ORNL/TM-9738

ornl

OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

Results of the Survey Activities and Mobile Gamma Scanning in Monticello, Utah

C. A. Little
B. A. Berven

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes: Printed Copy $[illegible]; Microfiche $3.00

ORNL/TM-9738

HEALTH AND SAFETY RESEARCH DIVISION

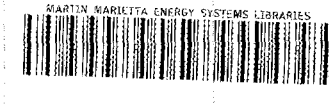
Nuclear and Chemical Waste Programs
(Activity No. AH 10 05 00 0; ONLWC01)

RESULTS OF THE SURVEY ACTIVITIES AND MOBILE GAMMA SCANNING IN MONTICELLO, UTAH

C. A. Little
B. A. Berven

Manuscript Completed - July 1984
Date of Issue - November 1985

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400



CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

Research for this project was sponsored by the Division of Remedial Action Projects, U.S. Department of Energy. The authors wish to acknowledge the support of J. E. Baublitz, Director, Division of Remedial Action Projects, E. G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, A. J. Whitman, L. C. Brazley, and members of their staff. The authors recognize the valuable contributions of R. W. Doane, B. S. Ellis, J. B. Kark, J. L. Marley, S. V. Kaye, D. A. Roberts, J. A. Roberts, W. H. Shinpaugh, and D. A. Witt of the RASA group for participation in collection, analysis, and reporting of data at the site of the survey. In addition, the authors appreciate the manuscript preparation by S. E. Huckaba.

RESULTS OF THE SURVEY ACTIVITIES AND MOBILE GAMMA SCANNING IN MONTICELLO, UTAH*

C. A. Little
B. A. Berven

ABSTRACT

The town of Monticello, Utah, was once the site of an active mill which processed vanadium ore (1942-1948), and uranium ore (1948-1960). Properties in the vicinity of that mill have become contaminated with radioactive material from ore processing. The Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) was requested by the division of Remedial Action Projects (DRAP) in the Department of Energy (DOE) to: (1) identify potentially contaminated properties; (2) assess natural background radiation levels; and (3)rapidly assess the magnitude, extent, and type (i.e. ore, tailings, etc.) of contamination present on these properties (if any). This survey was conducted by RASA during April 1983. In addition to the 114 properties previously identified from historical information, the ORNL mobile gamma scanning van located 36 new properties exhibiting anomalous gamma radiation levels. Onsite surveys were conducted on 145 of the 150 total properties identified either historically or with the gamma scanning van. Of these 145 properties, 122 of them appeared to have some type of contaminated material present on them; however, only 48 appeared to be contaminated to the extent where they were in excess of Environmental Protection Agency (EPA) criteria (40 CFR 192). Twenty-one other properties were recommended for additional investigation (indoor gamma scanning and radon daughter measurements); of these, only ten required further analysis.

This report provides the detailed data and analyses related to the radiological survey efforts performed by ORNL in Monticello, Utah.

---

* The survey was performed by members of the Radiological Survey Activities Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-840R21400.

INTRODUCTION

The town of Monticello, Utah, was once the site of an active mill which processed vanadium ore from 1942 through 1948 and uranium ore thereafter until closing in 1960. Vicinity properties in the town have been the subject of radiological surveys conducted in 1971, 1980, and 1982. During those surveys, 114 properties were listed as having or being suspected of having "anomalous" levels of radioactive materials within their confines. Due to limited soil sampling during those surveys, the presence or absence of uranium mill tailings on these properties was neither confirmed nor denied.

During the period April 11-22, 1983, members of the Radiological Survey Activities (RASA) Group of Oak Ridge National Laboratory (ORNL) visited Monticello. The objectives of the radiological survey were threefold: first, to take soil and gamma exposure measurements at numerous locations within the confines of the community to ascertain the gamma exposure background and the nominal ^{226}Ra content of the soil; second, to confirm or deny the presence or absence of uranium mill tailings on the previously listed properties; and third, to determine whether or not additional properties in Monticello were contaminated by scanning all accessible streets with the mobile gamma scanning van.

SURVEY METHODS

BACKGROUND MEASUREMENTS

Background samples of soil and measurements of gamma exposure were taken at 30 locations throughout Monticello. The locations were chosen systematically by utilizing a city map. Sample locations were evenly spaced at about two blocks apart. The soil samples were taken at a depth of 0-15 cm from undisturbed soils or turf whenever possible. Properties suspected of being contaminated were avoided. Samples and measurements were taken at curbside locations or public property rather than on private property. The 30 locations of background samples are listed in Table 1.

Gamma exposure measurements were made using a Pressurized Ionization Chamber (PIC) certified accurate by the National Bureau of Standards (NBS). Measurements were made at a height of 1 m above the ground surface. An average of about 10 instantaneous measurements was taken to be the gamma exposure in μR/h at that location. Measurements of the gamma exposure rate in counts per minute (cpm) were made at the same location using a hand-held scintillator.

WALK-ON SURVEY

The walk-on surveys conducted in Monticello were for the express purpose of confirming or denying the presence of uranium mill tailings on the property. The survey also had the previous information as supplied by Bendix Field Engineering Corporation (see Appendix I). For each property, this information included a picture of the property, a rough drawing of the boundaries and structures, and a gamma map from a previous survey.

Each property was completely gamma-scanned using hand-held gamma scintillators at the ground surface. The resulting regions of elevated radioactivity, if any, were drawn on the existing map of the property. If no map was available, a rough sketch of the property was drawn. The regions of contamination were compared with the extant gamma maps in an attempt to verify that no region had been missed.

Following complete gamma scanning of the property, samples were taken from the contaminated regions of the soil. Samples were taken at the location of highest gamma exposure rates. If necessary, a posthole digger was used for access to the contaminated region. Sampling pieces of uranium ore was avoided whenever possible since the presence of these ore pieces would not accurately reflect concentrations of radionuclides in soil. If more than one region of contamination was found on a property, several samples may have been taken. At least one sample was taken from each property. On uncontaminated properties, a soil sample was taken from the location of maximum gamma exposure since this sample would reflect the maximum concentration of radionuclides in soil present on that property.

Properties that exhibited unexpectedly high gamma exposures in building materials were so noted. If possible, a sample of the suspect building material was taken for analysis. Such samples were frequently unavailable.

MOBILE GAMMA SCANNING

The following is a brief description of the scanning methods utilized for the mobile scanning of the Monticello area. Details of the system description and operation are described elsewhere.[1]

Instrumentation

The gamma radiation detection system employed in the ORNL scanning van consists of three 4 x 4 x 16-in. NaI(Tl) log crystals housed in a lead-shielded steel frame to provide a 12 x 16-in. detector surface area for acceptance of gamma radiation through one side of the survey van. The detector and shield height can be varied with a hydraulic lift mechanism to to optimize the detector field-of-view. The detector output is transferred to a computer-controlled, eight-channel discriminator and interface, which provides for continuous analysis of data inputs for correlation of system location with count rate information. Six separate energy regions-of-interest are analyzed and a ^{226}Ra-specific algorithm is employed to identify locations containing residual radium-bearing materials. Multichannel analysis capabilities are included in the system for additional qualitative radionuclide identification.

Mobile Scanning Methods

The data analysis method employed on the ORNL van is based on computations involving background count rates in specific energy regions. These background levels are normally obtained within small (10 square block) survey areas, based on coverage of at least 75% of the accessible streets in that area. Subsequent street-by-street scans of these areas are conducted at a slow speed (<5 mph), minimizing the distance between the detectors and the subject properties. All accessible streets, alleyways, and other public thoroughfares are scanned in both directions to maximize the number of views obtained for each property. Anomaly

locations are highlighted by the computer system when the preset hit criteria are exceeded during the scan.

LABORATORY ANALYSIS METHODS

Radiological Analysis

Samples collected for both background determination and from surveyed properties were analyzed for both ^{226}Ra and ^{238}U. Samples were dried at 110° C for 24 h, ground, placed in capped sample vials and weighed. Samples counted for ^{226}Ra on a high purity germanium semiconductor detection system coupled with a Nuclear Data Corporation ND 2400 gamma spectrometer. Details about the counting system, its operation, and specifications are given in section 15.1 of Reference 2. Samples were analyzed for ^{238}U by the Analytical Chemistry Division of ORNL. A 5 cm^3 aliquot of soil is subjected to a thermal neutron flux in the Oak Ridge Research Reactor, counted for ^{235}U and converted to concentration of ^{238}U. Details of this procedure are given in section 15.2 of Reference 2.

Elemental Analysis

Multi-elemental analysis was conducted for each property and background soil sample taken in Monticello. The samples were analyzed using an inductively coupled plasma optical emission spectrometry (ICP-OES) system.[3] Samples were analyzed for concentrations of the following elements: aluminum, barium, beryllium, boron, calcium, cesium, chromium, cobalt, copper, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, phosphorus, potassium, scandiu, sodium, strontium, thorium, titanium, vandadium, zinc, and zirconium. Relative to results of the surveys conducted in Monticello, only two elements were of interest -- vanadium and copper; therefore, in this document, concentrations for only these two elements have been reported. These two elements (vanadium and copper) were the only elements which were found to be helpful in discriminating between material originating from the Dry Valley and Monticello mill sites.

CRITERIA FOR CONTAMINATION CLASSIFICATION

Three criteria were used to judge the extent of contamination or need for remedial action: (1) ^{226}Ra concentration in soil; (2) ^{238}U concentration in soil; and (3) areal extent of contamination in the soil. In addition, because the tailings in the Monticello region conceivably come from several sources (Monticello and Dry Valley mills) and several different processes (acid leach, carbonate leach, etc.) they are difficult to identify visually. Therefore, we instituted a criteria to separate tailings from ore when found in soil. This criteria and the three above will each be discussed briefly in the following sections. If remedial action is found to be required based on data within this report, the remedial action would be based on EPA's "Standards for Remedial Action at Inactive Uranium Processing Sites," 40 CFR 192, and not on site-specific health effect assessments.

RADIUM CONCENTRATION IN SOIL

Soil samples were analyzed for ^{226}Ra concentration in soil by the methods described above. A property was considered to be in violation of the radium criteria if it exceeded 5 pCi above background per dry gram of soil. This was the interim guideline for remedial action published by the U. S. Environmental Protection Agency (EPA) for surface soil at the time of the surveys (40 CFR 192.12). Because no augering was done during the soil sampling, and no samples were taken below 15 cm of depth, the more conservative 5 pCi/g guideline was applied rather than the less stringent 15 pCi/g standard for subsurface soils. Based on the background sampling done in Monticello, this means that any sample having ^{226}Ra in concentration equal to greater than 7.5 pCi/g would exceed the criterion. No attempt was made to apply statistical or probabilistic tests to the mean or any sample when comparing with the criterion.

URANIUM CONCENTRATION IN SOIL

Soil samples were also analyzed for ^{238}U in soil by the methods described above. A property was considered to exceed the ^{238}U criterion if it exceeded 75 pCi/g above background. This criterion is equivalent to the "soil remedial action guideline" suggested by the Department of Energy (DOE) for the Formerly Utilized Sites Remedial Action Program (FUSRAP).[4] Again, the background sampling at Monticello imply that the ^{238}U criterion would be exceeded by a soil concentration of 77 pCi/g of dry soil. As before, no attempt was made to apply statistical tests to the mean or any sample when comparing with the criterion.

AREAL EXTENT OF CONTAMINATION

The areal extent of contamination criterion applied to the surveyed properties is 100 m^2. Any property which appeared to have a contaminated region exceeding this area, either in one contiguous region or several substantial subregions, was considered to be in excess of the criterion. This criterion is in concert with the distribution of contamination used to estimate health effects when developing the FUSRAP radiological guidelines.[4] As with the ^{226}Ra and ^{238}U criteria, the areal extent criterion was considered to be deterministic rather than probabilistic.

TAILINGS IDENTIFICATION

As previously mentioned, the tailings found at Monticello represent several different sources and processes. The two potential sources of tailings include the Monticello mill which processed during its history for both uranium and vanadium, and the Dry Valley site which processed for vanadium alone. Anecdotal evidence indicates that residents of the region have had at some time, access to both sites and the tailings located at each. This varying of both source and process made visual identification of the tailings material difficult and unreliable.

Because suspected tailings could not be reliably identified visually, an arbitrary criterion was established to classify a property as being tailings-contaminated. Following completion of soil sample

analysis for both ^{226}Ra and ^{238}U, the concentrations of these two radionuclides were ratioed. The ad hoc criterion was established that if the ratio exceeded 1.5 for any soil sample on a property, the property would be classified as being contaminated with tailings. This criterion is independent of the ^{226}Ra and ^{238}U criteria discussed above.

The rationale for this criterion comes from the collection of 327 and 355 background soil samples across the U.S. and analyses for concentrations of ^{226}Ra and ^{238}U, respectively.[5] In those samples, the mean concentration of ^{226}Ra was found to be 1.1 pCi/g. The mean concentration for ^{238}U was 1.0 pCi/g. These data suggest, as might be expected, that the radium was in equilibrium with the natural uranium in background sites. Without formally accounting for the variation expected in both the numerator and denominator of the ratio, the value of 1.5 seems to be a prudent indicator of the breakpoint between a background ratio and one indicative of tailings. Since there is no standard or guideline to describe "tailings", except for the ^{226}Ra and ^{238}U criteria described above, the classification of properites as tailings-contaminated should be considered qualitative only.

ORE IDENTIFICATION

Ore is more easily identified than tailings in many instances. This is because ore may take the form of rocks which are both visible and characteristically emit more localized gamma radiation. In some cases in Monticello, however, there seemed to be properties on which ore was found, but for which no "rock" existed. Local residents stated that during mill operations, ore dust from ore stockpiles, haul trucks, and the ore crusher were common in portions of Monticello nearest the mill. However, this material appeared to be more "tailings-like" in quality. In such cases, the decision to list a property as contaminated with ore was again made using the ^{226}Ra to ^{238}U ratio. Inverse to the situation with tailings, a property was classified as having ore involvement when the Ra/U ratio was below 1.5. As with the tailings classification, the ore designation should be considered only qualitative because of the probabilistic nature of the Ra/U ratio, and because the classification may include visual sightings alone.

RESULTS

BACKGROUND RADIATION LEVELS

The results of the thirty soil samples taken throughout the city of Monticello are shown in Table 1. The concentration of ^{226}Ra in the 30 samples ranged from 0.88 to 9.7 pCi/g, with a mean concentration of 2.4 pCi/g. The ^{238}U concentrations of the same samples ranged from 0.80 to 7.5 pCi/g and averaged 2.0 pCi/g. The ratio of ^{226}Ra to ^{238}U ranged in these samples from 0.39 to 1.7 and averaged 1.2. A ^{226}Ra to ^{238}U ratio of about unity is generally accepted as indicative of background.

The gamma exposure rate measured at the same 30 locations was much less variable than the ^{226}Ra and ^{238}U concentrations in soil samples. Measurements with a PIC tend to average over a much greater area than the discrete soil samples, and therefore, tend to display much less variability. The range of measurements was from 11 to 15 uR/h with an average value of 13 uR/h.

WALK-ON SURVEYS

The previous listing of properties by Bendix (Table 2) was utilized as a source of potentially contaminated sites which required walk-on gamma surveys. In addition, properties were surveyed which fell into one or more of three categories:

1. possible contamination as indicated by a hit from the mobile gamma scanning van;
2. request for a walk-on survey from the property owner or occupant;
3. evidence of contamination during a walk-on survey of the adjacent property.

A list of 38 such "new" properties which were surveyed during the April 1983, trip is included as Table 3. Property #150 was an owner request, and #151 fell into category 3 above; the remaining 36 properties were all detected by the ORNL mobile gamma scanning van which scanned the entire community.

SOIL SAMPLE RESULTS

Results of soil samples taken on the surveyed properties are listed in Table 4. Nearly 200 samples were collected from the 145 properties that were surveyed. The concentration of ^{226}Ra in the sampled medium (soil or building materials) ranged from background levels to as high as 23,000 pCi/g; concentrations for ^{238}U exceeded that range to a maximum of 24,000 pCi/g. Vanadium and copper concentrations ranged from background to 16,500 and 59,000 ppm, respectively.

The soil sample data in Table 4, coupled with the gamma maps developed during walk-on scanning of the properties, were used to place each property into a contamination category based on the criteria discussed above. These categories, along with the criteria exceeded for each property, are listed in Table 5. Contamination categories are defined as follows:

1. Uncontaminated - no evidence of contamination; gamma exposure rate, ^{226}Ra and ^{238}U concentrations in soil are within the normal range of background.

2. Building materials - indication of artificially high gamma exposures emanating from building materials; likely contamination with mill tailings.

3. Ore - visible ore, high gamma levels associated with rocks, or soil samples with ^{226}Ra to ^{238}U ratio less than 1.5.

4. Tailings - soil samples with ^{226}Ra to ^{238}U ratio greater than 1.5.

As indicated by Table 5, there are several cases in which a property may fall within one or more contamination categories, but not exceed any of the criteria for inclusion for remedial action. Conversely, properties listed as uncontaminated give no evidence whatsoever of contaminated materials onsite and, therefore, exceed no criteria. For each property that exceeds the ^{226}Ra criterion, exclusive of the 100 m^2 criterion, a figure displaying the contaminated region is included in Appendix II.

SUMMARY OF CONTAMINATED PROPERTIES

The radioactively contaminated status of the properties surveyed in the Monticello community is summarized by Table 6. This table is merely a tally of the various contamination categories and criteria exceeded as listed in Table 5. The summation indicates that 86 properties had ^{226}Ra in excess of 5 pCi/g above background (e.g. greater than 7.4 pCi/g). Forty-four properties appeared to have soil contamination that exceeded 100 m^2 in area. Nineteen properties appeared to have tailings involvement as indicated by the $^{226}Ra/^{238}U$, but did not necessarily exceed the 5 pCi/g criteria. Radioactivity in building materials exceeding normal expectations was detected at 21 properties; this was presumably the result of tailings use in mortar or concrete. Ore (either visible, or indicated by the Ra/U) was found on 104 properties. A total of 23 properties were thought to be uncontaminated (radiation levels not above background).

RADIOLOGICAL AND ELEMENTAL COMPARISONS OF MILLSITES

An ancillary activity to the property surveys in Monticello was to investigate the possibility that one or more "signatures" or set of chemical or radiological characteristics could be ascertained for each of the millsites. To this end samples of materials from each pile were analyzed for both radiological and elemental concentrations as previously discussed. This section briefly describes comparisons between those sets of samples.

As shown in Table 7, a total of 17 samples were taken from five piles at the two mill sites. The five piles were chosen because they were distinct and because there was at least anecdotal evidence that the four Monticello piles were created during different types of ore processing.

Mean concentrations for the five types of piles are also shown in Table 7. Data are shown only for ^{226}Ra, ^{238}U, V, and Cu. Although 28 elemental concentrations were determined for each soil sample, only copper and vanadium are reported herein. These appear to be the only two elements which may be used to assign a "signature." A statistical

analysis of the data in Table 7 indicates that mean ^{226}Ra and ^{238}U concentrations for the Dry Valley piles are different from the other piles. The Monticello Vanadium piles (upper and lower) appear to have both higher ^{238}U and V concentrations than the other three piles; however, the variability in the data prevent any statistical significance. The vanadium concentrations are so widely spread that no significant difference ($p>.05$) is observed between any of the piles or processes. The copper concentrations are significantly lower in the Dry Valley piles. However, when the Dry Valley tailings are mixed with undisturbed soil, the concentration of copper would be indistinguishable from natural background concentrations.

Several sets of calculations have been made that attempt to segregate tailings involvement on vicinity properties in Monticello into two groups: those contaminated by Dry Valley tailings and those contaminated by Monticello tailings. The purpose of this section is to describe the results of those calculations and to interpret the results.

The ratioed concentrations of Ra to V and Cu to V for samples taken at the Dry Valley pile and the four distinct Monticello piles have been averaged. The results of these calculations are provided in Table 8. Confidence levels were not calculated for these values because the confidence intervals between concentration ratios between Dry Valley and Monticello soil data overlap. Because this overlap occurs even at the 68% confidence level, there is no way to decide which properties were contaminated by materials from which mills. However, there do appear to be some distinct differences between the mean values for Dry Valley and the mean for the four Monticellos. It should be noted that the variance is large enough and the sample sizes small enough that 95% confidence intervals on the mean Cu/V ratio would overlap zero for several Monticello piles. Therefore, any projections made using these data should be considered very unreliable.

Because the Cu/V ratio had greater separation between the Monticello and Dry Valley samples, the Cu/V ratio was used for purposes of segregation. The breakpoint chosen for this separation was a Cu/V ratio of 0.01. Therefore, any sample with a Cu/V ratio of 0.01 or smaller was considered to have come from Dry Valley. A listing of such samples is given in Table 9. By extension, any samples not listed in Table 9 would

be judged to have come from the Monticello millsite. These differentiations are subject to dispute and are given for information only. This is especially true with the present analysis, because it makes no attempt to consider statistical attributes of the data sets involved in the analysis.

SIGNIFICANCE OF FINDINGS

The results of these surveys have been used to develop a list of properties which may be in excess of EPA criteria for inclusion in the Uranium Mill Tailings Remedial Action Project (UMTRAP), the major DOE project which is active in performing remedial action at properties similarly contaminated to those at Monticello.

Forty-eight properties are believed to be contaminated to the degree that they could be eligible for remedial action under the EPA UMTRA criteria. These properties are listed in Table 10. Additionally, the millsite where the contaminated material most probably originated (based on the preceding section's analysis) is listed in this table. The fact that a property exceeds both the ^{226}Ra and the 100 m^2 criteria does not by extension indicate that a 100 m^2 area is uniformly contaminated to greater than 5 pCi/g. The present mill tailings remedial action criteria (40 CFR 192) were not in effect during the Monticello survey (April 1983). Further, DOE guidance given to the survey team did not dictate compliance to the then-existent draft criteria. Rather, the surveys performed in Monticello by ORNL were for the purpose of determining whether or not tailings contamination existed on the property. Therefore, it is possible that some properties listed as exceeding both the ^{226}Ra and 100 m^2 criteria are not actually in excess of the present EPA standards.

Twenty-one properties were not sufficiently contaminated to warrant an inclusion recommendation, and require further information before a decision could be made. It was recommended that the properties listed in Table 11 receive indoor gamma scanning and/or radon daughter measurements. In June 1984, these 21 properties were the subject of further investigation by the EPA.[6] Ten buildings were found to have radon daughter concentrations in excess of 0.01 WL or 3 pCi/L of ^{222}Rn. If

was recommended that these ten properties be the subject of additional investigation, and the remaining properties be dropped from further consideration. These properties are given in Table 12. The EPA report describing these surveys is provided in Appendix III.

REFERENCES

1. Myrick, T. E., M. S. Blair, R. W. Doane, and W. A. Goldsmith, A Mobile Gamma-Ray Scanning System for Detecting Radiation Anomalies Associated with Radium-226-bearing Materials, ORNL, Oak Ridge, TN, ORNL/TM-8475 (1982).

2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the ORNL Remedial Action Survey and Certification Activities (RASCA) Program, ORNL, Oak Ridge, TN, ORNL/TM-8600.

3. Larson, G. F., R. T. Goodpasture, and R. W. Morrow. 1979. Simultaneous Multielement Analysis of Natural Waters in Inductively Coupled Plasma-Optical Emission Spectrometry. Y/DK-239. Oak Ridge Y-12 Plant, Oak Ridge, TN.

4. U.S. Department of Energy, Radiological Guidelines for Application to DOE's Formerly Utilized Sites Remedial Action Program, ORO-831, U.S. DOE, Oak Ridge Operations, Oak Ridge, TN (1983).

5. Myrick, T. E., B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343, ORNL, Oak Ridge, TN (1981).

6. U.S. Environmental Protection Agency, EPA Survey of Possible Mill Tailings Contamination in Monticello, Utah, USEPA Region VIII, Denver, CO (June 1984).

Table 1. Background measurements and samples at Monticello, Utah (April 17, 1983)

Sample No.	Location	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)		Gamma exposure rate (μR/h)
		^{226}Ra	^{238}U	V	Cu	
MB-1	S end of park on Circle Dr.	1.7 ± 0.1	4.4	62	22	12
MB-2	SE corner of S 1st W and W 4th S	1.6 ± 0.2	1.4	51	26	14
MB-3	SE corner of S 1st W and W 2nd S	1.3 ± 0.04	1.0	64	38	13
MB-4	SE corner of S 1st W and W Center	3.2 ± 0.2	2.3	71	34	13
MB-5	N end of N 1st W	1.2 ± 0.1	1.2	45	22	12
MB-6	N end of city park on E 1st N	0.97 ± 0.09	0.80	50	18	13
MB-7	SW corner of S 1st E and E 1st S	1.8 ± 0.2	1.4	51	22	13
MB-8	NW corner of S 1st E and E 3rd S	9.7 ± 0.6	7.5	110	34	15
MB-9	NE corner of S 1st E and E 4th S	1.4 ± 0.1	1.3	71	31	13
MB-10	NE corner of E 3rd S and S 3rd E	5.5 ± 0.2	3.5	90	26	14
MB-11	Just inside cemetery gate on right	1.1 ± 0.07	1.0	50	22	14
MB-12	SE corner of 1st S and 3rd E	7.1 ± 0.6	5.7	100	38	15
MB-13	NW corner of 1st N and 5th E	3.8 ± 0.2	2.2	68	34	14
MB-14	West end of Uranium	1.2 ± 0.08	0.90	62	19	11
MB-15	North side of Abajo opposite N. Creek Ln.	1.3 ± 0.06	1.1	57	97	12
MB-16	SE corner of Abajo and Silverstone East	1.6 ± 0.05	1.3	56	30	13
MB-17	S side Abajo between Silverston W intersection	1.7 ± 0.05	1.5	80	19	12
MB-18	E side of Pinion Dr.	1.2 ± 0.1	0.93	51	16	12
MB-19	E side of W 4th opposite Oakcrest Dr.	1.2 ± 0.1	1.1	56	88	13
MB-20	NW corner 3rd W. Central	0.95 ± 0.06	0.83	51	22	13
MB-21	SW corner, Central and Main	1.3 ± 0.05	1.1	56	22	13
MB-22	SE corner 2nd E and Central	2.4 ± 0.1	1.9	55	30	12
MB-23	SW corner Meadowlark Lane and S East	4.1 ± 0.2	2.4	76	22	14
MB-24	SW corner 2nd East 2 South	3.7 ± 0.2	2.8	76	27	14

Table 1. (Continued)

Sample No.	Location	Radionuclide concentration (pCi/g) ^{226}Ra	^{238}U	Chemical concentration (ppm) V	Cu	Gamma exposure rate (μR/h)
MB-25	SW corner 2nd South and Main	0.88 ± 0.08	1.1	57	34	13
MB-26	N or 2nd South at school	1.3 ± 0.05	1.0	89	23	12
MB-27	SE corner 4th South 2nd West	1.9 ± 0.09	1.8	200	21	13
MB-28	North side of 1st N opposite 3rd E	5.6 ± 0.4	4.2	85	28	13
MB-29	South side of Blue Mt. (garden)	0.96 ± 0.1	0.93	52	25	12
MB-30	One mile marker E on Central	1.5 ± 0.04	1.2	62	22	12
Mean ±2σ		2.4 ± 4.2	2.0 ± 3.2	70 ± 60	31 ± 37	13 ± 2
Range		0.88-9.7	0.80-7.5	45-200	16-97	11-15

Table 2. Previously identified Monticello properties (by Bendix - Appendix I) and surveyed by ORNL (April 1983)

Code	Property address	Code	Property address
1	333 Silverstone W	45	80 W 4th S
2	248 Silverstone W	46	390 S Main
3	32 Pinion Dr.	47	432 S Main
4	32 Blue Mountain Dr.	48	464 S Main
5	Cedar Lane, N End	49	480 S Main
6	333 Silverstone E	50	496 S Main
7	348 Silverstone E	51	533 S Main
8	Silverstone Subd, Lot #9	52	62 E 6th N
9	465 Oakcrest Dr.	53	64 E 5th N
10	32 Parkview Dr.	54	164 E 5th N
11	249 Blue Mountain Dr.	55	432 N Main
12	380 Abajo Dr	56	132 N Main
13	381 Abajo Dr.	57	65 E 1st N
14	165 N 1st W	58	117 S Main
15	65 N 1st W	59	181 S Main
16	65 S 2nd W	60	197 S Main
17	149 W 1st S	61	317 S Main
18	180 W 3rd S	62	316 S 1st E
19	316 S 1st W	63	323 S Main
20	396 S 2nd W	64	333 S Main
21	381 S 2nd W	65	359 S Main
22	216 Uranium Dr.	66	417 S Main
23	196 Uranium Dr.	67	48 E 4th S
24	480 S 1st W	68	449 S Main
25	516 Circle Dr.	69	96 E 4th S
26	233 Uranium Dr.	70	432 S 1st E
27	unknown	71	464 S 1st E
28	197 S Uranium Dr.	72	493 S Main
29	350 S 2nd W	73	65 E 5th S
30	564 Circle Dr.	74	87 E 5th S
31	96 W 2nd N	75	16 E 5th S
32	48 W 1st N	76	98 E 5th S
33	16 S Main	77	615 S Main
34	49 S 1st W	78	96 E 1st N
35	80 S Main	79	181 E. 1st S
36	116 S Main	80	80 S 2nd E
37	180 S Main	81	197 E 2nd S
38	16 W 2nd S	82	197 E 3rd S
39	248 S Main	83	196 E 3rd S
40	280 S Main	84	348 S 2nd E
41	286 S Main	85	396 S 2nd E
42	296 S Main	86	164 E 4th S
43	296 S Main	87	148 E 4th S
44	364 S Main	88	433 S 1st E

Table 2. (Continued)

Code	Property address	Code	Property address
89	164 E 1st N	102	417 S 2nd E
90	260 E Central	103	449 S 2nd E
91	265 E 1st S	104	449 S 2nd E
92	273 E 1st S	105	Mill Site, Hill on S side
93	80 S 3rd E	106	332 E Central
94	281 E 1st S	107	249 S 3rd E
95	137 S 2nd E	108	395 E 3rd S
96	196 S 3rd E	109	Unknown
97	217 S 2nd E	110	317 Meadowlark Lane
98	248 S 3rd E	111	539 E Central
99	280 S 3rd E	112	665 E Central
100	333 S 2nd E	113	585 E Highway
101	389 S 2nd E	114	225 S 2nd E

Table 3. Monticello properties identified and surveyed by ORNL (April 1983)[a]

Code	Property Address
115	332 N Creek Lane
116	349 N Creek Lane
117	N Creek Lane (2nd lot fr N)
118	497 Oakcrest Dr.
119	496 Blue Mountain Dr.
120	380 Silverstone E
121	Silverstone E
122	(see #8, Table 2)
123	264 Silverstone W
124	301 Silverstone W
125	401 Silverstone W
126	548 Circle Dr.
127	549 Circle Dr.
128	516 S Main
129	148 Uranium Dr.
130	76 W 3rd S
131	51 W 3rd S
132	97 N 2nd W
133	217/233 S 3rd E
134	216 S 3rd E
135	196 S 2nd E
136	EG&G Area 6
137	600 N Main
138	281 E 3rd S
139	365 S 2nd E
140	381 E 3rd S
141	395 E 3rd S
142	Cemetery Rd. (N side)
143	544 E Cemetery Rd.
144	524 E Cemetery Rd.
145	600 Cemetery Rd.
146	Mill Access Rd.
147	299 E 4th S
148	464 S 2nd E
149	448 S Main
150	416 S Main
151	196 W 3rd S
152	NE corner - end Cedar Ln.

[a]Surveyed as a result of indication from mobile gamma scanning van, request from owner, or evidence of contamination during walk-on survey of adjacent property.

