01$	$0.12 \pm 0.02$
	1235	9-11-68	$0.24 \pm 0.01$	$0.29 \pm 0.02$
	1200	9-25-68	$0.69 \pm 0.02$	$0.71 \pm 0.03$
	1000	10-9-68	$0.55 \pm 0.03$	$0.57 \pm 0.03$
95	1000	11-14-67	$0.52 \pm 0.02$	
	1047	12-5-67	$0.20 \pm 0.01$	
	1055	1-23-68	$0.58 \pm 0.03$	
	0825	2-7-68	$0.58 \pm 0.03$	
	1130	2-28-68	$0.32 \pm 0.02$	
	1015	3-20-68		0.17
	1050	4-9-68		0.22
	1040	5-7-68		0.19

TABLE I (CONT)

Sta- tion no.	Midpoint of sampling time		Concentration of radon 222 (pCi/liter)		
	hour	day	USAEC		SWRHL
95	1120	5-28-68			0.21
	1045	6-19-68			0.21
	1350	7-11-68			0.20
	1100	7-24-68			0.28
	1205	8-7-68	0.20 ± 0.02	0.19 ± 0.01	
	1300	8-14-68	0.10 ± 0.01	0.16 ± 0.04	
	1030	8-28-68			0.21
	1435	9-18-68	0.14 ± 0.01	0.16 ± 0.02	
96	1417	10-29-67	0.16 ± 0.01		
	1045	11-21-67			0.15
	1155	12-12-67	0.17 ± 0.02		
	1200	1-7-68			0.45
	1400	1-30-68	0.12 ± 0.01		
	1320	2-20-68			0.21
	1225	3-13-68	0.12 ± 0.01	0.12 ± 0.01	
	1205	4-3-68	0.17 ± 0.01		
	1155	5-14-68	0.06 ± 0.01		
	1235	6-5-68	0.09 ± 0.01		
	1145	6-25-68			0.24
	0915	7-18-68	0.22 ± 0.02	0.42 ± 0.03	0.38 0.31
	1200	8-14-68	0.25 ± 0.02		
	1525	9-25-68			0.44
	2230	10-8-68	0.28 ± 0.02	0.27 ± 0.02	

## Location of radon sampling stations in Salt Lake City, Utah:

- 81 Center of tailings (700 West 3300 South).
- 82 Sewage Plant, 650 West 3300 South.
- 83 American Smelting & Refining Company, Hygiene &  
Research Department, 3422 South 7th West.
- 84 D. B. Harmon, 1080 West 3300 South.
- 85 Bonneville News Company, 965 Beardsley Place.
- 86 J. A. Skogg, 1501 West Claybourne Avenue.
- 91 D. Bolton, 570 West 3740 South.
- 92 Chris Body and Paint Shop Inc., 3152 South 2d West.
- 93 Tuloma Gas Products Co., 201 West 27th South.
- 94 Aluminum Manufacturing & Supply Co., 1809 South 8th  
West.
- 95 A. H. Higham, 105 Westwood Avenue.
- 96 Salt Lake City Health Department, 610 South 2d East.



TABLE II

AVERAGE CONCENTRATIONS OF  
RADON 222 FOR SALT LAKE CITY,  
UTAH (1967-1968 PHS Study)

Station and location	Number of samples	Concentration of radon 222 (pCi/liter)		
		Average	Standard deviation	Range
81 <sup>a</sup>	16	10	6.4	1.6 - 22
82 <sup>b</sup>	15	4.2	1.4	2.3 - 6.6
83	16	.43	.31	.09 - 1.3
84	15	.39	.24	.21 - 1.1
85	13	.68	.30	.23 - 1.4
86	13	.28	.14	.11 - .54
91	15	.44	.30	.15 - .99
92	14	.42	.24	.17 - .85
93	14	.24	.12	.06 - .55
94	17	.44	.26	.07 - .94
95	17	.29	.16	.13 - .60
96	16	.22	.12	.06 - .45

<sup>a</sup>Onpile stations.

<sup>b</sup>This station is not actually onpile, but adjacent to the pile at the sewage plant.

TABLE III  
THERMOLUMINESCENT DOSIMETER RESULTS  
(1967-1968 PHS Study)

Location	Station	Net average exposure rate (mR/hour)
Salt Lake City, Utah	81 <sup>a</sup>	1.1
(June 17 to July 17,	85	.01
1968)	86	.01
	91	.01
	96	.01

<sup>a</sup>Onpile stations.

TABLE IV  
AIR SAMPLING RESULTS

#75002 - SEWAGE TREATMENT PLANT (INDOOR)  
LOCATION: SALT LAKE CITY, UTAH

YEAR: 1970

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V l/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I(2-5)	I(6-20)	I(21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C'	
11/3/70	1830	5	(820) *	(578)	(603)	1.22	30.4	0.02940	8.61	3.56	0.54	0.41	0.06	N.S.	-	-	-	-
11/5/70	1200	5	(33)	(32)	(21)	1.22	30.4	0.00070	LT0.01	0.04	0.20	-	-	1.20	0.008	0.033	0.167	5.83
11/5/70	1400	5	(59)	(35)	(32)	1.22	30.4	0.00160	0.58	0.13	0.08	0.22	0.14	0.91	0.637	0.143	0.088	17.58
11/5/70	1600	5	(29)	(25)	(23)	1.22	30.4	0.00100	0.12	0.12	0.07	1.00	0.58	0.82	0.146	0.146	0.085	12.20
11/5/70	1700	5	(41)	(20)	(24)	1.22	30.4	0.00130	0.69	0.14	LT0.01	0.20	LT.01	N.S.	-	-	-	-
11/5/70	1800	5	(177)	(121)	(110)	1.22	30.4	0.00520	1.37	0.50	0.31	0.36	0.23	5.20	0.263	0.096	0.060	10.00
11/5/70	2330	5	(60)	(36)	(31)	1.22	30.4	0.00150	0.52	0.11	0.11	0.21	0.21	N.S.	-	-	-	-
11/6/70	0930	5	(48)	(31)	(33)	1.22	30.4	0.00160	0.58	0.19	0.02	0.33	0.03	N.S.	-	-	-	-
11/6/70	1130	5	(46)	(42)	(42)	1.22	30.4	0.00190	0.24	0.26	0.08	1.08	0.33	N.S.	-	-	-	-
						Average**		0.00213	0.52	0.20	0.17	-	-	2.03	0.256	0.099	0.084	10.50
			* Numbers in parentheses are counts per minute (obtained at five minutes, 15 minutes, and 30 minutes post collecting period).															
			**Only samples with Radon analysis included.															

TABLE V

## INTEGRATED WORKING LEVELS - SALT LAKE CITY, UTAH, SAMPLING STATIONS

LOCATION	CORRECTED VOLUME (LITERS)	DATE START	DATE FINISH	OFF FLOW (LPM)	TIME (HOURS)	WORKING LEVELS	COMBINED WORKING LEVEL	TOTAL TIME	TOTAL WORKING LEVELS	NO. OF SAM.	AVERAGE WORKING LEVEL
42326-01	18287	5/ 3/73	5/ 9/73	2.2	146.3	.01971					
42326-02	6155	5/ 9/73	5/11/73	2.5	48.3	.02110					
42326-03	17812	5/11/73	5/17/73	2.5	142.5	.02743					
42326-04	15395	5/17/73	5/22/73	2.5	120.8	.02313		457.9	.09137	4	.0228
42328-01	18287	5/ 3/73	5/ 9/73	2.2	146.3	.01594					
42328-02	6312	5/ 9/73	5/11/73	2.6	47.7	.02370					
42328-03	17429	5/11/73	5/17/73	2.3	142.3	.02143					
42328-04	16065	5/17/73	5/22/73	2.5	121.4	.02470		457.7	.08577	4	.0214
42329-01	18632	5/ 3/73	5/ 9/73	2.3	146.2	.12817					
42329-02	5858	5/ 9/73	5/11/73	2.4	47.8	.11420					
42329-03	17079	5/11/73	5/17/73	2.3	142.2	.13370					
42329-04	12757	5/17/73	5/22/73	2.5	104.1	.08768		440.3	.46375	4	.1159
42330-01	19704	5/ 3/73	5/ 9/73	2.5	146.2	.46676					
42330-02	2131	5/ 9/73	5/11/73	0.0	28.0	.56602 NV-1					
42330-03	19165	5/11/73	5/17/73	2.5	142.2	.38304					
42330-04	16969	5/17/73	5/22/73	2.7	121.5	.55888		409.9	1.40869	3	.4696
75001-01	3954	5/ 2/73	5/ 4/73	2.9	26.9	.00352					
75001-02	7643	5/ 4/73	5/ 6/73	2.7	55.7	.00684					
75001-03	6885	5/ 7/73	5/ 9/73	2.7	49.3	.00903					
75001-04	6760	5/ 9/73	5/11/73	2.8	48.4	.01293					
75001-05	10182	5/11/73	5/14/73	2.7	74.2	.01086					
75001-06	9515	5/14/73	5/17/73	2.6	71.9	.01599					
75001-07	10027	5/17/73	5/20/73	2.6	74.4	.01081					
75001-08	6550	5/20/73	5/22/73	2.7	48.6	.01021		449.4	.08019	8	.0100
75002-01	6038	5/ 2/73	5/ 4/73	2.6	44.0	.00474					
75002-02	7224	5/ 4/73	5/ 6/73	2.7	53.6	.00584					
75002-03	6021	5/ 7/73	5/ 9/73	2.6	45.5	.00691					
75002-04	6930	5/ 9/73	5/11/73	2.7	50.5	.00717					
75002-05	9739	5/11/73	5/14/73	2.6	73.6	.00972					
75002-06	8871	5/14/73	5/17/73	2.5	68.3	.01237					
75002-07	9741	5/17/73	5/20/73	2.5	75.0	.00805					
75002-08	6240	5/20/73	5/22/73	2.7	46.3	.00701		456.8	.06180	8	.0077
75003-01	2987	5/ 2/73	5/ 4/73	2.0	29.0	.00499					
75003-02A	429	5/ 4/73	5/ 5/73	0.0	8.3	.03666 NV-1					
75003-02B	306	5/ 6/73	5/ 6/73	2.5	2.5	.00131					
75003-03	1353	5/ 7/73	5/ 9/73	0.0	20.4	.01679 NV-1					
75003-04	4825	5/ 9/73	5/11/73	2.7	35.8	.00675					
75003-05	4925	5/11/73	5/14/73	1.2	50.2	.01384					
75003-06	4420	5/14/73	5/17/73	2.6	33.4	.00272					
75003-07	3824	5/17/73	5/20/73	2.6	28.9	.00594					
75003-08	2846	5/20/73	5/22/73	2.3	25.8	.00376		205.6	.03931	7	.0056
75004-01	3687	5/ 2/73	5/ 4/73	2.3	32.0	.00334					
75004-02	940	5/ 4/73	5/ 5/73	0.0	15.3	.01070 NV-1					
75004-03	5331	5/ 9/73	5/11/73	2.3	43.5	.00756					
75004-04	8726	5/17/73	5/20/73	2.4	71.2	.01090					
75004-05	5417	5/20/73	5/22/73	2.5	44.2	.00831		190.9	.03011	4	.0075

TABLE VI  
AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH

YEAR: 1973

PAGE 1 OF 3

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V L/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I(2-5)	I(6-20)	I(21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C	
5/2/73	1500	5	61	226	145	1.22	30.84	0.00073	0.119	0.100	0.026	0.84	0.22	4.0	0.03	0.03	0.01	1.8
5/2/73	1910	5	80	215	93	1.22	31.10	0.00044	0.121	0.009	0.072	0.08	0.59	3.6	0.03	0.00	0.02	1.2
5/2/73	2200	5	236	645	321	1.22	30.46	0.00165	0.475	0.110	0.160	0.23	0.34	N.S.	-	-	-	-
5/3/73	0200	5	486	1153	592	1.22	30.08	0.00337	1.355	0.239	0.204	0.18	0.15	12.0	0.11	0.02	0.02	2.8
5/3/73	0600	5	190	547	281	1.22	31.36	0.00138	0.351	0.107	0.128	0.31	0.37	N.S.	-	-	-	-
5/3/73	1000	5	102	372	201	1.22	29.70	0.00096	0.095	0.096	0.102	1.01	1.08	2.2	0.04	0.04	0.05	4.4
5/3/73	1430	5	69	207	121	1.22	29.95	0.00065	0.165	0.072	0.031	0.43	0.19	N.S.	-	-	-	-
5/3/73	1745	5	(21)*	(11)	(11)	1.22	28.80	0.00062	0.292	0.053	0.011	0.18	0.04	2.3	0.13	0.02	.00	2.7
5/3/73	2200	5	404	1069	559	1.22	28.75	0.00316	1.014	0.251	0.226	0.25	0.22	N.S.	-	-	-	-
5/4/73	0150	5	86	326	171	1.22	29.12	0.00081	0.044	0.075	0.102	1.71	2.33	1.7	0.03	0.04	0.06	4.8
5/4/73	0600	5	946	2293	1155	1.22	29.00	0.00669	2.577	0.446	0.475	0.17	0.18	N.S.	-	-	-	-
5/4/73	1010	5	55	182	106	1.22	29.24	0.00056	0.108	0.063	0.034	0.59	0.31	1.4	0.08	0.05	0.02	4.0
5/9/73	0930	5	118	431	244	1.22	28.14	0.00127	0.152	0.141	0.106	0.93	0.70	2.8	0.05	0.05	0.04	4.5
5/9/73	1306	5	59	186	99	1.22	24.46	0.00061	0.119	0.055	0.056	0.46	0.47	N.S.	-	-	-	-
5/9/73	1640	5	56	191	86	1.22	24.92	0.00045	0.023	0.017	0.090	0.77	3.99	2.2	0.01	0.01	0.04	2.0
5/9/73	2110	5	418	1136	581	1.22	30.17	0.00306	0.909	0.228	0.259	0.25	0.29	N.S.	-	-	-	-
5/10/73	0045	5	680	1765	886	1.22	29.40	0.00487	1.610	0.330	0.411	0.21	0.26	21.0	0.08	0.02	0.02	2.3