Table 4. Analytical results from soil sampling at Monticello, Utah

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
1	333 Silverstone W	1.4 ± 0.09	1.3	56	18
3	32 Pinion Dr.	1.5 ± 0.05	1.2	57	17
4	32 Blue Mountain Dr.	1.2 ± 0.1	1.1	51	18
5	Cedar Lane - NW end lot	1.2 ± 0.06	1.1	52	22
6	333 Silverstone E	28 ± 0.7	28	560	19
9	465 Oakcrest Dr.	1.2 ± 0.2	1.3	63	26
10	32 Parkview Dr.	37 ± 0.8	42	770	22
12	380 Abajo Dr.	230 ± 8	270	55	41
13	201 E 2nd S	c	c	c	c
14A	165 N 1st W	120 ± 2	190	3200	13
14B	165 N 1st W	120 ± 2	130	d	d
15	65 N 1st W	1.5 ± 0.1	1.7	62	20
16A	65 S 2nd W	c	c	c	c
16B	65 S 2nd W	39 ± 2	37	440	22
18	180 W 3rd S	2.2 ± 0.08	1.9	48	23
19	316 S 1st W	c	c	c	c
20	396 S 2nd W	5.5 ± 0.1	6.1	85	30
21	381 S 2nd W	5.6 ± 0.4	5.2	140	30
22	216 Uranium Dr.	2800 ± 90	78	2800	1200
23	196 Uranium Dr.	c	c	c	c
24	480 S 1st W	4.4 ± 0.3	4.8	79	100
25A	516 Circle Dr.	15 ± 0.4	11	150	38
25B	516 Circle Dr.	17 ± 0.4	13	180	170
26	233 Uranium Dr.	630 ± 6	790	76	27
28	197 S Uranium Dr.	360 ± 20	78	1700	68
29	350 S 2nd W	1.4 ± 0.04	1.2	56	50
31A	96 W 2nd N	23 ± 0.4	27	d	d
31B	96 W 2nd N	27 ± 1	41	110	91
32	48 W 1st N	1.4 ± 0.08	1.7	61	29

Table 4. (Continued)

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
34	49 S 1st W	c	c	c	c
36	116 S Main	5.5 ± 0.3	5.5	140	14
37	180 S Main	94 ± 1	82	1400	24
38	16 W 2nd S	2.7 ± 0.06	2.7	66	45
39	248 S Main	110 ± 5	16	620	50
40	280 S Main	23000 ± 1000	24000	20	59000
41A	286 S Main	880 ± 20	810	960	2500
41B	286 S Main	1500 ± 50	1300	4600	800
41C	286 S Main	120 ± 7	120	3800	9.9
43	296 S Main	2000 ± 30	1500	83	22000
45	80 W 4th S	180 ± 0.08	230	1600	100
47	432 S Main	5.1 ± 0.1	4.1	80	34
48A	464 S Main	5.6 ± 0.2	5	65	26
49A	480 S Main	150 ± 6	33	680	83
49B	480 S Main	c	c	c	c
50A	496 S Main	2500 ± 100	2900	2100	26
50B	496 S Main	1.7 ± 0.1	1.3	44	23
51	533 S Main	c	c	c	c
52	62 E 6th N	1.1 ± 0.06	1.2	51	18
53	64 E 5th N	1000 ± 50	1400	17000	15
54	164 E 5th N	180 ± 2	160	5300	8.7
55A	32 N Main	420 ± 5	190	44	150
56	132 N Main	c	c	c	c
57A	65 E 1st N	36 ± 1	33	580	54
57B	65 E 1st N	3.2 ± 0.1	4.3	90	18
59	181 S Main	15 ± 0.8	3.1	110	26
61	317 S Main	18 ± 0.7	11	99	110
62	316 S 1st E	220 ± 20	200	83	580
64A	333 S Main	7.9 ± 0.4	10	84	46
64B	333 S Main	c	c	c	c
65	359 S Main	9.6 ± 0.4	6.4	120	30

Table 4. (Continued)

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
66	417 S Main	2.2 ± 0.6	1.7	76	32
67	48 E 4th S	7.7 ± 0.08	6.8	95	31
68A	449 S Main	2.9 ± 0.06	2.6	67	22
68B	449 S Main	c	c	c	c
69	96 E 4th S	5.9 ± 0.2	6.2	98	30
70	432 S 1st E	35 ± 0.6	32	330	58
71	464 S 1st E	62 ± 1	56	580	78
71A	464 S 1st E	7.3 ± 0.4	6.0	88	33
72A	493 S Main	200 ± 10	150	480	30
72B	493 S Main	c	c	c	c
73	65 E 5th S	21 ± 1	35	120	87
74	87 E 5th S	61 ± 5	46	380	130
75	16 E 5th S	13 ± 0.4	9.3	94	69
76	98 E 5th S	110 ± 1	82	630	210
77	615 S Main	24 ± 0.5	22	54	120
78	96 E 1st N	1800 ± 100	4000	6100	3200
79	181 E 1st S	6.0 ± 0.1	4.8	91	26
80	80 S 2nd E	27 ± 0.3	22	500	18
81	197 E 2nd S	29 ± 0.3	33	350	55
82	197 E 3rd S	7.2 ± 0.3	6.0	100	27
83A	196 E 3rd S	27 ± 1	33	290	59
83B	196 E 3rd S	50 ± 3	51	450	190
84	348 S 2nd E	45 ± 2	33	310	97
85A	396 S 2nd E	68 ± 0.6	57	440	140
85B	396 S 2nd E	48 ± 4	39	330	120
86	164 E 4th S	74 ± 1	68	460	70
87A	148 E 4th S	75 ± 3	66	580	120
87B	148 E 4th S	55 ± 0.8	45	390	110

Table 4. (Continued)

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
88A	433 S 1st E	33 ± 2	26	280	66
88B	433 S 1st E	64 ± 2	56	550	100
89A	164 E 1st N	4.9 ± 0.3	4.4	79	30
89B	164 E 1st N	c	c	c	c
90	260 E Central	9.4 ± 0.2	9.7	110	30
91A	265 E 1st S	14 ± 0.2	13	140	51
91B	265 E 1st S	5.2 ± 0.08	4.4	59	41
92	273 E 1st S	430 ± 10	73	84	2800
93	80 S 3rd E	c	c	c	c
94	281 E 1st S	12 ± 0.3	15	170	53
95	137 S 2nd E	120 ± 2	49	110	64
96A	196 S 3rd E	7.7 ± 1.0	4.8	85	30
96B	196 S 3rd E	3.3 ± 0.2	2.0	68	22
96C	196 S 3rd E	9.1 ± 0.7	6.1	110	30
96D	196 S 3rd E	6.9 ± 0.2	3.3	120	30
96E	196 S 3rd E	6.8 ± 0.3	7.4	100	34
97	217 S 2nd E	710 ± 20	630	69	19
98	248 S 3rd E	18 ± 1	25	280	50
99	280 S 3rd E	23 ± 0.4	17	230	82
100	333 S 2nd E	82 ± 4	78	580	130
101	389 S 2nd E	29 ± 0.5	33	300	50
103	449 S 2nd E	170 ± 7	130	710	310
104	449 S 2nd E	300 ± 8	220	1000	590
105A	Mill Site - hill on S side	160 ± 2	89	150	130
105B	Mill Site - hill on S side	450 ± 20	310	440	20
106	332 E Central	8.3 ± 0.3	7.1	110	46
107	249 S 3rd E	16 ± 0.3	11	150	38
108	395 E 3rd S	91 ± 3	63	640	240
110	317 Meadowlark Lane	10 ± 0.2	8.2	120	42
111	539 E Central	c	c	c	c

Table 4. (Continued)

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
112	665 E Central	6.2 ± 0.1	2.8	79	42
113	585 E Highway	3.6 ± 0.1	2.4	71	22
114	225 S 2nd E	1400 ± 60	760	100	37
115	332 N Creek Lane	2.9 ± 0.07	2.0	80	37
116	349 N Creek Lane	75 ± 3	76	1700	15
117	N Creek Lane (2nd lot fr N)	15 ± 0.2	16	400	58
118	497 Oakcrest Dr.	1.0 ± 0.1	0.93	48	22
120A	380 Silverstone E	54 ± 0.7	41	1000	25
120B	380 Silverstone E	2.5 ± 0.2	1.8	66	26
121	Silverstone E	1.4 ± 0.05	1.2	66	210
122A	Silverstone E (N of #432)	24 ± 2	17	300	26
122B	Silverstone E (N of #432)	120 ± 1	130	1500	23
124	301 Silverstone W	100 ± 4	120	2000	12
126	548 Circle Dr.	74 ± 5	57	1300	32
128	516 S Main	54 ± 2	57	1700	79
129A	148 Uranium Dr.	180 ± 8	180	1300	89
129B	148 Uranium Dr.	c	c	c	c
130	76 W 3rd S	1800 ± 30	1400	6300	270
131	50 W 3rd S	c	c	c	c
132A	97 N 2nd W	140 ± 7	37	800	70
132B	97 N 2nd W	47 ± 3	9.0	180	34
133	233 S 3rd E	38 ± 2	8.2	110	37
134A	216 S 3rd E	42 ± 0.9	34	430	61
134B	216 S 3rd E	c	c	c	c
135	196 S 2nd E	c	c	c	c
136	EG&G Area 6	c	c	c	c
137A	600 N Main	1.7 ± 0.9	1.4	57	18
137B	600 N Main	c	c	c	c
138A	281 E 3rd S	61 ± 0.1	63	470	100

Table 4. (Continued)

Sample no.	Property address	Radionuclide concentration (pCi/g)		Chemical concentration (ppm)	
		^{226}Ra[a]	^{238}U[b]	V	Cu
138B	281 E 3rd S	[c]	[c]	[c]	[c]
138C	281 E 3rd S	60 ± 0.6	52	290	45
139	365 S 2nd E	55 ± 0.7	37	250	170
140	381 E 3rd S	62 ± 4	60	830	34
141	395 E 3rd S	8.6 ± 0.2	4.8	98	25
143	544 E Cemetery Rd.	23 ± 1	9.1	190	30
144	524 E Cemetery Rd.	64 ± 3	21	330	66
145	600 Cemetery Rd.	43 ± 3	13	59	42
147	299 E 4th S	150 ± 6	74	160	2200
148	464 S 2nd E	3.9 ± 0.05	3.0	71	26
149	448 S Main	1.2 ± 0.06	1.3	51	22
150A	416 S Main	69 ± 1	43	530	230
150B	416 S Main	1.3 ± 0.09	3.9	56	15
151	16 W 3rd S	370 ± 20	410	6300	91
152	NE corner end of Cedar Lane	1.4 ± 0.2	1.1	51	19

[a]Indicated error is at the 95% confidence level.
[b]Counting error is less than ±3% (at the 95% confidence level).
[c]Visible or likely ore sample; not processed.
[d]Not analyzed.

Table 5. Contamination categories for Monticello properties

Sample number	Property Address	Contamination category[a]	Criteria exceeded[b] Ra-226	U-238	100 m^2
1	333 Silverstone W	uncontaminated			
2	248 Silverstone W	building materials			
3	32 Pinion Dr.	uncontaminated			
4	32 Blue Mountain Dr.	ore			
5	Cedar Lane - NW end lot	uncontaminated			
6	333 Silverstone E	building materials, ore	X		
7	348 Silverstone E	building materials			
8/122	Silverstone Lot No. 9 (see #122)				
9	465 Oakcrest Dr.	building materials			
10	32 Parkview Dr.	ore, building materials	X		X
11	249 Blue Mtn. Dr.	not surveyed			
12	380 Abajo Dr.	ore	X	X	X
13	381 Abajo Dr.	not surveyed			
14	165 N 1st W	tailings, ore	X	X	X
15	65 N 1st W	building materials			
16	65 S 2nd W	building materials, ore	X		
17	149 W 1st S	not surveyed			
18	180 W 3rd S	ore			
19	316 S 1st W	ore			
20	396 S 2nd W	uncontaminated			
21	381 S 2nd W	uncontaminated			
22	216 Uranium Dr.	tailings	X	X	
23	196 Uranium Dr.	ore	X	X	
24	480 S 1st W	uncontaminated			
25	516 Circle Dr.	ore	X		
26	233 Uranium Dr.	ore	X	X	
27	Unknown	not surveyed			
28	197 S Uranium Dr.	tailings	X	X	
29	350 S 2nd W	uncontaminated			
30	564 Circle Dr.	ore	X	X	
31	96 W 2nd N	ore	X		X
32	48 W 1st N	uncontaminated			
33	16 S Main	uncontaminated			
34	49 S 1st W	ore			
35	80 S Main	uncontaminated			
36	116 S Main	uncontaminated			
37	180 S Main	ore, building materials	X	X	
38	16 W 2nd S	ore			
39	248 S Main	tailings, building materials	X		
40	280 S Main	ore	X	X	
41	286 S Main	ore	X	X	X
42/43	296 S Main	ore	X	X	X

Table 5. (Continued)

Sample number	Property Address	Contamination category[a]	Criteria exceeded[b] Ra-226	U-238	100 m^2
44	364 S Main	uncontaminated			
45	80 W 4th S	ore	X	X	
46	390 S Main	uncontaminated			
47	432 S Main	uncontaminated			
48	464 S Main	ore			
49	480 S Main	tailings, ore	X		X
50	496 S Main	ore	X	X	
51	533 S Main	ore			X
52	62 E 6th N	uncontaminated			
53	64 E 5th N	ore	X	X	
54	164 E 5th N	ore	X	X	
55	432 N Main	ore, tailings	X	X	
56	132 N Main	ore			
57	65 E 1st N	ore, building materials	X		
58	117 S Main	uncontaminated			
59	181 S Main	tailings, building materials	X		X
60	197 S Main	uncontaminated			
61	317 S Main	ore	X		
62	316 S 1st E	ore	X	X	
63	323 S Main	ore			
64	333 S Main	ore	X		
65	359 S Main	tailings	X		
66	417 S Main	uncontaminated			
67	48 E 4th S	uncontaminated			
68	449 S Main	ore			
69	96 E 4th S	ore			X
70	432 S 1st E	ore	X		
71	464 S 1st E	ore	X		X
72	493 S Main	ore	X	X	
73	65 E 5th S	ore	X		
74	87 E 5th S	ore	X		X
75	16 E 5th S	ore	X		
76	98 E 5th S	ore	X	X	X
77	615 S Main	ore	X		
78	96 E 1st N	ore	X	X	
79	181 E 1st S	ore			
80	80 S 2nd E	ore	X		
81	197 E 2nd S	ore	X		
82	197 E 3rd S	uncontaminated			
83	196 E 3rd S	ore	X		X
84	384 S 2nd E	tailings, ore	X		X
85	396 S 2nd E	tailings, ore	X		X
86	164 E 4th S	ore	X		X
87	148 E 4th S	ore	X		X

Table 5. (Continued)

Sample No.	Property Address	Contamination category[a]	Criteria exceeded[b] Ra-226	U-238	100 m^2
88	433 S 1st E	ore	X		X
89	164 E 1st N	ore			
90	260 E Central	ore	X		
91	265 E 1st S	ore	X		
92	273 E 1st S	ore, tailings	X	X	X
93	80 S 3rd E	ore			X
94	281 E 1st S	ore	X		X
95	137 S 2nd E	ore, tailings	X		
96	196 S 3rd E	building materials, tailings	X		
97	217 S 2nd E	ore	X	X	X
98	248 S 3rd E	ore	X		
99	280 S 3rd E	ore	X		X
100	333 S 2nd E	ore	X	X	X
101	389 S 2nd E	ore	X		X
102	417 S 2nd E	ore			X
103	449 S 2nd E	ore	X	X	X
104	449 S 2nd E	ore	X	X	X
105	S US163	ore, tailings	X	X	X
106	332 E Central	ore	X		
107	249 S 3rd E	ore	X		
108	395 E 3rd S	ore	X		X
109	Unknown	not surveyed			
110	317 Meadowlark Lane	ore	X		
111	539 E Central	ore			
112	665 E Central	uncontaminated			
113	585 E Highway	uncontaminated			
114	225 S 2nd E	tailings	X	X	
115	332 N Creek Lane	building materials, ore			
116	349 N Creek Lane	ore, building materials	X		X
117	N Creek Lane (2nd lot fr N)	ore	X		
118	497 Oakcrest Dr.	building materials			
119	496 Blue Mountain Dr.	building materials, ore			
120	380 Silverstone E	building materials, ore	X		
121	Silverstone E	building materials			
122	Silverstone E (N of #432)	ore	X		
123	264 Silverstone W	ore			
124	301 Silverstone W	ore, building materials	X	X	
125	401 Silverstone W	building materials			
126	548 Circle Dr.	ore	X		
127	549 Circle Dr.	building materials, ore			

Table 5. (Continued)

Sample No.	Property Address	Contamination category[a]	Criteria exceeded[b] Ra-226	U-238	100 m^2
128	516 S Main	ore	X		
129	148 Uranium Dr.	ore	X	X	
130	76 W 3rd S	ore	X	X	
131	51 W 3rd S	ore			
132	97 N 2nd W	tailings, ore	X		
133	233 S 3rd E	tailings	X		X
134	216 S 3rd E	ore	X		X
135	196 S 2nd E	ore			
136	EG&G Area 6	ore			X
137	600 N Main	ore			
138	281 E 3rd S	ore	X		X
139	365 S 2nd E	ore	X		X
140	381 E 3rd S	ore	X		
141	393 E 3rd S	tailings	X		
142	N. side Cemetery Rd.	ore			
143	544 E Cemetery Rd.	tailings	X		X
144	524 E Cemetery Rd.	ore			X
145	600 Cemetery Rd.	tailings	X		X
146	Mill Access Rd.	ore			
147	299 E 4th S	ore, tailings	X		X
148	464 S 2nd E	ore			X
149	448 S Main	uncontaminated			
150	416 S Main	tailings, ore	X		X
151	196 W 3rd S	ore	X	X	
152	NE corner - end of Cedar Lane	ore			

[a]Contamination categorized as follows:
Uncontaminated - gamma exposure rate, ^{226}Ra concentration in soil and ^{238}U concentration in soil within normal range of background.
Building materials - indication of artificially high gamma exposures emanating from building materials; likely contamination with mill tailings.
Ore - high gamma levels associated with rocks, visible ore, or soil samples with ^{226}Ra to ^{238}U ratio <1.5.
Tailings - soil samples with ^{226}Ra to ^{238}U ratio greater than 1.5.

[b]Criteria:
^{226}Ra - greater than 5 pCi/g above background in any soil sample taken from property.
^{238}U - greater than 75 pCi/g above background in any soil sample taken from property.
100 m^2 - gamma levels or soil samples indicate that either ^{226}Ra criteria or ^{238}U criteria exceeded over an area of 100 m^2 or more.

Table 6. Summary of contamination categories for properties surveyed in or near Monticello, Utah

Category	Number of properties
Not surveyed	5
Uncontaminated	23
Contaminated	122
Source[a]	
Probable tailings	19
Building materials	21
Ore	104
Type[a]	
>5 pCi/g ^{226}Ra	86
>75 pCi/g ^{238}U	31
>100 m^2 area	44

[a]A single property may be counted in several categories.

Table 7. Radiological characteristics of millsites near Monticello, Utah

Millsite	Number of samples	Mean concentration from pile samples[a] ^{226}Ra (pCi/g)	^{238}U (pCi/g)	Vanadium (ppm)	Copper (ppm)
Monticello East U pile	3	300 (59)	65 (51)	250 (110)	2500 (1100)
Monticello South U pile	3	310 (76)	41 (17)	540 (410)	1900 (780)
Dry Valley pile	4	67 (3.5)	63 (8.9)	1700 (610)	8.5 (0.4)
Monticello Upper V pile	4	430 (280)	420 (530)	1800 (1000)	360 (120)
Monticello Lower V pile	3	460 (450)	100 (73)	3000 (2700)	350 (300)

[a]Values in parentheses are associated variability about the mean values at the 1σ level.

Table 8. Elemental ratios for tailings piles at Monticello and Dry Valley.

Millsite	No. samples	Mean Ratio	
		Ra/V	Cu/V
Dry Valley	4	0.041	0.005
Monticello East U pile	3	1.30	12.9
Monticello South U pile	3	1.04	9.20
Monticello Lower V pile	3	0.131	0.176
Monticello Upper V pile	4	0.220	0.390

Table 9. Probable soil samples originating from Dry Valley millsite[a]

Sample no.	Ra/V	Cu/V
14A	0.038	0.0041
41C	0.032	0.0026
53	0.060	0.0090
54	0.035	0.0016
116	0.044	0.0091
124	0.051	0.0061

[a]Selections based on an assumed lower bound of 0.01 for the ratio of Cu to V for Monticello millsite samples. Ratio of Ra to V is shown only for reference. No confidence level should be implied by these selections.

Table 10. Monticello properties believed to be in excess of EPA (40 CFR 192) criteria[a]

Sample number	Property address	Contamination category[b]	Millsite[c]
10	32 Parkview Dr	Building materials, ore	M
12	380 Abajo Dr	Ore	M
14	165 N 1st W	Ore, tailings	DV
31	96 W 2nd N	Ore	M
41	286 S Main	Ore	DV
42/43	296 S Main	Ore	M
49	480 S Main	Ore, tailings	M
50	496 S Main	Ore	M
51	533 S Main	Ore	M
59	181 S Main	Building materials, tailings	M
69	96 E 4th S	Ore	M
71	464 S 1st E	Ore	M
73	65 E 5th S	Ore	M
74	87 E 5th S	Ore	M
75	16 E 5th S	Ore	M
76	98 E 5th S	Ore	M
83	196 E 3rd S	Ore	M
84	384 S 2nd E	Ore	M
85	396 S 2nd E	Ore	M
86	164 E 4th S	Ore	M
87	148 E 4th S	Ore	M
88	433 S 1st E	Ore	M
91	265 E 1st S	Ore	M
92	273 E 1st S	Ore, tailings	M
93	80 S 3rd E	Ore	M
94	281 E 1st S	Ore	M
97	217 S 2nd E	Ore	M
99	280 S 3rd E	Ore, tailings	M
100	333 S 2nd E	Ore	M
101	389 S 2nd E	Ore	M
102	417 S 2nd E	Ore	M
103	449 S 2nd E	Ore	M
104	449 S 2nd E	Ore	M
105	S U S 163	Ore, tailings	M
108	395 E 3rd S	Ore	M
116	349 N Creek Lane	Building materials, ore	DV

Table 10. Continued.

Sample number	Property address	Contamination category[b]	Millsite[c]
133	233 S 3rd E	Tailings	M
134	216 S 3rd E	Ore	M
135	196 S 2nd E	Ore	M
136	EG&G Area 6	Ore	M
138	281 E 3rd S	Ore	M
139	365 S 2nd E	Ore	M
140	381 E 3rd S	Ore	M
141	395 E 3rd S	Tailings	M
143	544 E Cemetery Rd	Tailings	M
145	600 Cemetary Rd	Tailings	M
147	299 E 4th S	Ore, tailings	M
150	416 S Main	Ore, tailings	M

[a]The property is believed to have concentrations of ^{226}Ra in soil greater than 5 pCi/g above background in the upper 15 cm layer (or >15 pCi/g in any 15 cm layer below the top 15 cm), and gamma radiation levels or soil samples indicate that the ^{226}Ra criteria is exceeded over an area of 100 m^2 or more.

[b]Contamination categories are as follows:

Building materials - indication of artificially high gamma exposures emanating from building materials; likely contamination with mill tailings. Properties with building material involvement were automatically included for further consideration.

Ore - high gamma levels associated with rocks, visible ore, or soil samples with ^{226}Ra to ^{238}U ration <1.5.

Tailings - soil samples with ^{226}Ra to ^{238}U ratio greater than 1.5.

[c]Mill categories

M - Sample taken on property had Cu/V ratio in excess of assumed lower limit of 0.01, indicating that material was removed from Monticello millsite.

DV - sample taken on property had Cu/V ratio below assumed M lower limit of 0.01, indicating that material had been taken from Dry Valley millsite.

Table 11. Properties in Monticello requiring indoor radiological surveys before remedial action decisions can be made

Property no.	Address	Millsite[a]
2	248 Silverstone W	BM
6	333 Silverstone E	BM, M
7	348 Silverstone E	BM, M
9	465 Oakcrest Dr	BM
15	65 N 1st W	BM, M
16	65 S 2nd W	BM, M
28	197 S Uranium Dr	M
37	180 S Main	BM, M
39	248 S Main	BM, M
57	65 E 1st N	BM, M
118	497 Oakcrest Dr	BM, M
119	496 Blue Mountain Dr	BM
120	380 Silverstone E	BM, M
121	Silverstone E	BM, M
124	301 Silverstone W	BM, DV
125	401 Silverstone W	BM
127	549 Circle Dr	BM
130	76 W 3rd S	M
132	97 N 2nd W	M
137	600 N Main	M
144	524 E Cemetery Rd	M

[a]BM - contaminated building materials, origin unknown.

DV - Cu/V ratio indicates that contamination in soil may have come from Dry Valley millsite.

M - Cu/V ratio indicates that contamination in soil may have come from Monticello millsite.

Table 12. Monticello properties requiring additional investigation based on EPA June 1984 surveys.

Property Number	Address[a]
2	248 Silverstone W
6	333 Silverstone E
9	465 Oakcrest Drive
16	65 S 2nd W
39	248 S Main
118	497 Oakcrest Drive
120	380 Silverstone E
125	401 Silverstone W
132	97 N 2nd W
144	524 E Cemetary Road

[a]Radon daughter concentrations found to be between 0.01 and 0.04 WL.

APPENDIX I

DRAFT REPORT OF BENDIX GAMMA SURVEY OF MONTICELLO

PRELIMINARY

GJ-02(83)

GAMMA SCREENING SURVEYS ON INDIVIDUAL VICINITY PROPERTIES AT MONTICELLO, UTAH

Bendix Field Engineering Corporation
Grand Junction Operations
Grand Junction, Colorado 81502

April 1983

Prepared for U.S. Department of Energy
Assistant Secretary for Environmental Protection,
Safety, and Emergency Preparedness
Under Contract No. DE-AC07-GJ01664

PRELIMINARY

CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

Purpose and Scope

Gamma screening surveys of Monticello vicinity properties were conducted during the summer of 1982 by Bendix Field Engineering Corporation (BFEC). The purpose of the surveys was to provide further data that would be considered in any decision to designate individual properties under the U.S. Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). Properties selected for screening were those identified as "anomalous" by previous EPA-sponsored mobile gamma scanning surveys performed in 1971 and 1980 (U.S. EPA, 1972; BFEC, 1982), and the procedures were designed to substantiate the results of those mobile surveys. Gamma screening surveys were also performed on additional properties at the request of the property owners.

The first phase of the work consisted of a review of existing information, a search of property records, and contact with individual property owners. The second phase involved gamma-ray (exposure-rate) surveying of individual properties with scintillometers and pressurized ionization chambers (PICs), and collection and subsequent laboratory analysis for uranium and equivalent uranium of some soil, rock, and building material samples. The third phase consisted of recording the information on sketch maps of each property and on Gamma Survey Report forms, followed by inclusion of this material in a final report.

A total of 114 properties were investigated during the survey (for gamma screening survey locations, see Plate 1 in pocket, back inside cover). Of this total, 98 were identified by the earlier mobile surveys (referred to herein as the 1971 and 1980 surveys) and 16 were investigated at the request of individual property owners. Of the 98 EPA-identified properties, ten were not surveyed because three were previously investigated in detail by a DOE contractor (Arix, 1980 and 1981), two could not be located, and five property owners refused permission to survey. Gamma screening surveys were therefore performed on a total of 104 properties; of these, 35 were also sampled as part of an ancillary study to investigate the problem of determining the outside source of contamination (e.g., uranium ore or mill tailings, or vanadium tailings).

Historical Background

The mill adjacent to Monticello (see Plate 1) initiated processing in mid-1942 with vanadium as its only product. From 1943 to 1946, uranium and vanadium were produced by the mill for the Manhattan Engineer District, and from 1948 to 1956, uranium and vanadium were produced for the U.S. Atomic Energy Commission (AEC). From 1956 to 1960, the mill processed uranium only, for the AEC. Operation of the mill was discontinued in 1960, and the mill tailings ponds were initially stabilized in 1961 to prevent erosion of the radioactive tailings. Further decontamination and stabilization took place in the mid-1970s, leaving the millsite in its current configuration.

Prior to the mid-1970s, radioactive tailings were spread around the city of Monticello, both by man and by natural means. Tailings appear to have been

used as fill material, and as aggregate for mortar and concrete, and to have been carried from the millsite by wind and water erosion. Also, there are recent indications from Monticello residents that some of the low-level radioactive materials in the city of Monticello have come from sources other than the Monticello millsite, e.g., other tailings and ore from nearby uranium and vanadium mines. The 1971 and 1980 surveys mentioned above were conducted to determine the distribution of these low-level materials in the city of Monticello.

The 1971 Survey investigated 494 structures and recorded 62 anomalies. The 1980 Survey investigated 810 structures and recorded 55 anomalies. Combined, this represents 117 anomalies, 19 of which coincide, giving a net total of 98 properties identified as anomalous. Available information is insufficient to explain why there is so little concurrence on anomalous properties between the two surveys. We can only speculate that differences in measurement systems and survey techniques as well as physical changes in properties during the 9 years between surveys are contributing factors. We were also unable to uncover the exact overlap between the 494 and 810 structures surveyed.

In June 1982, the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP) was given responsibility for all remedial actions associated with the Monticello vicinity properties. At this time, FUSRAP does not have an approved set of criteria to be used when considering designation of a vicinity property under FUSRAP; therefore, for the purposes of this report, we have assumed that the EPA standards developed for the DOE Uranium Mill Tailings Remedial Action Program (U.S. EPA, 1983) are applicable to FUSRAP.

FIELD OPERATIONS

Preliminary Activity

Following review of the 1971 and 1980 surveys, a property record search was conducted on all properties identified as anomalous. This search identified owership and, in some instances, the names of lessees or occupants. However, building construction dates could not be established in the San Juan County Records office, and only a few construction dates were located in the County Assessors office. The city of Monticello issues building permits, but the files are destroyed at the end of each calendar year to make room for the coming year's permit activities.

Thus, to develop adequate property ownership records, a combination Permit Form/Questionnaire together with a cover letter and an addressed, stamped, return envelope were sent to each property owner (Appendix A). As the permit forms were returned, the project field leader contacted property owners and/or tenants to arrange appointments for the surveys to be conducted.

Prior to initiating the actual surveys, an informational meeting was held in the San Juan County Courthouse with the San Juan County Commissioners, the Mayor of Monticello, representatives of the Utah State Health Department, and project leaders from DOE and Bendix. A press release explaining the purpose and nature of the project was issued to the local press shortly after the meeting (Appendix A).

Gamma Screening

Prior to conducting the actual gamma survey at an individual property, a preliminary sketch map of that property was prepared. Each map showed the locations of fences, shrubs, gardens, driveways, sidewalks, and structures, as well as floor plans and the grid network that was to be used while performing both the indoor and outdoor surveys.

Two instruments were used for the surveying: pressurized ionization chambers (PICs) and hand-held scintillometers. The PICs were used to take measurements (3-ft elevation) at some grid-line intersections; these measurements were to be used later to correct the scintillometer readings to true exposure-rate values (see below). The scintillometers were used to take measurements (3-ft elevation and on the surface) at all grid-line intersections. All instruments were field-checked daily with radium check-sources to ensure that calibrations were stable, and weekly calibrations using a point-source geometry were performed at the laboratory.

The gamma readings were recorded on the preliminary sketch maps in the field. The sketch maps were later drafted, and information from them and from field notes was transferred to the Gamma Survey Report forms along with a photo of each property. The completed report form and sketch map for each surveyed property are contained in Appendix B. The following conventions were used to present the PIC data and the uncorrected scintillometer data on the maps:

$\boxed{A}$ = 3-foot PIC reading (in true μR/hr values)

$$\frac{15}{12} = \frac{\text{3-foot scintillometer reading}}{\text{surface scintillometer reading}} \quad \text{(in uncorrected μR/hr values)}$$

The average background exposure rate for the Monticello area is taken to be 15 μR/hr, based on work done under the authority of the Surplus Facilities Management Program (Abramiuk, 1983).

The correction equation to convert scintillometer readings to true exposure rate was derived by least-square fitting a straight line to 244 points representing both indoor and outdoor PIC/scintillometer data pairs for the Monticello area (Figure 1). The result is

$$\text{scintillometer}/_{CORR} = 0.44\ \text{scintillometer}/_{UNCORR} + 8.1\ \mu R/hr$$

where

$\text{scintillometer}/_{CORR}$ = true exposure rate in μR/hr

$\text{scintillometer}/_{UNCORR}$ = scintillometer readings in μR/hr

Note that the highest uncorrected scintillometer value used in this derivation was 80 μR/hr, so the correction equation becomes increasingly unreliable at higher and higher values.

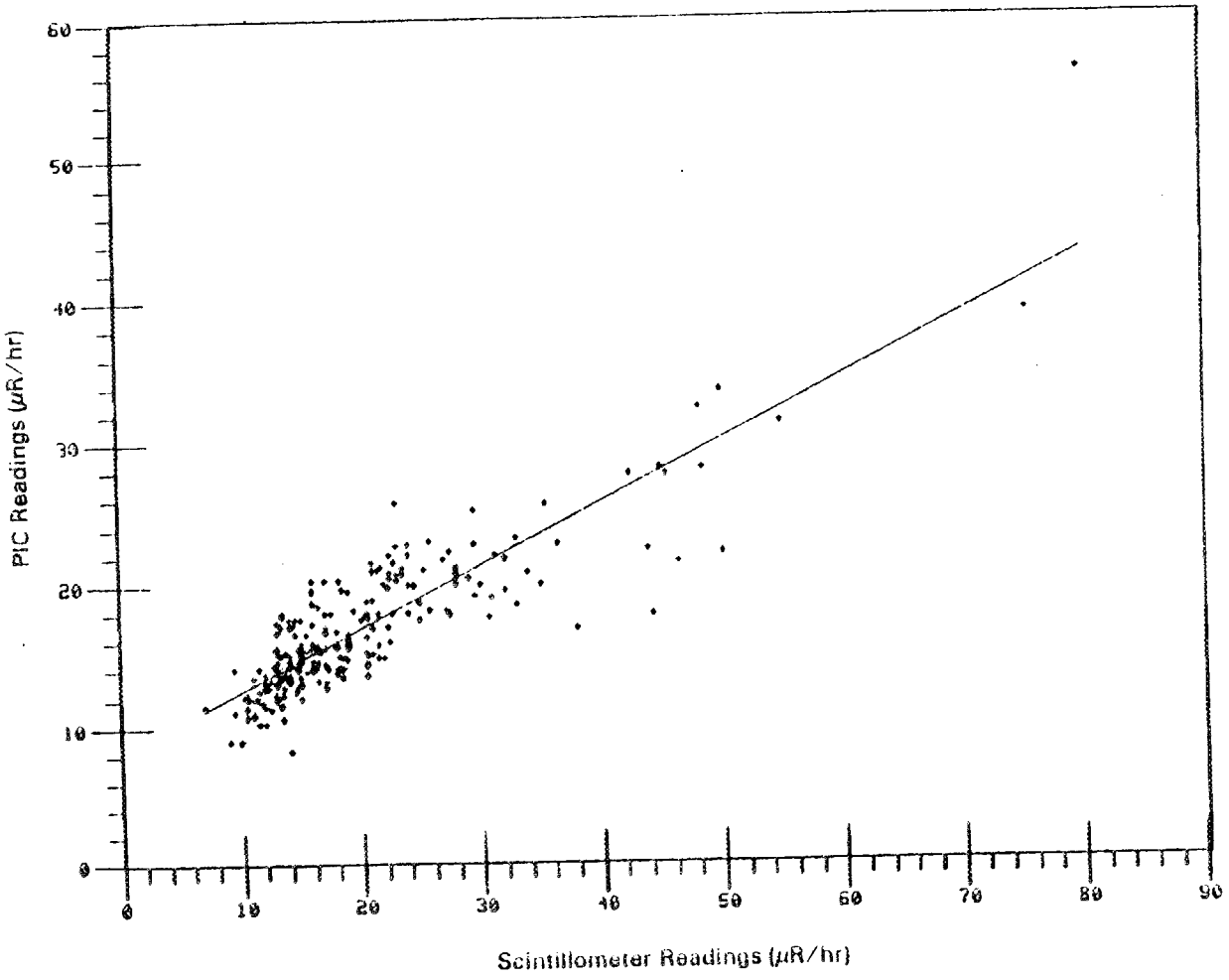


Figure 1. PIC Readings Versus Scintillometer Readings

Sampling

Supplemental to the original scope (gamma screening only) of the project, an arbitrary number of surface samples were taken from some of the properties to explore the problem of determining the outside source of contamination. These samples represented a variety of materials and a wide range of radioactivity, and were used to investigate the possibility of using a radiometric signature to distinguish residual uranium mill tailings from uranium ore or vanadium mill tailings contamination originating at other sites. To this end, laboratory analyses were performed on 60 samples taken from 35 properties (see locations on individual property sketch maps in Appendix B) to determine "chemical" uranium (U) and "equivalent" uranium (eU). The former was determined by the fluorimetric or colorimetric method, as appropriate; the latter was determined by gamma spectroscopy using either a sodium iodide or germanium detector and either the 1765-keV or the 609-keV Bi-214 peak, as appropriate.