TABLE VI (Cont.)  
AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH YEAR: 1973

PAGE 2 OF 3

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V l/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I(2-5)	I(6-20)	I(21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C'	
5/10/73	0445	5	5054	12121	6788	1.22	28.52	0.04169	16.502	3.836	1.403	0.23	0.09	N.S.	-	-	-	-
5/10/73	0920	5	123	387	202	1.22	27.00	0.00111	0.212	0.095	0.111	0.45	0.53	1.9	0.11	0.05	0.06	5.8
5/10/73	1230	5	65	204	100	1.22	28.08	0.00051	0.087	0.034	0.067	0.39	0.77	N.S.	-	-	-	-
5/10/73	1740	5	71	219	113	1.22	28.08	0.00060	0.121	0.049	0.061	0.40	0.51	2.1	0.06	0.02	0.03	2.9
5/10/73	2110	5	2498	5894	3288	1.22	28.30	0.02050	8.338	1.855	0.669	0.22	0.08	N.S.	-	-	-	-
5/11/73	0045	5	729	2216	1102	1.22	28.08	0.00579	1.165	0.406	0.679	0.35	0.58	9.8	0.12	0.04	0.07	5.4
5/11/73	0445	5	195	548	305	1.22	27.68	0.00178	0.513	0.173	0.102	0.34	0.20	N.S.	-	-	-	-
5/11/73	0853	5	91	317	152	1.22	28.52	0.00072	0.049	0.045	0.117	0.90	2.38	0.91	0.05	0.05	0.13	7.9
5/20/73	0950	5	39	133	56	1.22	27.64	0.00025	0.001	0.002	0.063	2.68	67.6	1.1	LT.01	LT.01	0.06	2.3
5/20/73	1330	5	52	167	93	1.22	28.19	0.00050	0.099	0.051	0.038	0.52	0.38	N.S.	-	-	-	-
5/20/73	1808	5	(34)	(16)	(15)	1.22	27.64	0.00090	9.495	0.057	0.026	0.12	0.05	6.6	0.08	0.01	LT.01	1.4
5/20/73	2120	5	273	572	287	1.22	28.52	0.00184	0.917	0.113	0.087	0.12	0.09	N.S.	-	-	-	-
5/21/73	0038	5	226	462	242	1.22	28.30	0.00160	0.821	0.114	0.049	0.14	0.06	7.1	0.12	0.02	0.01	2.3
5/21/73	0520	5	245	474	239	1.22	26.83	0.00171	0.956	0.103	0.055	0.11	0.06	N.S.	-	-	-	-
5/21/73	0910	5	76	196	116	1.22	28.63	0.00070	0.245	0.075	0.018	0.30	0.07	2.2	0.11	0.03	0.01	3.2
5/21/73	1300	5	(23)	(13)	(8)	1.22	30.30	0.00037	0.114	LT.001	0.079	LT.01	0.69	N.S.	-	-	-	-
5/21/73	1710	5	62	201	100	1.22	28.14	0.00051	0.075	0.037	0.065	0.48	0.87	2.2	0.03	0.02	0.03	2.3

TABLE VI (Cont.)  
AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH YEAR: 1973

PAGE 3 OF 3

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V L/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I(2-5)	I(6-20)	I(21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C	
5/21/73	2104	5	237	581	314	1.22	28.30	0.00190	0.721	0.161	0.091	0.22	0.13	N.S.	-	-	-	-
5/22/73	0058	5	1387	2874	1516	1.22	28.36	0.00996	4.994	0.727	0.304	0.15	0.06	31.0	0.16	0.02	0.01	3.2
5/22/73	0513	5	1764	4132	2110	1.22	28.52	0.01274	5.246	0.881	0.768	0.17	0.15	N.S.	-	-	-	-
5/22/73	0920	5	174	495	270	1.22	28.91	0.00149	0.410	0.138	0.099	0.34	0.24	2.6	0.16	0.05	0.04	5.7
						AVERAGE**		0.00180	0.596	0.137	0.131	-	-	5.75	0.10	0.02	0.02	3.13

\*Numbers in parentheses are counts per minute (obtained at five minutes, 15 minutes, and 30 minutes post collecting period).

\*\*Only those samples with radon analysis included in average.

TABLE VII

## AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah

YEAR: 1973

PAGE 1 OF 3

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V (L/min)	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON (pCi/l)	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I(2-5)	I(6-20)	I(21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C	
5/2/73	1330	5	(23)*	(10)	(10)	1.22	29.46	0.00058	0.355	0.039	0.005	0.11	0.01	1.4	0.25	0.03	1.01	4.1
5/2/73	1752	5	60	160	73	1.22	32.72	0.00034	0.100	0.013	0.045	0.13	0.45	0.65	0.15	0.02	0.07	5.2
5/2/73	2250	5	609	1190	633	1.22	30.20	0.00405	2.195	0.295	0.078	0.13	0.04	NS	--	--	--	--
5/3/73	0240	5	291	860	452	1.22	30.83	0.00226	0.541	0.191	0.196	0.35	0.36	3.0	0.18	0.06	0.07	7.5
5/3/73	0640	5	199	471	244	1.22	28.22	0.00149	0.601	0.109	0.085	0.18	0.14	NS	--	--	--	--
5/3/73	0944	5	74	280	147	1.22	29.57	0.00068	0.038	0.063	0.086	1.65	2.24	1.4	0.03	0.05	0.06	4.9
5/3/73	1510	5	41	133	65	1.22	31.21	0.00029	0.041	0.020	0.041	0.47	0.99	NS	--	--	--	--
5/3/73	1830	5	55	202	106	1.22	31.60	0.00047	0.036	0.043	0.057	1.18	1.57	1.5	0.02	0.03	0.04	3.1
5/3/73	2300	5	341	673	383	1.22	29.49	0.00253	1.328	0.221	0.010	0.17	0.01	NS	--	--	--	--
5/4/73	0240	5	58	187	101	1.22	30.37	0.00050	0.092	0.047	0.044	0.51	0.48	1.1	0.08	0.04	0.04	4.5
5/4/73	0600	5	591	1852	924	1.22	29.49	0.00456	0.809	0.328	0.552	0.41	0.68	NS	--	--	--	--
5/4/73	0930	5	25	76	46	1.22	30.64	0.00024	0.062	0.029	0.009	0.46	0.15	1.1	0.06	0.03	0.01	2.2
5/9/73	0845	5	96	301	186	1.22	28.69	0.00105	0.253	0.130	0.035	0.51	0.14	1.5	0.17	0.09	0.02	7.0
5/9/73	1343	5	34	114	58	1.22	28.72	0.00029	0.038	0.023	0.035	0.61	0.94	NS	--	--	--	--
5/9/73	1745	5	34	103	46	1.22	29.49	0.00022	0.036	0.007	0.038	0.21	1.07	0.64	0.06	0.01	0.06	3.4
5/9/73	2235	5	770	1786	1025	1.22	30.20	0.00609	2.547	0.584	0.134	0.23	0.05	NS	--	--	--	--
5/10/73	0130	5	451	1344	670	1.22	28.92	0.00346	0.755	0.243	0.389	0.32	0.52	3.8	0.20	0.06	0.10	9.1



TABLE VII (Cont.)  
AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah

YEAR: 1973

PAGE 2 OF 3

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V l/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I (2-5)	I (6-20)	I (21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C'	
5/10/73	0525	5	1128	2947	1708	1.22	28.69	0.01013	3.454	1.042	0.343	0.30	0.10	NS	--	--	--	--
5/10/73	0950	5	59	196	114	1.22	28.72	0.00061	0.116	0.069	0.037	0.60	0.32	0.57	0.20	0.12	0.07	10.7
5/10/73	1340	5	25	103	58	1.22	28.46	0.00028	0.012	0.032	0.029	2.78	2.47	NS	--	--	--	--
5/10/73	1730	5	(3)	(13)	(6)	1.22	28.46	0.00006	LT.001	0.003	0.137	--	--	0.99	LT.01	0.00	0.14	0.61
5/10/73	2145	5	96	302	169	1.22	27.41	0.00095	0.202	0.098	0.067	0.48	0.33	NS	--	--	--	--
5/11/73	0135	5	582	1548	937	1.22	28.71	0.00559	1.869	0.630	0.126	0.34	0.07	6.7	0.28	0.09	0.02	6.6
5/11/73	0523	5	135	437	258	1.22	29.49	0.00137	0.288	0.158	0.072	0.55	0.25	NS	--	--	--	--
5/11/73	0930	5	60	250	112	1.22	29.46	0.00044	LT.001	0.017	0.113	--	--	1.1	LT.01	0.02	0.10	4.0
5/20/73	1040	5	49	142	77	1.22	29.25	0.00042	0.108	0.038	0.030	0.35	0.27	0.68	0.16	0.06	0.04	6.2
5/20/73	1247	5	21	91	53	1.22	26.41	0.00028	0.009	0.035	0.025	3.91	2.86	NS	--	--	--	--
5/20/73	1725	5	62	212	118	1.22	26.03	0.00067	0.105	0.070	0.056	0.67	0.54	2.0	0.05	0.04	0.03	3.4
5/20/73	2205	5	169	435	271	1.22	28.49	0.00167	0.594	0.195	0.018	0.33	0.03	NS	--	--	--	--
5/21/73	0055	5	173	483	303	1.22	25.92	0.00199	0.616	0.242	0.034	0.39	0.05	2.5	0.25	0.10	0.01	8.0
5/21/73	0530	5	331	719	395	1.22	25.35	0.00286	1.326	0.240	0.074	0.18	0.06	NS	--	--	--	--
5/21/73	0900	5	52	173	86	1.22	26.66	0.00045	0.058	0.033	0.061	0.57	1.06	1.0	0.06	0.03	0.06	4.5
5/21/73	1345	5	24	91	51	1.22	26.30	0.00028	0.025	0.031	0.026	1.21	1.03	NS	--	--	--	--
5/21/73	1630	5	24	51	37	1.22	24.84	0.00029	0.135	0.039	LT.001	0.29	LT.01	1.0	0.14	0.04	LT.01	2.9

TABLE VII (Cont.)  
AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah

YEAR: 1973

PAGE 3 OF 3

[illegible]

**TABLE VIII**  
**AIR SAMPLING RESULTS**

BUSINESS BUILDINGS (INDOOR) SALT LAKE CITY, UTAH  
LOCATION: (#42326, 42328, 42329 and 42330, Respectively)

YEAR: 1973

DATE	TIME	COLLECTION PERIOD (MINUTE)	TIME INTEGRATED COUNTS PER MINUTE			C (dpm/cpm)	V L/min	W.L.	RADON DAUGHTER CONCENTRATIONS (pCi/l)			CONCENTRATION RATIOS		RADON pCi/l	EQUILIBRIUM RATIOS (RADON=1.0)			PERCENT EQUILIBRIUM
			I (2-5)	I (6-20)	I (21-30)				Ra-A	Ra-B	Ra-C	B/A	C/A		A	B	C-C'	
5/21/73	1010	5	707	2505	1366	1.22	26.03	0.00760	0.931	0.765	0.739	0.82	0.79	3.0	0.31	0.25	0.25	25.3
5/21/73	1115	5	850	3017	1688	1.22	27.64	0.00896	1.191	0.960	0.768	0.81	0.64	4.1	0.29	0.23	0.19	21.9
5/21/73	1035	5	203	655	398	1.24	27.41	0.00234	0.517	0.285	0.098	0.55	0.19	1.6	0.32	0.18	0.06	14.6
5/21/73	1045	5	1264	3199	1817	1.22	26.66	0.01168	4.210	1.136	0.424	0.27	0.10	18.0	0.23	0.06	0.02	6.5

TABLE IX

INTEGRATING RADON AIR SAMPLING RESULTS  
SALT LAKE CITY, UTAH

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT YEAR: 1973

DATE/TIME	"ON"	DATE/TIME	"OFF"	MEASURED RADON IN pCi/l
5/2/73	1500	5/4/73	1010	2.3
5/4/73	1015	5/6/73	1605	4.1
5/7/73	0830	5/9/73	0947	No Sample
5/9/73	1000	5/11/73	0910	9.3
5/11/73	0920	5/14/73	0915	6.3
5/14/73	1110	5/17/73	0720	6.8
5/17/73	0915	5/20/73	0750	6.6
5/20/73	-	5/22/73	-	No Sample
Average				5.9

TABLE X

INTEGRATING RADON AIR SAMPLING RESULTS  
SALT LAKE CITY, UTAH

LOCATION: #75002 - SEWAGE TREATMENT PLANT YEAR: 1973

DATE/TIME	"ON"	DATE/TIME	"OFF"	MEASURED RADON IN pCi/l
5/2/73	1330	5/4/73	0930	2.4
5/4/73	0930	5/6/73	1530	1.7
5/7/73	1010	5/9/73	-	No Sample
5/9/73	1300	5/11/73	0945	3.4
5/11/73	0955	5/14/73	1130	No Sample
5/14/73	1140	5/17/73	0745	7.8
5/17/73	0800	5/20/73	0730	3.8
5/20/73	1100	5/22/73	0900	2.9
Average				3.67

TABLE XI

INTEGRATING RADON AIR SAMPLING RESULTS  
SALT LAKE CITY, UTAH

LOCATION: #75003 -- South Side of Tailings Pile YEAR: 1973

DATE/TIME	"ON"	DATE/TIME	"OFF"	MEASURED RADON IN pCi/l
5/2/73	1225	5/4/73	1100	2.1
5/5/73	1700	5/6/73	1550	4.1
5/9/73	1045	5/11/73	1012	6.1
5/11/73	1035	5/14/73	0950	3.8
5/14/73	1025	5/17/73	0710	6.5
AVERAGE:				4.52

TABLE XII

INTEGRATING RADON AIR SAMPLING RESULTS  
SALT LAKE CITY, UTAH

LOCATION: #75004 -- West Side of Tailings Pile YEAR: 1973

DATE/TIME	"ON"	DATE/TIME	"OFF"	MEASURED RADON IN pCi/l
5/4/73	1015	5/6/73	1605	4.1
5/9/73	1100	5/11/73	1150	9.7
5/17/73	1400	5/22/73	1020	9.4
AVERAGE:				7.73

TABLE XIII

## RADON SAMPLING METHOD COMPARISON

LOCATION: #75001, SALT LAKE CITY, UTAH

DATE: May 1973

SAMPLING DATE		AVERAGE*	INTEGRATED**	AVERAGE <sup>Δ</sup>	INTEGRATED <sup>†</sup>	AVERAGE	AVERAGE
ON	OFF	RADON (pCi/l)	RADON (pCi/l)	WORKING LEVEL	WORKING LEVEL	% EQUILIBRIUM (5 MINUTE SAMPLES)	% EQUILIBRIUM (INTEGRATED)
5/2/73	5/4/73	3.89	2.3	0.00107	0.00352	2.75	15.30
5/9/73	5/11/73	5.82	9.3	0.00212	0.01293	3.64	13.90
5/20/73	5/22/73	7.54	NS	0.00220	0.01021	2.92	---
AVERAGE:		5.75	5.8	0.00180	0.00889	3.10	14.60

\* Average of 5 minute samples collected every eight hours during a 48-hour period.