Using results from the analyses, the ratio eU/U was calculated for each sample based upon the assumption that if the ratio is less than or approximately equal to 1 then this sample probably contains uranium ore or vanadium tailings in varying degrees of disequilibrium, and if the ratio is significantly greater than 1, residual uranium mill tailings may be present.

SURVEY RESULTS

Gamma Screening

A total of 114 properties were investigated, and gamma screening surveys were performed on 104. The previous EPA-sponsored mobile surveys identified 98 properties as anomalous of which two were not located, five property owners refused permission to conduct surveys, and three were the subject of previous radiologic and engineering assessments. In addition to the remaining 88 properties, 16 properties were surveyed upon request by the owners.

The complete screening survey results for all properties investigated are presented in Appendix B. In addition, Figures 2A through 2F are bar graphs which illustrate and compare the corrected high inside gamma (HIG), high outside gamma (HOG), and low outside gamma (LOG) readings for each property.

Table 1 lists each property by its screening survey number and gives a summary of pertinent and specific information for each property, including the address and the corrected values for the HOG, HIG, and LOG readings.

Table 2 provides an overall summary of survey results by listing properties by number and land-use designation, according to whether or not true (corrected) exposure rates exceeded certain values tied directly or indirectly to EPA standards. The table also indicates the degree of need for further study in order to designate these properties as part of FUSRAP, based upon the assumptions of EPA standards and the presence of residual uranium mill tailings from the Monticello millsite.

In Table 2, properties with HIG values of 35 μR/hr or greater are isolated because they exceed the EPA exposure-rate standard of background [15 μR/hr for the Monticello area (Abramiuk, 1983)] plus 20 μR/hr. Properties with HOG values of 20 μR/hr or greater are isolated based on a similar criterion (background plus 3-5 μR/hr) found to be successful in identifying contaminated lands under the Grand Junction Remedial Action Program (H. Langner, BFEC, personal communication, April 1983). However, the HOG exposure-rate criterion should not be used to supplant the EPA radium-in-soil standard.

Sampling

A compilation of results from spectral (eU) and chemical (U) analysis of the 60 samples taken from 35 of the properties is presented in Table 3. Also included is the radium concentration for each sample based on the conversion equation by George and Knight (1982):

$$\frac{pCi}{g} \text{ Ra-226} = 0.3337 \text{ (wt-ppm eU)}$$

The eU/U ratios vary from 0.22 to 5.56, and, on the basis of the expected behavior of the ratio for uranium mill tailings versus uranium ore and vanadium mill tailings, it is clear that two properties (100 and 104) contain uranium tailings. (We can make the assumption that they are from the Monticello millsite.) Note that in Table 2 property 104 has been shown to exceed the EPA exposure-rate standard and property 100 is a "possible." If we assume a cutoff value of the ratio to be 1.5 (not a statistically based number) for the probable presence of uranium mill tailings, then properties 39, 85, 86, 88, 95, and 102 fit that category (Table 3); from Table 2, property 39 has been shown to exceed the EPA exposure-rate standard and the five remaining properties are in the "possible" category. Several other properties with higher uranium concentrations (e.g., 4, 43, 48, and 105) clearly contain uranium ore and/or vanadium mill tailings.

The data in Table 3 indicate the distinct possibility of using the eU/U approach to help determine the origin of contamination on individual Monticello vicinity properties. However, the final discrimination procedure would, of course, have to result from a more thorough, systematic, and statistical study than that presented above.

DISCUSSION AND CONCLUSIONS

Until a definitive study (see below) can be done to obtain a reliable method to determine the outside origin of radioactive materials on individual properties at Monticello, we cannot make a firm recommendation that any of the properties investigated here be designated (assuming EPA standards) under FUSRAP. However, from Table 2, we can say that 15 properties are very good candidates (especially 39 and 104, based on sampling results); 50 more properties are "possibles" and should be surveyed with in-situ radium measuring instruments to facilitate direct comparison with the EPA radium-in-soil standard. Of these 50 properties, at least 5 (85, 86, 88, 95, and 102) should be investigated first because of the probable presence of uranium mill

tailings. Finally, 39 properties, as shown in Table 2, are poor candidates for designation, and further measurements should be given the lowest priority.

It is interesting albeit disconcerting that 9 of the 16 "requested" properties (none shown as anomalous in the 1971 and 1980 mobile surveys) have HOG readings $\geq$20 μR/hr, and are therefore "possibles." On the other hand, 39 of the mobile survey anomalies could not be substantiated. These facts bring into question the practice of relying mainly on mobile scanning surveys to identify individual properties for further on-site investigation.

The ancillary sampling study was by no means rigidly designed or statistically based. The results are encouraging, though, that a definitive study could lead to determination of criteria for distinguishing uranium mill tailings from uranium ore or vanadium mill tailings. Such a study is proposed in Appendix C.

ACKNOWLEDGMENTS

The authors wish to acknowledge the support of Dr. William E. Mott, Director, Public Safety Division, and members of his staff. Special mention and thanks also go to Larry F. Anderson, Director, Bureau of Uranium Mill Tailings Management, Utah Department of Health, and Wayne Ball, Southeastern Utah District Health Department.

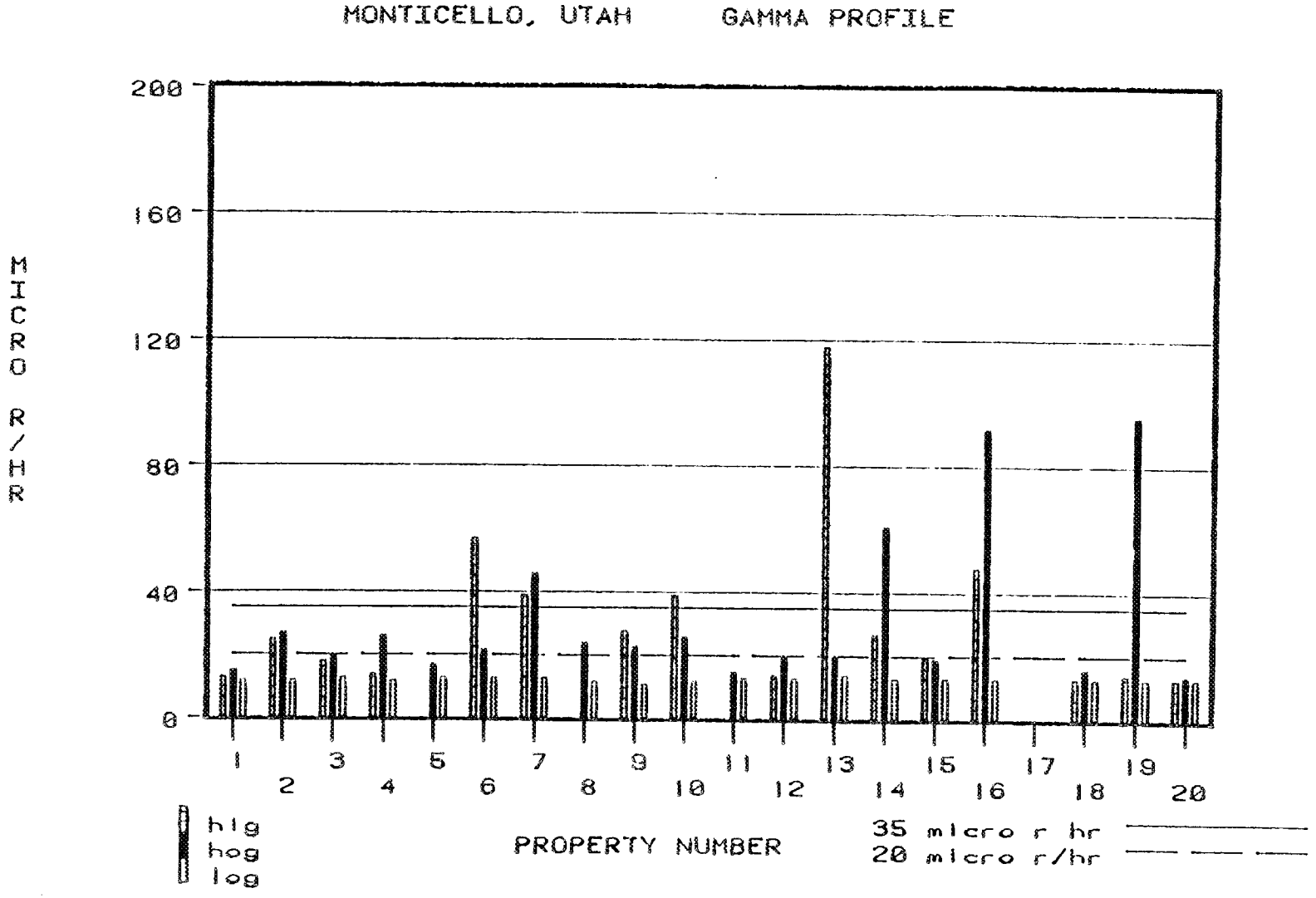


Figure 2A. Gamma Exposure Rates (corrected) for Properties 1 through 20

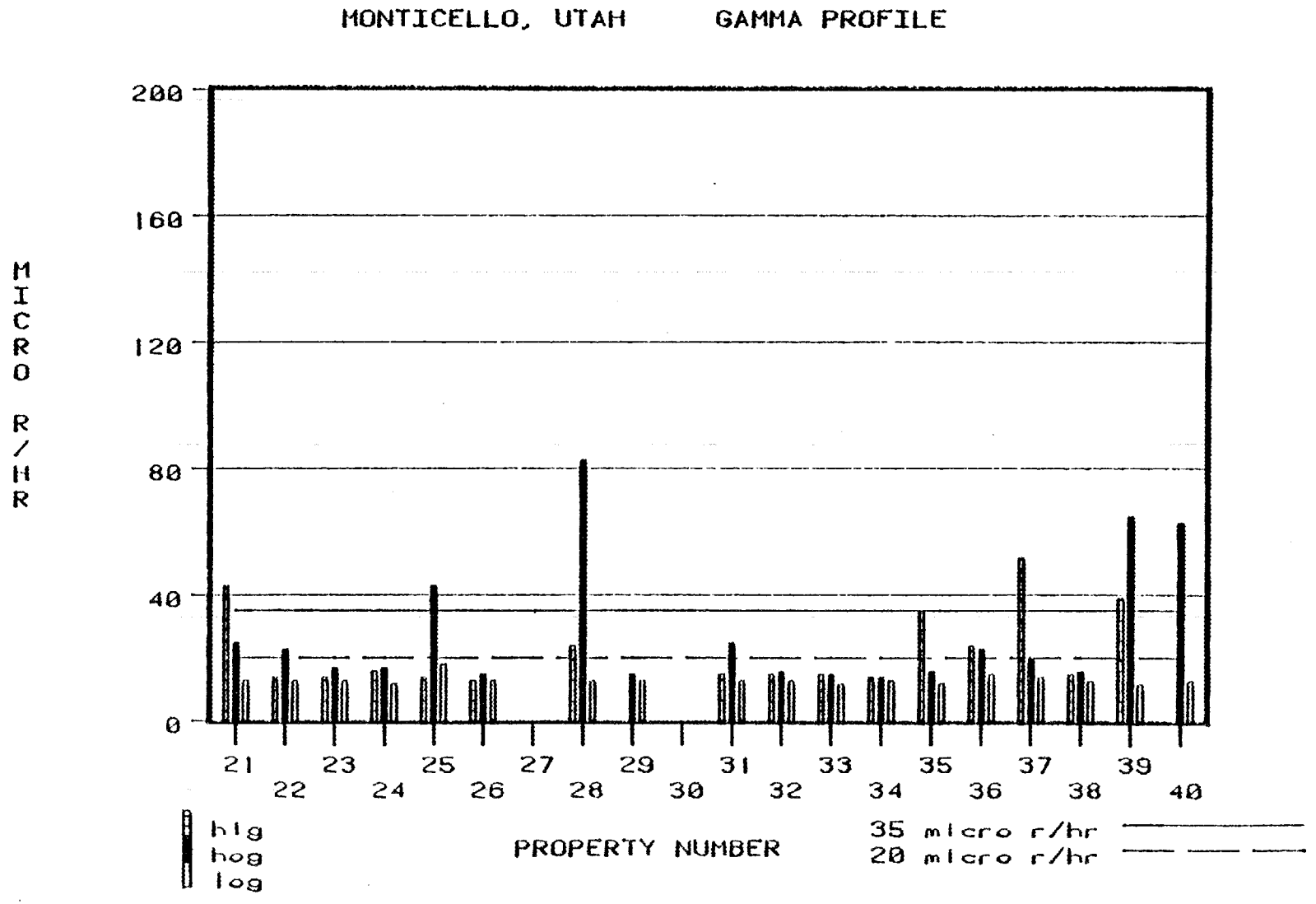


Figure 2B. Gamma Exposure Rates (corrected) for Properties 21 through 40

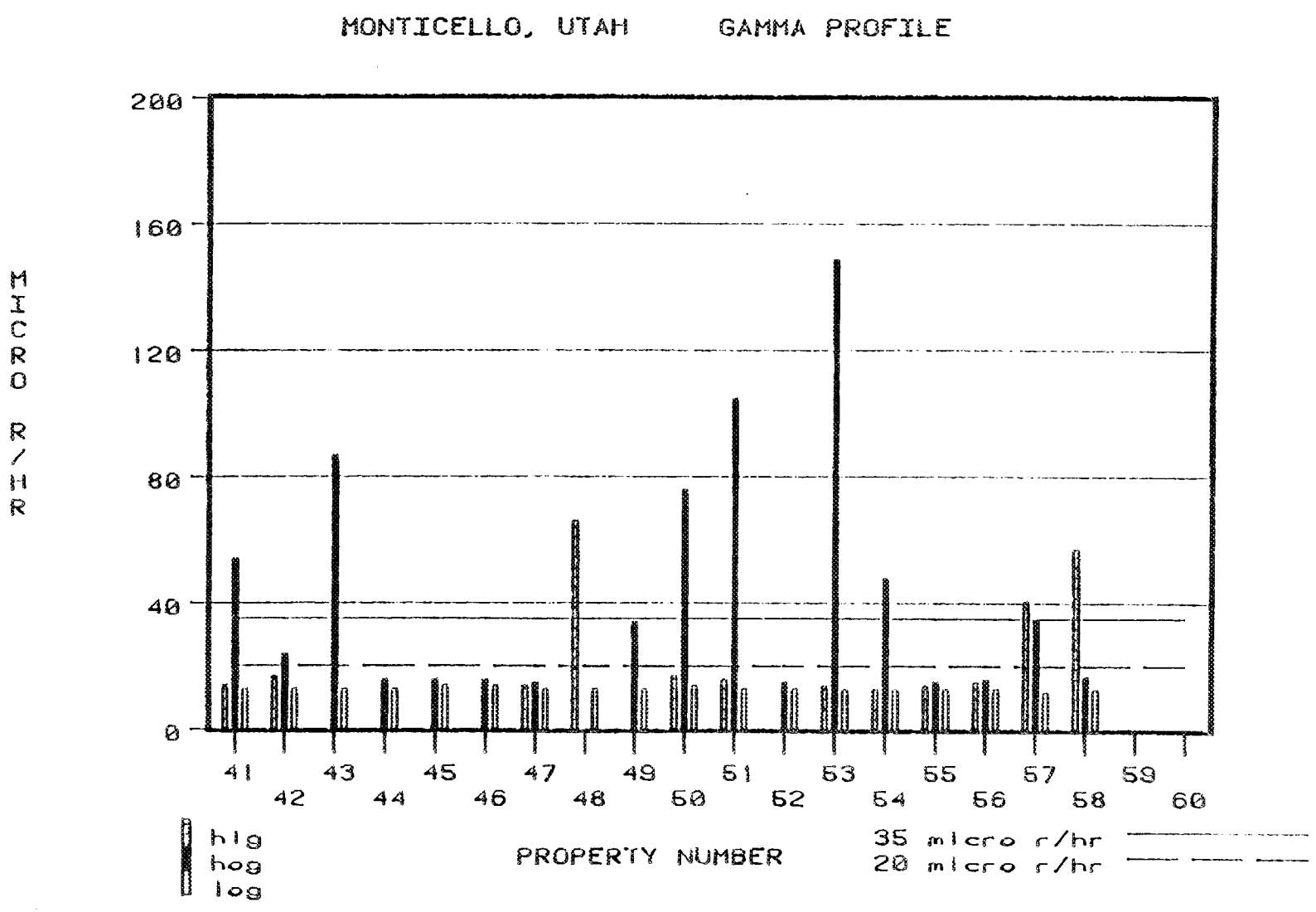


Figure 2C. Gamma Exposure Rates (corrected) for Properties 41 through 60

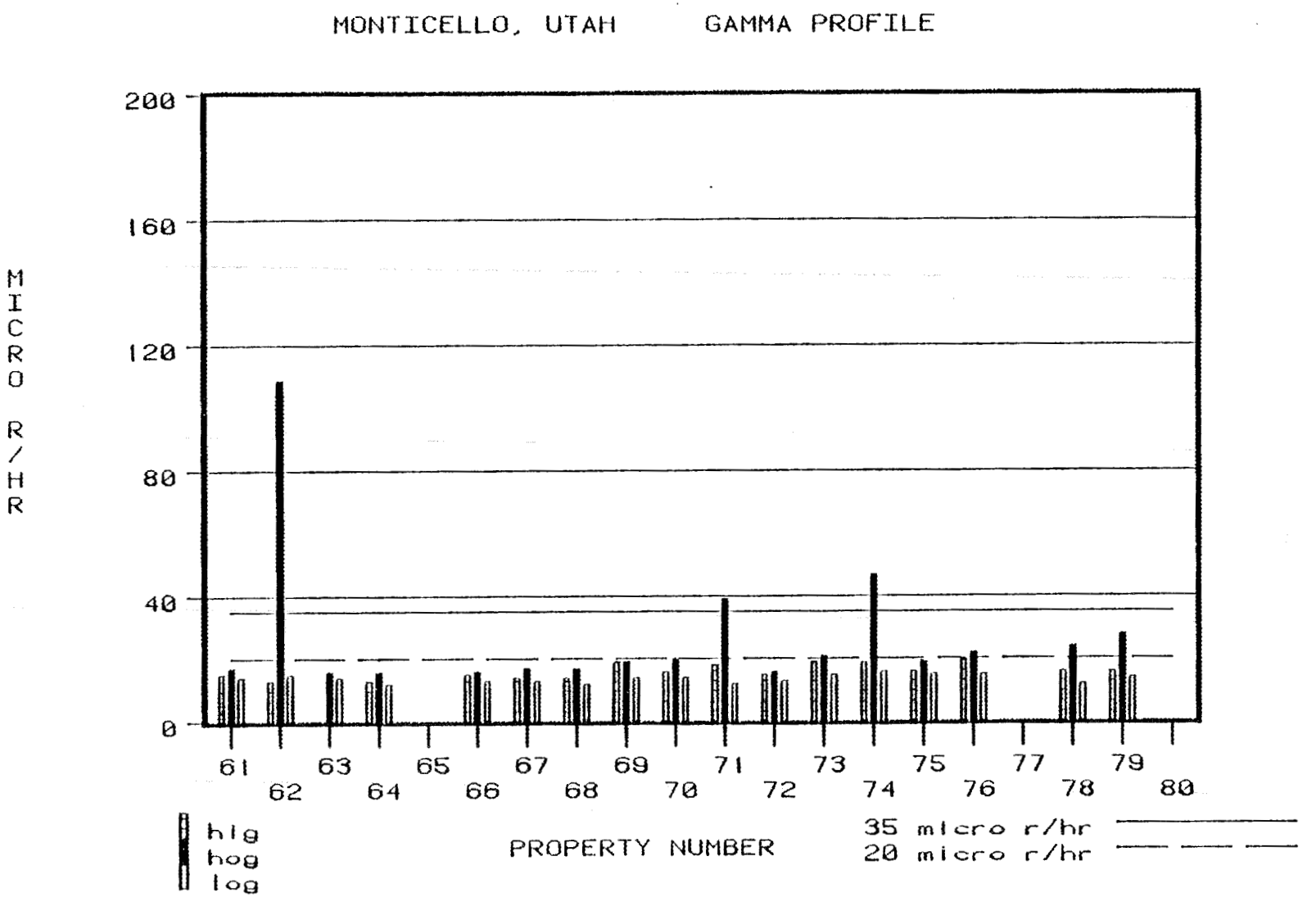


Figure 20. Gamma Exposure Rates (corrected) for Properties 61 through 80

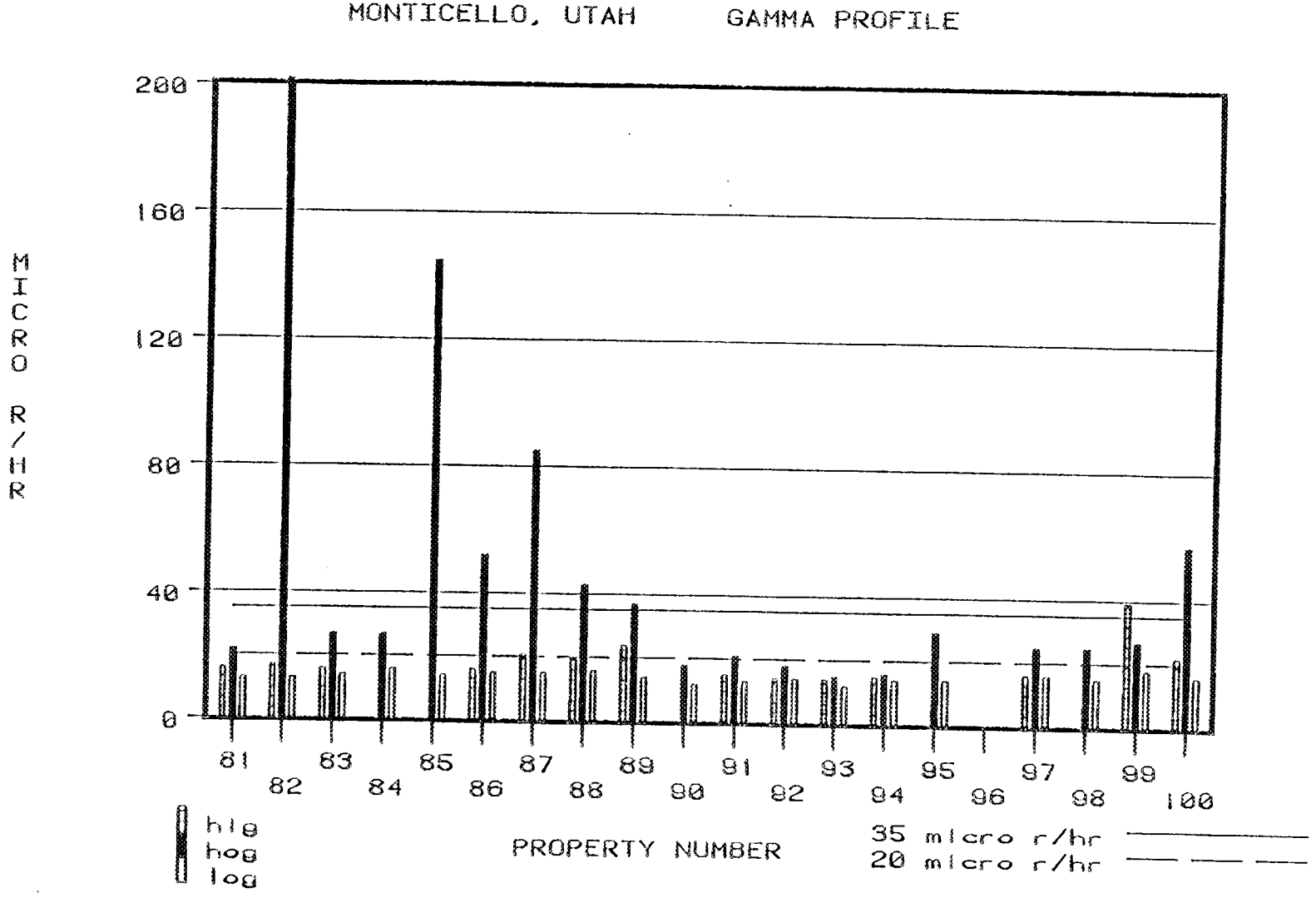


Figure 2E. Gamma Exposure Rates (corrected) for Properties 81 through 100

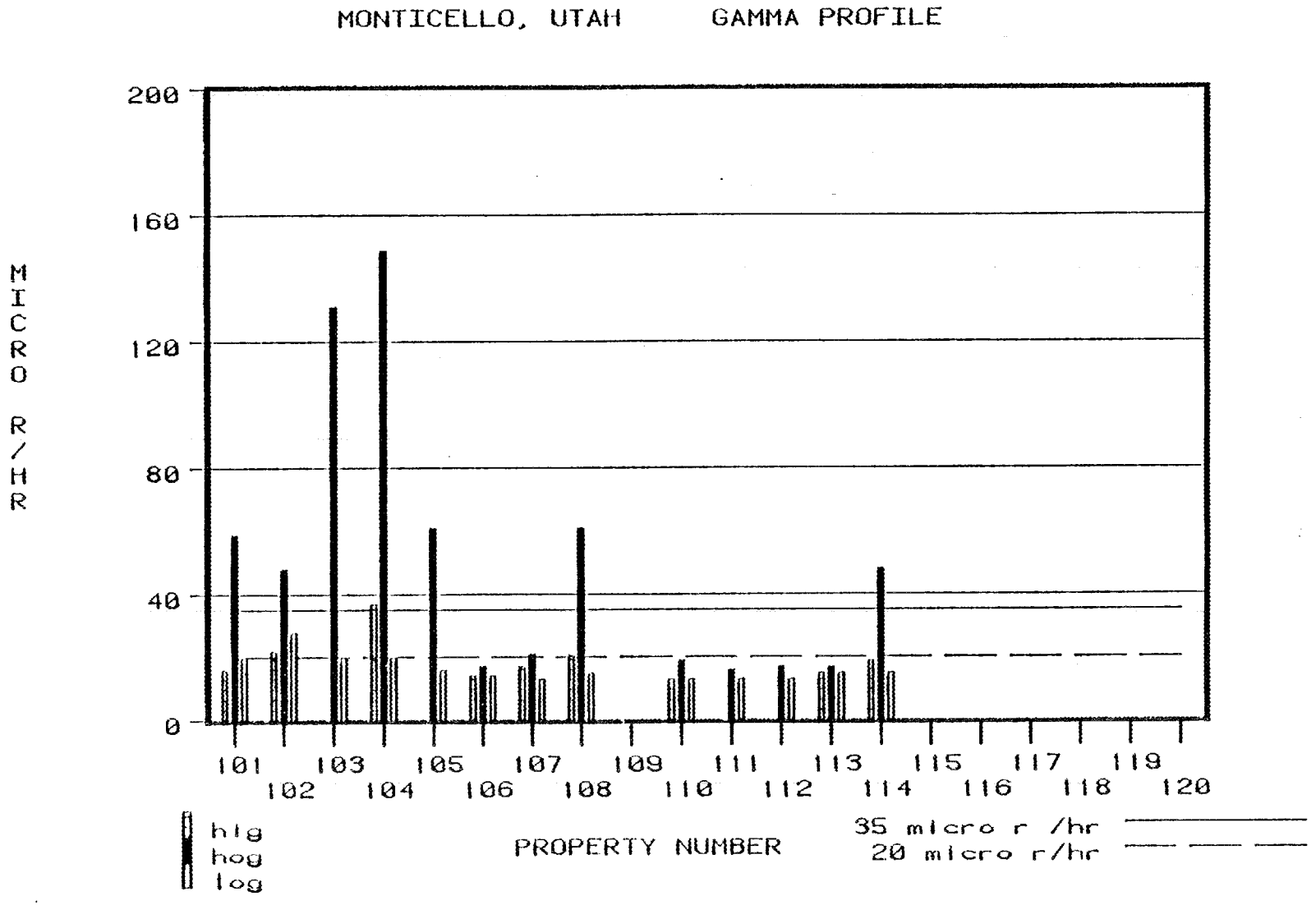


Figure 2F. Gamma Exposure Rates (corrected) for Properties 101 through 114

Table 1. Gamma Screening Survey Data

Survey Number	Mobile Survey Anomaly Number 1971	Mobile Survey Anomaly Number 1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
1	--	31	--	--	R	333 Silverstone West	13	15	12	0
2	--	30	--	--	R	248 Silverstone West	25	27	12	0
3	--	22	--	--	R	32 Pinion Drive	18	20	13	0
4	45	24	--	--	R	32 Blue Mountain Drive	14	26	12	1
5	--	32	--	--	OL, R	North end of Cedar Lane	--	17	13	0
6	--	29	--	--	R	333 Silverstone East	57	22	13	1
7	--	27	--	--	R	348 Silverstone East	39	46	13	0
8	--	28	--	--	OL, R	Lot #9 in Silverstone Subdivision	--	24	12	0
9	--	21	--	--	R	465 Oakcrest Drive	28	23	11	0
10	--	25	--	--	R	32 Parkview Drive	39	26	12	0
11	--	26	--	--	OL, R	249 Blue Mountain Drive	--	15	13	0
12	--	47	--	--	R	380 Abajo Drive	14	20	13	0
13	46	48	--	--	R	381 Abajo Drive	118	20	14	0
14	53	--	--	--	R	165 North 1st West	27	61	13	1
15	54	--	--	--	R	65 North 1st West	20	19	13	0

[a] OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b] HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
16	--	20	--	--	R	65 South 2nd West	48	92	13	1
17	--	45	--	X	R	149 West 1st South	--	--	--	--
18	--	54	--	--	R	180 West 3rd South	13	16	13	0
19	--	49	--	--	R	316 South 1st West	14	96	13	0
20	--	19	--	--	R	396 South 2nd West	13	14	13	0
21	61	--	--	--	R	381 South 2nd West	43	25	13	1
22	57	--	--	--	R	216 Uranium Drive	14	23	13	0
23	58	--	--	--	R	196 Uranium Drive	14	17	13	1
24	55	--	--	--	P	480 South 1st West	16	17	12	0
25	59	56	--	--	R	516 Circle Drive	14	43	18	0
26	--	58	--	--	R	233 Uranium Drive	13	15	13	0
27[c]	60	--	--	--	--	--	--	--	--	--
28	62	57	--	--	R	197 South Uranium	24	83	13	0
29	56	--	--	--	OL, R	350 South 2nd West	--	15	13	0
30	18	59	--	X	R	564 Circle Drive	--	--	--	--

[a]OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b]HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

[c]Unable to locate.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
31	--	40	--	--	R	96 West 2nd North	15	25	13	0
32	52	--	--	--	R	48 West 1st North	15	16	13	0
33	11	--	--	--	C	16 South Main	15	15	12	0
34	--	18	--	--	R	49 South 1st West	14	14	13	0
35	--	46	--	--	C	80 South Main	35	16	12	0
36	--	5	--	--	C	116 South Main	24	23	15	2
37	--	6	--	--	C	180 South Main	52	20	14	1
38	43	--	--	--	R	16 West 2nd South	15	16	13	0
39	--	7	--	--	C	248 South Main	39	65	12	1
40	--	8	--	--	OL, C	280 South Main	--	63	13	0
41	12	--	--	--	C	286 South Main	14	54	13	1
42	13	9	--	--	C	296 South Main	17	24	13	0
43	40	53	--	--	OL, C	296 South Main	--	87	13	1
44	14	--	--	--	OL, R	364 South Main	--	16	13	0
45	50	--	--	--	OL, R	80 West 4th South	--	16	14	0

[a] OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b] HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
46	49	--	--	--	OL, R	390 South Main	--	16	14	0
47	--	10	--	--	R	432 South Main	14	15	13	0
48	15	--	--	--	R	464 South Main	66	360	13	1
49	16	--	--	--	OL, R	480 South Main	--	34	13	0
50	17	11	--	--	R	496 South Main	17	76	14	1
51	19	12	--	--	C	533 South Main	16	105	13	0
52	10	--	--	--	OL, R	62 East 6th North	--	15	13	0
53	8	--	--	--	R	64 East 5th North	14	149	13	0
54	9	--	--	--	R	164 East 5th North	13	48	13	0
55	7	--	--	--	R	432 North Main	14	15	13	0
56	--	17	--	--	R	132 North Main	15	16	13	0
57	--	41	--	--	R	65 East 1st North	41	35	12	0
58	--	16	--	--	P	117 South Main	57	17	13	0
59[c]	--	15	--	--	C	181 South Main	--	--	--	--
60[c]	6	14	--	--	P	197 South Main	--	--	--	--

[a]OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b]HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

[c]Property was surveyed and the Remedial Action Engineering Assessment completed prior to the 1982 survey.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
61	5	--	--	--	R	317 South Main	15	17	14	0
62	41	--	--	--	R	316 South 1st East	13	109	15	1
63	4	--	--	--	OL, R	323 South Main	--	16	14	0
64	3	--	--	--	R	333 South Main	13	16	12	0
65	2	--	--	X	OL, R	359 South Main	--	--	--	--
66	1	--	--	--	R	417 South Main	15	16	13	0
67	--	--	X	--	R	48 East 4th South	14	17	13	0
68	--	13	--	--	R	449 South Main	14	17	12	0
69	36A	--	--	--	R	96 East 4th South	19	19	14	4
70	--	--	X	--	R	432 South 1st East	16	20	14	0
71	--	--	X	--	R	464 South 1st East	18	39	12	1
72	--	--	X	--	R	493 South Main	15	16	13	0
73	--	--	X	--	R	65 East 5th South	19	21	15	0
74	--	--	X	--	R	87 East 5th South	19	47	16	0
75	--	--	X	--	R	16 East 5th South	16	19	15	2

[a] OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b] HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
76	--	--	X	--	R	98 East 5th South	20	22	15	0
77	20	--	--	X	R	615 South Main	--	--	--	--
78	--	42	--	--	R	96 North 1st East	16	24	12	2
79	--	--	X	--	R	181 East 1st South	16	28	14	1
80	39	33	--	X	R	80 South 2nd East	--	--	--	--
81	--	34	--	--	R	197 East 2nd South	16	22	13	0
82	--	52	--	--	R	197 East 3rd South	17	202	13	2
83	--	35	--	--	R	196 East 3rd South	16	27	14	0
84	27	--	--	--	OL, R	384 South 2nd East	--	27	16	0
85	28	36	--	--	R	396 South 2nd East	--	145	14	1
86	51	--	--	--	R	164 East 4th South	16	52	15	1
87	--	--	X	--	R	148 East 4th South	21	85	15	2
88	36B	--	--	--	R	433 South 1st East	20	43	16	4
89	--	43	--	--	R	164 East 1st North	24	37	14	0
90	21	--	--	--	OL, C	260 East Central	--	18	12	0

[a] OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b] HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	uR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
91	38	--	--	--	R	265 East 1st South	15	21	13	2
92	37	--	--	--	OL, C	273 East 1st South	14	18	14	0
93	--	--	X	--	C	80 South 3rd East	14	15	12	0
94	--	--	X	--	R	281 East 1st South	15	16	14	0
95	35	--	--	--	OL, R	137 South 2nd East	--	29	14	2
96[c]	22,42	38	--	--	R	196 South 3rd East	--	--	--	--
97	34	--	--	--	P	217 South 2nd East	16	25	16	0
98	23	--	--	--	OL, R	248 South 3rd East	--	25	15	1
99	--	51	--	--	R	280 South 3rd East	39	27	18	0
100	33	37	--	--	C	333 South 2nd East	22	57	16	2
101	32	--	--	--	R	389 South 2nd East	16	59	20	0
102	31	55	--	--	R	417 South 2nd East	22	48	28	1
103	30	--	--	--	OL, R	449 South 2nd East	--	131	20	2
104	29	--	--	--	R	449 South 2nd East	37	149	20	6
105	--	--	X	--	OL, R	South of millsite on hill	--	61	16	3

[a]OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b]HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

[c]Property was surveyed and the Remedial Action Engineering Assessment completed prior to the 1982 survey.