\*\* Bn pCi/l calculated for midpoint of collection during a 48-hour continuous sample.

Δ Average W.L. obtained from the calculated radon daughters (A, B, C-C') concentrations.

† Measured with TLD air sampler.

TABLE XIV

## RADON SAMPLING METHOD COMPARISON

LOCATION: #75002, SALT LAKE CITY, UTAH

DATE: May 1973

SAMPLING DATE		AVERAGE*	INTEGRATED**	AVERAGE <sup>Δ</sup>	INTEGRATED <sup>†</sup>	AVERAGE	AVERAGE
ON	OFF	RADON (pCi/l)	RADON (pCi/l)	WORKING LEVEL	WORKING LEVEL	% EQUILIBRIUM (5 MINUTE SAMPLES)	% EQUILIBRIUM (INTEGRATED)
5/2/73	5/4/73	1.45	2.4	0.00072	0.00474	4.97	19.75
5/9/73	5/11/73	2.19	3.4	0.00163	0.00717	7.44	21.09
5/20/73	5/21/73	2.80	2.9	0.00172	0.00701	6.14	24.17
AVERAGE:		2.15	2.9	0.00136	0.00631	6.18	21.67

\* Average of 5 minute samples collected every eight hours during a 48-hour period.

\*\* Rn pCi/l calculated for midpoint of collection during a 48-hour continuous sample.

Δ Average W.L. obtained from the calculated radon daughters (A, B, C-C') concentrations.

† Measured with TLD air sampler.

TABLE XV

COMPARISON OF TLD AND E500B GAMMA RADIATION EXPOSURE RATES  
VITRO URANIUM MILL TAILINGS PILE  
SALT LAKE CITY, UTAH

NORTH TO SOUTH GRID	WEST TO EAST GRID						
	1	3	5	7	9	11	13
1	0.28* (0.25)	0.34 (0.4)	0.30 (0.2)	Suburban Sewage Treatment Plant			
3	0.38 (0.30)	1.58 (1.3)	0.26 (0.2)				
5	1.01 (1.0)	1.22 (1.1)	0.35 (0.5)				
7	0.31 (0.30)	0.39 (0.4)	0.42 (0.4)	0.35 (0.35)	0.56 (0.5)	0.05 (0.6)	0.39 (0.3)
9	0.46 (0.5)	1.52 (1.2)	2.24 (2.0)	0.64 (0.7)	0.41 (0.4)		0.12 (0.18)
10				0.60 (0.7)		0.30 (0.3)	
11	Business	0.86 (0.8)	0.80 (0.7)	0.68 (0.6)	0.82 (0.6)	0.62 (0.6)	0.58 (0.15)
12	Buildings			0.80 (0.5)	0.63 (0.6)	0.29 (0.45)	0.21 (0.15)
13		1.13 (0.95)	0.69 (0.8)				

\*All Measurements in mR/h  
0.00 TLD mR/h  
(0.00) E500B mR/h



**TABLE XVI**  
**COMMUNITY GAMMA SCANNING AND SCREENING RESULTS**

COMMUNITY	NUMBER OF STRUCTURES SCANNED	ANOMALIES REPORTED	ANOMALIES CHECKED	FIELD FORMS PREPARED	TAILINGS LOCATIONS	NON-TAILINGS LOCATIONS	ANOMALIES UNABLE TO SCREEN		
							REFUSAL	BAD ADDRESS	DUPLICATION
Salt Lake City	39,301*	245	247	226	71	131	7	17	15

\*Total structures scanned in the Salt Lake Valley, including Magna, Utah.

**TABLE XVII**  
**COMPUTER CODES AND LOCATION NUMBERS USED**

STATE		COUNTY		CITY		LOCATION NUMBERS ASSIGNED
NAME	CODE	NAME	CODE	NAME	CODE	
Utah	43	Salt Lake	035	Salt Lake City	1904	42,295-42,476 and 42,511-42,554

TABLE XVIII

## DETERMINED CAUSE OF REPORTED SCANNING ANOMALIES

## SALT LAKE CITY, UTAH

NUMBER OF LOCATIONS	CAUSE IDENTIFICATION LETTER FOR TABLE IV	CAUSE OF ANOMALY/REMARKS
40	A	Unexplained - Nothing detected on property to indicate a reason for the reported anomaly.
17	B	Bad address - Unable to find the location reported by the mobile unit.
7	C	Refusal - Occupant and/or owner refused to allow the survey.
1	D	Radium dial instrument on property.
4	F	"Shine" from other reported anomaly.
10	G	Uranium ore on property.
68	I	Natural activity in brick walls or fireplaces
1	K	Natural activity in fertilizer.
3	M	Natural activity in gravel and/or soil.
2	N	Natural activity in stucco walls.
2	O	Natural activity in concrete walls in highway underpass.
20	P	Possible tailings use - Unable to make positive field identification.
(32)*	Q	Tailings on property - Windblown from tailings pile.
13	R	Tailings deposit on property - Greater than ten feet from a habitable structure.

# SALT LAKE TABLE XLVII (CONT)

NUMBER OF LOCATIONS	CAUSE IDENTIFICATION LETTER FOR TABLE IV	CAUSE OF ANOMALY/REMARKS
37	S	Tailings deposit on property - Under or within ten feet of a habitable structure.
1	T	Uranium mill tailings pile - Mill area screen.
<hr/>		
226 Total Screening Forms		

\*Not added into total - Windblown tailings locations are in both the possible and determined tailings use locations.

**TABLE XIX**  
**ANOMALY OCCURRENCE IN SURVEYED COMMUNITIES**

UTAH COMMUNITY	FIELD FORMS PREPARED	CAUSE OF ANOMALY FROM TABLE III																			
		UNKNOWN			RADIOACTIVE SOURCE OR ORE					NATURAL RADIOACTIVITY						TAILINGS LOCATIONS					
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Salt Lake City	226	40	17	7	1		4	10		68		1		3	2	2	20		13	37	1
		64			15					76						71					

APPENDIX B

MOBILE GAMMA SCANNING REPORT

SALT LAKE VALLEY, UTAH

SUMMATION: MOBILE RADIATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5-11, 1972

CURRENT REPORT PERIOD: April 5-11, 1972

<u>Survey Days</u>	7.0
<u>Structures Surveyed</u>	3,871
<u>Radiation Anomalies</u>	88
<u>Miles Surveyed</u>	54.90

## MOBILE RADIATION SURVEY

-1

SALT LAKE CITY, UTAH

Report Period: April 5 - 11, 1972

Form LP-1-BL-13 (12-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
1	NE/4	700W	3300S	Vacant Land, 700 W at 3300 So.	475	2,313	West side, Tailing Pile due north
2				Vacant Land, 700 West St.	475	1,475	120 feet north of 3422, 700 West Street
3				3422, 700 West Street	475	650	
4				3415, 3410 South St.	463	725	
5				Fire Engineering Co., 700 West St.	500	788	South of 3363, 700 West Street
6				3363, 700 West St.	600	1,663	South of Tailings Pile, East side
7				3349, 700 West St.	600	838	South of Tailings Pile, East side
8				3341, 700 West St.	600	1,213	South of Tailings Pile, East side
9				3327, 700 West St.	600	1,925	South of Tailings Pile, East side
10				Address ?, 700 West St.	600	1,825	North of 3327, 700 West St.
11				Address ?, 700 West St.	600	2,188	Corner of 700 W and 3300 So., East side
12		500 W	3300S	Westerner's Salvage, 500 W. St.	525	788	Office Building
13		580W	3740S	560, 3740 So. Street	425	525	Drive
14		500W	3600S	Vacant Land, 500 West St.	350	488	South of 3585, 500 West Street
15				3585, 500 West St.	500	1,150	
16			3500S	3513, 500 West St.	500	2,500	
17				3499, 500 West St.	500	5,525	
18				Vacant Lot, 500 West St.	500	9,835	North of 3499, 500 West St.
19			3440S	Central Landscape, 500 West St.	500	9,250	
20		900W	3300S	3302, 900 West Street	575	1,225	Southwest of Tailings Pile, West side
21			3340S	3340, 900 West Street	575	1,000	
22				3342, 900 West Street	575	975	
23				3344, 900 West Street	575	800	
24				Vacant Lot, 900 West Street	575	750	South of 3344, 900 West St.
25			3440S	3432, 900 West St.	575	963	Drive
26			3340S	3347, 900 West St.	625	775	Southwest of Tailings Pile, East side
27				3339, 900 West St.	625	1,500	Drive
28				Address ?, 900 West St.	625	1,025	North of 3339, 900 West St.

CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION

CONTRACT NO. AT (40-1)21

P. O. BOX 148

GRAND JUNCTION, COLORADO 81501

-2

Report Period: April 5 - 11, 1972

Form LPI-BL-13 (12-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
29	NE/4	900W	3300S	881, 3300 South Street	625	1,400	
30				Tailings Pile, 900 West	625	3,300	900 West and 3300 South, East side
31				Vacant Land, 900 West St.	625	4,600	South Salt Lake City Limits Sign
32				Sierra Corp., 900 W. St.	625	4,500	Tailings Pile due East
33				Vacant Land, 900 W. St.	625	5,450	North of Sierra Corp.
34			3200S	3237, 900 W. St.	625	6,000	
35				3215, 900 W. St.	625	7,700	
36				3195, 900 W. St.	625	10,200	
37			3100S	Old Tailings Pond, 900 W. St.	625	23,750	North of 3195, 900 W. St., continuing 560 feet to Creek
38				Old Tailings Pond, 900 W. St.	625	14,750	From small creek north to Mill Creek, East side
39		900W	2910S	Vacant Land, 900 W. St.	625	1,088-2,900	From Mill Creek north to railroad, East side
40		900W	2550S	2550, 900 West St.	375	525	
41				2560, 900 West St.	375	588	
42			2870S	Grand Central Warehouse, 900 W. St.	550	913	
43				Vacant Land, 900 W. St.	550	1,300	South of Grand Central Warehouse
44				Mill Creek, 900 W. St.	550	1,700	West side of road
45				Vacant Land, 900 W. St.	550	5,400	From Mill Creek North to Small Creek, West side
46				Vacant Land, 900 W. St.	550	6,200	260 feet north of Small Creek, West side
47				Vacant Land, 900 W. St.	550	2,000	West of Tailings Pile at 3300 So. St.
48		1700W	2100S	Standard Station, 2100 So. St.	413	3,400	Redwood Road & 2100 So. St.
49		900W	2100S	Address, 72100 So.	375	488	West of 940, 2100 South Street
50				989 Jewel Ave.	325	475	Bricks, two feet away from truck
51		1300W	3300S	Vacant Lot, 3300 So. St.	500	675	140 feet East of 1061, 3300 South St.
52		1000W	3300S	Vacant Lot, 1000 West St.	525	675	North of 3363, 1000 West St.
53				999, 1000 West St.	525	638	
54				Vacant Lot, 3300 South St.	525	813	East of 999, 3300 South St.
55				949, 3300 South St.	525	875	Southwest of Tailings Pile
56				Vacant Lot, 3300 South St.	525	888	East of 949, 3300 South St.