Table 1. Gamma Screening Survey Data (continued)

Survey Number	Mobile Survey Anomaly Number 1971	1980	Survey Requested	Survey Refused	Property Classification[a]	Address	μR/hr (corrected)[b] HIG	HOG	LOG	No. of Samples Taken
106	24	--	--	--	R	332 East Central	14	17	14	0
107	--	39	--	--	R	249 South 3rd East	17	21	13	3
108	--	50	--	--	C	395 East 3rd South	21	61	15	2
109[c]	--	44	--	--	R	--	--	--	--	--
110	--	--	X	--	R	317 Meadowlark Lane	13	19	13	1
111	26	--	--	--	OL, C	539 East Central	--	16	13	0
112	25	--	--	--	OL, C	665 East Central	--	17	13	0
113	--	--	X	--	R	585 East Highway	15	17	15	0
114	--	--	X	--	R	225 South 2nd East	19	48	15	0

[a]OL = Open Lands; R = Residential; C = Commercial; P = Public.

[b]HIG = High Inside Gamma; HOG = High Outside Gamma; LOG = Low Outside Gamma.

[c]Unable to locate.

Table 2. Summary of Gamma Screening Results (corrected values)

Exposure Rate[a]	Total Properties and Survey Number(s)					Total Properties
	Residential	Residential Open Lands	Commercial	Commercial Open Lands	Public	
HIG ≥ 35 μR/hr and HOG < 20 μR/hr Exceeds EPA standard of BG + 20 μR/hr indoors; may not require further study.	0 properties	N/A	1 property: 35	N/A	1 property: 58	2
HIG ≥ 35 μR/hr and HOG ≥ 20 μR/hr Exceeds EPA standard of BG + 20 μR/hr indoors and possibly exceeds EPA radium standard outdoors; may not require further study.	11 properties: 6, 7, 9, 10, 13, 16, 21, 48, 57, 99, 104	N/A	2 properties: 37, 39	N/A	0 properties	13
HIG < 35 μR/hr and HOG ≥ 20 μR/hr Possibly exceeds EPA radium standard outdoors; further study required.	34 properties: 2, 3, 4, 12, 14, 19, 22, 25, 28, 31, 50, 53, 54, 62, 70, 71, 73, 74, 76, 78, 79, 81, 82, 83, 85, 86, 87, 88, 89, 91, 101, 102, 107, 114	7 properties: 8, 49, 84, 95, 98, 103, 105	6 properties: 36, 41, 42, 51, 100, 108	2 properties: 40, 43	1 property: 97	50
HIG < 35 μR/hr and HOG < 20 μR/hr Further study to determine if EPA standards are exceeded is not necessary or of low priority.	24 properties: 1, 15, 18, 20, 23, 26, 32, 34, 38, 47, 55, 56, 61, 64, 66, 67, 68, 69, 72, 75, 94, 106, 110, 113	8 properties: 5, 11, 29, 44, 45, 46, 52, 63	2 properties: 33, 93	4 properties: 90, 92, 111, 112	1 property: 24	39
Not Surveyed	6 properties: 17, 27, 30, 80, 96, 109	2 properties: 65, 77	1 property: 59	0 properties	1 property: 60	10
TOTALS (114 properties)	75	17	12	6	4	114

[a] HIG = High Inside Gamma; HOG = High Outside Gamma.

Table 3. Results of Sample Analysis

Property Number	BFEC Sample Number	Gamma Spectroscopy Analysis Ra (pCi/g)	Gamma Spectroscopy Analysis eU (ppm)	Chemical Analysis U (ppm)	eU/U (ratio)	Sample Material
4	MMR 909	9,583	28,972	42,000	0.69	rock
6	977	7	22	18	1.22	soil
14	908	8	232	281	0.83	gravel
16	907	5	458	501	0.91	sandbox
21	982	6	19	13	1.46	soil
23	976	81	242	336	0.72	soil
36	978	49	146	136	1.07	mortar
	985	-	-	7	-	brick
37	979	80	240	264	0.91	mortar
39	999	5	103	47	2.19	mortar and dirt
41	997	324	969	1,402	0.69	soil
43	998	7,430	22,230	22,570	0.98	soil
48	851	6,932	20,742	20,845	1.00	soil
50	993	659	1,973	1,850	1.07	soil
62	852	2	1,012	765	1.32	soil
69	956	2	7	6	1.17	soil
	957	2	7	6	1.17	soil
	973	3	9	8	1.07	soil
	974	4	11	8	1.37	soil
71	904	10	30	29	1.03	soil
75	905	7	20	14	1.43	soil
	906	7	22	20	1.10	soil
78	983	276	819	852	0.96	soil
	984	3	9	9	1.00	soil
79	962	3	9	7	1.34	soil
82	980	10	30	25	1.20	soil
	981	11	34	28	1.21	soil
85	972	29	86	51	1.69	soil
86	994	264	791	410	1.93	soil
87	995	99	297	267	1.11	soil
	996	75	226	191	1.18	soil

Table 3. Results of Sample Analysis (continued)

Property Number	BFEC Sample Number	Gamma Spectroscopy Analysis Ra (pCi/g)	Gamma Spectroscopy Analysis eU (ppm)	Chemical Analysis U (ppm)	eU/U (ratio)	Sample Material
88	MMR 958	34	102	64	1.59	soil
	959	36	108	78	1.39	soil
	960	15	44	47	0.94	soil
	961	19	55	44	1.25	soil
91	969	8	24	27	0.89	soil
	970	11	32	29	1.10	soil
95	951	19	55	23	2.39	soil
	952	12	36	36	1.00	soil
98	971	18	52	52	1.00	soil
100	986	61	183	133	1.38	soil
	987	7,515	22,485	4,797	4.69	rock and soil
102	953	40	119	57	2.09	soil
103	963	228	680	673	1.01	soil
	964	132	393	285	1.38	soil
104	954	<1	3	3	1.00	soil
	955	126	375	319	1.18	soil
	965	149	443	340	1.30	soil
	966	112	334	1,524	0.22	soil
	967	419	1,252	225	5.56	soil
	968	236	706	367	1.92	soil
105	990	2,514	7,522	7,060	1.06	soil
	991	1,067	3,193	3,030	1.05	soil
	992	3,032	9,073	9,160	0.99	soil
107	901	4	13	12	1.08	soil
	902	11	29	20	1.45	soil
	975	11	34	36	0.94	soil
108	988	74	222	235	0.94	soil
	989	155	465	390	1.19	soil
110	903	8	23	17	1.35	soil

REFERENCES

Abramiuk, Nick, 1983, Background radiation study in Monticello site analysis report: Bendix Field Engineering Corporation, Grand Junction, Colorado, in preparation for the U.S. Department of Energy.

Arix, 1980, Engineering assessment and remedial action plan at the H.S. Randall residence, nine North Third East Street,* Monticello, Utah, 24 p.

Arix, 1981, Engineering assessment and remedial action plan at Montgomery Wards catalogue sales store (and the post office), eighteen North Main Street,* Monticello, Utah, 26 p.

Bendix Field Engineering Corporation, 1982, Utah surface gamma-ray scanner survey: Grand Junction, Colorado, prepared for the U.S. Environmental Protection Agency, Office of Radiation Programs, Las Vegas, BFEC-1982-7, 100 p.

George, D. C., and Knight, L., 1982, Field calibration facilities for environmental measurement of radium, thorium, and potassium: Bendix Field Engineering Corporation, Grand Junction, Colorado, U.S. Department of Energy Report GJ/TMC-01(82), 53 p.

U.S. Environmental Protection Agency, Office of Radiation Programs, National Environmental Research Center, Las Vegas, 1972, Community summary report for radiation surveys, Monticello, Utah: Lucius Pitkin, Inc., Grand Junction, Colorado, prepared for the U.S. Atomic Energy Commission, 18 p.

U.S. Environmental Protection Agency, 1983, Standards for remedial actions at inactive uranium processing sites (40 CFR Part 192), Federal Register, 5 January 1983.

*Monticello street addresses were changed between publication of the Arix reports and the 1982 screening survey.

Appendix A

SAMPLE COVER LETTER, PERMIT FORM/QUESTIONNAIRE, AND PRESS RELEASE

Department of Energy
P.O. Box 2567
Grand Junction, CO 81502-2567

June 7, 1982

Dear Property Owner:

As you may know, the United States Atomic Energy Commission operated the Monticello uranium mill from 1949 until shutdown in January 1960. Stabilization of the mill tailings piles was completed in 1962. Dismantling of the mill was completed in 1964 and the ore stockpile areas were cleaned up during 1974-1975.

In 1979 the U.S. Department of Energy (DOE) established the Surplus Facilities Management Program to decommission DOE facilities surplus to the Department's needs, to eliminate potential hazards to public health and to the environment, and if possible to permit other productive uses of the facilities and/or property in the future.

In cooperation with the DOE and as part of this remedial action effort, the U.S. Environmental Protection Agency (EPA) and representatives of the Utah State Health Department have conducted preliminary surveys to determine if mill tailings were used or transported to any vicinity properties in Monticello. Your property has tentatively been identified as having elevated radioactive readings in comparison to the normal background radioactivity level in the Monticello area.

The purpose of this letter is to obtain your permission to conduct a gamma survey of your property to determine whether radioactive materials, and especially uranium mill tailings deposits, are in fact present. The survey will be primarily looking for uranium mill tailings but may also identify objects such as luminous-dial instruments, propane tanks, petrified wood or bone, and ore samples that may have caused your property to be identified for inclusion in the gamma survey effort. Firebrick and some brick and tile may also contribute to elevated readings due to the natural radioactivity of the material used in their manufacture.

The gamma survey will be conducted by Bendix Field Engineering Corporation (BFEC), contractor to the DOE and based in Grand Junction, Colorado. A permission and information form granting the survey team (two persons) access to your property is enclosed for your signature. Following your signing and returning of the form, and its acceptance by DOE, you will be contacted directly by the team's supervisor for schedule arrangements.

While a minimum need is currently identified for the collection of soil and/or construction samples for assay, this letter warrants that BFEC will promptly repair, to the fullest extent practicable, any areas disturbed by digging, sampling or other work performed under the attached agreement.

Your assistance in support of this effort to eliminate any potential radioactive hazard in your community is greatly appreciated. Should you have any questions, please contact one of the following:

Utah State Health Department

Larry Anderson
P.O. Box 2500
Salt Lake City, Utah 84110

(801) 533-5021

U.S. Department of Energy (DOE)

Mike Tucker
P.O. Box 2567
Grand Junction, CO 81502

(303) 242-8621, Ext. 387
FTS 322-9387

Sincerely,

Donald L. Curry
Director, Project Management Division

Enclosures
Permission and Information Form
Return Envelope

Dear Property Owner:

To make this survey more convenient for you and to assist us in scheduling survey personnel, please complete this Permission and Information form and return it in the enclosed stamped and addressed envelope.

Address and/or legal description of your property in Monticello_____

_____

_____

Your telephone no._____

Please indicate use of property (example: home, business, vacant lot, rental property, etc.)_____

_____

_____. Approximate date of original construction_____

Approximate date(s) of subsequent construction_____

If rental, leassee's name _____

Leassee's telephone no._____

The survey usually takes about 2 hours to complete. Please indicate the most convenient days and times for us to do the survey (example: Mondays, Wednesdays and Fridays from 2:15 pm to 6:00 pm). Preferred days_____

_____

Preferred times_____

Your comments_____

_____

_____

_____

I hereby grant DOE and its designees the right to enter on my property for the purpose of conducting radiological surveys.

Your address _____

Owner's Signature _____ Date_____

Leassee's Signature _____ Date_____

PRESS RELEASE ISSUED TO LOCAL PRESS FOLLOWING INFORMATIONAL MEETING

A radiological survey of the former uranium millsite and of a number of private properties in Monticello, Utah, will be conducted during June by personnel of the Bendix Field Engineering Corporation, it was jointly announced today by the Utah Department of Health and the U.S. Department of Energy (DOE).

Bendix, operating contractor for DOE's Grand Junction (Colorado) Area Office, will also award a contract to drill numerous shallow holes in the vicinity of the former millsite. These assessment holes will allow scientists to study the natural background radiation of the Monticello area, the level of radiation at the millsite, and the effects on groundwater from the uranium tailings at the site.

Previous surveys conducted by state and federal agencies have identified about 90 properties in the Monticello area which may have levels of radioactivity which exceed normal background levels. Bendix personnel will be contacting property owners in an attempt to further define the limits and extent of possible mill tailings located on these properties. The elevated radiation levels may be caused by mill tailings, ore samples, or masonry construction materials which typically emit a higher level of natural radioactivity. Some other materials which naturally emit higher levels of radioactivity on occasion include petrified wood or bones, fire brick, tile, and propane.

The purpose of the Monticello survey is to verify the presence or absence of uranium mill tailings, and to determine the source of radiation on each property. The Department of Energy will utilize the information to prepare a basic cost estimate which will be submitted to Congress on which to base a decision to fund possible future remedial action activities in the Monticello area; and to determine the need for future surveys based on Environmental Protection Agency (EPA) standards. EPA is scheduled to publish guidelines in January 1983 establishing safe working levels and radiation exposure limits to reduce potential hazard to the public and to the environment.

-0-

Released by Utah Department of Health
6/3/82

PRELIMINARY

Appendix B

GAMMA SURVEY REPORTS AND MAPS

FOR MONTICELLO PROPERTIES

EXPLANATION OF NUMBERS USED ON GAMMA SURVEY REPORTS

The following categories are listed on the Gamma Survey Report form with the appropriate numbers for each property. Refer to this listing for an explanation of those numbers.

Property Classification

0. Vacant Lot
1. Single-Family Residence
2. Multi ($\leq$4) Family Residence
3. Multi ($>$4) Family Residence
4. Motel, Hotel, or Hospital
5. Single Business (in one unit)
6. Multiple Business Unit (connected)
7. School
8. Church
9. Other

Gamma Map

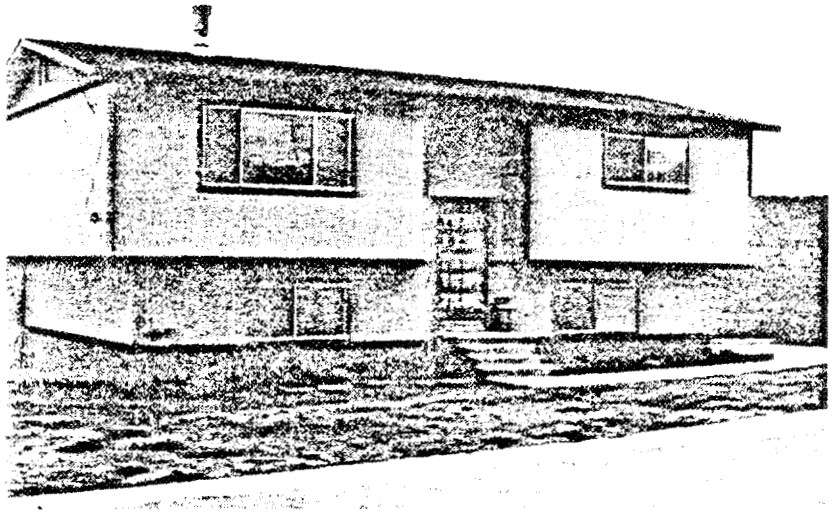
0. None
1. Completed
2. Occupant Refusal
3. No - Ask Owner
4. Owner Refusal
5. Owner Refusal; Signed Refusal Form
6. No One To Contact
7. No - Bad Address
8. Outside Only
9. Special Scheduling
10. Other

Tailings Use

0. None
1. Under
2. Away
3. Under-Away
4. Possible
5. Unknown

Under: Gamma readings are 20 µR/hr or greater inside and/or within 10 feet of habitable structure.

Away: Gamma readings are 20 µR/hr or greater further than 10 feet from habitable structure.



GAMMA SURVEY REPORT

Owner: Mike Palmer

Occupant: Same

Property Classification: 1 Gamma Map: 1 Tailings Use: 9

Type of Structure		Material	
X	Basement		Adobe
	Slab on Grade		House Trailer
	Crawl Space		Masonry
	Unknown	X	Non Masonry

Number of Levels: 2 Other:

Comments: Husband used to work in the mines and has since removed the ore samples.

Elevated reading associated with:

Survey No.: 1
Event No.: 1980 31 1971 -
Street Address: 333 Silverstone West
City/State: Monticello, Utah
County: San Juan
Date: August 10, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	13	11
HOG	15	15
LOG	12	10

Location HIG: Living Room

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No X Number 0

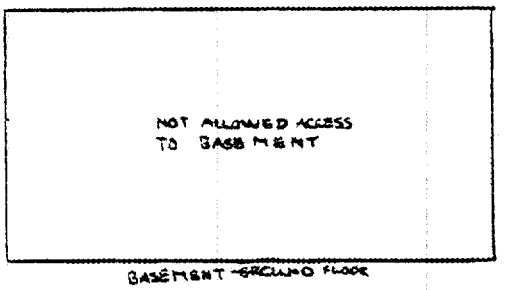
Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

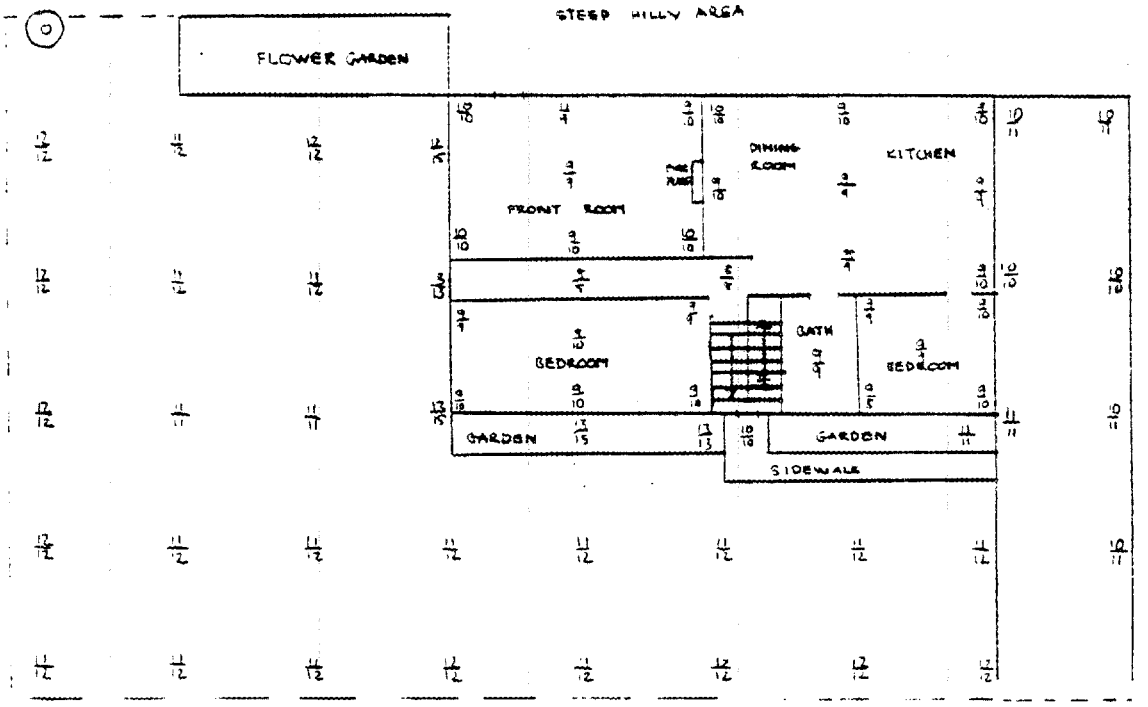
MSS1

N

⑤ - TREE



BASEMENT - GROUND FLOOR



GAMMA SURVEY REPORT

Owner G.O. Miller

Occupant Same

Property Classification 1 Gamma Map 1 Tailings Use 9

Type of Structure	Material
X Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	X Non Masonry
Number of Levels 2	Other ___

Comments: Approximate date of original construction is 1979.

Elevated reading associated with: Brick or mortar in exterior wall, basement wall.

Survey No. 2
Event No. 1980 30 1971 -
Street Address 248 Silverstone West
City/State Monticello, Utah
County San Juan
Date August 3, 1982
Surveyors D.T. & E.B.
Meter No. C.3558.S

	Corrected	Uncorrected
HIG	25	38
HOG	27	42
LOG	12	10

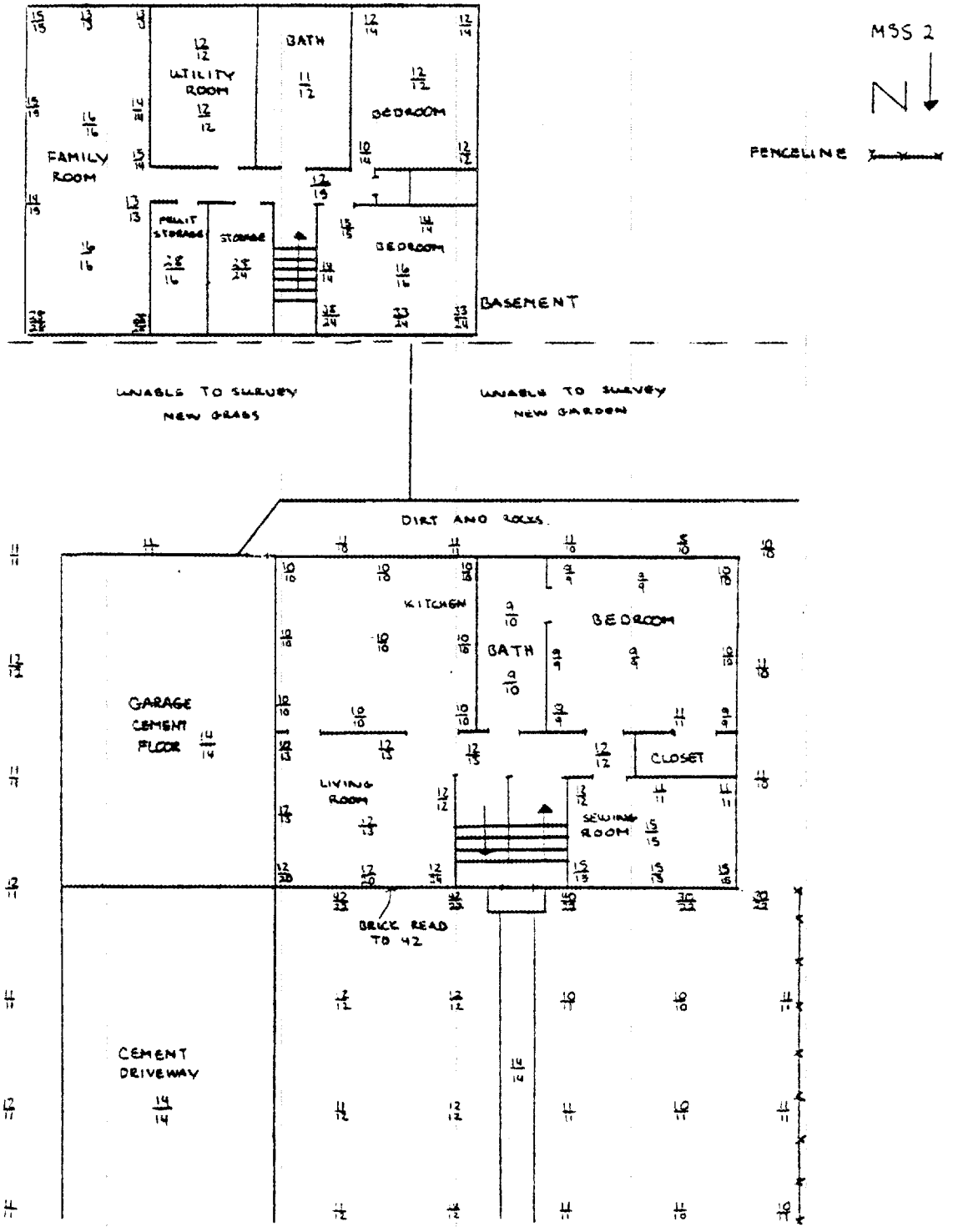
Location HIG Bedroom

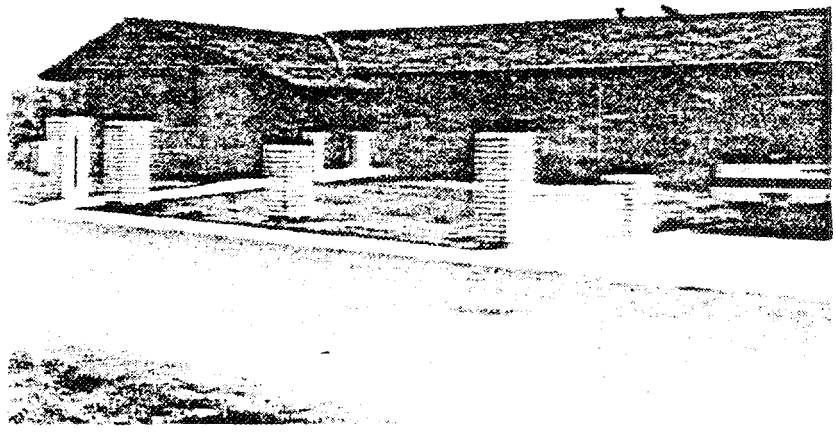
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 2
N
FENCELINE
FAMILY ROOM
UTILITY ROOM
BATH
BEDROOM
FRUIT STORAGE
STORAGE
BEDROOM
BASEMENT
UNABLE TO SURVEY NEW GRASS
UNABLE TO SURVEY NEW GARDEN
DIRT AND ROCKS
GARAGE CEMENT FLOOR
KITCHEN
BATH
BEDROOM
CLOSET
LIVING ROOM
SEWING ROOM
BRICK READ TO 42
CEMENT DRIVEWAY



GAMMA SURVEY REPORT

Owner: Ronald Young

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure		Material	
X	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels: 2 | Other:

Comments: Backyard recently landscaped.

Elevated reading associated with: Brick on exterior wall.

Survey No.: 3
Event No.: 1980 22 1971 -
Street Address: 32 Pinion Drive
City/State: Monticello, Utah
County: San Juan
Date: August 10, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	18	22
HOG	20	27
LOG	13	11

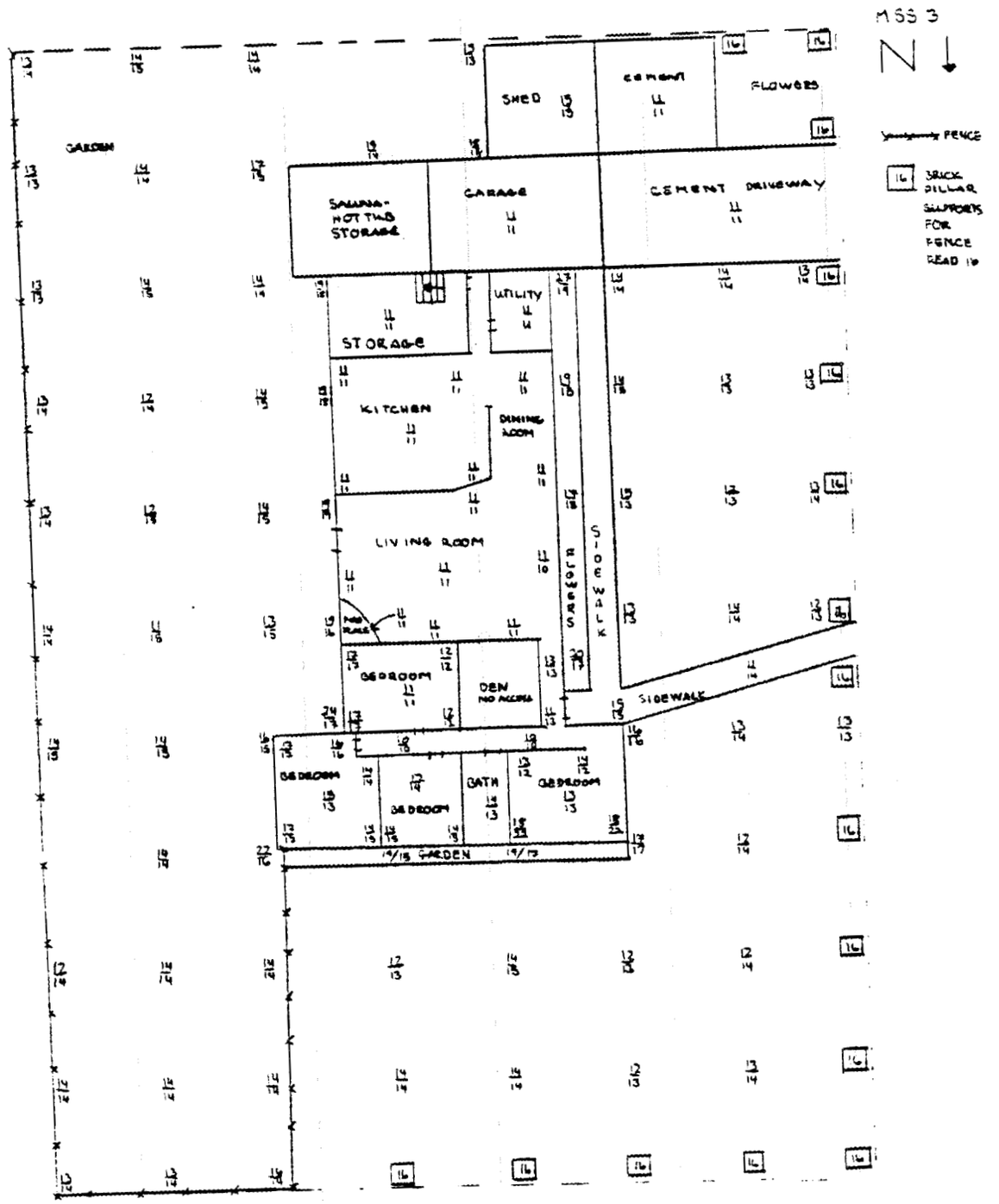
Location HIG: Master Bedroom

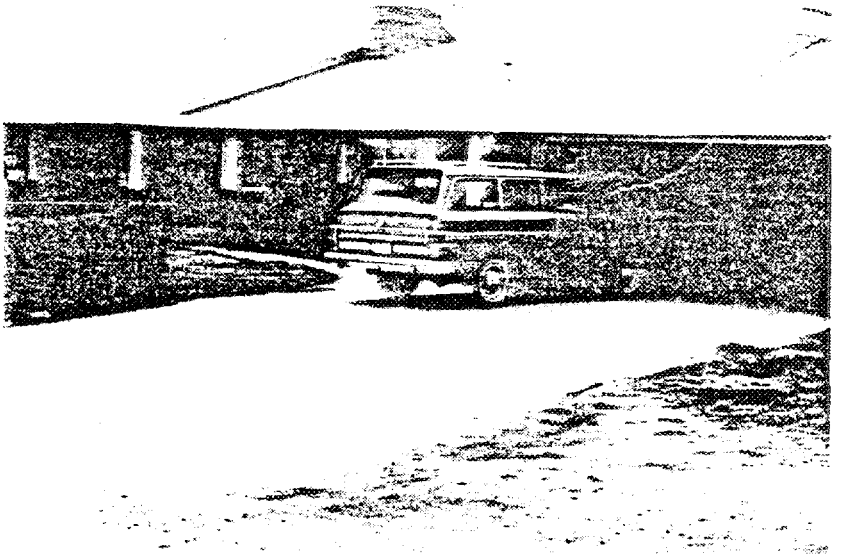
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ___ No X Number 0

Sample Numbers: ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


N 88 3
SHED
CEMENT
FLOWERS
GARDEN
SAUNA-NOT THIS STORAGE
GARAGE
CEMENT DRIVEWAY
UTILITY
STORAGE
KITCHEN
DINING ROOM
LIVING ROOM
BEDROOM
DEN NO ACCESS
SIDEWALK
BEDROOM
BEDROOM
BATH
BEDROOM
GARDEN
BRICK PILLAR SUPPORTS FOR FENCE READ IN



GAMMA SURVEY REPORT

Owner: David Adams

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure		Material	
	Basement		Adobe
X	Slab on Grade		House Trailer
	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels: 1 | Other:

Comments: Ore sample in the yard led to 900 microR/hr. reading.

Elevated reading associated with: Yard (rock collection)

Survey No.: 4
Event No.: 1980 24 1971 45
Street Address: 32 Blue Mtn. Drive
City/State: Monticello, Utah
County: San Juan
Date: August 5, 1982
Surveyors: D.T. & P.B.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	14	14
HOG	26	40
LOG	12	10

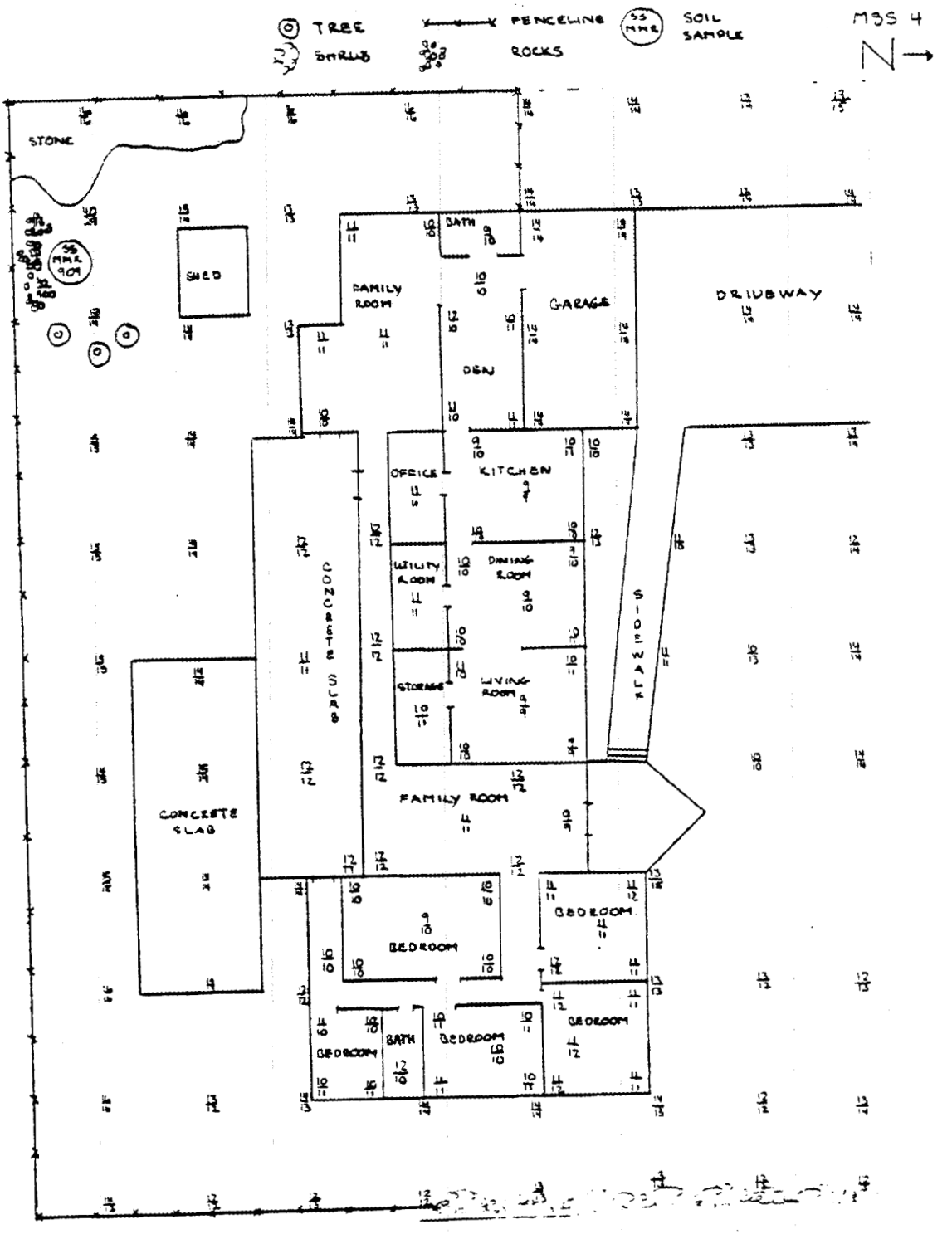
Location HIG: Garage

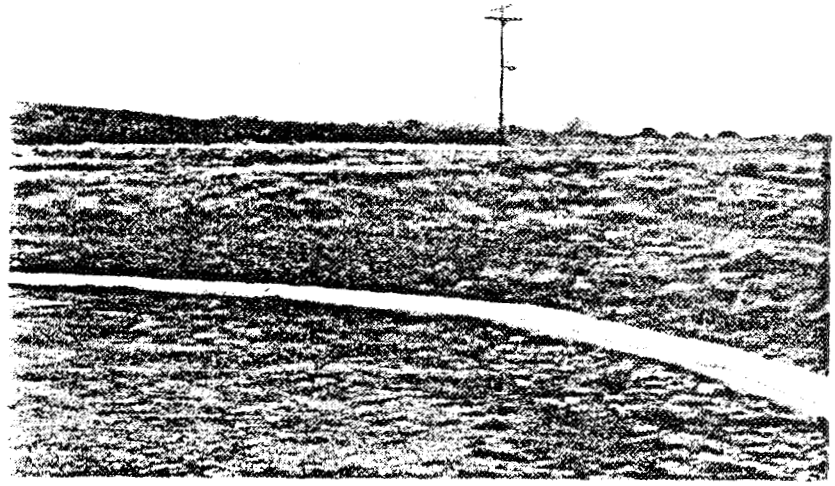
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes X No ____ Number 1

Sample Numbers: MMR 909

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


TREE
SHRUB
FENCELINE
ROCKS
SOIL SAMPLE
MSS 4
N
STONE
SHED
FAMILY ROOM
BATH
GARAGE
DRIVEWAY
DEN
OFFICE
KITCHEN
UTILITY ROOM
DINING ROOM
STORAGE
LIVING ROOM
OVERHANG
SLOPE
CONCRETE SLAB
FAMILY ROOM
BEDROOM
BEDROOM
BEDROOM
BATH
BEDROOM
BEDROOM



GAMMA SURVEY REPORT

Owner Lex Pro Corp.

Occupant Vacant Lot

Property Classification 0 Gamma Map 1 Tailings Use 2

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 5
Event No. 1980 32 1971 -
Street Address North and of Cedar Lane
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors F.C. & P.B.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	-	
HOG	17	20
LOG	13	12

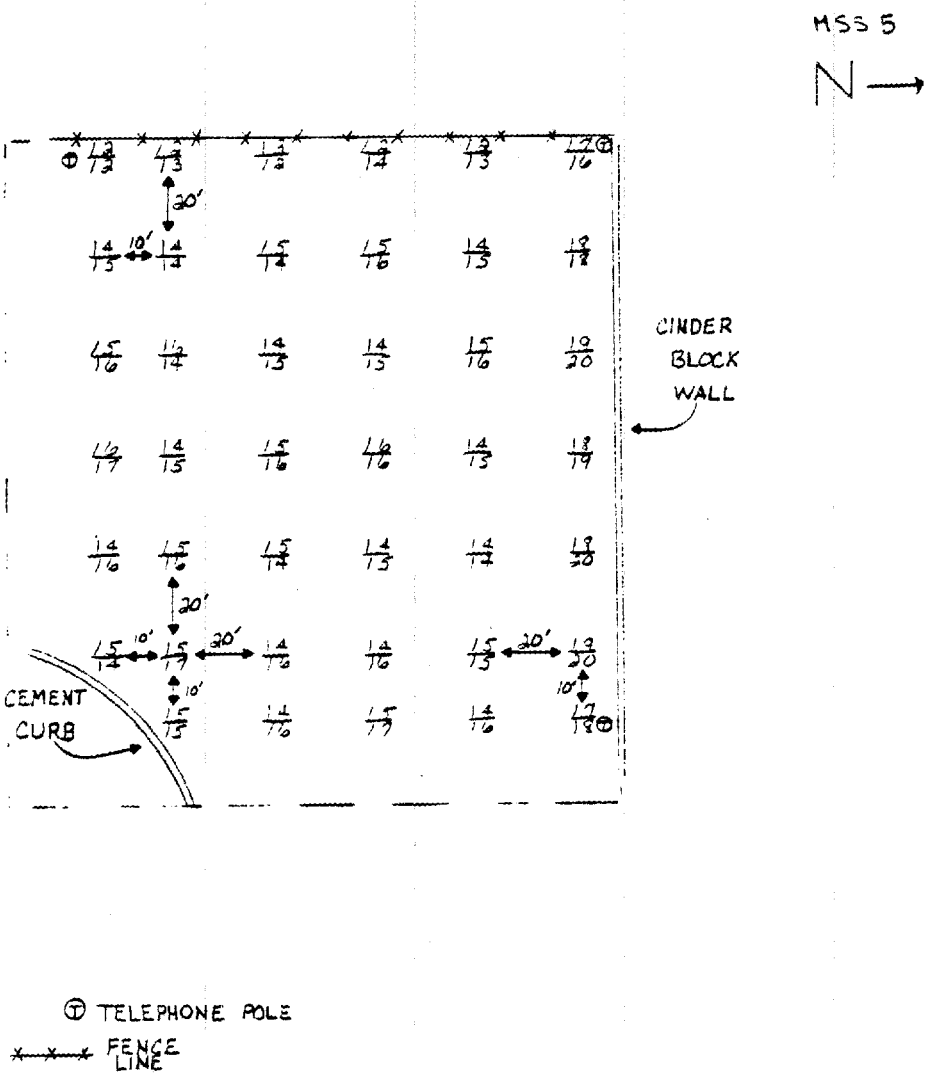
Location HIG ____

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

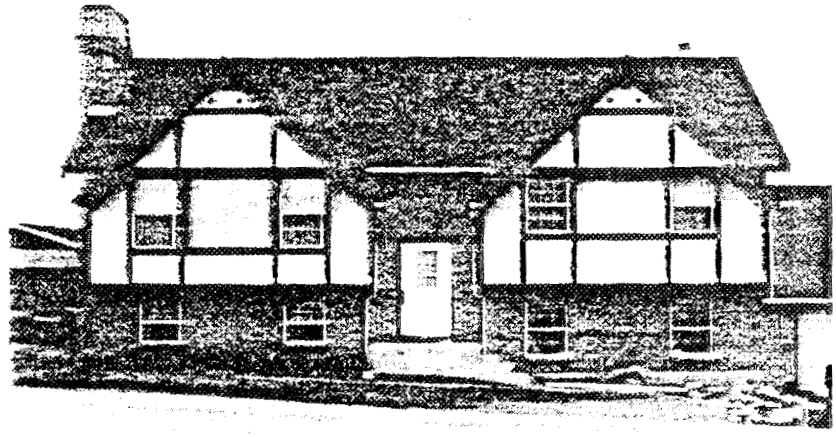
Sample Numbers ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



Ⓣ TELEPHONE POLE

FENCE LINE



GAMMA SURVEY REPORT

Owner Dave Kraaskop

Occupant Same

Property Classification	Gamma Map	Tailings Use
1	1	9

Type of Structure	Material
___ Basement	___ Adobe
X Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	___ Non Masonry
Number of Levels 2	Other ___

Comments: Backyard has been used as a dumping place for broken bricks. Approximate date of original construction is 1978.

Elevated reading associated with: Brick and/or mortar in fireplace.

Survey No. 6
Event No. 1980 29 1971 -
Street 333 Silverstone
Address East
City/State Monticello, Utah
County San Juan
Date June 16, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	57	110
HOG	22	31
LOG	13	12

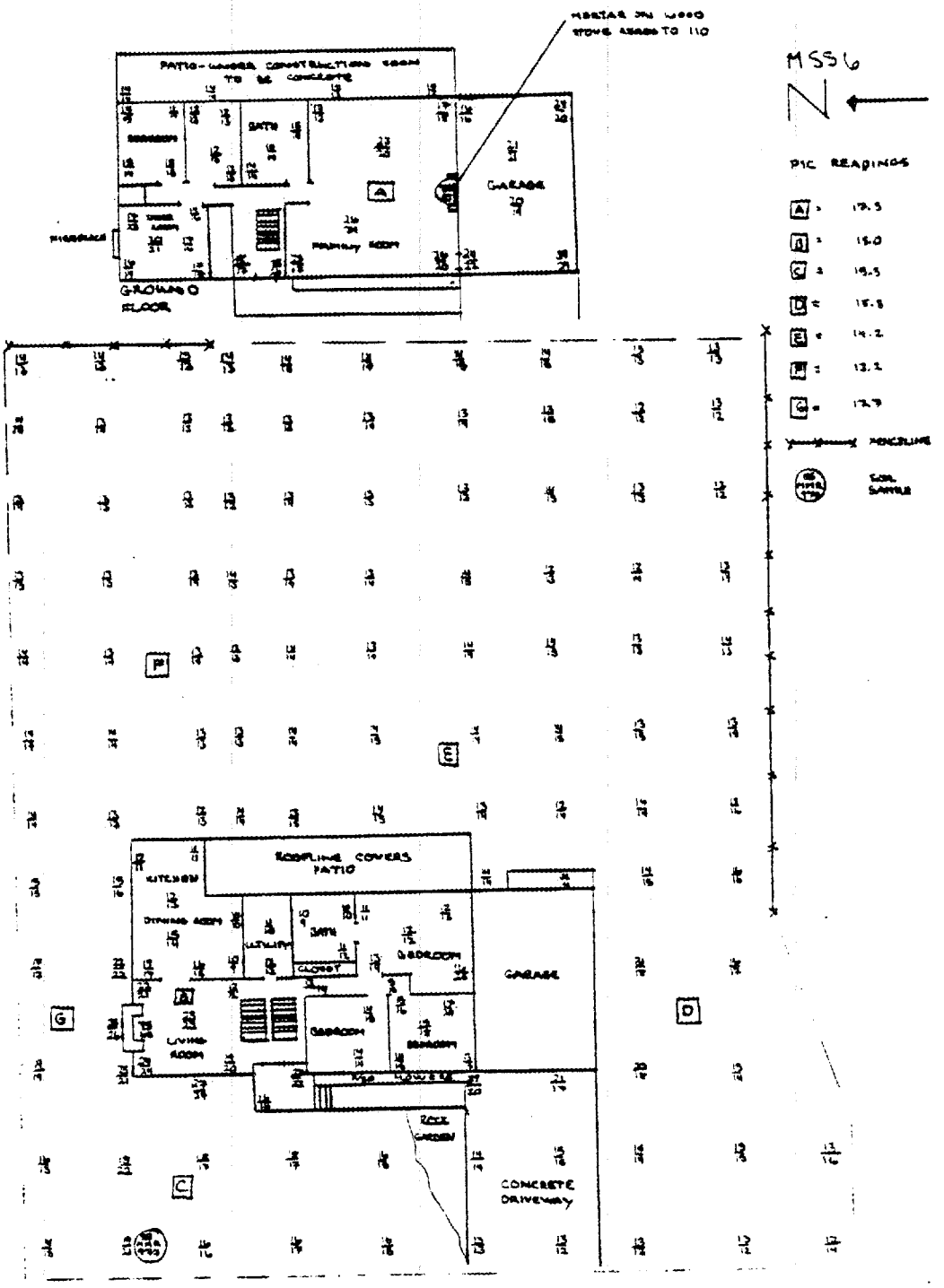
Location HIG Den-Family Room

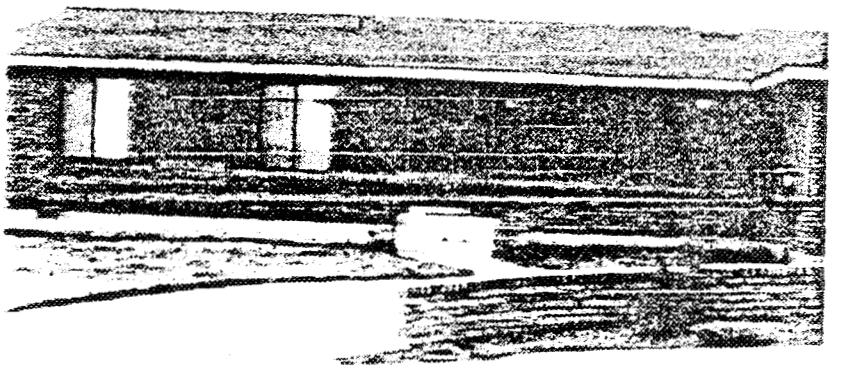
Number of PIC Readings Taken
Inside 2 Outside 5

Soil Samples Taken
Yes X No ___ Number 1

Sample Numbers MMR 977

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS6
PIC READINGS
GARAGE
GROUND FLOOR
ROOFLINE COVERS PATIO
CONCRETE DRIVEWAY
ROCK GARDEN
GARAGE
BEDROOM
BATH
KITCHEN
CLOSET



GAMMA SURVEY REPORT

Owner Juan Hansen

Occupant

Property Classification	Gamma Map	Tailings Use
1	1	9

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels 1 Other

Comments: Patio is under construction in the backyard. Approximate date of original construction is the summer of 1979.

Elevated reading associated with: Brick and/or mortar in the exterior wall.

Survey No. 7
Event No. 1980 27 1971 -
Street Address 348 Silverstone East
City/State Monticello, Utah
County San Juan
Date August 3, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	39	70
HOG	46	85
LOG	13	11

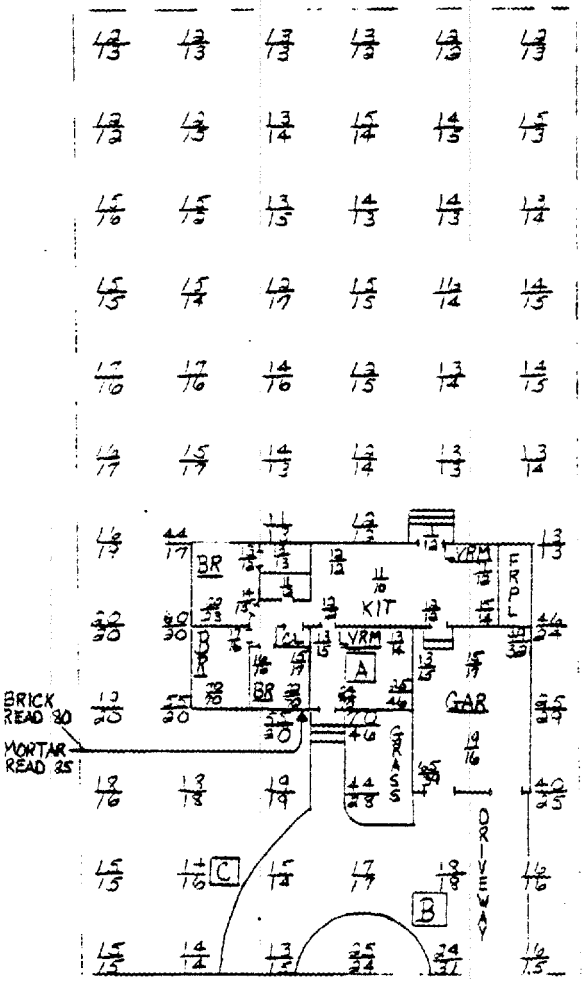
Location HIG Two Bedrooms and the Livingroom

Number of PIC Readings Taken
Inside 1 Outside 2

Soil Samples Taken
Yes No X Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



M.S.S. #7

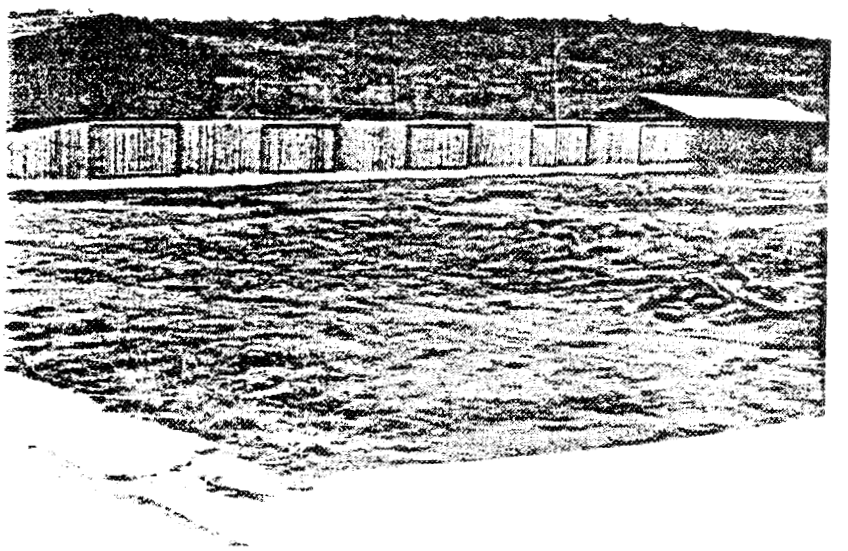
N

PIC READINGS

A = 14.7

B = 14.1

C = 14.2



GAMMA SURVEY REPORT

Owner: Buckley Jensen

Occupant: Vacant Lot

Property Classification: 0 Gamma Map: 1 Tailings Use: 9

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels: 0	Other: ____

Comments: ____

Elevated reading associated with: ____

Survey No.: 8
Event No.: 1980 28 1971 -
Street Address: Lot #9 Silverstone Subdivision
City/State: Monticello, Utah
County: San Juan
Date: July 14, 1982
Surveyors: F.C. & P.B.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	-	
HOG	24	37
LOG	12	10

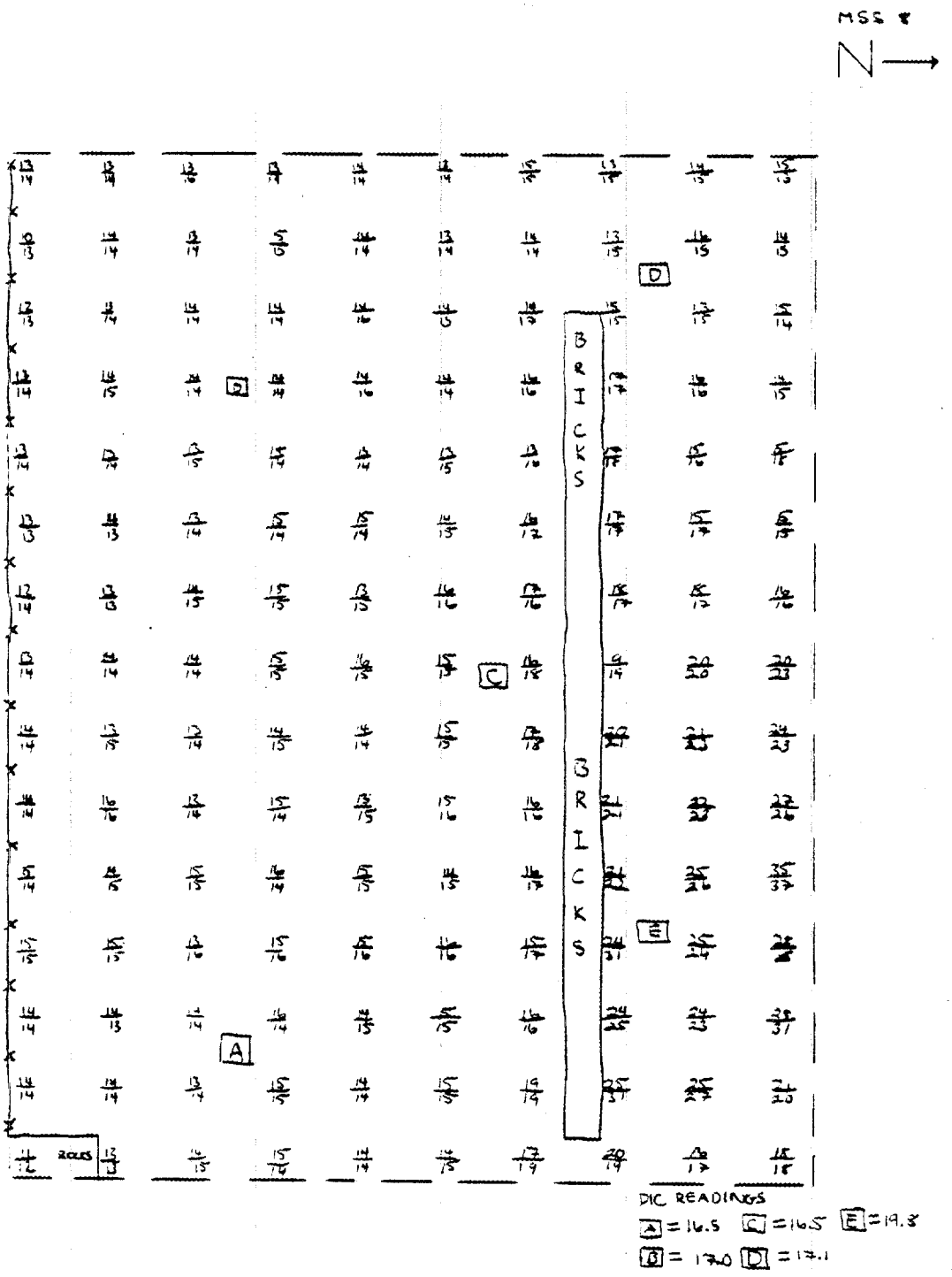
Location HIG: ____

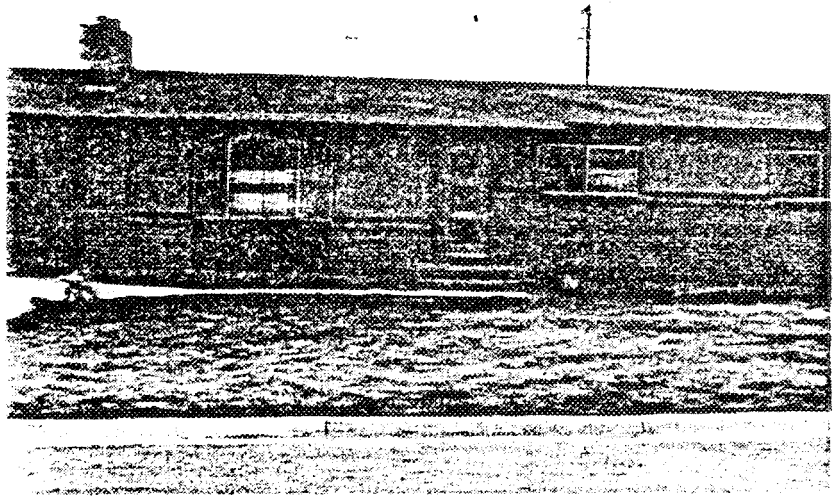
Number of PIC Readings Taken
Inside: 0 Outside: 5

Soil Samples Taken
Yes: ____ No: X Number: 0

Sample Numbers: ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


N
BRICKS
GRICKS
ROAD
A
B
C
D
E
DIC READINGS
A = 16.5
B = 17.0
C = 16.5
D = 17.1
E = 19.8



GAMMA SURVEY REPORT

Owner Robert Day

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 9

Type of Structure	Material
X Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	X Masonry
____ Unknown	X Non Masonry
Number of Levels 2	Other ____

Comments: ____

Elevated reading associated with: Brick wainscott and the brick and/or mortar in fireplace and exterior wall.

Survey No. 9
Event No. 1980 21 1971 -
Street Address 465 Oakcrest Drive
City/State Monticello, Utah
County San Juan
Date August 5, 1982
Surveyors D.I. & P.B.
Meter No. C.3558.S

	Corrected	Uncorrected
HIG	28	46
HOG	23	34
LOG	11	7

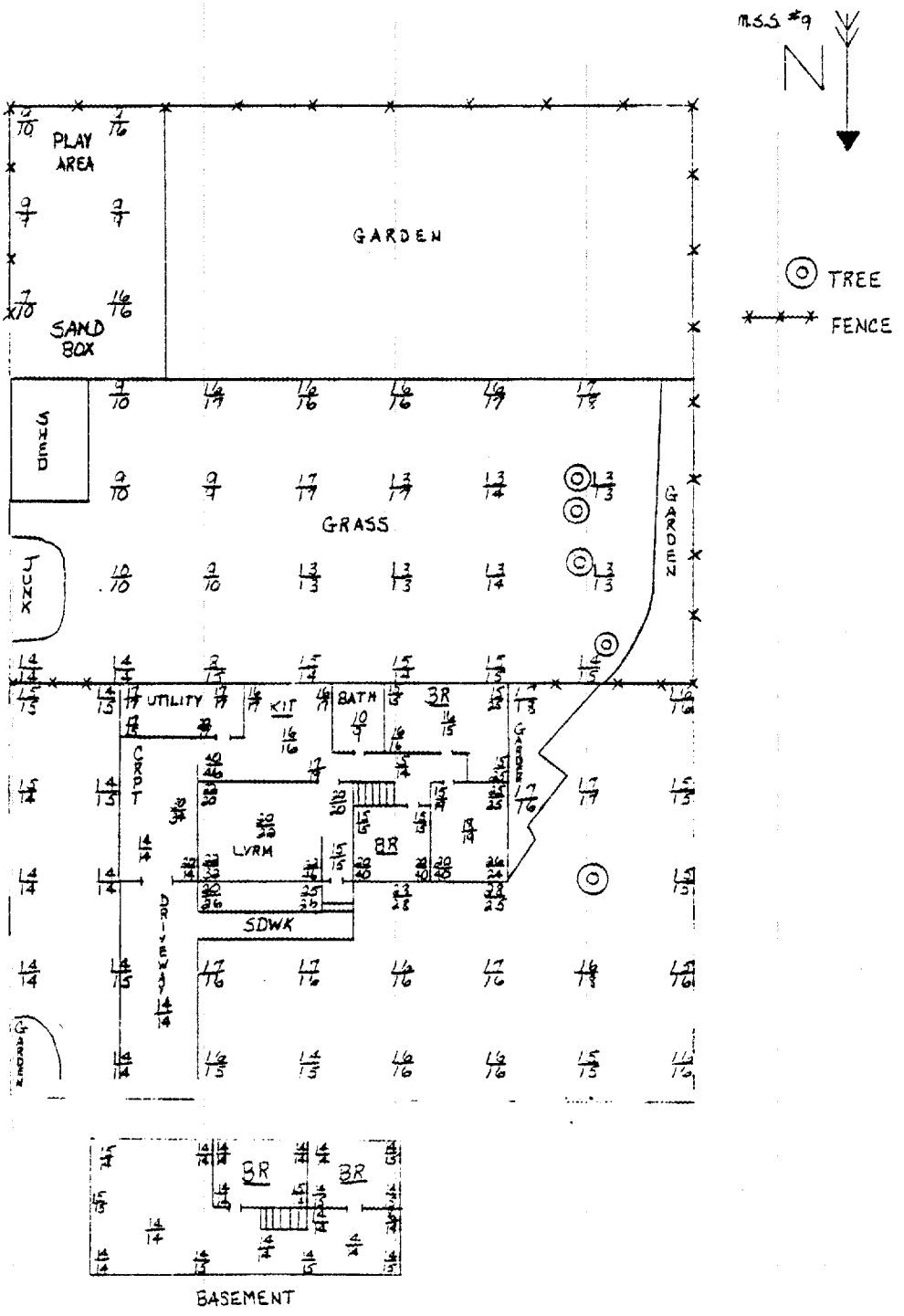
Location HIG Kitchen

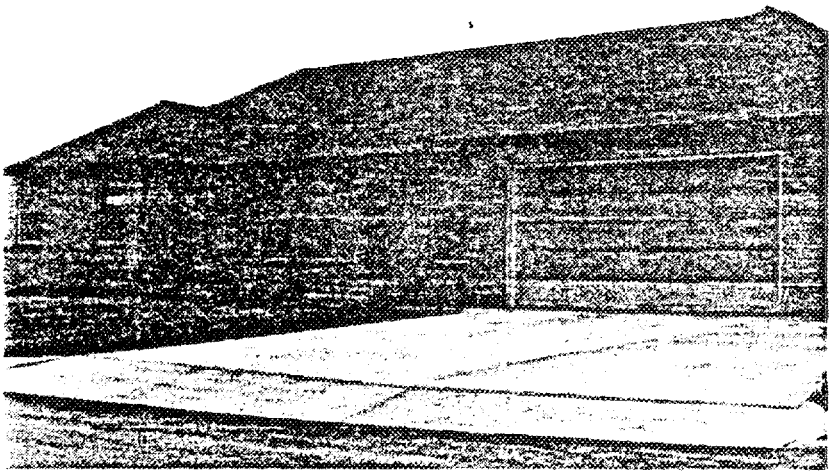
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S #9
N
TREE
FENCE
PLAY AREA
SAND BOX
GARDEN
SHED
GRASS
JUNK
GARDEN
UTILITY
KIT
BATH
3R
CRPT
LVRM
BR
SDWK
DRIVEWAY
GARDEN
3R
3R
BASEMENT



GAMMA SURVEY REPORT

Owner Julia Redd

Occupant

Property Classification 1 | Gamma Map 1 | Tailings Use 9

Type of Structure	Material
X Basement	Adobe
Slab on Grade	House Trailer
Crawl Space	X Masonry
Unknown	Non Masonry
Number of Levels 1	Other

Comments: Approximate date of original construction is 1980.