WESTERN URANIUM PROJECT  
**LUCIUS PITKIN, INC.**  
CONTRACTOR HAS STARTED ATOMIC ENERGY COMMISSION  
CONTRACT NO. AT (40-1)42

P. O. BOX 1488  
GRAND JUNCTION, COLORADO 81501

77

MOBILE RADIATION SURVEY  
SALT LAKE CITY, UTAH

Report Period: April 5 - 11, 1972

-3

Form LPI-BL-13 (12-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
57	NE1/4	900W	3300S	925, 3300 South St.	525	1,163	South of Tailings Pile
58				881, 3300 South St.	525	1,600	
59				871, 3300 South St.	525	1,688	
60				863, 3300 South St.	525	2,063	
61				855, 3300 South St.	525	2,500	
62				845, 3300 South St.	525	2,550	
63				837, 3300 South St.	525	4,475	
64				Vacant Lot, 3300 South St.	525	6,800	East of 837, 3300 So. St. south of tailings
65		700W	3300S	681, 3300 South St.	525	1,850	
66				671, 3300 South St.	525	1,650	
67				661, 3300 South St.	525	1,695	
68				651, 3300 South St.	525	1,725	
69				647, 3300 South St.	525	1,400	
70				585, 3300 South St.	525	838	
71				Western Salvage, 3300 So. St.	525	800	
72		500W	3300S	Vacant Land, 3300 So. St.	525	863	Dirt bank from 500 W to Railroad Underpass
73		300W	3300S	315, 3300 So. St.	375	575	
74		500W		Vacant Lot, 3300 So. St.	425	988	Dirt bank, East of Vitro Uranium Mill
75				Vitro Mill, 3300 South St.	425	1,988	
76				Vitro Office, 3300 South St.	425	1,575	
77				Parking Lot, 3300 South St.	425	2,500	West of Vitro's Office
78		700W	3300S	Tailings Pile, 3300 So. St.	425	12,750	From racking Lot, West to Opposite 700 W
79				Tailings Pile, 3300 So. St.	425	14,875	West, opposite 700 W. to paved road
80		900W		Tailings Pile, 3300 So. St.	425	19,500	Opposite 835 West St.
81				Vacant Land, 3300 So. St.	425	1,975	From 900W to KCPX Radio Station
82		6 W	800S	M.J.B.T., Genesee	375	525	Brick, West of 723 Genesee
83			1300S	Machinery Center, 6th W	375	763	North of 1201, 6th W
84			1100S	1101, 6th W. St.	375	563	



SALT LAKE CITY, UTAH

Report Period: April 5-11, 1972

Form LP-62-13 (12-70)

[illegible]

SUMMATION: MOBILE RADIATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : April 18-27, 1972

Survey Days

Prior to Report Period	7.00
During Report Period	<u>8.00</u>
Total	15.00

Structures Surveyed

Prior to Report Period	3,871
During Report Period	<u>6,995</u>
Total	10,866

Radiation Anomalies

Prior to Report Period	88
During Report Period	<u>35</u>
Total	123

Miles Surveyed

Prior to Report Period	54.90
During Report Period	<u>66.40</u>
Total	121.30

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

Report Period: April 18-27, 1972

Form LPT-01-13 (12-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
1	NE1/4	1300W	800S	1400 Indiana Avenue	425	550	Brick
2		900W	500S	484, 9th West Street	375	500	Brick
3		900W	400S	1036, 400 South Street	400	513	Brick
4		900W	400S	Church, Goshen Street	375	550	Brick, south of 344 Goshen Street
5		900W	300S	325 and 329 Post Street	375	525	Between properties
6		1500W	700S	Old Vacant School, Wasatch	475	663	Brick, West of 1387 Wasatch Avenue
7		1500W	900S	Address 7, Indiana Avenue	400	525	Brick, South of 1527, 800 South
8		1300W	200S	Navajo Street Underpass at 200 S St.	450	713	Concrete Underpass
9		900W	400S	402, 900 West Street	375	600	Brick, 15 feet away
10		600W	400S	412, 600 West	375	575	Brick
11		700W	400S	Ketchum's Hardware, 400 S.	350	513	Brick, 10 feet away
12		900W	200S	9th W. St. Underpass at I-80	375	413	Concrete Underpass
13		1000W	200S	175, 10th West St.	425	700	Brick, 5 feet away
14		1300W	200S	151 Navajo Street	375	525	Brick
15		1300W	200S	122 Navajo Street	375	550	Brick
16		900W	100S	930, 100 South Street	375	475	Brick
17		1100W	100N	Building No. 11, State Fairgrounds	375	650	Brick, 10 feet away
18		1100W	100N	Coliseum, State Fairgrounds	413	525	Brick
19		1300W	500N	488 Colorado Street	425	538	
20		800W	400N	Church, Grant Street	375	475	Brick, 160 feet South of 435 Grant
21		1200W	1100N	1304 Valentine Street	400	500	
22		1000W	1100N	Address, Topaz St.	400	475	West of 971, 11th North Street
23		1400W	1000N	Northwest Jr. Hi School, Goodwin	375	475	Brick
24		1200W	700N	Church, Picture Drive	400	500	Brick, South of 7th N
25		1300W	500N	610 Colorado Street	400	500	
26		100E	3900S	Vacant Lot, 3900 South St.	425	875	200 feet East of 41, 3900 So. Street
27		0E-0W	3700S	1340 South Main Street	400	1,000	
28		0E-0W	3700S	Fire Station, 3700 So. Main	475	2,125	

SALT LAKE CITY, UTAH

Form LP 1-62-12 112-701

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82

SUMMATION: MOBILE RADLATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : May 3-6, 1972

Survey Days

Prior to Report Period 15.00

During Report Period 3.50

Total 18.50

Structures Surveyed

Prior to Report Period 10,866

During Report Period 2,364

Total 13,230

Radiation Anomalies

Prior to Report Period 123

During Report Period 47

Total 170

Miles Surveyed

Prior to Report Period 121.30

During Report Period 20.03

Total 141.33

**MOBILE RADIATION SURVEY**  
**SALT LAKE CITY, UTAH**

Report Period: May 3-6, 1972

Form LPI-96-13 (11-7-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Dett. Counts/Sec.	Comments
1	N1/2	200E	3400S	Address 7, State Street	400	563	Brick, Corner of Ford & State, South Side
2		100E	3050S	Holiday Inn Cafe, Gresson Street	400	625	Parking Lot in rear
3		100W	2950S	2955-2975 West Temple	375	550	Large Brick Building
4		0	2850S	2880 South Main Street	375	475	Brick
5		100E	2850S	Address, Louise Street	350	475	Brick, East of 80 Louise St.
6		100W	2450S	2465 West Temple	400	525	Brick
7		100W	2650	2650 West Temple	350	450	Brick
8		200W	3300S	Address 7 Walton Street	400	713	Yard, Old equipment, 120 feet west of 129 Walton
9		100E	2400S	Underpass, I-80 & State Street	375	525	Concrete
10		100E	2700S	2740 South State Street	375	488	
11		100E	3030S	3035 South State Street	425	525	Brick
12		100E	3040S	3040 South State Street	425	500	
13		100E	3000S	3007 South State Street	400	500	Driveway
14		100E	2935S	2935 South State Street	400	550	Brick 7
15		100E	2600S	2615 South State Street	375	475	Brick
16		100E	2560S	2561 South State Street	375	500	Brick
17		100E	2560S	2567 South State Street	375	500	Brick
18		100E	2300S	Address 7, Burton Avenue	375	575	West of 37 Burton St., Cinder Block
19		100E	2300 S	62 Burton Avenue	375	475	
20		100E	2300S	7 Burton Avenue	375	525	Brick
21		100E	2300S	Address 7 Burton Avenue	375	550	Howe Rental, East of 22 Burton Avenue
22		100E	2550S	2550 South State Street	375	500	Brick
23		100W	2550S	2550 West Temple	375	488	Brick
24		100W	2600S	150 Stratford Avenue	375	488	Brick
25		200W	2600S	Vacant Lot, Stratford Avenue	375	1,125	West of 150 Stratford, near railroad
26		200W	2650S	179 Crystal Avenue	375	550	Near railroad
27		100W	3100S	Address 7, West Temple	375	513	Brick, Across the street from 3140 W. Temple
28		100W	3100S	37 Miller Street	375	475	

GRAND JUNCTION, COLORADO 8188

CONDUCTED FOR THE U.S. ATOMIC ENERGY COMMISSION  
Contract No. AT-(40-1)-3401  
P. O. BOX 1848

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WESTERN URANIUM PROJECT  
LUCIUS PITKIN, INC.  
CONTRACTOR FOR UNITED STATES ARMY GROUND COMMAND

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ERAND JUNCTION. COLORADO 81384

SUMMATION:           MOBILE RADIATION SURVEY  
                           Salt Lake City, Utah

SURVEY COMMENCEMENT DATE:           April 5, 1972

CURRENT REPORT PERIOD           :           June 9 - 13, 1972

Survey Days

Prior to Report Period	18.50
During Report Period	<u>5.00</u>
Total	23.50

Structures Surveyed

Prior to report period	13,230
During report period	<u>3,149</u>
Total	16,379

Radiation Anomalies

Prior to report period	170
During report period	<u>25</u>
Total	195

Miles Surveyed

Prior to report period	141.33
During report period	<u>27.89</u>
Total	169.22



# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

Report Period: June 9-13, 1972

Form LPS-24-12 (11-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
1	N1/2	200E	2200S	Junk Yard, 2nd East	350	500	West side, 360 feet south of Wentworth Avenue
2		200E	2200S	Address 7, Wentworth Avenue	375	500	Brick, west of 134 Wentworth Avenue
3		300E	2400S	Underpass, 3rd East & Highway 80	375	663	Concrete
4		500E	2400S	Underpass, 5th East & Highway 80	375	588	Concrete
5		500E	2700S	501 East, 2700 South	375	563	Brick
6		700E	300S	342 South, Seventh East	350	475	Brick
7		700E	300S	350 South, Seventh East	350	475	Brick
8		700E	400S	440 South, Seventh East	375	475	Brick
9		700E	1700S	Hawthorne School, 7th E.	375	550	Brick
10		700E	2200S	2226 South, Seventh East	350	463	Brick
11		700E	2400S	Underpass, 7th E. & Highway 80	350	488	Concrete
12		700E	1400S	1399 South, 7th East	375	488	
13		700E	900S	Address 7, 900 S., 700E	375	475	Brick, North of 919 S, 700E
14		700E	100S	Address 7, 700 East	375	600	Brick, South of 100 South, East side
15		200E	2800S	2795 South State Street	375	575	Brick
16		100E	3300S	141 E, 3185 South Street	375	725	Driveway, East of 135 E, 3185 South Street
17		100E	2950S	Motel, Garden Street	375	500	Brick, West of 116 East Garden Street
18		300E	2700S	Church, 3rd East	400	525	Brick, North of 2721 S., 3rd E.
19		900E	2700S	Address 7, 900 East	425	525	Market, Brick, North of 2713 S., 900E.
20		900E	2100S	Underpass, 900 East & Highway 80	400	550	Concrete
21		900E	2100S	2179 South, 900 East	375	500	Brick
22		900E	1300S	1307 South, 900 East	400	513	Brick
23		900E	1100S	1093 South, 900 East	375	488	Brick
24		900E	3300S	3230 South, 900 East	400	525	Brick
25		100E	3900S	Pizza Place, 3900 South	375	588	Brick, 100 feet West of 123 E., 3900 S.

SUMMATION:

MOBILE RADIATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : June 20-27, 1972

Survey Days

Prior to Report Period	23.50
During Report Period	<u>7.00</u>
Total	30.50

Structures Surveyed

Prior to Report Period	16,379
During Report Period	<u>3,778</u>
Total	20,157

Radiation Anomolies

Prior to Report Period	195
During Report Period	<u>5</u>
Total	200

Miles Surveyed

Prior to Report Period	169.22
During Report Period	<u>42.69</u>
Total	211.91

SALT LAKE CITY, UTAH

**Report Period:** June 20-27, 1972

[illegible]

WESTERN URANIUM PROJECT  
**LUCIUS PITKIN, INC.**  
CORPORATION FOR UNITED STATES ATOMIC ENERGY COMMISSION  
CONTACT NO. AT 5-1134

P O BOX 1897  
GRAND JUNCTION, COLORADO 81501

SUMMATION: MOBILE RADIATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972  
CURRENT REPORT PERIODS : July 11-18, 1972  
July 24 - August 1, 1972

Survey Days

Prior to Report Period	30.50
During Report Periods	<u>16.00</u>
Total	46.50

Structures Surveyed

Prior to Report Period	20,157
During Report Periods	<u>8,860</u>
Total	29,017

Radiation Anomalies

Prior to Report Period	200
During Report Periods	<u>38</u>
Total	238

Miles Surveyed

Prior to Report Period	211.91
During Report Periods	<u>116.58</u>
Total	328.49

## MOBILE RADIATION SURVEY

July 11-18, 1972

Report Period: July 24 - August 1,

Form LPI-BL-13 (12-70)

SALT LAKE CITY, UTAH

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
1	N-1/2	2050W	3145S	3130 South, 2050 West	400	1,450	Front Yard
2	N-1/2	6000W	3500S	Whittier School	425	575	Brick
3	N-1/2	8400W	3240S	8390 West Powell Street	375	488	Southeast Magna Area
4	N-1/2	9100W	2900S	Address ?, 9100 West, 2900 South	425	525	Brick, north of 2900 S, East Side
5		9100W	2860S	Address ?, 9100 West 2860 South	375	475	Brick ?, south of 2860 S, East Side
6		9100W	2700S	9080 West, 2700 South	425	575	Brick, "Out House Bar"
7		9100W	2700S	Address ?, 9100 West	375	475	Brick, north of 2700 S, East Side
8		9100W	2700S	Rexall Drug, 2700 South	375	563	Brick
9		9100W	3000S	2960 South, 9100 West	400	500	
10		9100W	3100S	3068 South, 9100 West	400	500	
11		9150W	2700S	Bank, 9150 West, 2700S	375	613	Brick, 10 feet away
12		9150W	2700S	Address ?, 9150 West	375	588	Brick, 15 feet away, South of 2700 S, West Side
13		8800W	3100S	8810 West, 3100 South	388	500	
14		8850W	3000S	Vacant Lot, 8850 West	375	488	South of 2920 South, 8850 West
15		8850W	2800S	2828 South, 8850 West	425	525	
16		8900W	2800S	2792 South, 8900 West	425	575	
17		8950W	2800S	8927 West, 2800 South	400	588	Stucco
18		9100W	2900S	2891 South, 9100 West	425	600	Brick
19		8950W	2700S	Theatre, 8950W, 2700S	400	700	Brick, 15 feet away
20		8950W	2700S	Magna Water, 8950 W, 2700S	400	563	Brick, 20 feet away
21		8950W	2700S	Vacant Lot, 8950 West	400	538	South of 2700S, West Side
22		9050W	3000S	Vacant Lot, 9050 West	375	500	North of 3017 So., 9050 West
23		9050W	3000S	Vacant Lot, 9050 West	375	513	South of 2979 So., 9050 West
24		8950W	3000S	A&G Market, 8950 West	375	475	Brick
25		8800W	3000S	School, 3000 South	375	538	
26		8650W	2800S	2817 South, 8650 West	425	525	
27		8650W	2800S	2824 South, 8650 West	425	525	
28		8600W	2700S	2711 South, 8600 West	375	538	Brick

WESTERN URANIUM PROJECT  
LUCIUS PITKIN, INC.  
CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION  
CONTRACT NO. AT (40-1)-942

P. O. BOX 1889  
GRAND JUNCTION, COLORADO 81501

Report Period: July 24 - August 1, 1972

FOUO (PL-OL-1) (12-76)

SALT LAKE CITY, UTAH

[illegible]

LULIUS PIKIN, INC.  
CONTRACTOR IN UNITED STATES ATOMIC ENERGY COMMISSION  
CONTRACT NO. AT (40-1) 67

P O BOX 1009  
GRAND JUNCTION, COLORADO 81501

**SUMMATION:           MOBILE RADIATION SURVEY**  
**Salt Lake City, Utah**

**SURVEY COMMENCEMENT DATE:                   April 5, 1972**

**CURRENT REPORT PERIODS   :                   August 9 - 15, 1972**  
**August 22 - 29, 1972**

**Survey Days**

Prior to Report Period	46.50
During Report Periods	<u>13.00</u>
<b>Total</b>	<b>59.50</b>

**Structures Surveyed**

Prior to Report Period	29,017
During Report Periods	<u>6,986</u>
<b>Total</b>	<b>36,003</b>

**Radiation Anomalies**

Prior to Report Period	238
During Report Periods	<u>23</u>
<b>Total</b>	<b>261</b>

**Miles Surveyed**

Prior to Report Period	328.49
During Report Periods	<u>61.54</u>
<b>Total</b>	<b>390.03</b>

# MOBILE RADIATION SURVEY

August 9 - 15, 1972

Report Period: August 22 - 29, 1972

Form LPI-50-13 (12-70)

No.	Map	Coordinate		Address	Background Counts/Sec.	Max. Defl. Counts/Sec.	Comments
1	N 1/2	3400S	2700E	Old Mill, Evergreen	375	513	West of 2750 Evergreen
2	"	3760S	3500E	Underpass, I-212 & 3760S	400	588	Concrete
3	"	3500S	3650E	LDS Church, Mill Stream Lane	425	525	Brick
4	"	3500S	3800E	3431 So. Crestwood Drive	475	613	Soil embankment
5	"	3300S	3800E	3351 & 3357 South Crestwood Dr.	375	475	
6	"	3300S	700E	Church, Jeppson	375	588	Brick, west of 727 East Jeppson
7	"	2600S	800E	2583 South, 800 East	375	525	
8	"	2700S	1000E	Address ?, 1000 East	375	513	Brick, north of 2756 South, 1000 East
9	"	3000S	1300E	Bank, Elgin & Highland Dr.	375	500	Brick
10	"	3000S	1300E	3010 South Richmond	400	500	Brick
11	"	3200S	1100E	3194 South Riches Ave.	425	538	Stucco
12	"	3100S	1100E	Brick yard, Welby Avenue	375	513	Corner of Welby & 1100 E, south side
13	"	3000S	1000E	1005 E. Austin	400	513	Brick
14	"	3100S	1100E	Brick yard, 1100 East	400	713	Between Welby and Riches, both sides of street
15	"	3300S	1100E	Address ?, 1100 East	413	613	Brick, south of 3233 South, 1100 East
16	"	3100S	1300E	Villa, Gunn and Highland	375	588	Brick
17	"	2700S	900E	A&G Market, 2700 South	375	525	Brick, East of 900 East, South Side
18	"	2900S	1500E	1527 Zenith	400	600	East side of house
19	"	2400S	1300E	2420 Highland Drive	375	538	100 feet south of Power Transformers
20	"	2500S	1500E	A&G Market, Glenmore & Stratford	375	488	Brick
21	"	3300S	1400E	Church, Woodland & Highland Drive	375	725	Brick
22	"	3300S	1600E	Address ?, 1575 East	400	525	Brick, Corner of 1575 E & 3300S, West side
23	"	3000S	1300E	Address ?, 3000 South	375	550	Brick, Corner of 3000S and Highland, East side

LOUIS FLENNY, INC.  
CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION  
CONTRACT NO. AT (40-1)40

P. O. BOX 1889  
GRAND JUNCTION, COLORADO 81509



SUMMATION: MOBILE RADIATION SURVEY  
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : September 14-21, 1972

Survey Days

Prior to Report Period	59.50
During Report Period	<u>7.00</u>
Total	66.50

Structures Surveyed

Prior to Report Period	36,003
During Report Period	<u>3,298</u>
Total	39,301

Radiation Anomalies

Prior to Report Period	261
During Report Period	<u>11</u>
Total	272

Miles Surveyed

Prior to Report Period	390.03
During Report Period	<u>26.90</u>
Total	416.93

**LUCIUS PITKIN, INC.**  
CONTRACTOR FOR LOWTED STATES ATOMIC ENERGY COMMISSION

COPIES DESTROYED FOR LOW TIED AT A TLE YOUNG D-CLASS A COUNCILMAN  
COUNCILMAN NO. 17 (MAY 1953)

1. The first step is to identify the problem.

GRAND JUNCTION, COLORADO 81504

Form LP 1-04-13 (12-70)

Report Period: September 14-21, 1972

[illegible]

## APPENDIX C.

### RECOMMENDATIONS OF ACTION FOR RADIATION EXPOSURE LEVELS IN DWELLINGS CONSTRUCTED ON OR WITH URANIUM MILL TAILINGS

#### External Gamma Radiation

<u>Level</u>	<u>Recommendations</u>
Greater than 0.1 mR/hr	Remedial action indicated
From 0.05 to 0.1 mR/hr	Remedial action may be suggested
Less than 0.05 mR/hr	No action indicated

#### Indoor Radon Daughter Products

<u>Level</u>	<u>Recommendations</u>
Greater than 0.05 WL	Remedial action indicated
From 0.01 to 0.05 WL	Remedial action may be suggested
Less than 0.01 WL	No action indicated

#### EXPLANATORY NOTES

1. These recommendations are written specifically for dwellings constructed on or with uranium mill tailings. This situation may involve continuous exposure of members of the public to radon daughter product activities and whole-body gamma irradiation levels in excess of the background radiation levels found within dwellings in the area not constructed with or on uranium mill tailings.

2. Although the initial concern was the presence of radon daughter product activities within these dwellings, preliminary surveys have indicated that, in some instances, the gamma radiation levels were of prime importance. Thus, recommendations are made concerning both types of radiation. The recommendation applicable to a particular dwelling will be determined by whichever type of radiation has the higher level.

3. Three levels for action are recommended for both external gamma and radon daughter product exposures. This graded system of actions is proposed to allow latitude in the middle ranges for the judgment of the on-site investigators.

4. The external gamma and radon daughter product levels proposed constitute exposures which are in addition to the natural background levels found within dwellings in the area not constructed on or with uranium mill tailings. In the Grand Junction, Colorado, area these levels are approximately 0.01 mR/hr (approximately 90 mrem/yr) and 0.004 Working Levels (WL) (approximately 0.2 CWM/yr) respectively (1).

5. The expected health effects of concern will be different for the two types of radiation, i.e., leukemia for whole body gamma radiation exposure and lung cancer for exposure to inhaled radon daughter products. This expectation is based, in part, on findings derived from population studies such as the Japanese atomic bomb survivors and uranium miners. These specific health effects are considered to be mutually exclusive. The basis for this assumption is that the expected radiation contribution to whole body exposure from inhaled

radon and daughter products would be considerably less than the direct exposure from external gamma radiation at the levels encountered in the dwellings. Conversely, the external gamma radiation contribution to the lung dose is considered to comprise a negligible additional risk of lung cancer.

6 a. A Working Level (WL) is the term used to describe radon daughter product activities in air. This term is defined as any combination of short-lived radon daughter products in 1 liter of air that will result in the ultimate emission of  $1.3 \times 10^5$  MeV of potential alpha energy (2). The numerical value of the WL is derived from the alpha energy released by the total decay through Ra C' of the short-lived radon daughter products, Ra A, Ra B and Ra C, at radioactive equilibrium with 100 pCi of  $^{222}\text{Rn}$  per liter of air (3).

6 b. A Working Level Month (WLM) is the term used to express the occupational exposure incurred in one working month of 170 hours by a uranium miner laboring in an atmosphere containing radon daughter products; i.e., one working month in a mine atmosphere containing 1 WL of radon daughter products equals 1 WLM.

6 c. Cumulative Working Level Months (CWLM) is the term used to express the total accumulated occupational exposure to radon daughter products in air; i.e., an air concentration of radon daughter products of 1 WL would, in one working month, equal 1 WLM, and in 1 year or 12 months would equal 12 CWLM.

6 d. Since occupational exposures are based upon 170 hours per month and continuous exposure involves approximately 170 hours per

week, then an occupational exposure to an air concentration of 1 WL is equivalent to continuous exposure to 0.25 WL.

7. These recommendations are based on the assumption of a linear, non-threshold dose-effect relationship. The lack of definitive information precludes allowances for possible differences in radiosensitivity due to age, sex, or other biological characteristics.

8. No action is indicated when the external gamma exposure rate is less than 0.05 mR/hr and the radon daughter product activity is less than 0.01 WL since under conditions of continuous exposure these levels would result in maximum annual exposures of approximately 400 mrem and 0.5 CWLM, respectively. The maximum annual value of 400 mrem is less than the dose limits recommended for an individual member of the general public by the FRC (4) and ICRP (5) for whole body exposure to external gamma irradiation.

The ICRP (5) recommends that the annual dose limit for members of the public shall be 1/10 of the corresponding annual occupational maximum permissible dose. The maximum annual value of 0.5 CWLM of radon daughter product exposure is approximately 1/10 of the 4 CWLM annual occupational exposure limit recommended by the FRC (6) for implementation on 1 January 1971, and less than 1/20 of the annual occupational exposure limit of 12 CWLM recommended for uranium miners in the present FRC regulations (4).

9. Remedial action may be suggested in the case of external gamma exposure rates of 0.05-0.10 mR/hr or radon daughter product activities of 0.01-0.05 WL since under conditions of continuous exposure

these levels would result in maximum annual exposures of approximately 400-900 mrem and 0.5-2.5 CWLM. The upper limit of these ranges exceeds the strictly applied recommendations of the FRC and ICRP for exposures of an individual member of the public. However, this extension seems justified in situations in which unforeseen exposures have occurred, since as stated by ICRP (5) "in general it will be appropriate to institute countermeasures only when their social cost and risk will be less than those resulting from the exposure." It is further stated by the ICRP (5) that very low levels of risk are implied in the dose limits for members of the public and that it is likely to be of minor consequence to their health if the dose limits are marginally or even substantially exceeded.

10. Remedial action is indicated at gamma exposures greater than 0.1 mR/hr or at radon daughter product activities greater than 0.05 WL. Under conditions of continuous exposure, these levels would result in minimum annual exposures of 900 mrem and 2.5 CWLM. All values above these would indicate the necessity for remedial action, since at these levels the maximum annual exposures recommended by the FRC and ICRP for an individual member of the public is exceeded.

11. With respect to the external gamma irradiation, from the estimates published by ICRP (7), it can be interpolated that the annual risk of leukemia under conditions of continuous exposure to 500 mrem per year is an increased incidence of about 10 cases per year per million persons exposed. The natural annual incidence of leukemia for all ages is given by ICRP (8) as 10-100 cases per million persons.

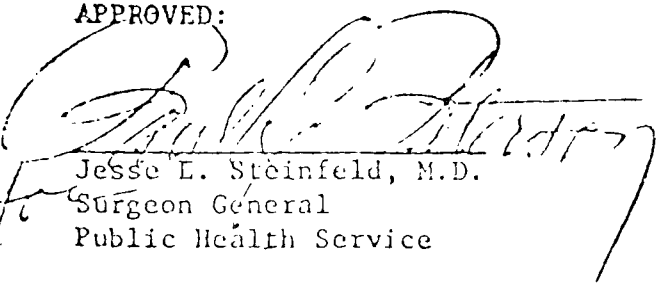
With respect to radon daughter product exposures, it has been estimated by Archer and Lundin (9) that an exposure of 120 CWLM to a group of white adult males in the United States appears to approximately double the normal lung cancer incidence which for this population is about 2-3 cases per year per 10,000 persons. At an annual exposure of 2.5 CWLM, 48 years would be required to reach 120 CWLM.

12. It is considered that implementation of these recommendations for the various exposure ranges would make it highly unlikely that any serious health effects would result from exposure to radon daughter products or external gamma irradiation in this particular situation.

13. It is suggested that remedial action be taken only after an adequate number of measurements taken under a diversity of temporal and climatic conditions have clearly established that the average exposure is in excess of 0.1 mR/hr or 0.05 WL.

14. It is recognized that some time lapse will be inherent in establishing that radiation levels in excess of 0.1 mR/hr or 0.05 WL exist and in instituting corrective measures. However, it is considered that the additional health risks from continued exposure over this time period are of lesser consequence than the economic and social discomfitures of precipitous action.

APPROVED:

  
Jesse E. Steinfeld, M.D.  
Surgeon General  
Public Health Service

27 July 1970  
Date



### References

1. Personal communication. Mr. Robert D. Siek, Colorado State Department of Health.
2. U. S. Public Health Service Publication No. 494. Control of Radon and Daughters in Uranium Mines and Calculations on Biologic Effects, 1957.
3. Federal Radiation Council Report No. 8 Revised. Guidance for the Control of Radiation Hazards in Uranium Mining, 1967.
4. Federal Radiation Council Report No. 1. Background Material for the Development of Radiation Protection Standards, 1960.
5. Recommendations of the International Commission on Radiological Protection. ICRP Publication 9 (1966).
6. Federal Register, Vol. 34, No. 10 pp 576-577 (1969).
7. The Evaluation of Risks from Radiation. ICRP Publication 8 (1966).
8. Radiosensitivity and Spatial Distribution of Dose. ICRP Publication 14 (1969).
9. V. E. Archer and F. E. Lundin, Jr.: Radiogenic Lung Cancer in Man: Exposure-Effect Relationship, Environmental Research 1, 370-383 (1967).