Elevated reading associated with: Mortar and/or brick in exterior wall and the fireplace.

Survey No. 10
Event No. 1980 25 1971 -
Street 32 Parkview Drive
Address
City/State Monticello, Utah
County San Juan
Date August 5, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	39	70
HOG	26	40
LOG	12	10

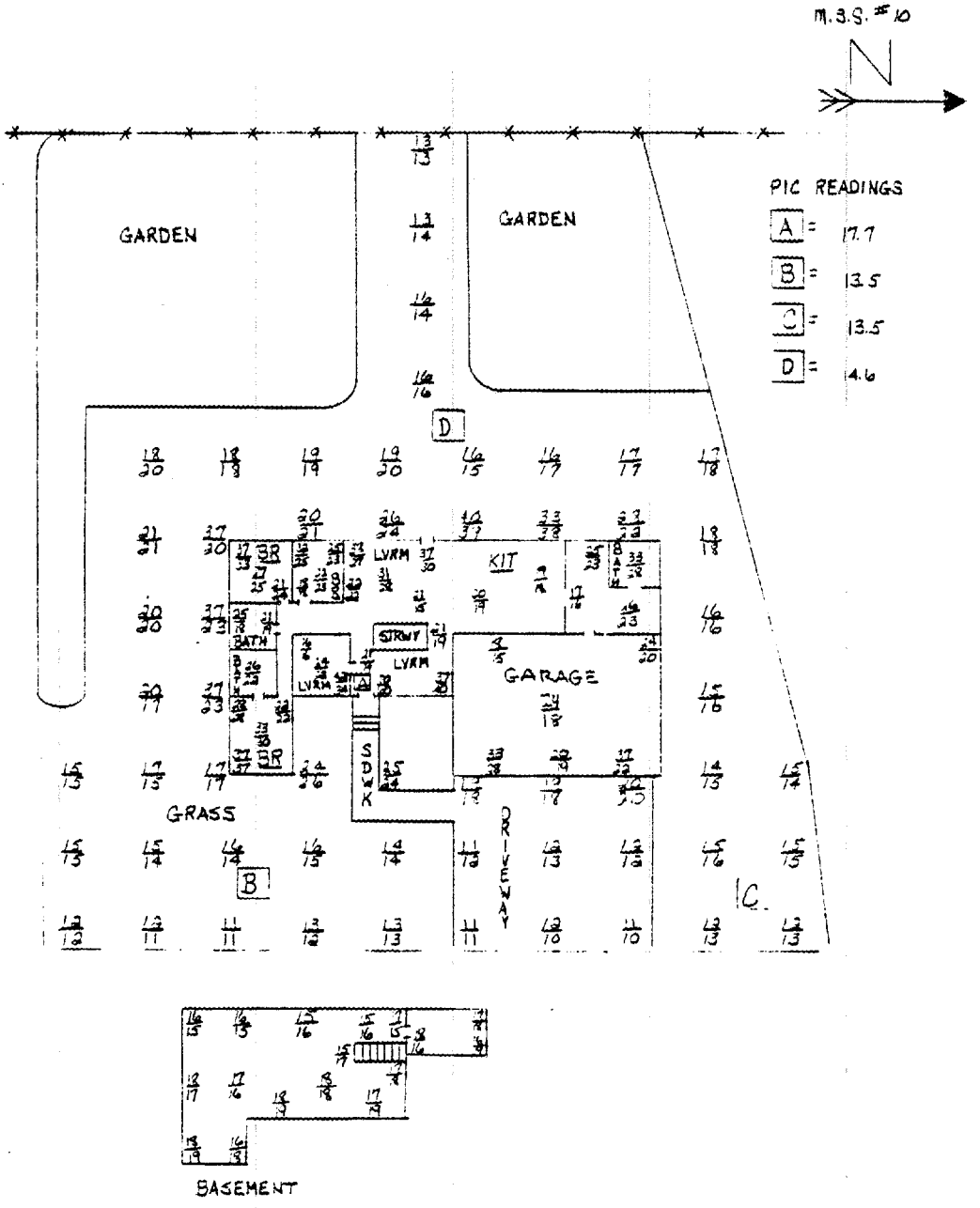
Location HIG Living Room

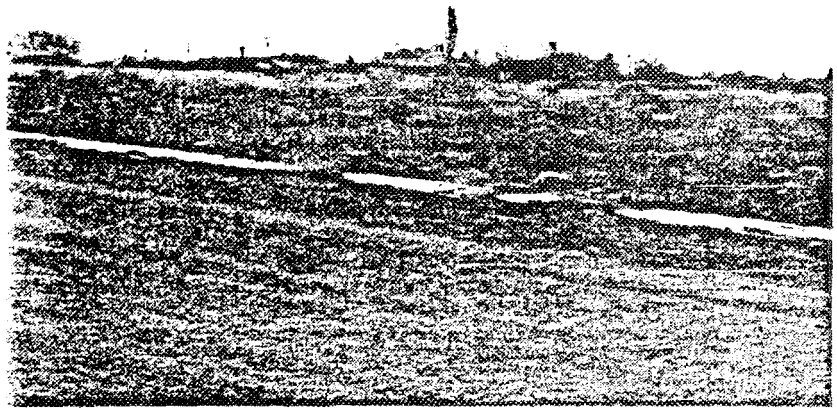
Number of PIC Readings Taken
Inside 1 Outside 3

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.B.S. # 10
N
PIC READINGS
A = 17.7
B = 13.5
C = 13.5
D = 14.6
GARDEN
GARDEN
D
LVRM
KIT
BATH
STRWY
LVRM
GARAGE
BR
BR
SDWK
GRASS
DRIVEWAY
B
C
BASEMENT



GAMMA SURVEY REPORT

Owner Reita Sparks

Occupant Vacant Lot

Property Classification 0 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 11
Event No. 1980 26 1971 -
Street Address 249 Blue Mtn. Drive
City/State Monticello, Utah
County San Juan
Date July 30, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	-	
HOG	15	15
LOG	13	11

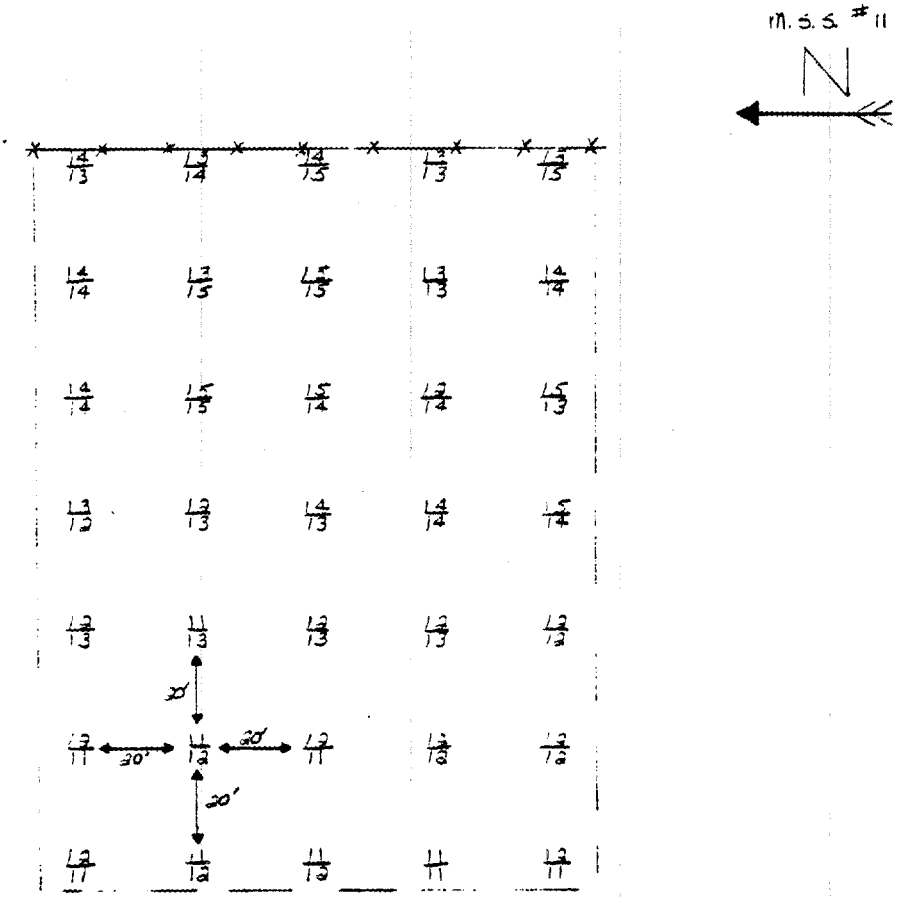
Location HIG ____

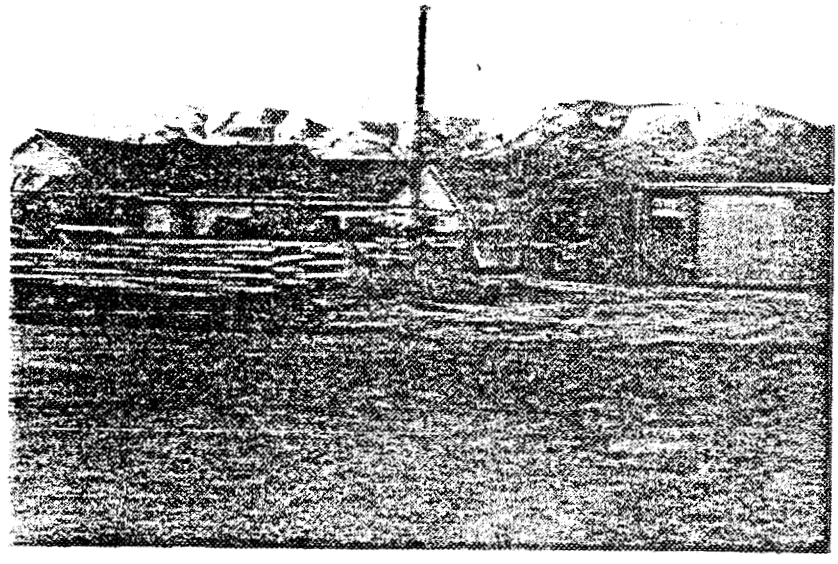
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M. S. S. #11
N
20'
30'
20'
20'
FENCE



GAMMA SURVEY REPORT

Owner: Robert Holden

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 0

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels: 1 | Other:

Comments: Sample in garage read over 5000. Approximate date of original construction was in the late forties.

Elevated reading associated with: Ore samples

Survey No.: 12
Event No.: 1980 47 1971 -
Street Address: 380 Abajo Drive
City/State: Monticello, Utah
County: San Juan
Date: August 11, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	14	13
HOG	20	28
LOG	13	12

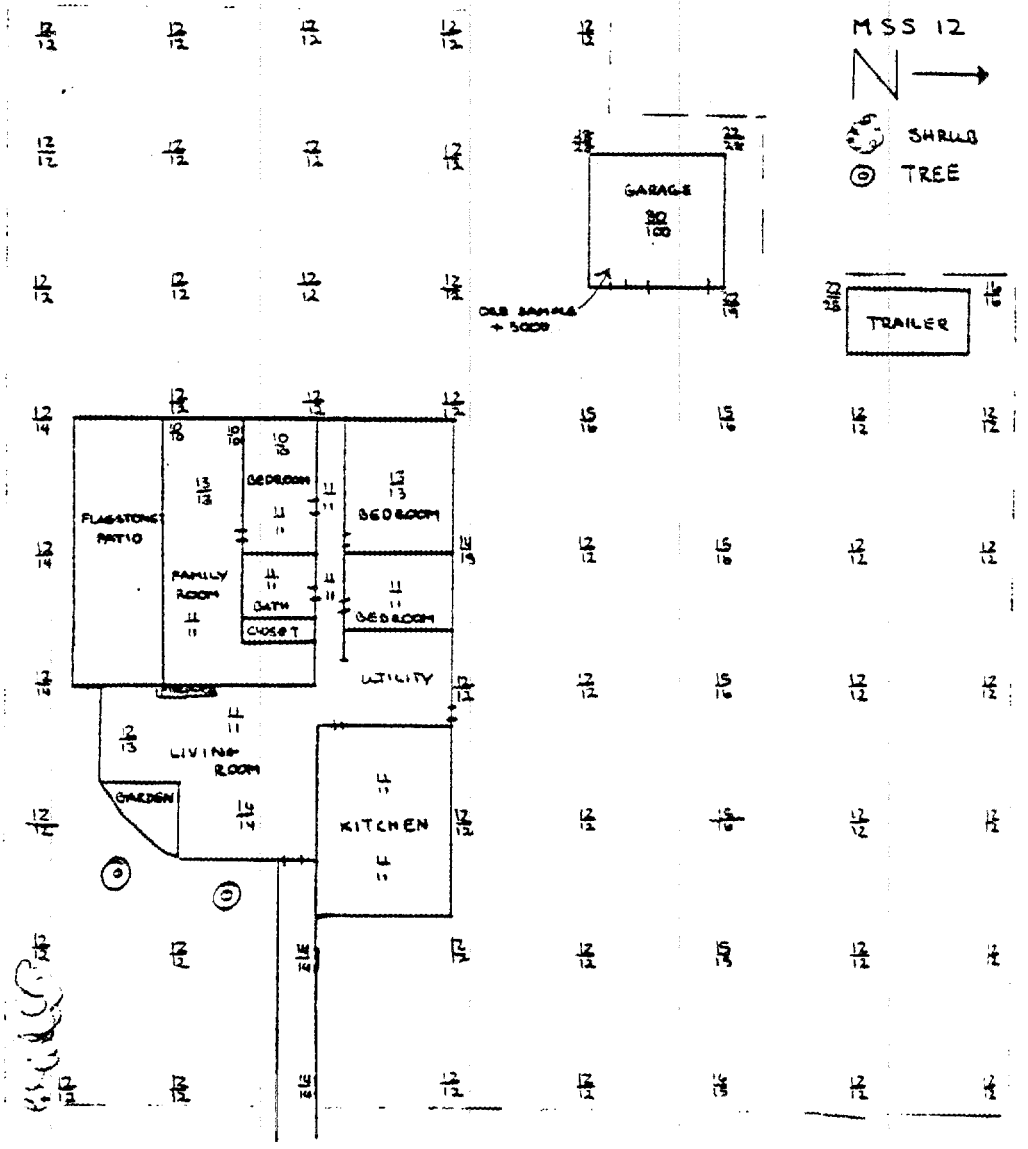
Location HIG: Family Room, Bedroom and Living Room

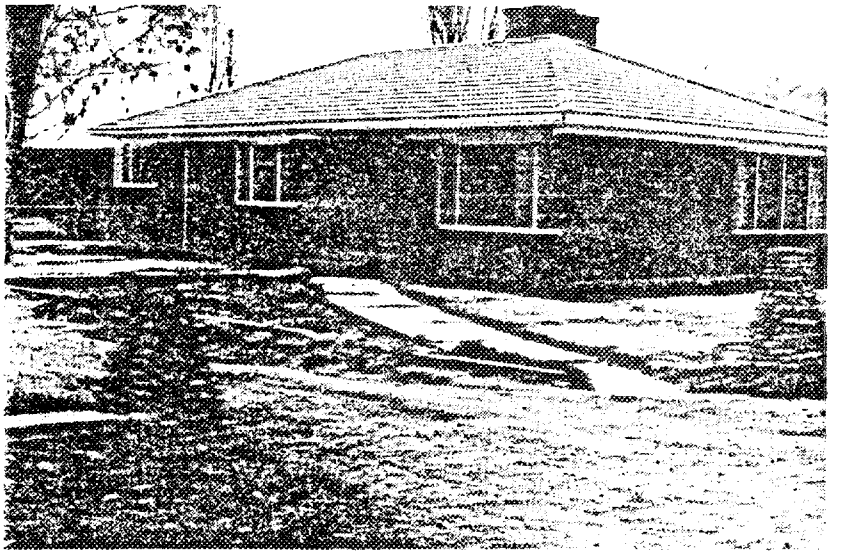
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ____ No X Number 0

Sample Numbers: ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 12
SHRUB
TREE
GARAGE
TRAILER
OBS SAMPLE + SOIL
FLAGSTONE PATIO
FAMILY ROOM
BEDROOM
BATH
CLOSET
BEDROOM
BEDROOM
UTILITY
LIVING ROOM
GARDEN
KITCHEN



GAMMA SURVEY REPORT

Owner Zola B. Holden

Occupant None

Property Classification 1 Gamma Map 1 Tailings Use 9

Type of Structure	Material
___ Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	x Masonry
x Unknown	___ Non Masonry
Number of Levels 1	Other ___

Comments: Family of miners and rock collectors. Approximate date of original construction was the late fifties. Rock wall led to 250 micro R/hr. reading.

Elevated reading associated with: Rock pillars led to 5000 micro R/hr. reading. Rock samples and ornamental rocks throughout the area.

Survey No. 13
Event No. 1980 48 1971 46
Street Address 381 Abajo Drive
City/State Monticello, Utah
County San Juan
Date August 11, 1982
Surveyors E.B. & D.T.
Meter No. C.3560.S

	Corrected	Uncorrected
HIG	118	250
HOG	20	28
LOG	14	14

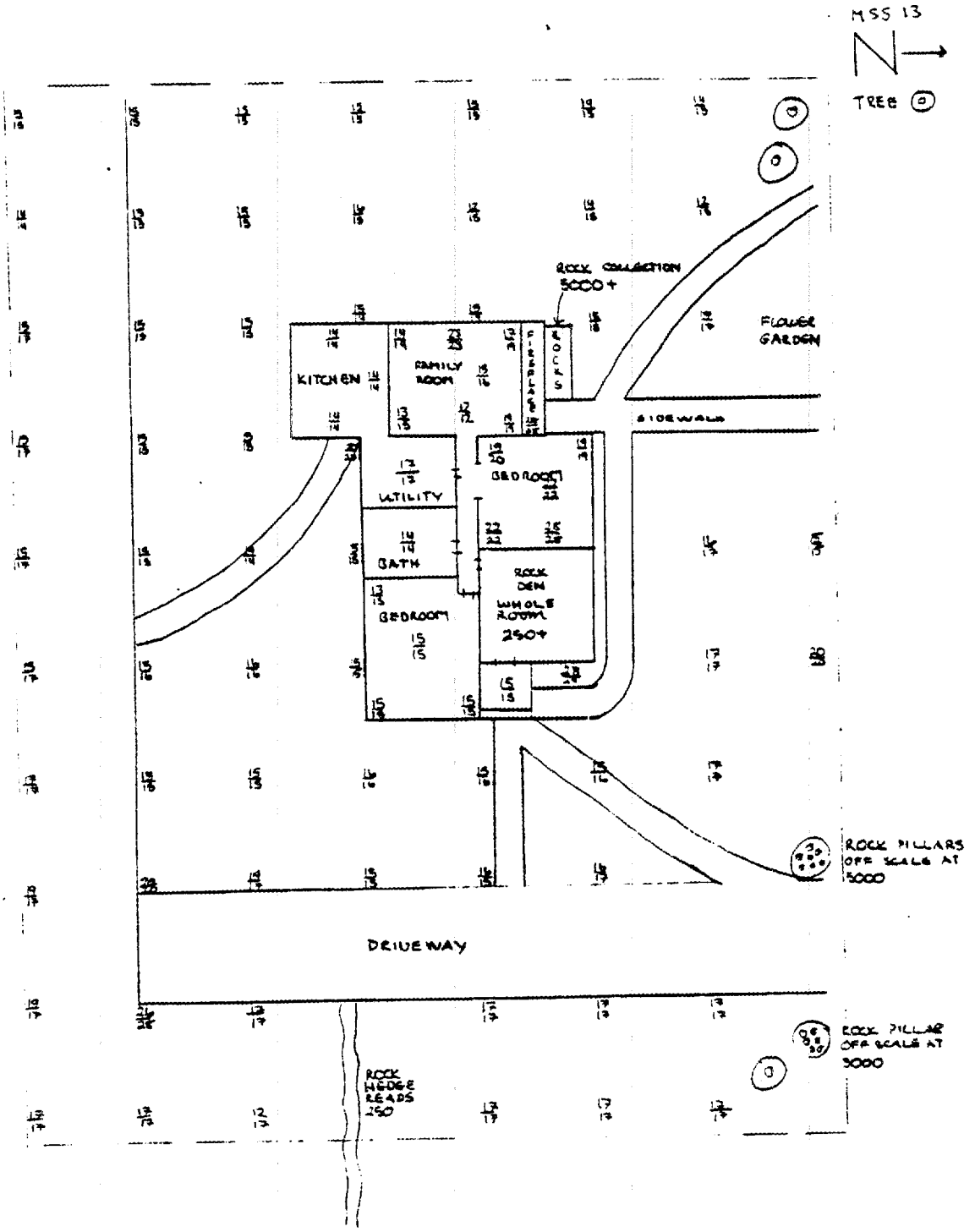
Location HIG Den-Family Room

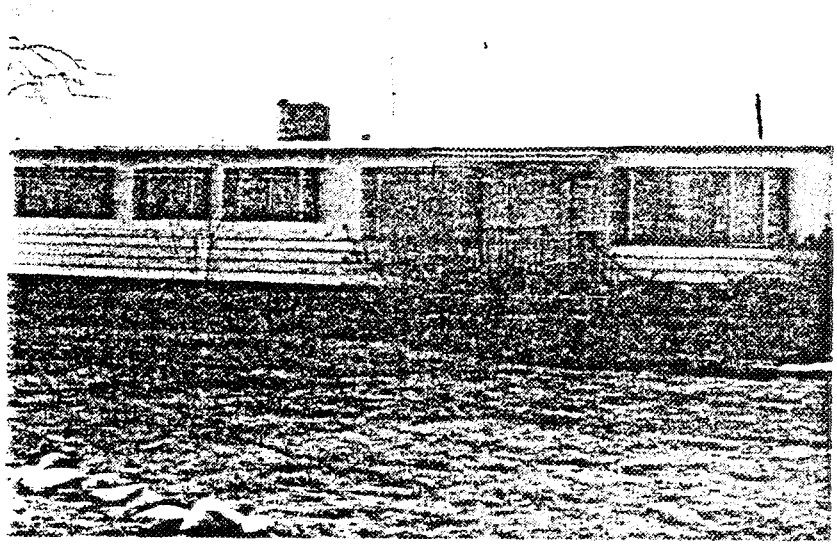
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No x Number 0

Sample Numbers ___ ___ ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 13
TREE
ROCK COLLECTION
5000+
FLOWER
GARDEN
KITCHEN
FAMILY
ROOM
SIDEWALK
UTILITY
BEDROOM
BATH
ROCK
DEN
WHOLE
ROOM
250+
BEDROOM
ROCK PILLARS
OFF SCALE AT
5000
DRIVEWAY
ROCK
HEDGE
READS
250
ROCK PILLAR
OFF SCALE AT
5000



GAMMA SURVEY REPORT

Owner: Earl Randall

Occupant: Kevin Phillips

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 4

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade	X	House Trailer
X	Crawl Space		Masonry
	Unknown		Non Masonry

Number of Levels: 1

Other:

Comments:

Elevated reading associated with: Driveway

Survey No.: 14
Event No.: 1980 - 1971 53
Street Address: 165 North 1st West
City/State: Monticello, Utah
County: San Juan
Date: August 5, 1982
Surveyors: D.T.
Meter No.: C.3558.5

	Corrected	Uncorrected
HIG	27	42
HOG	61	120
LOG	13	11

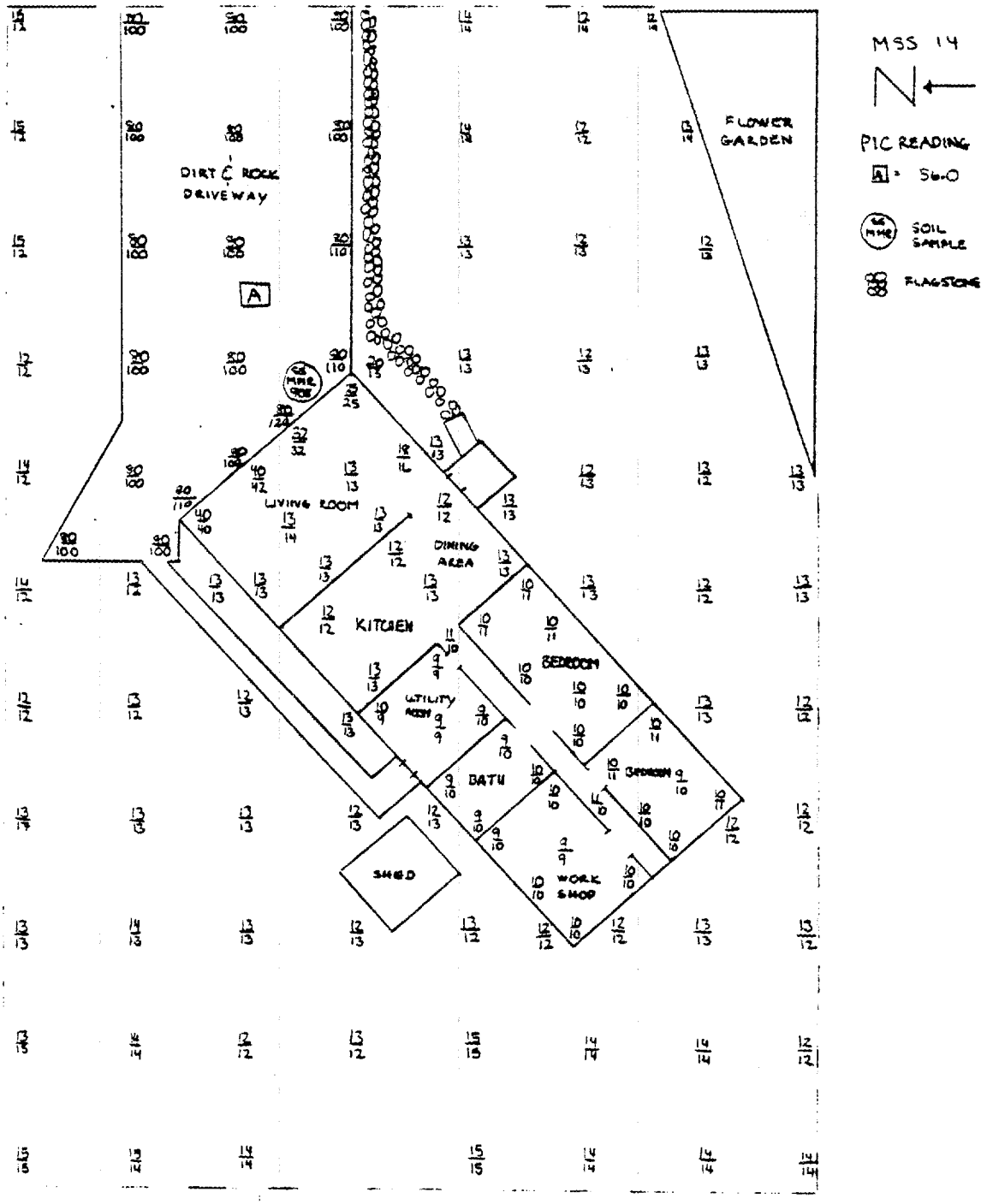
Location HIG: Wall in front room near driveway

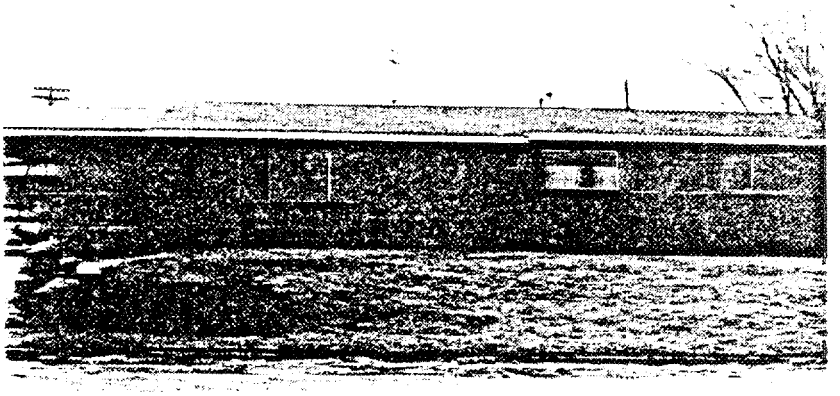
Number of PIC Readings Taken: Inside 0 Outside 1

Soil Samples Taken: Yes X No ___ Number 1

Sample Numbers: MMR 908

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 14
PIC READING
A = 56.0
SOIL SAMPLE
FLAGSTONE
FLOWER GARDEN
DIRT & ROCK DRIVEWAY
A
LIVING ROOM
DINING AREA
KITCHEN
BEDROOM
UTILITY ROOM
BATH
BEDROOM
SHED
WORK SHOP



GAMMA SURVEY REPORT

Owner: Dale Black

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure		Material	
____	Basement	____	Adobe
X	Slab on Grade	____	House Trailer
____	Crawl Space	X	Masonry
____	Unknown	____	Non Masonry

Number of Levels: 1 | Other: ____

Comments: ____

Elevated reading associated with: Foundation, brick and/or mortar.

Survey No.: 15
Event No.: 1980 - 1971 54
Street Address: 65 North 1st West
City/State: Monticello, Utah
County: San Juan
Date: August 10, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	20	27
HOG	19	24
LOG	13	12

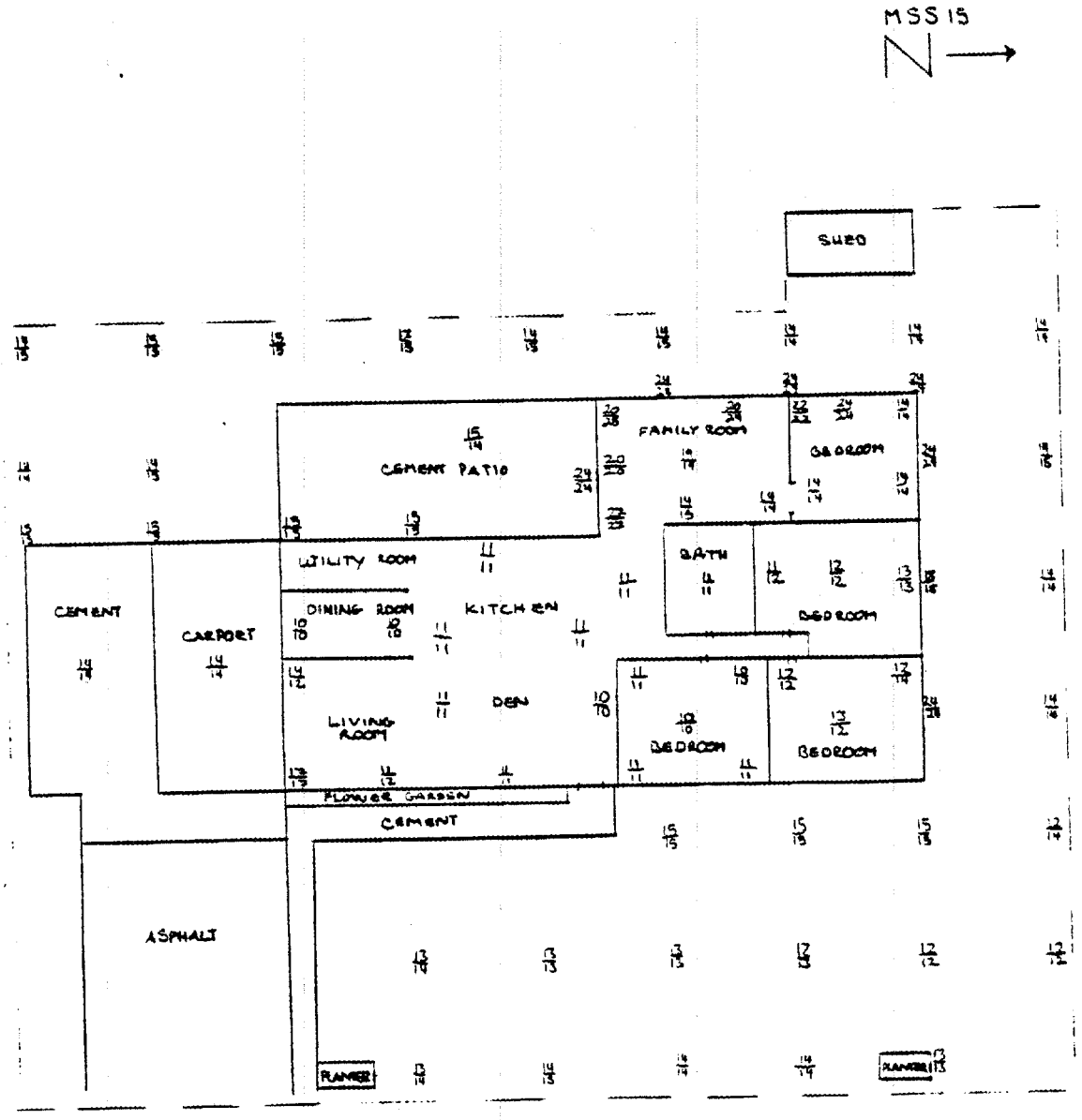
Location HIG: Family Room

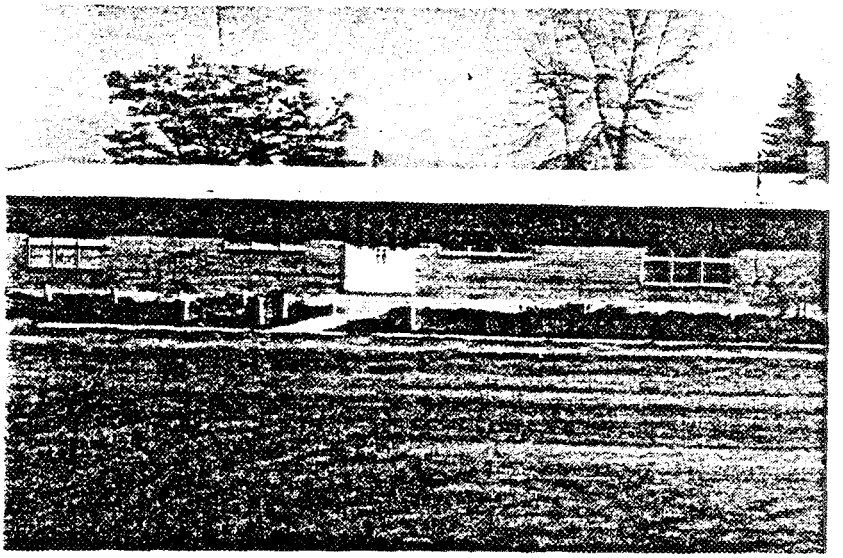
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ____ No X Number 0

Sample Numbers: ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 15
SHED
CEMENT PATIO
FAMILY ROOM
BEDROOM
UTILITY ROOM
BATH
CEMENT
CARPORT
DINING ROOM
KITCHEN
BEDROOM
LIVING ROOM
DEN
BEDROOM
BEDROOM
FLOWER GARDEN
CEMENT
ASPHALT
PLANTER
PLANTER



GAMMA SURVEY REPORT

Owner: Dow & Suzy Young

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure		Material	
	Basement		Adobe
X	Slab on Grade		House Trailer
	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels: 1 | Other:

Comments: Approximate date of original construction was 1958.