## APPENDIX D.

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE		C L S						
SALT LAKE CITY, UT				01/09/73		L T E M C						
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	A Y V A R U M							
					S	P	E	T	E	S	A	
COMMENTS					LOG	LOC	S	E	L	E	E	P
							S	N				
42534	01005 E AUSTIN AVE		00012									
A 613	BRICK WALLS TO 16		00008					1	1	2	1	7 0 6
42437	02782 S BLAIR AVE	FUNKHOUSER I	00015	00014								
A 38C	ORE TO 300 IN YARD	FUNKHOUSER I	00010	6				1	1	2	1	1 0 6
42420	00007 E BURTON AVE											
A 20C												6 9 7
42418	00035 E BURTON AVE	NOLAN R	00012									
A 18C			00008					1	3	1	2	7 9 5
42419	00062 E BURTON AVE											
A 19C												6 9 7
42365	00405 CALIFORNIA ST											
A 86A												6 9 5
42385	00488 N COLORADO ST	VALLONE J	00015	00019								
A 19B	UNEXPLAINED	VALLONE J	00011	6				1	1	2	1	1 0 6
42391	00610 N COLORADO ST	VAUGHT J	00016									
A 25B	BRICK TO 18	VAUGHT J	00009					1	3	1	1	7 0 6
42526	03357 S CRESTWOOD DR	SIMONSON JR	00015	00012								
A 65	BRICK WALLS TO 19	SIMONSON JR	00009	1				1	1	2	1	1 0 6
42525	03431 S CRESTWOOD DR		00015									
A 64	ROCK RETAINING WALL TO 28		00011					1	2	2	1	7 0 5
42426	00170 CRYSTAL AVE		00016									
A 26C	UNEXPLAINED	UNKNOWN	00008					1	3	1	2	7 9 5
42513	02190 DELONG ST											
A F30	DELONG 500 TO 850 SOUTH											6 9 5
42361	00733 W GENESEE	M J B CO	00016									
A 82A	BRICK TO 18		00012					5	2	1	1	7 0 5
42389	01400 GOODWIN AVE	NW JR HIGH	00013	00013								
A 23B	BRICK INSIDE TO 20	SALT LAKE C SCH DT	00007	9				7	2	1	1	1 0 6
42539	02420 S HIGHLAND DR	GENERATING PLANT	00014									
A 619	BRICK WALLS TO 17	UTAH PWR+LIGHT CO	00010					5	1	3	1	7 0 5
42543	03007 S HIGHLAND DR	NATIONWIDE LOANS	00015	00012								
A 623	BRICK WALLS TO 18	LANDES+SONS INC	00010	9				6	2	1	1	1 0 6
42530	03020 S HIGHLAND DR	VALLEY BANK+TRUST	00012	00012								
A 69	BRICK WALLS TO 16	VALLEY BANK+TRUST	00008	9				5	2	1	1	1 0 6
42536	03092 S HIGHLAND DR	VILLA THEATRE	00012	00012								
A 616	BRICK WALLS TO 16	NATIONAL GENERAL	00008	9				6	9	1	1	0 6
42368	01400 W INDIANA AVE	POPLAR GROVES DAY	00012									
A 01B	BRICK TO 18		00010					7	1	3	1	7 0 5

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.					PAGE	C	L	S
SALT LAKE CITY, UT					01/09/73	L	T	E
						A	Y	V
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG		S	P	E
COMMENTS		OWNER	LOG	LOC		S	E	L
						S	N	
42373	01527	W INDIANA AVE						
A 7B								6 9 5
42343	00989	JEWELL AVE	AMERICAN STONE	00014	00011			
A 50A ROCKS TO 27		ASTON DR	00007	9		5	2	1 2 1 0 5
42429	02440	S MAIN ST	UNDERPASS 180	00016				
A 29C UNEXPLAINED POSS GEOMETRY		CITY OF SALT LAKE	00010		9			1 0 6
42430	02500	S MAIN ST	BONWOOD BOWL	00013	00012			
A 30C UNEXPLAINED		WHITE W	00009	9		5	2	1 1 1 0 6
42433	02685	S MAIN ST	MAIN ST POULTRY	00014	00013			
A 33C UNEXPLAINED		NEALL M	00009	9		5	2	1 1 1 0 6
42432	02701	S MAIN ST	RITE WAY AUTO SALE					
A 32C		TAVISH F				5		2 9 2
42404	02880	S MAIN ST	HEWLETT PACKARD	00011	00014			
A 04C UNEXPLAINED		CAPTOL INDUSTRIES	00009	9		5	2	2 1 1 0 6
42393	03336	S MAIN ST	THE SHADE SHOP	00300	00012			
A 27B T NE + SW CRNRS OF BLDG		LAYCOCK J	00015	9		5	2	1 1 1 3 7
42394	03700	S MAIN ST	SLC FIRE DEPT	00400	00110			
A 28B T ENTIRE AREA		COUNTY OF SALT LAK	00040	5		9	2	1 1 1 3 1
42428	00037	W MILLER ST						
A 28C								6 9 5
42524	03650	E MILLSTREAM LN	MILL CREEK WARD 13	00015	00014			
A 63 BRICK WALLS TO 20		LDS CHURCH	00012	9		8	2	2 1 1 0 6
42519	01435	E MURPHEY LN	JONES CL E	00015	00012			
A F36 BRICK WALLS TO 18		JONES CL E	00010	6		1	1	3 1 1 0 6
42518	01445	E MURPHEY LN	WANSLEY LF	00010	00012			
A F35 BRICK WALLS TO 18		WANSLEY LF	00008	6		1	1	2 1 1 0 6
42381	00122	S NAVAJO ST	SILVEX IND	00012	00014			
A 15B BRICK TO 18		AFCO IND PARK	00009	9		5	2	2 1 1 0 6
42380	00151	S NAVAJO ST	VACANT	00013				
A 14B UNABLE TO CK DRK-2ND FLOR			00008			5	2	2 1 7 9 5
42374	00200	S NAVAJO ST	HWY UNDERPASS	00017				
A 8B HOG DUE TO GEOMETRY		CITY OF SALT LAKE	00011		9			1 0 6
42372	00327	S POST ST	VACANT AREA	00016				
A 05B HOG DUE TO GEOMETRY			00009		0			1 0 7
42531	03010	S RICHMOND ST	BASWELL V	00015	00014			
A G10 BRICK WALLS TO 20		BASWELL V	00010	6		2	1	2 1 1 0 6
42445		S STATE ST	W OF 2319 S, STATE					
A 46C								6 9 7

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.,					PAGE		C L S					
SALT LAKE CITY, UT					01/09/73		L T E M C					
LOC.NO.		ADDRESS	OCCUPANT	HOG	HIG	S P E T E S A						
COMMENTS		OWNER	LOG	LOC	S E L L E E P							
					S N							
42448	02225	S STATE ST	DOG + CAT HOSPITAL	00012	00011							
A 2D BRICK TO 17		DENKERS D	00009	9	5 2 1 1 1 0 6							
42444	02319	S STATE ST										
A 45C						6 9 7						
42446	02325	S STATE ST										
A 47C						6 9 7						
42409	02400	S STATE ST	UNDERPASS HWY I-80	00012								
A 9C POSS DUE TO GEOMETRY		CITY OF SALT LAKE	00009		9	1 0 6						
42443	02481	S STATE ST	MADISON SCHOOL	00011								
A 44C BRICK TO 22-ADDRESS GUESS		SLC SCHOOL DISTRICT	00008			7 1 3 1 7 0 6						
42442	02547	S STATE ST	FIRESTONE TIRE	00012	00010							
A 43C UNEXPLAINED		LARSON R	00009	9	5 2 1 1 1 0 6							
42422	02550	S STATE ST	THE ASSOCIATES FIN	00013	00012							
A 22C UNEXPLAINED		FAIRCLOUGH A	00009	9	6 2 1 1 1 0 6							
42416	02561	S STATE ST	PRINTING	00013	00012							
A 16C BRICK TO 17		LARSON R	00008	9	6 2 1 1 1 0 6							
42417	02567	S STATE ST	SANDERS WIN SHD CO	00012	00010							
A 17C UNEXPLAINED		SANDERS R	00009	9	6 2 1 1 1 0 6							
42415	02615	S STATE ST	CHARELSWORTH	00012	00012							
A 15C BRICK TO 17		CHARELSWORTH	00010	9	6 2 2 1 1 0 6							
42436	02700	S STATE ST	MASTERCRAFT UPHOLS	00016	00010							
A 36C BRICK TO 18		CALL WG	00009	9	5 2 1 1 1 0 6							
42410	02740	S STATE ST	LEAVER DRUGS	00012	00013							
A 10C BRK TO 17 CLOCKS TO 50		LEAVER SC	00007	9	5 2 1 1 1 0 6							
42461	02795	S STATE ST	XL CLEANERS	00015	00013							
A 15D UNEXPLAINED		DIETZ J	00009	9	5 2 1 1 1 0 6							
42405	02862	S STATE ST	JERMAN REALTORS	00015	00014							
A 05C BRICK TO 17		JERMAN OR INV CO	00010	9	5 1 3 1 1 0 6							
42414	02935	S STATE ST	BOBS MOTEL	00016	00012							
A 14C+17D UNEXPLAINED		TRIPP O	00009	9	4 1 3 1 1 0 6							
42413	03007	S STATE ST	MILLSTREAM TRLR PK	00200								
A 13C T NEXT TO ST N OF DRWY		KITCHENS G	00007		9 3 1 2 7 2 7							
42411	03035	S STATE ST	HOLIDAY MOTEL	00014	00012							
A 11C SHINE FR A 12C		MIYAZAKI	00008	9	4 2 1 2 1 0 6							
42412	03040	S STATE ST	HOLIDAY INN	00200	00014							
A 12C + 2C-Y N + W OF BLDG		WRIDE	00011	9	4 2 2 1 1 3 7							
42398	03319	S STATE ST	THE SPOT	00014	00013							
A 32B UNEXPLAINED		WILLIE C	00008	9	6 2 1 1 1 0 6							

## APPENDIX 'D' (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE	C L S			
SALT LAKE CITY, UT				01/09/73	L T E M C			
					A Y V A R U H			
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	S	P	E	T
COMMENTS		OWNER	LOG	LOC	S	E	L	E
					S	N		
42402	03419 S STATE ST	PEDERSEN INTERIORS	00010	00015				
A 01C	STUCCO TO 19	PEDERSEN R	00006	9	5	2	1	1 1 0 6
42399	03566 S STATE ST	NIGHT LIFE	00013	00014				
A 33B	BRICK FRPLACE TO 20	CARROLE M	00008	9	5	2	1	1 1 0 6
42397	03620 S STATE ST	VALLEY BANK BUILD						
A 31B					5			2 9 2
42400	03650 S STATE ST	DUCE SPORT GOODS	00013	00012				
A 34B	BRICK TO 19	MALOUF G	00009	9	5	2	1	1 1 0 6
42401	03750 S STATE ST	ALBERTSONS	00012	00009				
A 35B	BRICK TO 17	PAPONICHLOS	00006	9	6	2	1	1 1 0 6
42470	03897 S STATE ST	BOBS V CLUB						
A 25D		BRUNO J			6			2 9 2
42424	00150 W STRATFORD AVE	RIDER PLASTICS	00016	00014				
A 24C	BRICK TO 17	RIDER PLASTICS	00011	9	5	2	1	1 1 0 6
42425	00164 W STRATFORD AVE	VACANT LOT	00035					
A 25C	T SW CORN LOT - SHINE 40	UNKNOWN	00012		0			1 2 7
42388	01186 TOPAZ DR	STATES L D	00014					
A 22B	UNEXPLAINED	STATES L D	00009		1	2	1	1 7 9 5
42387	01304 VALENTINE ST							
A 21B	NO SUCH ADD							6 9 7
42406	02465 S W TEMPLE	MARSH + SON	00015	00015				
A 6C	UNEXPLAINED	MARSH RW	00008	7	5	2	1	1 1 0 6
42431	02511 S W TEMPLE	LE VOYS	00013	00014				
A 31C	BRICK TO 20	SORENSEN J	00009	9	5	2	2	1 1 0 6
42423	02550 S W TEMPLE	JUDKINS CO	00015	00013				
A 23C	BRICK TO 19	JUDKINS R	00008	9	5	2	2	1 1 0 6
42407	02650 S W TEMPLE	HEUSSER BALANCES	00011	00011				
A 07C	UNEXPLAINED	RUEFENACHT W	00007	9	5	2	1	1 1 0 6
42403	02975 S W TEMPLE	WORTHINGTON	00060	00009				
A 03C	T IN DR N OF BLDG BRK 18	PRICE J	00011	9	5	2	1	1 1 3 7
42427	03135 S W TEMPLE	DAY T	00018	00016				
A 27C	HOG BUSHES S SD HSE	KINGSTON JB	00010	6	1	1	2	2 1 0 6
42538	01527 E ZENITH ST	RAY OA	00015	00014				
A 618	ORE INSIDE + OUT TO 3000+	RAY OA	00010	6	1	1	2	1 1 0 6
42383	01000 W 100 N ST	STATE FAIR BLDG 11	00013					
A 17B	UNEXPLAINED	STATE OF UTAH	00009		9	2	1	1 7 9 5
42384	01000 W 100 N ST	STAT FAIR COLISEUM	00014	00011				
A 18B	BRICK TO 21	STATE OF UTAH	00008	9	9	2	1	1 1 0 6