Elevated reading associated with: Sandbox, brick in exterior wall, fireplace.

Survey No.: 16
Event No.: 1980 20 1971 -
Street Address: 65 South 2nd West
City/State: Monticello, Utah
County: San Juan
Date: August 4, 1982
Surveyors: D.T. & B.F.
Meter No.: C.3500.S

	Corrected	Uncorrected
HIG	48	90
HOG	92	190
LOG	13	12

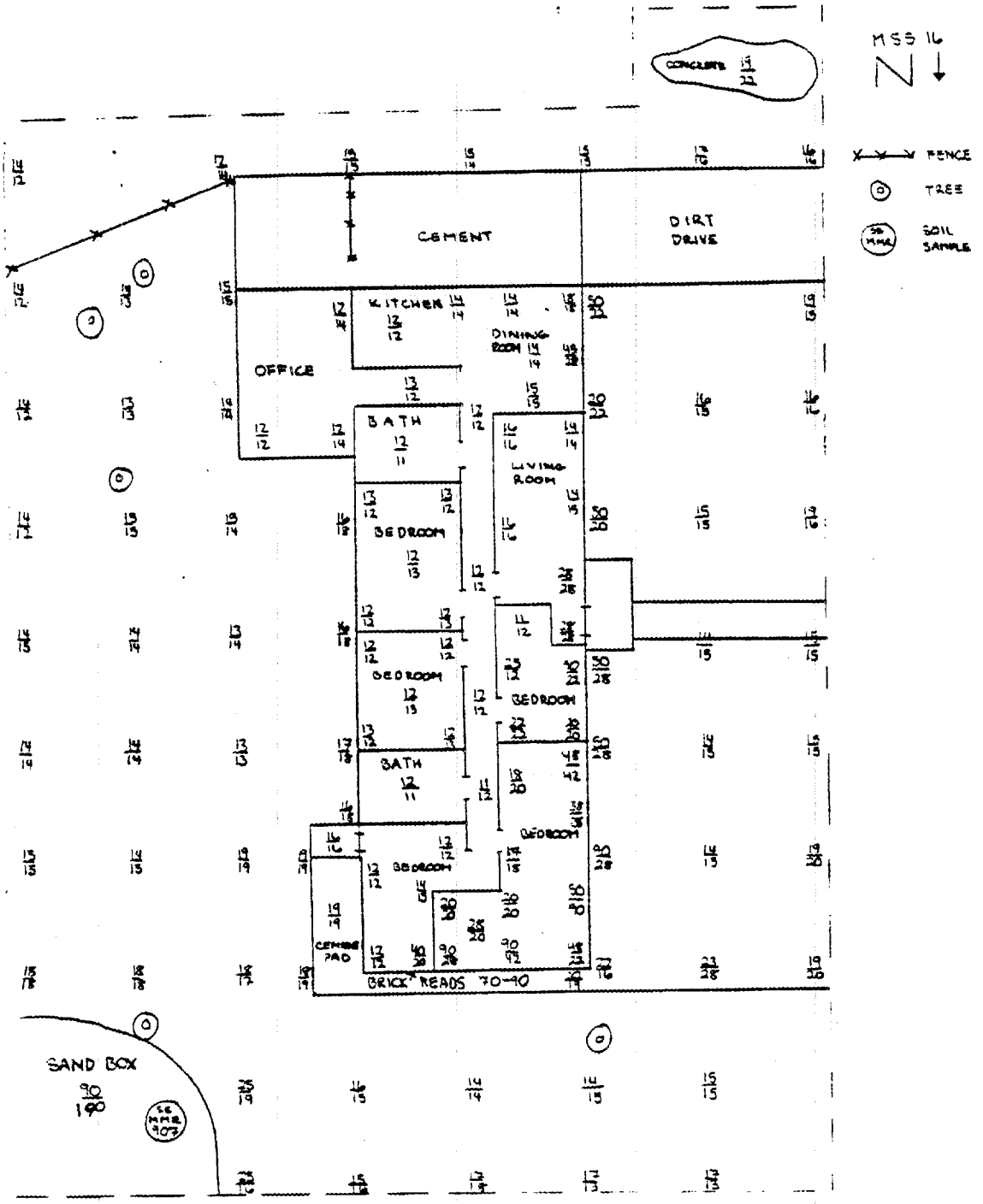
Location HIG: Bedroom

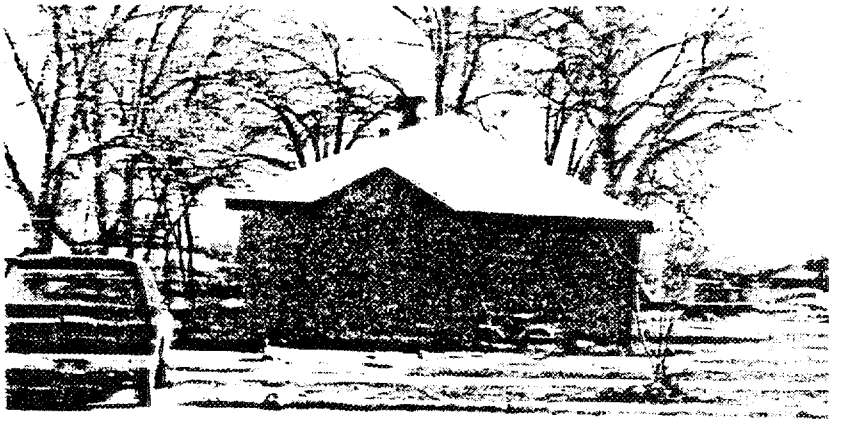
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes X No ___ Number 1

Sample Numbers: MMR 907

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


CEMENT
DIRT DRIVE
KITCHEN
DINING ROOM
OFFICE
BATH
LIVING ROOM
BEDROOM
BEDROOM
BEDROOM
BATH
BEDROOM
BEDROOM
CEMENT PAD
BRICK READS 70-90
SAND BOX
1980
FENCE
TREE
SOIL SAMPLE



GAMMA SURVEY REPORT

Owner: Bill Francom

Occupant: Same

Property Classification: 1 | Gamma Map: 2 | Tailings Use:

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels ____	Other ____

Comments: REFUSAL - Owner is a miner and knows that there are ore samples on the property.

Elevated reading associated with: ____

Survey No.: 17

Event No.: 1980 AD 1971 -

Street Address: 149 West 1st South

City/State: Monticello, Utah

County: San Juan

Date: August 6, 1982

Surveyors: ____

Meter No.: ____ (Corrected) ____ (Uncorrected)

HIG: ____ ____

HOG: ____ ____

LOG: ____ ____

Location HIG: ____

Number of PIC Readings Taken
Inside ____ Outside ____

Soil Samples Taken
Yes ____ No ____ Number ____

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

GAMMA SURVEY REPORT

Owner Louise Jones

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
___ Basement	___ Adobe
X Slab on Grade	___ House Trailer
___ Crawl Space	___ Masonry
___ Unknown	X Non Masonry
Number of Levels 2	Other ___

Comments: Owner told us that the shed in the backyard was moved from old mill site. Approximate date of original construction was 1940.

Elevated reading associated with: ___

Survey No. 18
Event No. 1980 34 1971 -
Street 180 West 3rd South
Address ___
City/State Monticello, Utah
County San Juan
Date June 25, 1982
Surveyors P.B. & F.C.
Meter No. C.3559.S

	Corrected	Uncorrected
HIG	13	12
HOG	16	19
LOG	13	10

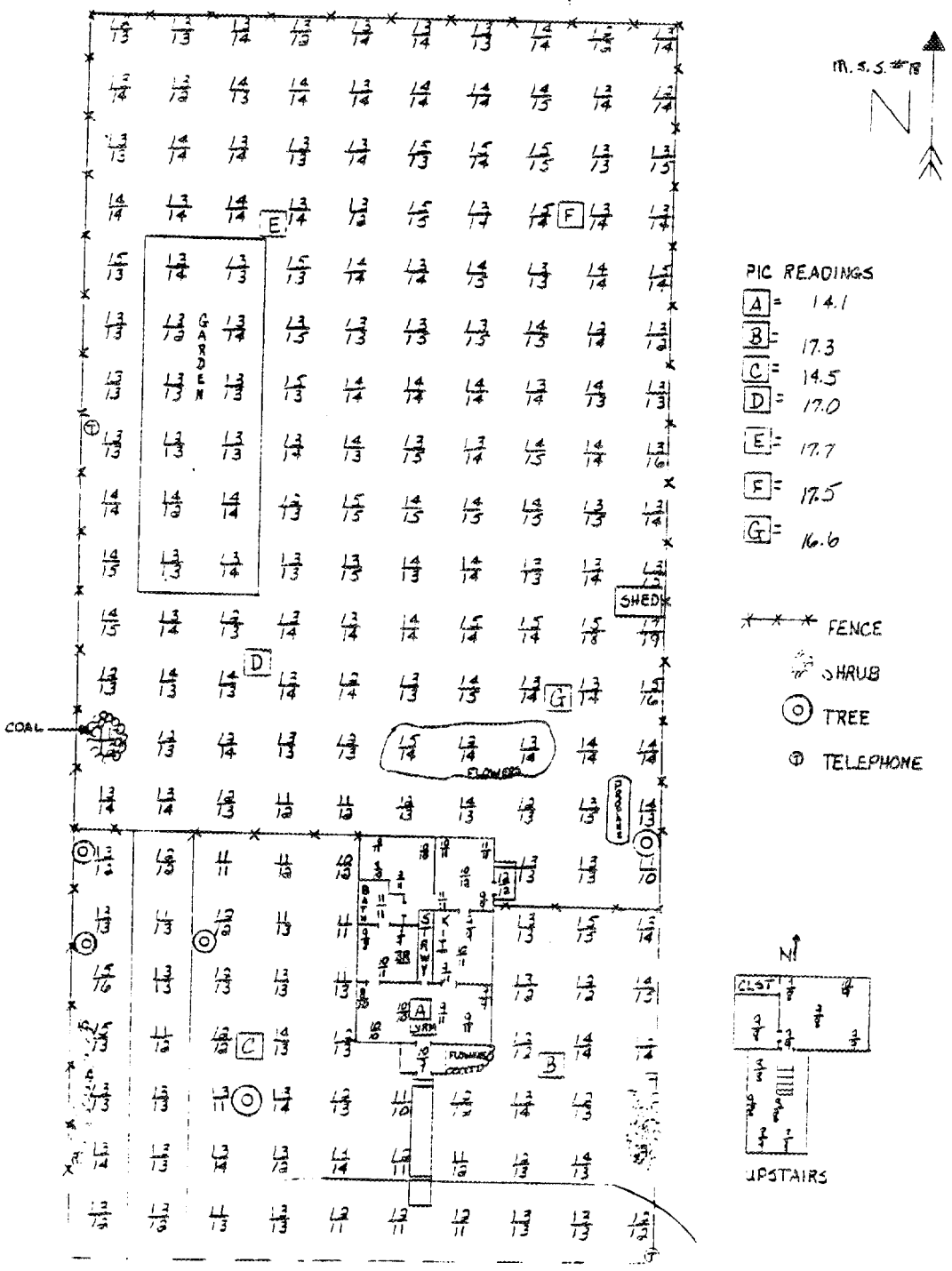
Location HIG Dining room.

Number of PIC Readings Taken
Inside 1 Outside 6

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M. S. S.
PIC READINGS
A = 14.1
B = 17.3
C = 14.5
D = 17.0
E = 17.7
F = 17.5
G = 16.6
GARDEN
SHED
COAL
FLOWERS
FENCE
SHRUB
TREE
TELEPHONE
N
CLOT
UPSTAIRS

GAMMA SURVEY REPORT

Owner: Howard Rogers

Occupant: Michael Sheers

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 2

Type of Structure		Material	
____	Basement	____	Adobe
____	Slab on Grade	____	House Trailer
X	Crawl Space	____	Masonry
____	Unknown	X	Non Masonry

Number of Levels: 1 | Other: ____

Comments: ____

Elevated reading associated with: Yard

Survey No.: 19
Event No.: 1980 49 1971 -
Street Address: 316 South 1st West
City/State: Monticello, Utah
County: San Juan
Date: July 27, 1982
Surveyors: F.C. & P.B.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	14	13
HOG	96	200
LOG	13	10

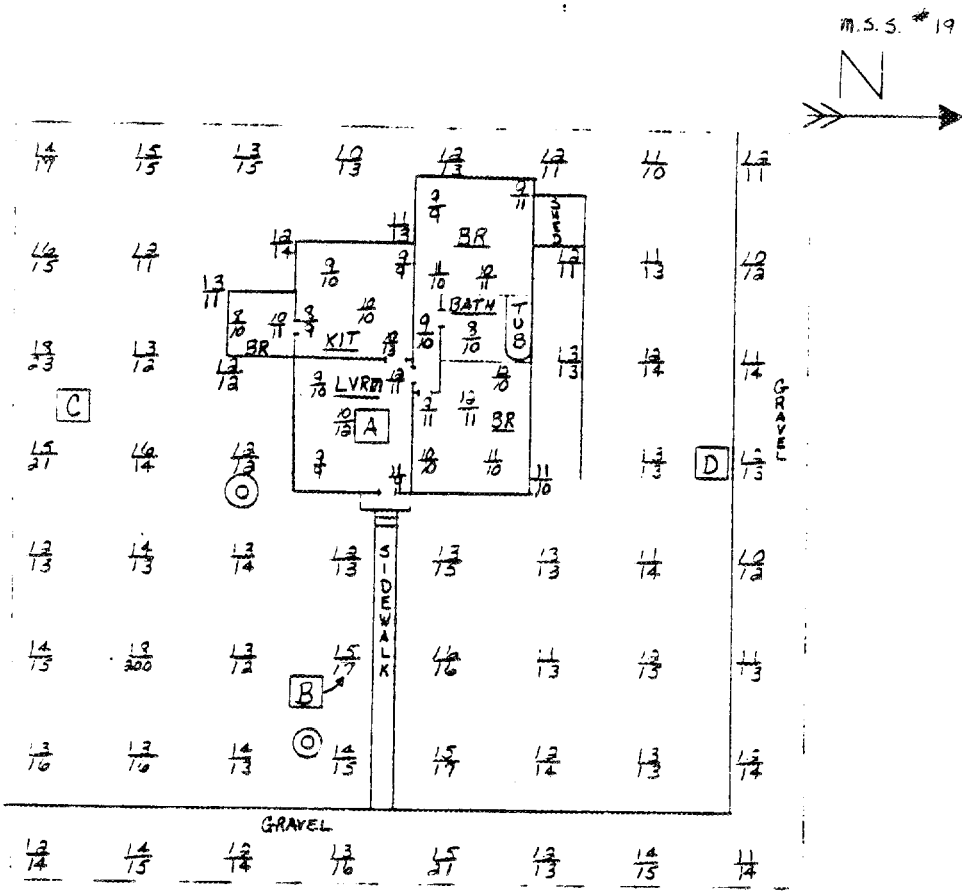
Location HIG: Kitchen

Number of PIC Readings Taken
Inside 1 Outside 3

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



PIC READINGS

A = 12.0

B = 12.9

C = 14.4

D = 12.7

◎ TREE

GAMMA SURVEY REPORT

Owner John Gardner

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
____ Basement	____ Adobe
X Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	X Non Masonry
Number of Levels 2	Other ____

Comments: Owner used to work in the mines and had collected samples but has since removed them.

Elevated reading associated with: ____

Survey No. 20
Event No. 1980 19 1971 -
Street Address 396 South 2nd West
City/State Monticello, Utah
County San Juan
Date August 5, 1982
Surveyors D.T.
Meter No. C.3558.S

	Corrected	Uncorrected
HIG	13	11
HOG	14	14
LOG	13	11

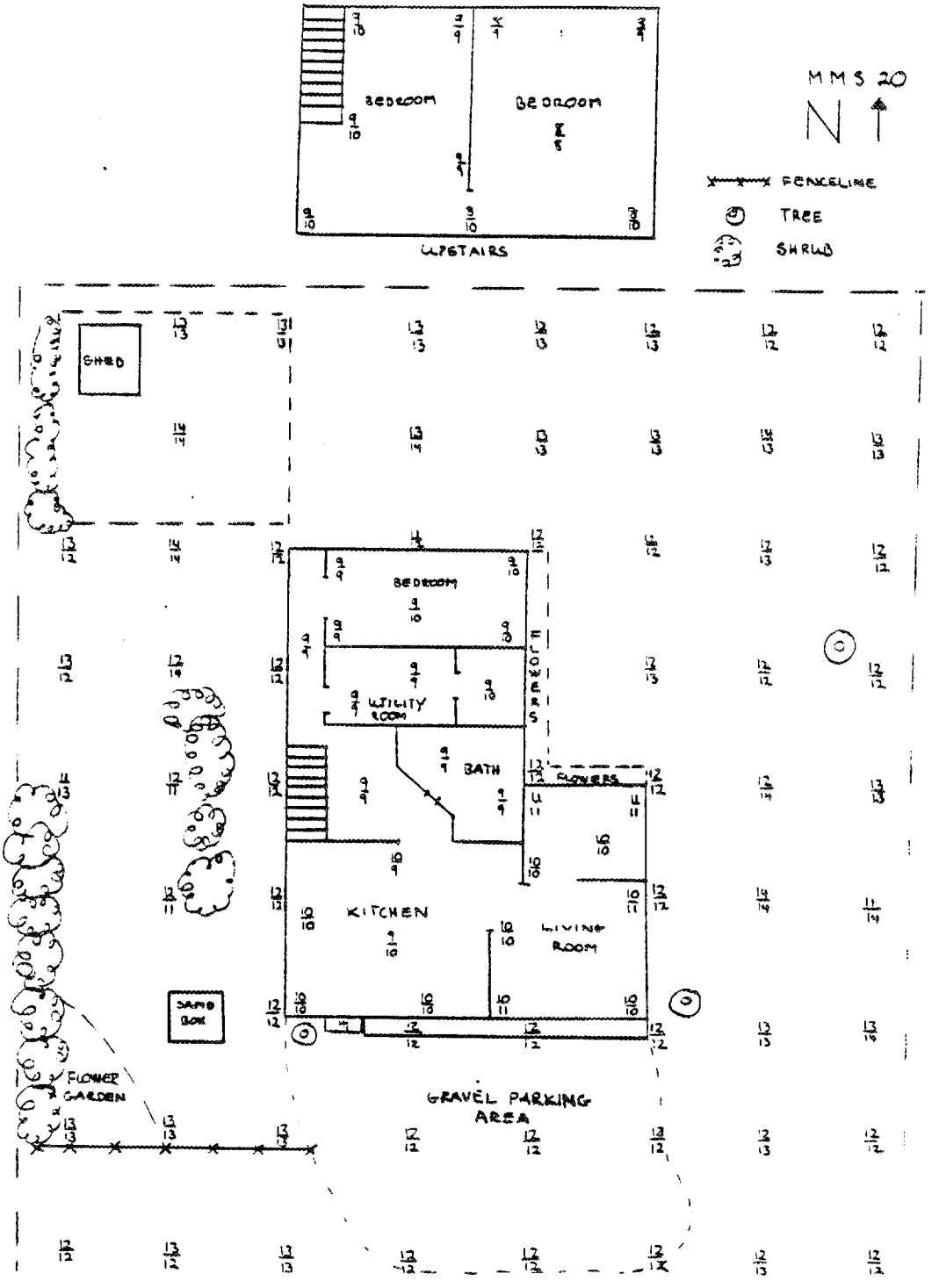
Location HIG Living Room

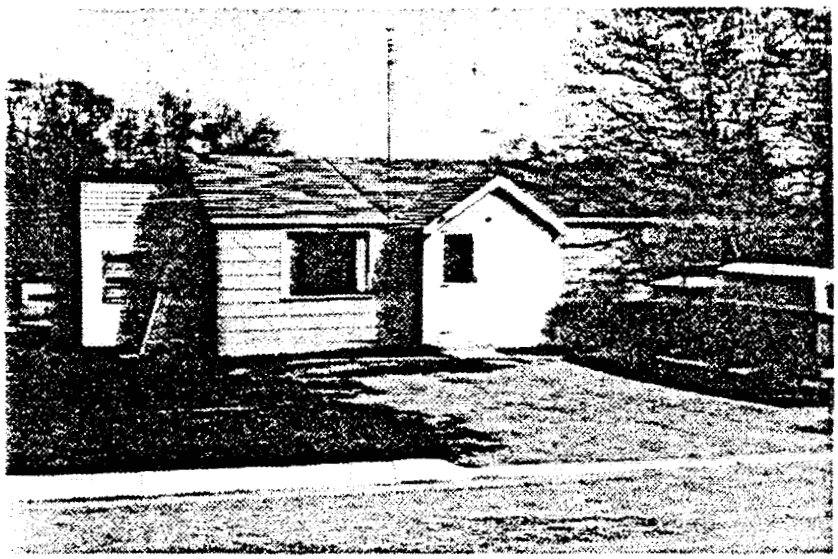
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MMS 20
N
FENCELINE
TREE
SHRUB
BEDROOM
BEDROOM
UPSTAIRS
SHED
BEDROOM
UTILITY ROOM
BATH
FLOWERS
KITCHEN
LIVING ROOM
SAND BOX
FLOWER GARDEN
GRAVEL PARKING AREA



GAMMA SURVEY REPORT

Owner J.J. Steffen

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 2

Type of Structure		Material	
X	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space		Masonry
	Unknown	X	Non Masonry
Number of Levels	2	Other	

Comments: Approximate date of original construction was 1948.

Elevated reading associated with: Yard and foundation.

Survey No. 21
Event No. 1980 - 1971 61
Street Address 381 South 2nd West
City/State Monticello, Utah
County San Juan
Date June 23, 1982
Surveyors F.C. & P.B.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	43	80
HOG	25	39
LOG	13	11

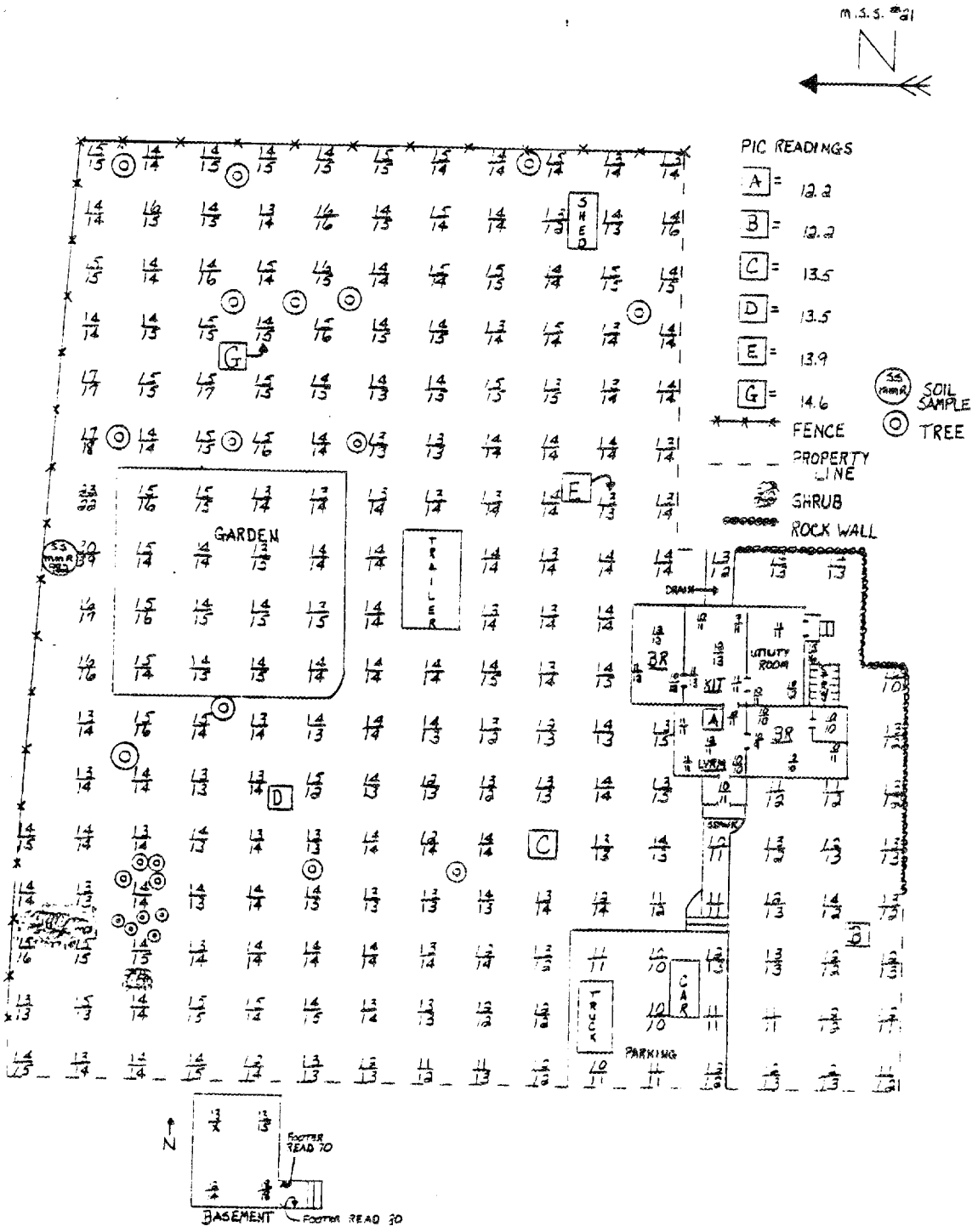
Location HIG Basement

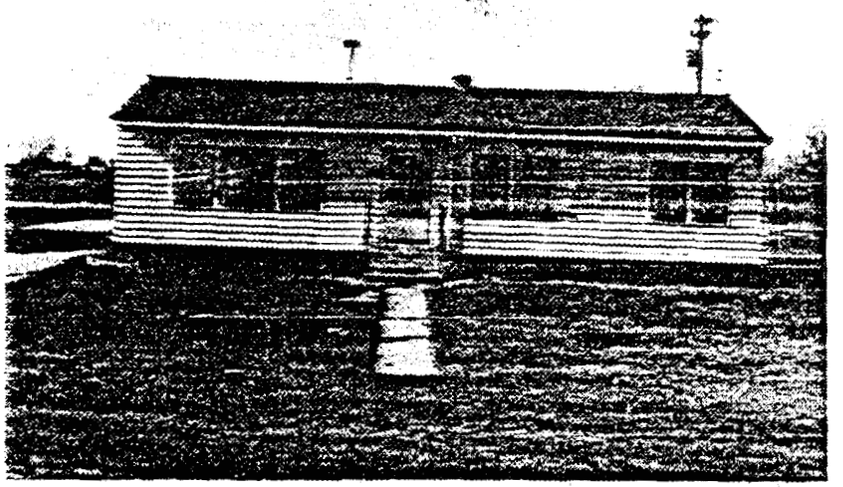
Number of PIC Readings Taken
Inside 1 Outside 5

Soil Samples Taken
Yes X No ___ Number 1

Sample Numbers MMR 982

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. #21
N
PIC READINGS
A = 12.2
B = 12.2
C = 13.5
D = 13.5
E = 13.9
G = 14.6
SOIL SAMPLE
TREE
FENCE
PROPERTY LINE
SHRUB
ROCK WALL
GARDEN
TRAILER
SHED
DRAIN
BR
UTILITY ROOM
LIVING
CAR
TRUCK
PARKING
FOOTER READ 70
BASEMENT
Footer READ 30



GAMMA SURVEY REPORT

Owner: U.S.A. Forest Service

Occupant: Sue Wight

Property Classification: 1 Gamma Map: 1 Tailings Use: 9

Type of Structure		Material	
____	Basement	____	Adobe
____	Slab on Grade	____	House Trailer
X	Crawl Space	____	Masonry
____	Unknown	X	Non Masonry
Number of Levels: ____		Other: ____	

Comments: ____

Elevated reading associated with: Yard

Survey No.: 22
Event No.: 1980 - 1971 57
Street Address: 216 Uranium Drive
City/State: Monticello, Utah
County: San Juan
Date: June 15, 1982
Surveyors: E.B. & M.B.
Meter No.: C.3558.S

	Corrected	Uncorrected
HIG	14	13
HOG	23	34
LOG	13	11

Location HIG: Store Room

Number of PIC Readings Taken
Inside: 0 Outside: 3

Soil Samples Taken
Yes: ____ No: X Number: 0

Sample Numbers: ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

MSS 22

N

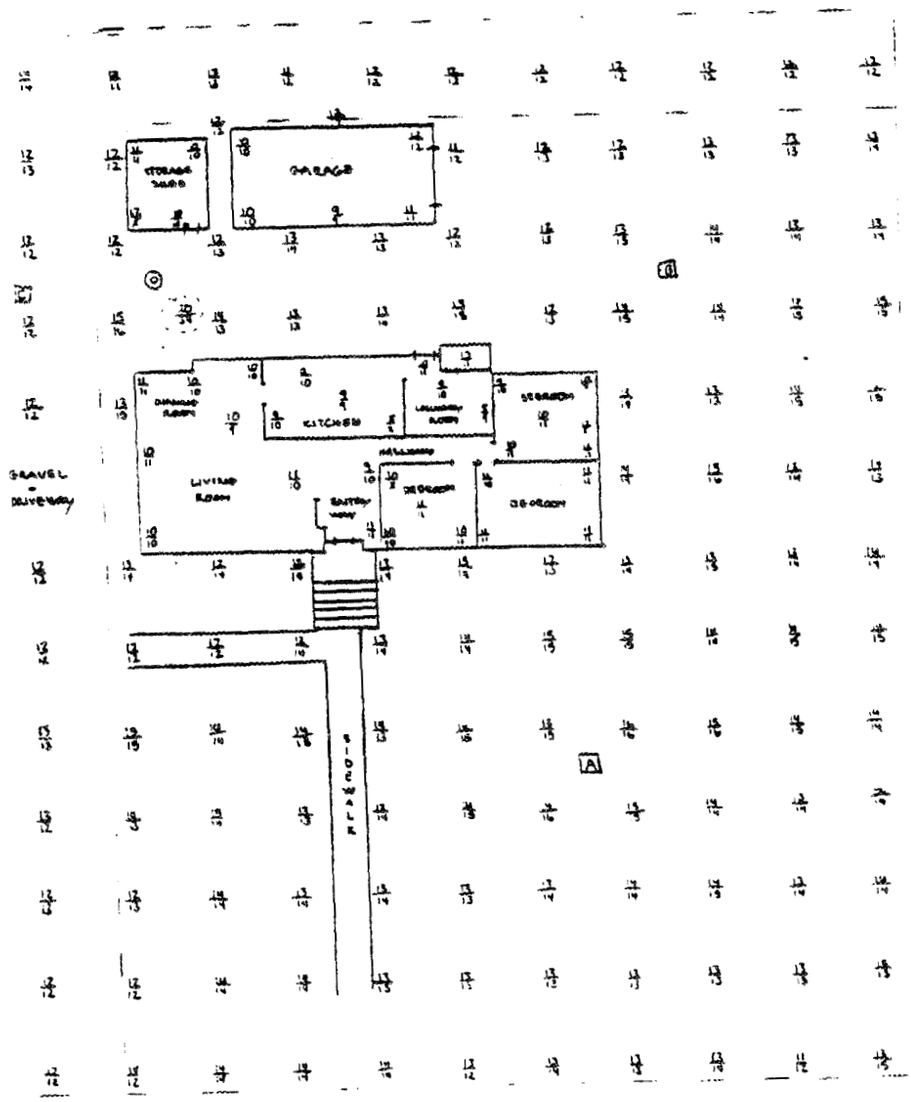
PIC READINGS

A = 12.5

B = 12.5

C = 11.5

⊙ = TREE



GAMMA SURVEY REPORT

Owner: BLM

Occupant: None

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 0

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space		Masonry
	Unknown	X	Non Masonry
Number of Levels: 1			Other

Comments: Approximate date of original construction was 1948.