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.					PAGE	C L S				
SALT LAKE CITY, UT					01/09/73	L T E M C				
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG		A	Y	V	A	R
COMMENTS		OWNER	LOG	LOC		S	P	E	T	E
						S	E	L	L	E
42460 00702 E 100 S ST		HALF PRICE MARKET	00012	00010						
A 140 BRICK TO 17		TAFT W	00009	9		5	2	1	1	0 6
42382 00930 W 100 S ST		METAL ART CO	00015	00012						
A 168 UNEXPLAINED		TELFORD RW	00009	9		6	2	1	1	0 6
42529 02742 S 1000 E ST		STORAGE + GARAGE	00014	00015						
A 68 BRICK WALLS TO 17		BIESINGER FG	00010	9		5	2	2	1	0 6
42345 03341 S 1000 W ST		E OF 999 3300 ST	00020							
A 52A+54A POSS WND BLN T+SHNE 25		UNKNOWN	00015			0				1 4 6
42533 03100 S 1100 E ST		INTERSTATE BRICK	00017	00014						
A 612+14 CLAY+BRICK TO 25		MTN FUEL CO	00012	9		5	1	2	1	0 6
42532 03194 S 1100 E ST			00016							
A 611 STUCCO WALLS TO 20		UNKNOWN	00012			2	3	2	1	7 0 5
42379 00175 S 1100 W ST		VACANT	00013							
A 138 BRK TO 17			00009			5	2	2	1	7 0 5
42367 00345 S 1335 W ST		LDS CHURCH	00011							
A 88A BRICK TO 19			00009			8	2	1	1	7 0 5
42541 03175 S 1390 E ST		WILFORD WARD 1+2	00015							
A 621 BRICK WALLS TO 22		LDS CHURCH	00011			8	1	3	1	7 0 5
42447 S 200 E ST										
A 010										6 9 5
42544 02750 S 2000 E ST		VACANT HOUSE	00014							
A H1-NO 2730 ADD-BRICK WALL 20		UNKNOWN	00010			1	3	1	1	7 0 5
42511 03130 S 2050 W ST		HILLS EE	00080	00014						
A F1 T FR YD+S SIDE		HILLS EE	00010	9		1	3	1	1	1 3 7
42341 00850 W 2100 S ST		AMERICAN SERVICE	00015	00011						
A 48A UNEXPLAINED		LOWELL BM	00008	9		6	2	2	1	0 6
42342 00964 W 2100 S ST		LEAK M	00015	00016						
A 49A UNEXPLAINED		LEAK M	00009	0		1	2	1	1	0 6
42521 03695 S 2175 E ST										
A F38						1	1	2	1	4 9 4
42421 00055 E 2400 S ST		HOWE RENTALS	00016	00013						
A 21C UNEXPLAINED		HOWE H	00008	9		5	2	1	1	0 6
42540 01567 E 2585 S ST		SAVRITE A+G MARKET	00012	00012						
A 620 BRICK WALLS TO 16		ALLRED HB	00008	9		5	2	1	1	0 6
42546 02980 S 2700 E ST		TAGGART NM B	00080	00016						
A H3 T CARPORT SLAB ONLY		TAGGART NM B	00010	3		1	1	2	1	1 3 7
42522 03435 S 2700 E ST		VACANT	00012							
A G1 OLD FLOUR MILL SITE RCK 20			00008			9				7 0 6

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE	C L S			
SALT LAKE CITY, UT				01/09/73	L T E M C			
					A Y V A R U M			
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	S	P	E	T
COMMENTS		OWNER	LOG	LQC	S	E	L	E
					S N			
42435	00014 E 2700 S ST							
A 35C								6 9 7
42463	00304 E 2700 S ST	LDS CHURCH	00014					
A 18D + 37C BRICK TO 21		LDS CHURCH SLC	00008		8			7 0 6
42451	00501 E 2700 S ST	NIBLEY PARK MARKET	00015					
A 05D BUS CLOSED UNEXPLAINED			00007			5	2	1 1 7 0 5
42441	00545 E 2700 S ST	EHLERT J	00013	00014				
A 42C BRICK FIREPLACE TO 17		EHLERT J	00010	6		1	1	2 1 1 0 6
42440	00547 E 2700 S ST	BULLOCK	00015	00014				
A 41C BRICK TO 17			00009	6		1	1	2 1 1 0 6
42439	00555 E 2700 S ST	ARCHULETA M	00014					
A 40C BRICK TO 18			00008			1	1	2 1 7 0 5
42438	00563 E 2700 S ST	FELLOWS WE	00014	00010				
A 39C BRICK TO 18		FELLOWS WE	00008	6		1	1	2 1 1 0 6
42464	00902 E 2700 S ST	NYGRENS MARKET	00015	00012				
A 19D+17G BRICK TO 18		NYGREN P	00010	9		5	1	2 1 1 0 6
42537	00902 E 2700 S ST	NYGRENS MARKET-DUP						
A 19D+17G DUPLICATE LOC 42464		NYGREN-DUP 42464						
42434	00031 W 2700 S ST							
A 34C								6 9 7
42472	03687 S 2740 W ST	CARTER JA	00300	00050				
A 2E T ENTIRE PROP		PAIZ E	00014	6		1	1	2 1 1 3 1
42471	03690 S 2740 W ST	ADAMSON NW						
A 01E		ADAMSON NW				1	2	2 1 4 9 4
42545	02206 E 2935 S ST	GARDEN HEIGHTS WRD	00012	00012				
A H2 BRICK TO 18		LDS CHURCH	00008	9		8	1	2 1 1 0 6
42449	02400 S 300 E ST	HWY I 80 UNDERPASS	00016					
A 03D UNEXPLAINED		CITY OF SALT LAKE	00010		9			1 0 6
42296	02545 S 300 W ST	VACANT LOT	01000					
NO MOB-ADD GUESS-T ENTIRE LOT		US GOVT	00100		0			1 2 7
42396	03365 S 300 W ST	BOYERS FOOD PROD	00300	00015				
A 30B T PARKING AREA			00008	9		5	2	1 1 1 3 7
42395	03451 S 300 W ST	YOUNGS TRUCK LINES	00012	00013				
A 29B UNEXPLAINED		ATCO INVESTMENT	00007	6		5	1	2 2 1 0 6
42462	00137 E 3185 S ST	VACANT HSE TRLR	00100					
A 16D T UNDER S SEC OF TRLR HSE		UNKNOWN	00012			1	3	1 2 7 3 7
42548	00047 E 3300 S ST	LDS CHURCH	00016	00015				
A H5 BRICK WALLS TO 20		LDS CHURCH	00010	9		8	1	2 1 1 0 6

UTAH COMPREHENSIVE BY CITY, STREET ADD.					PAGE		C L S				
SALT LAKE CITY, UT					01/09/73		L T E M C				
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	S P E T E S A					A Y V A R U M	
COMMENTS		OWNER	LOG	LOC	S E L L E E P					S N	
42547 00067	E 3300 S ST	MILLERS HONEY	00015	00010							
A H4 BRICK WALLS TO 13		MILLER D	00011	9	5	2	2	1	1	0	6
42552 00220	E 3300 S ST	AMOS RENTS	00012	00015							
A H9 BRICK WALLS TO 18		TOWERS JM	00009	9	6	3	1	1	1	0	6
42553 00704	E 3300 S ST	SCOTT J	00015								
A H10 BRICK TO 18-INSIDE REFUSE		SCOTT J	00010		1	1	2	1	7	0	4
42517 01103	E 3300 S ST	J+K MARKET	00014	00012							
A F34 BRICK WALLS TO 17		KUMARELAS V	00009	9	6	1	2	1	1	0	6
42535 01105	E 3300 S ST	BARBARA JENSEN INT	00010	00012							
A G15 BLOCK WALLS TO 15		BARBARA JENSEN INT	00008	9	5	2	1	1	1	0	6
42514 01444	E 3300 S ST	APOSHIAN ENGINEERS	00040	00012							
A F31 Y ASPHALT PARKING N SIDE		APOSHIAN GZ	00010	9	6	2	2	1	1	3	7
42542 01565	E 3300 S ST	POND C	00013								
A G22 BRICK WALLS TO 22		POND C	00009		1					7	0 5
42515 02405	E 3300 S ST	IVINS LR	00014	00014							
A F32 ORE FRNT YD BY STEPS 300		IVINS LR	00010	6	1	1	2	1	1	0	6
42516 03298	E 3300 S ST	DON QUIXOTE RESTRN	00012								
A F33 BRICK WALLS TO 16			00009		6	1	2	1	7	0	6
42295	W 3300 S ST	VITRO MILL AREA	3000+								
NO MOB-DUNCAN REQUEST		SEVERAL	00020		9					1	3 1
42549 00010	W 3300 S ST	OLSONS SPORTS CAR	00011	00014							
A H6 BRICK WALLS TO 16		ANDERSON EI	00008	9	5	2	1	1	1	0	6
42551 00155.5	W 3300 S ST	VACANT LOT	00040								
A H8 T CENTER-NORTH SIDE		GREAT BASIN SUPPLY	00010		0					1	2 7
42408 00184	W 3300 S ST	KOHLER PLUMB SUPP	01000	00190							
A 8C+H7-HIG IN DISPLAY AREA		ADAMS A	00020	8	5	2	1	1	1	3	1
42550 00184	W 3300 S ST	KOHLER PLUMB - DUP									
A 8C+H7-DUPLICATE OF LOC 42408		ADAMS A-DUP 42408									
42359 00315	W 3300 S ST	LOSSER R	00110	00013							
A 73A T IN DRIVE E SIDE HSE		LOSSER R	00009	2	1	2	1	2	1	3	7
42360 00498	W 3300 S ST	VACANT LOT	00030								
A 74A-POS WND BLWN T/SHINE TO 30		UNKNOWN	00020		0					1	4 6
42358 00499	W 3300 S ST		00030								
A 72A T WND BLWN+SHINE TO 30			00014		0					1	2 7
42308 00595	W 3300 S ST	WESTERN AUTO WRECK	00040	00019							
A 12A+70A+71A WND BLWN/SHINE 45		PETERSON C D	00025	9	5	2	1	1	1	4	6
42357 00651	W 3300 S ST	KENNEDY K	00090	00018							
A 68A T WND BLWN ENTIRE PROP		THUET J	00040	0	1	2	1	1	1	3	6



APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE	C L S						
SALT LAKE CITY, UT				01/09/73	L T E M C						
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	S	P	E	T	E	S	A
COMMENTS		OWNER	LOG	LOC	S	E	L	L	E	E	P
-----											S N
42356	00661 W 3300 S ST										
A 67A					1					2	9 2
42355	00671 W 3300 S ST	BLUMENTHAL BROS	00090								
A 66A T WND BLWN ENTIRE PROP			00035		5	2	1	1	7	3	5
42307	00681 W 3300 S ST	VACANT HOUSE	00110								
A 11A+65A T WND BLWN ENTIRE YD		UNKNOWN	00040		1	1	2	1	7	3	5
42354	00825 W 3300 S ST		00220								
A 64A T S SD OF ROAD + WND BLWN			00025		0				1	2	7
42353	00837 W 3300 S ST	MARTINEZ JG	00100								
A 63A T WND BLWN/SHINE TO 110			00060		1	3	1	1	7	4	5
42352	00845 W 3300 S ST	HANSON RL	00120	00040							
A 62A T WND BLWN YARD-HIG SHINE		HANSON RL	00040	1	1	3	1	1	1	3	1
42351	00855 W 3300 S ST	WHITAKER EH	00080	00040							
A 61A T ENTIRE YRD/SHINE TO 90		WHITAKER EH	00040	1	1	3	1	1	1	3	1
42350	00863 W 3300 S ST	BINGHAM RL	00070	00025							
A 60A T WND BLWN YD+SHINE TO 70		BRADSHAW GL	00025	0	1	3	1	1	1	3	1
42349	00871 W 3300 S ST	LAVADIE M	00060	00018							
A 59A T WND BLWN ENTIRE PROP		LAVADIE M	00040	9	1	3	1	1	1	3	6
42323	00881 W 3300 S ST	UNKNOWN	00065								
A 29A+58A WND BLWN T+SHINE TO 65			00030		1	3	1	1	7	4	5
42348	00925 W 3300 S ST	FREDRICKSON E	00050								
A 57A+556 WND BLWN/SHINE TO 55			00020		1	2	1	1	7	4	5
42347	00949 W 3300 S ST	CRACROFT JW	00030	00013							
A 55A T WND BLWN SHINE TO 40		CRACROFT JW	00017	6	1	1	2	1	1	3	6
42346	00999 W 3300 S ST	ARMONDS LOUNGE	00019	00012							
A 53A SHINE TO 20		PERRY A	00012	9	5	2	1	1	1	0	6
42344	01021 W 3300 S ST	E OF 1061 3300 S	00030								
A 51A T WND BLWN/SHINE TO 45			00020		0				1	4	6
42473	02000 W 3500 S ST	MURRAY 1ST THRIFT	00050	00014							
A 03E T UNDER SW CORNR		MURRAY 1ST THRIFT	00010	9	5	2	1	2	1	1	7
42512	05975 W 3500 S ST	WHITTIER ELE SCHL	00015	00014							
A F2 BRICK WALLS TO 18		GRANITE SCHL DIST	00010	6	7	1	3	1	1	0	6
42475	03895 S 3520 W ST		00016								
A 05E BRICK TO 20		UNKNOWN	00009		1	2	1	1	7	0	6
42309	00560 W 3740 S ST	SANCHEZ FD	00030								
A 13A T E SIDE OF DRIVE			00010		1	3	1	1	7	2	7
42523	E 3800 S ST	UNDERPASS 1-215	00015								
A G2 HOG GEOMETRY OF CONCRETE		CITY OF SALT LAKE	00008		9				1	0	6

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE	C L S			
SALT LAKE CITY, UT				01/09/73	L T E M C			
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	A	Y	V	A
COMMENTS		OWNER	LOG	LOC	S	P	E	T
					S	E	L	E
42520	E 3900 S ST	I-15 UNDERPASS	00016					
A F37 HOG GEOMETRY OF CONCRETE		CITY OF SALT LAKE	00012		9			1 0 6
42392 00100	E 3900 S ST							
A 26B UNABLE TO LOCATE					0			6 9 5
42554 00922	S 400 E ST		00015					
A H11 ROCKS IN FR YD TO 400		UNKNOWN	00007		1 3 1 2 7 0 5			
42386 00740	W 400 N ST	28TH WARD CHAPEL	00012					
A 20B BRICK TO 22			00009		8 2 2 1 7 0 5			
42377 00699	W 400 S ST	KETCHUM HARDWARE	00011	00011				
A 11B BRICK PILE TO 18		KETCHUM CH	00009	9	5 2 1 1 1 0 6			
42370 01036	W 400 S ST							
A 03B								6 9 5
42371 01040	W 400 S ST		00011					
A 04B BRICK TO 21 ADD GUSS			00009		8 2 1 1 7 0 5			
42474	W 4000 S	W OF 3266 WEST						
A 04E		UNKNOWN						6 9 5
42450 02400	S 500 E ST	HWY I 80 UNDERPASS	00013					
A 04D UNEXPLAINED		CITY OF SALT LAKE	00009		9			1 0 6
42314 03443	S 500 W ST	CENTRAL LANDSCAPE	00017	00013				
A 19A UNEXPLAINED		FRENHER MC	00009	9	5 2 1 2 1 0 6			
42313 03499	S 500 W ST	LAMPER JL	00019					
A 17A+19A HOG SHINE		LAMPER JL	00011		1 3 1 2 7 0 6			
42312 03513	S 500 W ST	BARKER J	00016	00013				
A 16A SHINE FR A 15A TO 25		BARKER	00010	0	1 2 1 2 1 0 6			
42311 03585	S 500 W ST	A+R HEATS	00100	00060				
A 15A T FLOOR SLAB + YARD		A+R HEATS	00025	9	5 2 1 1 1 3 4			
42310 03595	S 500 W ST	S OF 3585 S 500 W	00016					
A 14A HOG IN SWAMP ADD GUESS		UNKNOWN	00007		0			1 0 6
42376 00412	S 600 W ST							
A 10B NO SUCH ADD								6 9 5
42452 00342	S 700 E ST		00015					
A 6D UNEXPLAINED			00009		3 1 2 1 7 9 5			
42453 00350	S 700 E ST	STEVENS HENAGER C	00015	00015				
A 07D UNEXPLAINED		STEVENS J	00009	6	7 1 3 1 1 0 6			
42454 00440	S 700 E ST	MID CITY PRO BLDG	00013	00012				
A 08D UNEXPLAINED		CHRISTENSEN	00007	6	6 1 3 1 1 0 6			
42459 00915	S 700 E ST		00014					
A 13D UNEXPLAINED			00009		1 1 3 1 7 9 5			

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.				PAGE	C L S			
SALT LAKE CITY, UT				01/09/73	L T E M C			
LOC.NO.	ADDRESS	OCCUPANT	HOG	HIG	A Y V A R U M			
COMMENTS		OWNER	LOG	LOC	S	P	E	S
					S	N		
42458 01399	S 700 E ST	WHITE ADVERTISING	00015	00012				
A 120 BRICK TO 23			00008	6	6	1	3	1 1 0 6
42455 01632	S 700 E ST	HAWTHORNE SCHOOL	00012					
A 09D BRICK TO 19		SLC SCH DIST	00009		7	1	3	1 7 0 6
42456 02226	S 700 E ST	CONTINENTAL BEAUTY	00015	00120				
A 100 T UNDER W END OF SHOP		LUND H	00008	7	7	1	2	1 1 1 1
42457 02400	S 700 E ST	HWY 1 80 UNDERPASS	00016					
A 110 UNEXPLAINED-POSS GEOMETRY		CITY OF SALT LAKE	00010		9			1 0 6
42527 03225	S 700 E ST	LDS GRANT 2ND WARD	00014	00014				
A 66 BRICK TO 18		LDS CHURCH	00011	9	8	1	3	1 1 0 6
42390 00755	W 700 N ST	LDS CHURCH 3 WARD	00011					
A 24B BRICK TO 19			00009		8	2	2	1 7 0 6
42364 00939	S 700 W ST	PACIFIC METALS	00012	00011				
A 85A BRICK TO 17		CASTLE	00009	9	5	2	1	1 1 0 6
42363 01101	S 700 W ST	KOLDAIRE	00050	00150				
A 84A T ENTIRE SLAB + PARKING		WHILHITE J	00009	9	5	2	1	1 1 3 1
42362 01201	S 700 W ST	MACHINERY CENTER	00014	00012				
A 83A ORE IN EQUIP WASH 350		PIERCE ESTATE	00008	9	5	2	1	1 1 0 6
42306 03319	S 700 W ST	TURNER J	00090					
A 10A T WND BLWN ENTIRE PROP			00035		1	3	1	1 7 3 5
42305 03327	S 700 W ST	GAYOILLE CF	00110					
A 09A T WND BLWN ENTIRE PROP			00025		1	3	1	2 7 3 5
42304 03341	S 700 W ST	SOMMERS T	00050	00018				
A 08A T WND BLWN ENTIRE PROP		SOMMERS T	00017	9	1	3	1	1 1 3 6
42303 03349	S 700 W ST	VACANT LOT	00050					
A 7A+69A WND BLWN T ENTIRE PROP		SOMMERS T	00017		0			1 2 6
42297 03354	S 700 W ST	VACANT LOT	00130					
A 1A WND BLWN T ENTR LOT-ADD GUS		AMERICAN SMELTING	00080		0			1 4 7
42302 03363	S 700 W ST	ENSIGN SHOE CO	00110	00012				
A 6A WND BLWN T YD+TRACK IN SHOP		ENSIGN SHOE CO	00025	9	5	2	1	1 1 3 7
42298 03364	S 700 W ST	VACANT LAND	00090					
A 2A WIND BLOWN T + SHINE TO 90		AMERICAN SMELTING	00030		0			1 4 7
42301 03389	S 700 W ST	FIRE ENGINEERING	00035	00010				
A 5A WND BLWN T SM AREA BK BLDG		GILLET H	00013	9	5	2	2	1 1 3 7
42300 03415	S 700 W ST	WELDERS SUPPLY	00018	00012				
A 04A S SD YRD POSS ORE HOG		POLLOCK H	00009	9	5	2	1	2 1 0 6
42299 03422	S 700 W ST	AMER SMELT + REFIN	00020	00018				
A 03A HIG DUE TO BRICK HOG SHIN		AMER SMELT + REFIN	00012	9	5	2	1	1 1 0 7

## APPENDIX D (CONT)

114

## APPENDIX D (CONT)

UTAH COMPREHENSIVE BY CITY, STREET ADD.						PAGE		C L S						
SALT LAKE CITY, UT						01/09/73		L T E M C						
LOC.NO.		ADDRESS		OCCUPANT		HOG	HIG	S P E T E S A						
COMMENTS		OWNER		LOG		LOC		S E L L E E P						
								S N						
42333	02550	S 900 W ST	NATIONAL AD CO	00015	00013									
A 40A	UNEXPLAINED		SCIENCE SECURITY	00009	9			5	2	1	1	1	0	5
42334	02560	S 900 W ST	BROWN DIST CO											
A 41A			BROWN KC					5			1	2	9	2
42335	02850	S 900 W ST	GRAN CENTRAL WAREH	00060	00012									
A 42A	T S SD OF PARKING LOT		PRICE J	00012	9			5	2	1	1	1	2	7
42330	03195	S 900 W ST	WON DOOR CORP	02500	00500									
A 36A	T ENTIRE PROP-SHINE 1200		WON DOOR CORP	00110	7			5	2	2	1	1	3	1
42329	03215	S 900 W ST	WONDOOR CORP	00550	00350									
A 35A	T ENTIRE PROP SHINE 550		WONDOOR CORP	00100	9			5	2	1	1	1	3	1
42328	03237	S 900 W ST	INVENTORY SALES	00400	00090									
A 34A	T WINDBLWN/SHINE HOG		CROMAR G	00090	9			6	2	1	1	1	4	1
42327	03265	S 900 W ST	VACANT LOT	00300										
A 33A	T ENTIRE LOT-HOG SHINE		UNKNOWN	00120				0				1	4	7
42326	03275	S 900 W ST	SIERRA CORP	00300	00065									
A 32A	T POSS WND BLWN/SHINE HOG		BARRET B	00120	9			5	2	1	1	1	4	1
42325	03285	S 900 W ST	N OF 3300 S ST	00250										
A 31A	POSS WINDBLOWN T + SHINE		UNKNOWN	00090				0				1	4	7
42315	03302	S 900 W ST	KAY T	00050										
A 20A	T WND BLWN ENTIRE YRD		UNKNOWN	00020					1	2	2	1	7	3
42322	03331	S 900 W ST	NIELSEN WI	00040	00019									
A 28A	T WND BLN /SHINE TO 40		NIELSEN WI	00012	0				1	2	1	2	1	4
42321	03339	S 900 W ST	CORNELL S	00030	00060									
A 27A	TU SLAB FLOOR+SHINE TO 30		CORNELL S	00012	1				1	2	1	2	1	3
42316	03340	S 900 W ST	YATES R	00035										
A 21A	T WND BLWN ENTIRE YRD		UNKNOWN	00020					1	3	1	1	7	3
42317	03342	S 900 W ST	BROWN L	00030										
A 22A	WINDBLOWN T ENTIRE PROP		UNKNOWN	00020					1	1	2	2	7	3
42318	03344	S 900 W ST	COOK DL	00025	00013									
A 23A+24A	T WND BLWN ENTIRE YRD		HUDSON S	00017	6				1	1	2	2	1	3
42320	03347	S 900 W ST	JOHNSON WE	00027	00018									
A 26A	T WND BLN/ SHINE TO 27		JOHNSON WE	00017	0				1	2	1	2	1	4
42319	03432	S 900 W ST	NORMAN N	00250	00011									
A 25A	N OF HSE IN JUNK YRD DRWY		NORMAN N	00014	0				1	2	1	1	1	2

## APPENDIX F

### U.S. Environmental Protection Agency's Informal Guidance for Assessment of the Need for Remedial Action Based on the Follow-up Gamma Survey Reports for Communities which are Located Near Uranium Mills

We recommend that tailings be removed if at all feasible and properly disposed of in a properly designated location, such as a tailings pile or on land provided for this purpose. Alternatives, such as ventilation and the use of sealants, may also be utilized. Consideration should be given to any potential adverse health impact of residual radiation level, the cost of reducing the residual radiation level, and the economic effect of these protective measures. Recommendations of actions to be taken in the assessment of anomalies are as follows:

1. Experience has shown that if tailings are located more than 10 feet from an occupied structure, the uranium tailings will not produce elevated radon levels inside the structure. They should still be removed when it is convenient and at a minimal cost to the individual.
2. Ore or other radioactive sources should be properly disposed of if they have no specific value to the owners.
3. "External gamma level" is defined as the net corrected average ground floor gamma (AGFG) value for the occupied portion of the structure.
4. If external gamma levels inside a structure are equal to or greater than 20  $\mu\text{R/h}$  above background, the indoor radon concentration level may be presumed to equal or exceed 0.01 WL above background. If this condition exists, consideration should be given to further assessment to determine possible need of remedial action.
5. If external gamma levels inside a structure are less than 1  $\mu\text{R/h}$  above background, it should be presumed that the indoor radon daughter exposures would be below 0.01 WL above background and no further assessment is required.
6. If external gamma levels inside a structure are equal to or greater than 1  $\mu\text{R/h}$  above background but less than 20  $\mu\text{R/h}$  above background, measurements should be made to determine the indoor radon daughter level, the location of tailings, and the need for and type of appropriate remedial action to be taken if warranted.

## APPENDIX E (CONT)

7. If tailings are found outside a structure, the cleanup and removal of material should result in levels as close to background as possible. In any event, the readings, after cleanup, should not exceed 50  $\mu$ R/h above background.

Legislation exists which authorizes a Federal contribution to a joint Federal/State remedial action program in the area of Grand Junction, Colorado. However, there is no legislative authority to provide funds for support of a remedial action program in other areas.

## APPENDIX F

### U.S. Environmental Protection Agency's Recommendation for the Vitro Tailings Pile in Salt Lake City, Utah (June 7, 1973)

Studies at various uranium mill tailings pile sites have shown that the radon emanation from the tailings pile does not present a significant radiation exposure to the surrounding community outside a radius of one-half mile from the site. Workers on, or visitors to, the surface of the pile or adjacent to it would receive external gamma radiation exposure. The radon concentrations present on the Vitro pile exceed the current limits for population exposure; however, the short half-life progeny of radon are not in equilibrium with the parent radon. Thus, the observed working level (WL) exposures in the air at the sites sampled is low, but significant working level exposures can occur in a structure built over or adjacent to the tailings material.

EPA does not recommend approval of the "race track" proposal for the property known as the Vitro uranium mill tailings pile for the following reasons:

1. At the present time, the State of Utah has no regulations covering the use, non-use, stabilization, or otherwise effecting the disposition or control of radioactive mill tailings.
2. The current legal mechanisms by which the State of Utah may place restrictions on the property title or to control the use of this property and structures built on it are not specifically intended to cover such complex phenomena as ionizing radiation. This is of concern because of the possibility of future uses other than those originally approved which could result in unnecessary radiation exposure to workers or visitors at the tailings pile site.
3. Persons working at or attending given racing events would receive an unnecessary increment of radiation exposure. This unnecessary exposure, however low, would also be received unknowingly. According to a recent report of the National Academy of Sciences, "No exposure to ionizing radiation should be permitted without the expectation of a commensurate benefit."



## APPENDIX F (CONT)

Because studies have shown that an unstabilized and uncontrolled uranium mill tailings pile can create potential public health problems, EPA recommends that:

1. The State of Utah establish the necessary regulations to effect the disposition and control of radioactive mill tailings. These should not rule out the possibility of some acceptable use for any given closed mill site.

2. The Vitro uranium mill tailings pile should be properly stabilized to prevent migration of the tailings into the environment and prevent public ingress to the area. The pile should be graded, covered, properly fenced, and controlled to prevent any migration of the tailings into the surrounding environs by wind or water erosion, or removal of tailings for unauthorized purposes.

3. The State of Utah consider possible remedial actions for the businesses located on the west side of the Vitro uranium mill tailings pile along South 900 West.

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# **TECHNICAL REPORT DATA**

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16. ABSTRACT Environmental surveys were conducted for the Utah State Division of Health's Occupational and Radiological Health Section at the former Vitro Corporation uranium mill and the Salt Lake City, Utah area. The results of the surveys indicated that: the external radiation levels on the tailings area exceed recommended exposure limits for individuals in the general population; ambient levels of radon over the pile and in structures built immediately adjacent to the tailings pile are above the currently recommended concentration for the general population; the working level exposure in the adjacent buildings exceed existing recommendations; tailings material has been removed from the site and used around dwellings and businesses; and tailings material has become windborne and deposited against dwellings and structures in the vicinity. For general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels for the pile were not distinguishable from natural background levels and were found to be within current guides.				
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