Elevated reading associated with: Yard

Survey No.: 23
Event No.: 1980 - 1971 58
Street Address: 196 Uranium Drive
City/State: Monticello, Utah
County: San Juan
Date: June 16, 1982
Surveyors: P.B., F.C., E.B., & M.B.
Meter No.: C.3559.S & C.3558.S

	Corrected	Uncorrected
HIG	14	14
HOG	17	20
LOG	13	10

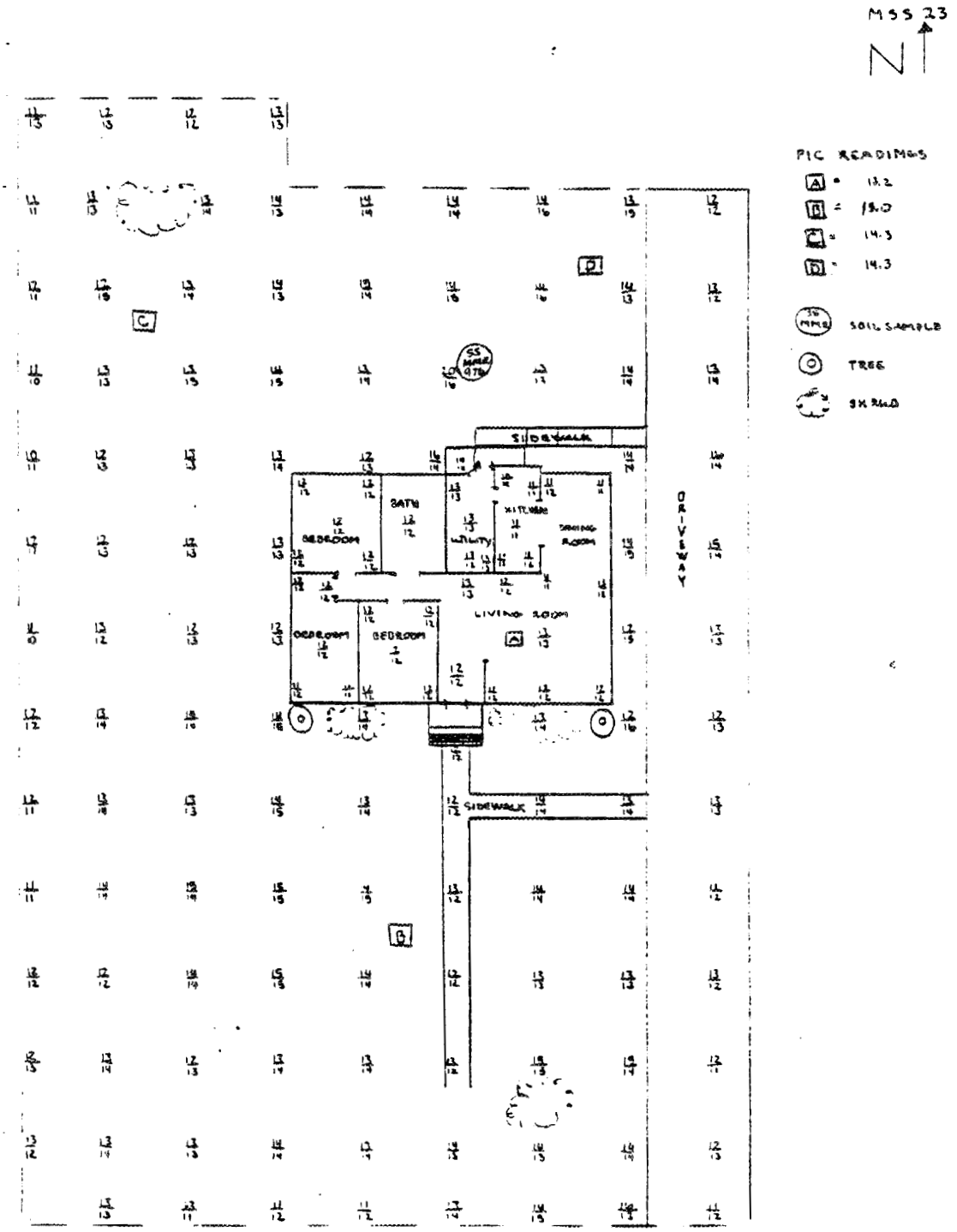
Location HIG: Pantry

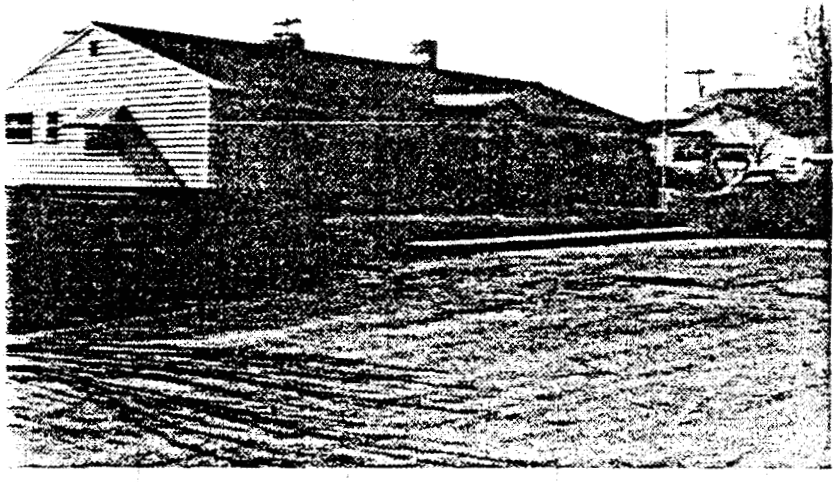
Number of PIC Readings Taken: Inside 1 Outside 3

Soil Samples Taken: Yes X No ___ Number 1

Sample Numbers: MMR 976

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 23
N
PIC READINGS
A = 13.2
B = 15.0
C = 14.5
D = 14.3
SOIL SAMPLE
TREE
SW RMD
SIDEWALK
BEDROOM
BATH
KITCHEN
DINING ROOM
LIVING ROOM
BEDROOM
BEDROOM
SIDEWALK
DRIVEWAY



GAMMA SURVEY REPORT

Owner BLM

Occupant Same

Property Classification 9 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
X Basement	____ Adobe
____ Slab on Grade	____ House Trailer
X Crawl Space	____ Masonry
____ Unknown	X Non Masonry
Number of Levels 2	Other ____

Comments: BLM office. Approximate date of original construction was 1948. *Ore samples in basement led to 55 micro R/hr reading.

Elevated reading associated with: Yard and basement.

Survey No. 24
Event No. 1980 1971 55
Street Address 480 South 1st West
City/State Monticello, Utah
County San Juan
Date June 15, 1982
Surveyors P.B., F.C., E.B., & M.B.
Meter No. C.3557.S & C.3558.S

	Corrected	Uncorrected
HIG	*16	19
HOG	17	20
LOG	12	9

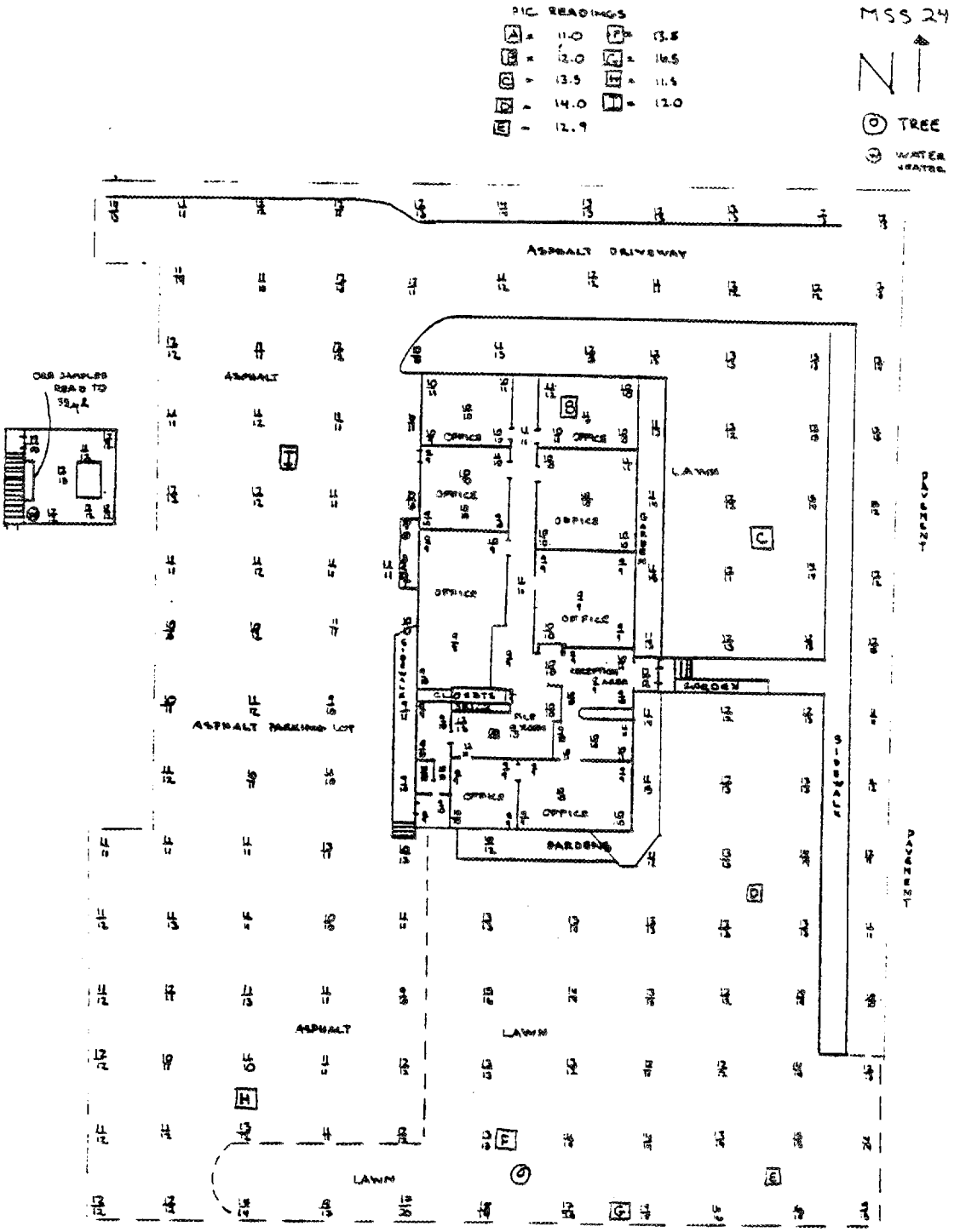
Location HIG Basement

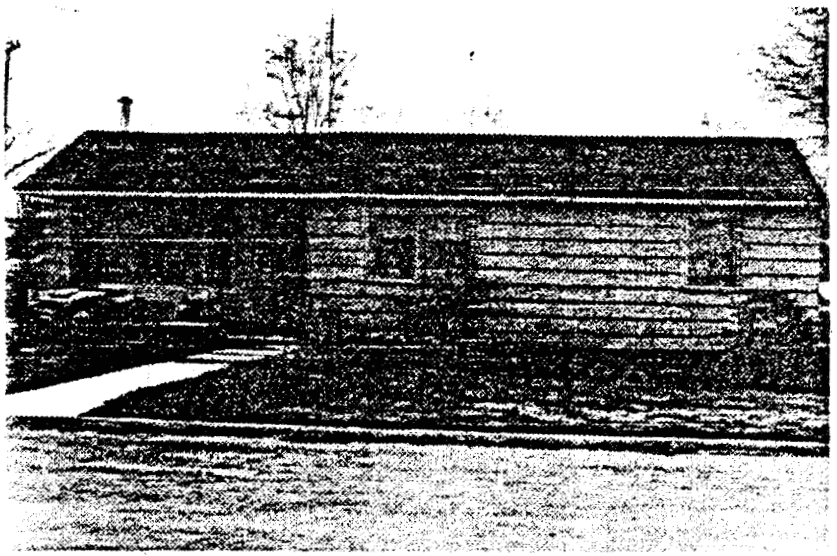
Number of PIC Readings Taken
Inside 2 Outside 7

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


PID READINGS
A = 11.0
B = 12.0
C = 13.5
D = 14.0
E = 12.9
F = 13.5
G = 16.5
H = 11.5
I = 12.0
MSS 24
N
TREE
WATER HEATER
ASPHALT DRIVEWAY
ASPHALT
ASPHALT PARKING LOT
OFFICE
LAWN
GARDEN
PARDENS
PAVEMENT
LAWN



GAMMA SURVEY REPORT

Owner: Graydon L. Martin

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 3

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space		Masonry
	Unknown	X	Non Masonry

Number of Levels: 1 | Other:

Comments: Rock garden has a couple pieces of ore in it.

Elevated reading associated with: Foundation

Survey No.: 25
Event No.: 1980 56 1971 59
Street Address: 516 Circle Drive
City/State: Monticello, Utah
County: San Juan
Date: August 11, 1982
Surveyors: P.B. & F.C.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	14	13
HOG	43	80
LOG	18	23

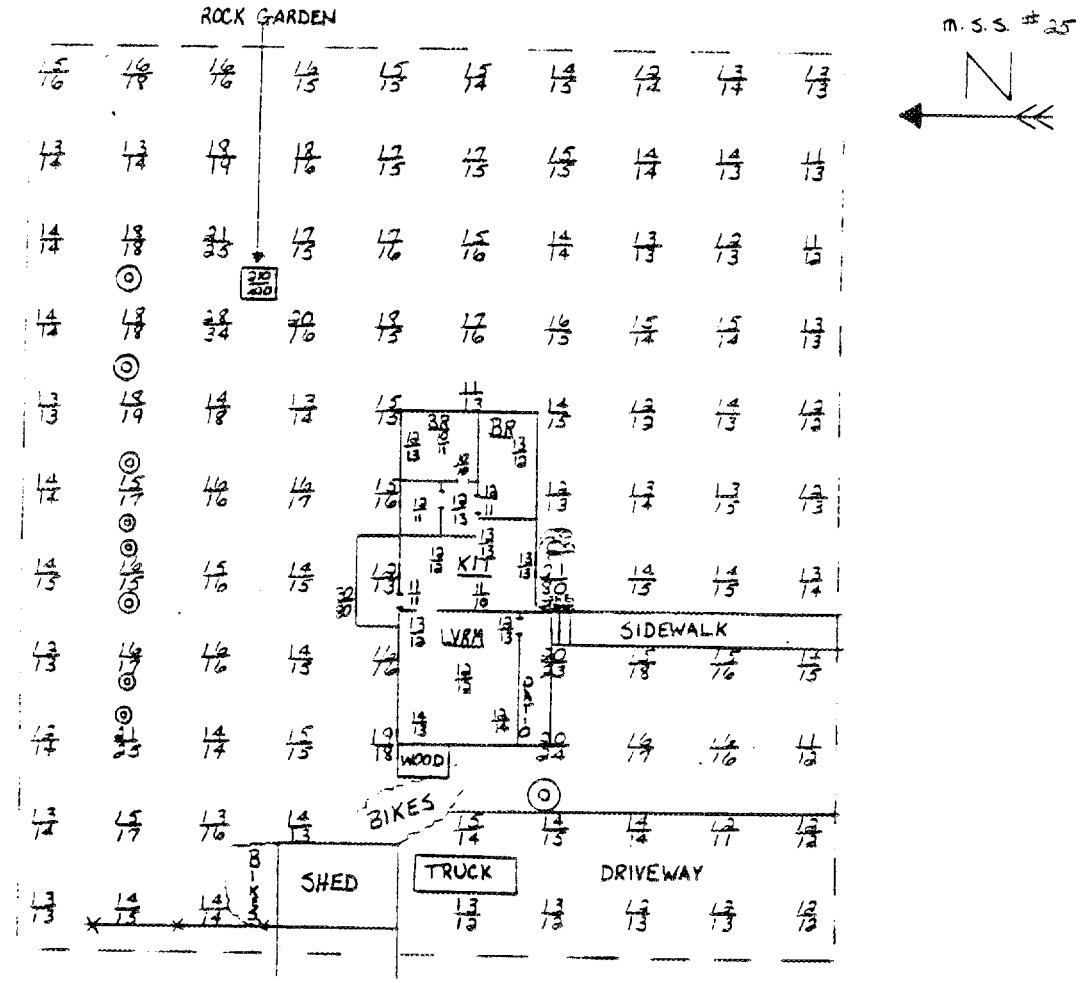
Location HIG: Patio

Number of PIC Readings Taken
Inside: 0 Outside: 0

Soil Samples Taken
Yes: ___ No: X Number: 0

Sample Numbers: ___ ___ ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


ROCK GARDEN
m.s.s. #25
N
BR
KIT
VRM
SIDEWALK
WOOD
BIKES
SHED
TRUCK
DRIVEWAY
B-K-S
TREE
SHRUB
FENCE

GAMMA SURVEY REPORT

Owner: Nick Sandberg

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 0

Type of Structure	Material
___ Basement	___ Adobe
___ Slab on Grade	___ House Trailer
X Crawl Space	___ Masonry
___ Unknown	X Non Masonry
Number of Levels: 1	Other:

Comments: Approximate date of original construction was 1956.

Elevated reading associated with:

Survey No.: 26
Event No.: 1980 58 1971 -
Street Address: 233 Uranium Drive
City/State: Monticello, Utah
County: San Juan
Date: June 15, 1982
Surveyors: P.B. & F.C.
Meter No.: C 3559 S

	Corrected	Uncorrected
HIG	13	12
HOG	15	16
LOG	13	11

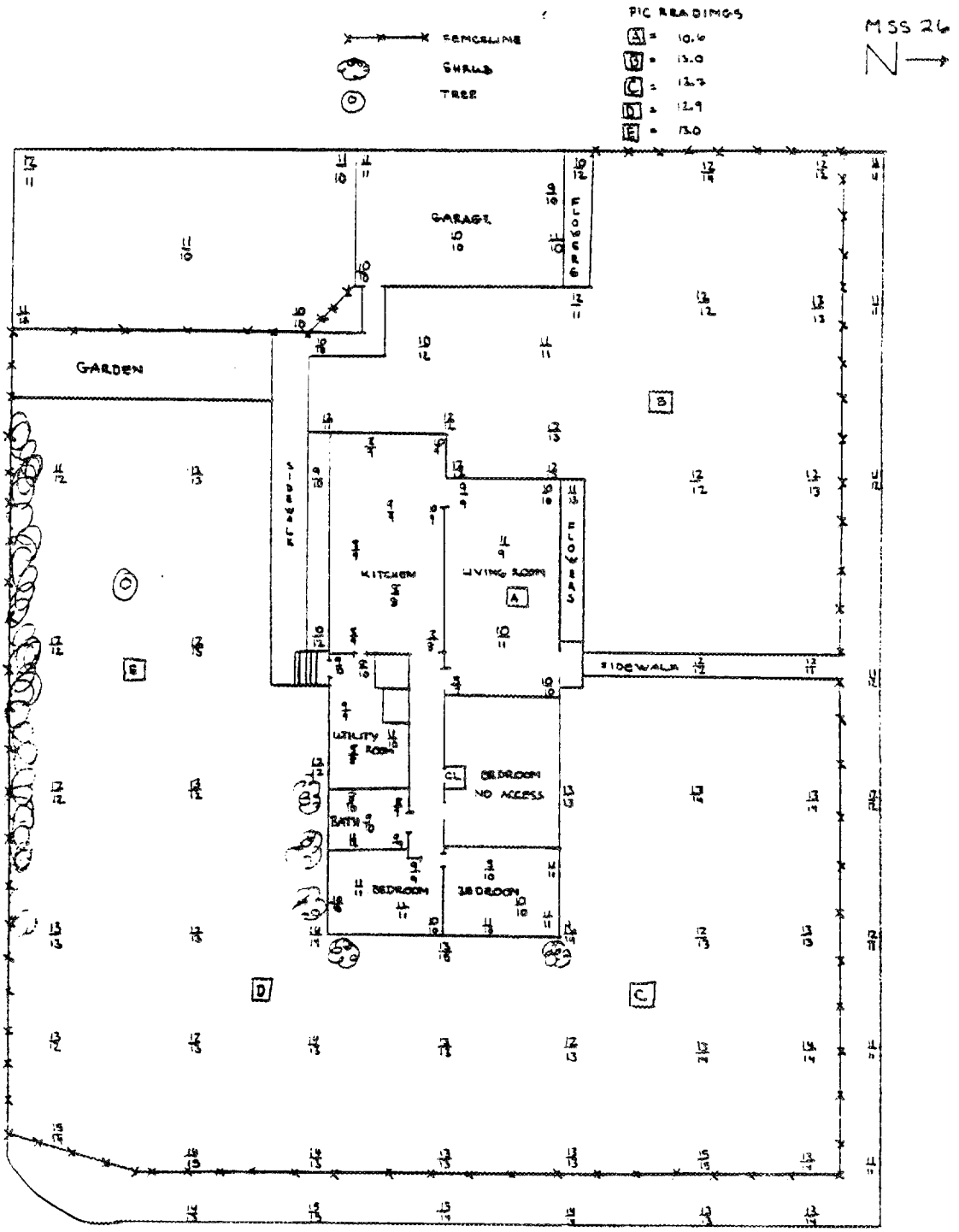
Location HIG: Bathroom

Number of PIC Readings Taken: Inside 1 Outside 4

Soil Samples Taken: Yes ___ No X Number 0

Sample Numbers: ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 26
N
PIC READINGS
FENCELINE
SHRUB
TREE
GARAGE
GARDEN
KITCHEN
LIVING ROOM
SIDEWALK
UTILITY ROOM
BATH
BEDROOM
BEDROOM
BEDROOM
NO ACCESS
A
B
C
D
E

GAMMA SURVEY REPORT

Owner _____

Occupant _____

Property Classification _____ Gamma Map _____ Tailings Use _____

Type of Structure	Material
_____ Basement	_____ Adobe
_____ Slab on Grade	_____ House Trailer
_____ Crawl Space	_____ Masonry
_____ Unknown	_____ Non Masonry
Number of Levels _____	Other _____

Comments: No picture or description -

Not located.

Elevated reading associated with: _____

Survey No. 27

Event No. 1980 ~ 1971 60

Street Address _____

City/State Monticello, Utah

County San Juan

Date _____

Surveyors _____

Meter No. _____

	Corrected	Uncorrected
HIG		
HOG		
LOG		

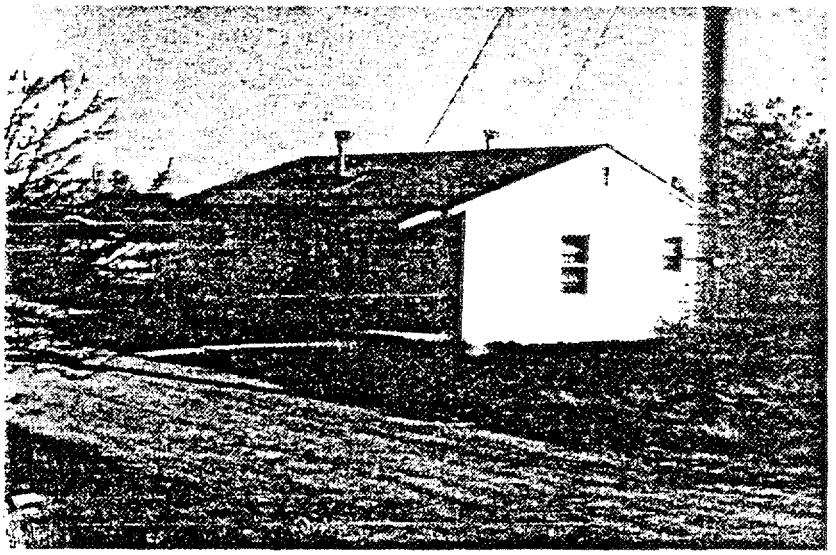
Location HIG _____

Number of PIC Readings Taken
Inside _____ Outside _____

Soil Samples Taken
Yes ____ No ____ Number _____

Sample Numbers _____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



GAMMA SURVEY REPORT

Owner: BLM

Occupant: Allen Ogden

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 1

Type of Structure		Material	
___	Basement	___	Adobe
___	Slab on Grade	___	House Trailer
X	Crawl Space	___	Masonry
___	Unknown	X	Non Masonry

Number of Levels: 1 | Other: ___

Comments: ___

Elevated reading associated with: Yard

Survey No.: 28
Event No.: 1980 57 1971 62
Street Address: 197 South Uranium Drive
City/State: Monticello, Utah
County: San Juan
Date: August 11, 1982
Surveyors: F.C. & P.B.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	24	37
HOG	83	170
LOG	13	11

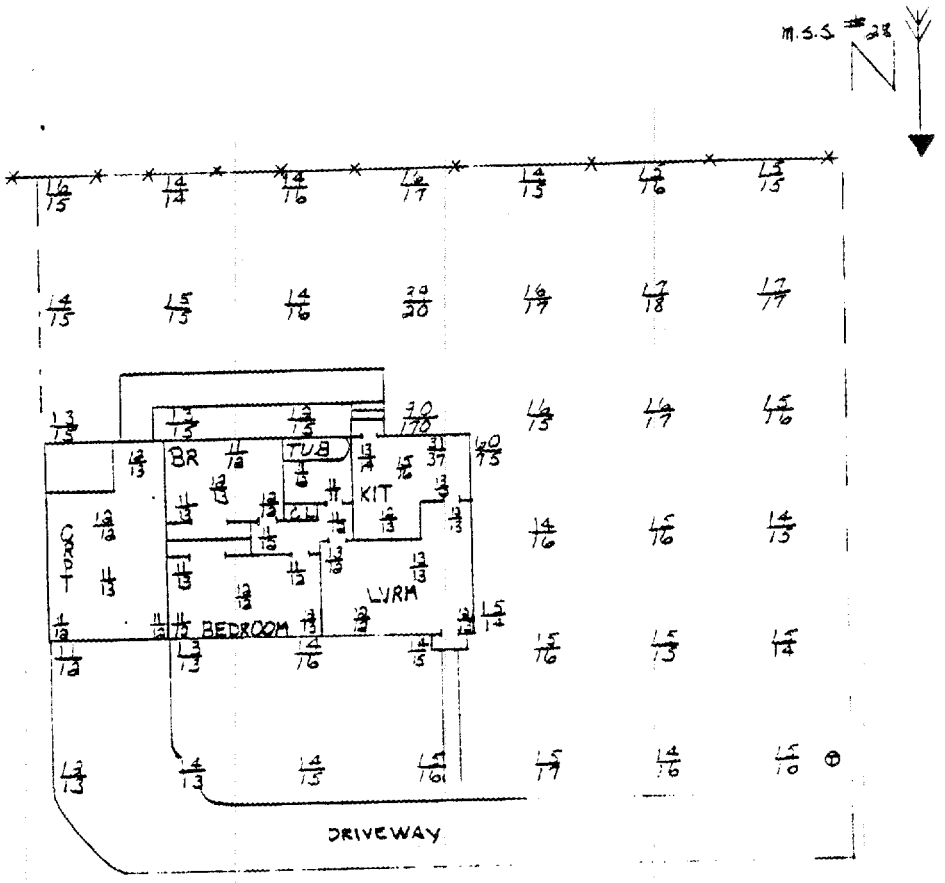
Location HIG: Kitchen

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



FENCE

TELEPHONE POLE

GAMMA SURVEY REPORT

Owner: Bennion Redd

Occupant: Vacant Lot

Property Classification: 0 Gamma Map: 1 Tailings Use: 9

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels: 0	Other: ____

Comments: ____

Elevated reading associated with: ____

Survey No.: 29
Event No.: 1980 - 1971 56
Street Address: 350 South 2nd West
City/State: Monticello, Utah
County: San Juan
Date: August 9, 1982
Surveyors: E.B. & D.I.
Meter No.: C.3558.S

	Corrected	Uncorrected
HIG	-	
HOG	15	15
LOG	13	11

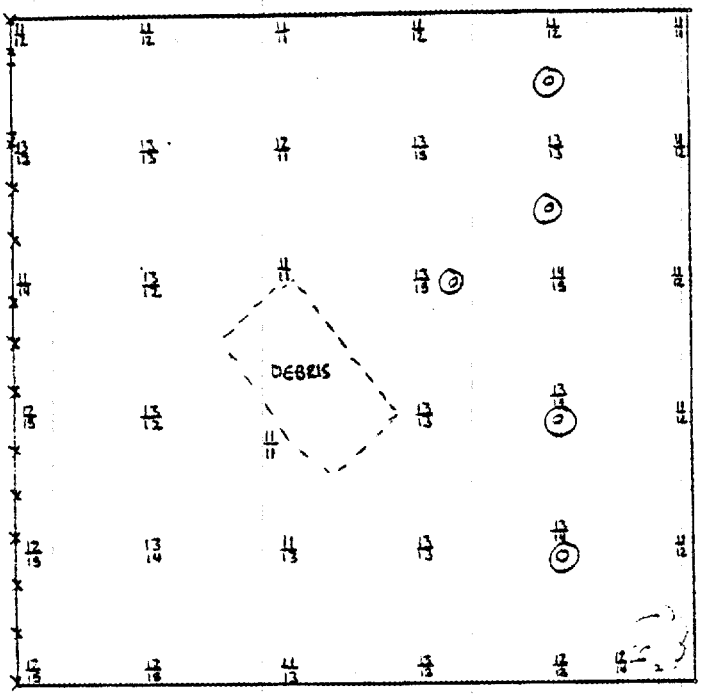
Location HIG: N/A

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



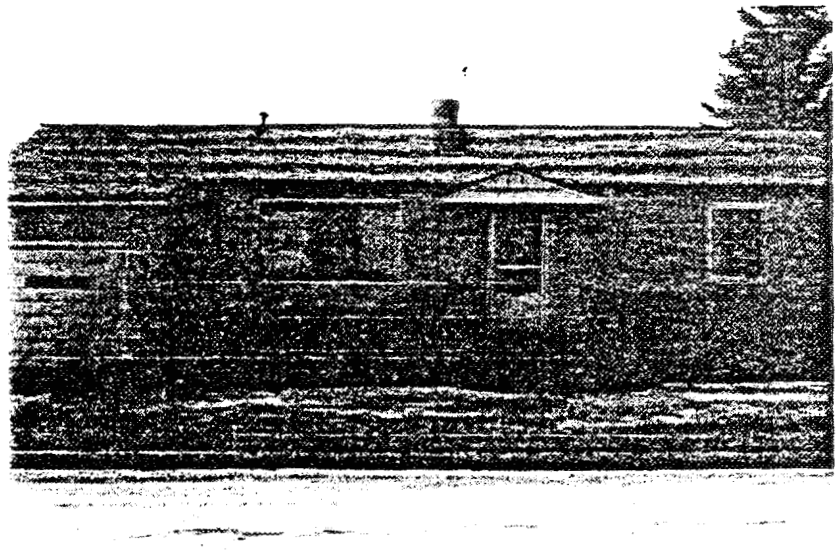
MSS 29

N

TREE

SHRUB

FENCELINE



GAMMA SURVEY REPORT

Owner Susan Jameson

Occupant Same

Property Classification 1 | Gamma Map 2 | Tailings Use ____

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels ____	Other ____

Comments: REFUSAL

Elevated reading associated with: ____

Survey No. 30
Event No. 1980 59 1971 18
Street 564 Circle Drive
Address ____
City/State Monticello, Utah
County San Juan
Date August 12, 1982
Surveyors ____
Meter No. ____

	Corrected	Uncorrected
HIG	____	____
HOG	____	____
LOG	____	____

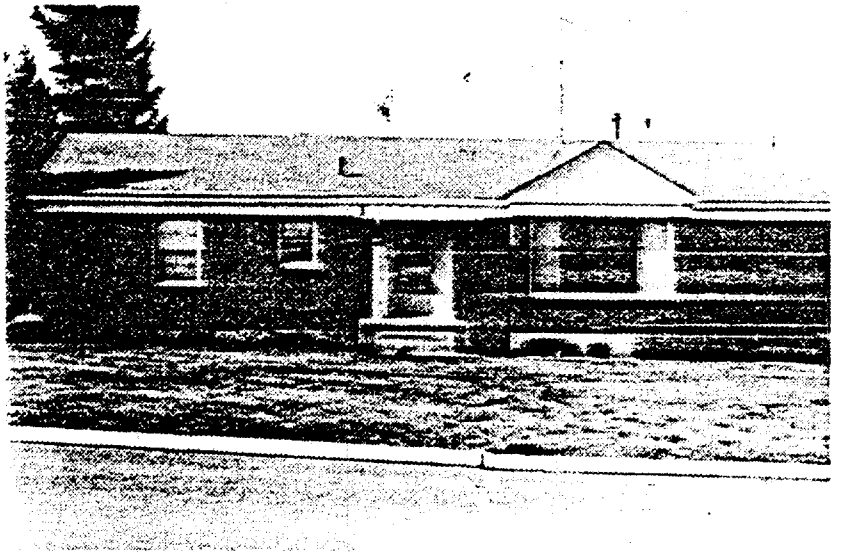
Location HIG ____

Number of PIC Readings Taken
Inside ____ Outside ____

Soil Samples Taken
Yes ____ No ____ Number ____

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



GAMMA SURVEY REPORT

Owner · Devere Hall

Occupant

Property Classification 1 | Gamma Map 1 | Tailings Use 2

Type of Structure	Material
___ Basement	___ Adobe
___ Slab on Grade	___ House Trailer
X Crawl Space	X Masonry
___ Unknown	___ Non Masonry

Number of Levels 1 | Other

Comments: Approximate date of original construction was 1952.

Elevated reading associated with: Yard

Survey No. 31
Event No. 1980 40 1971
Street 96 West 2nd North
Address
City/State Monticello, Utah
County San Juan
Date July 29, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	15	15
HOG	25	39
LOG	13	10

Location HIG Kitchen

Number of PIC Readings Taken
Inside 0 Outside 2

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

MSS 31

N

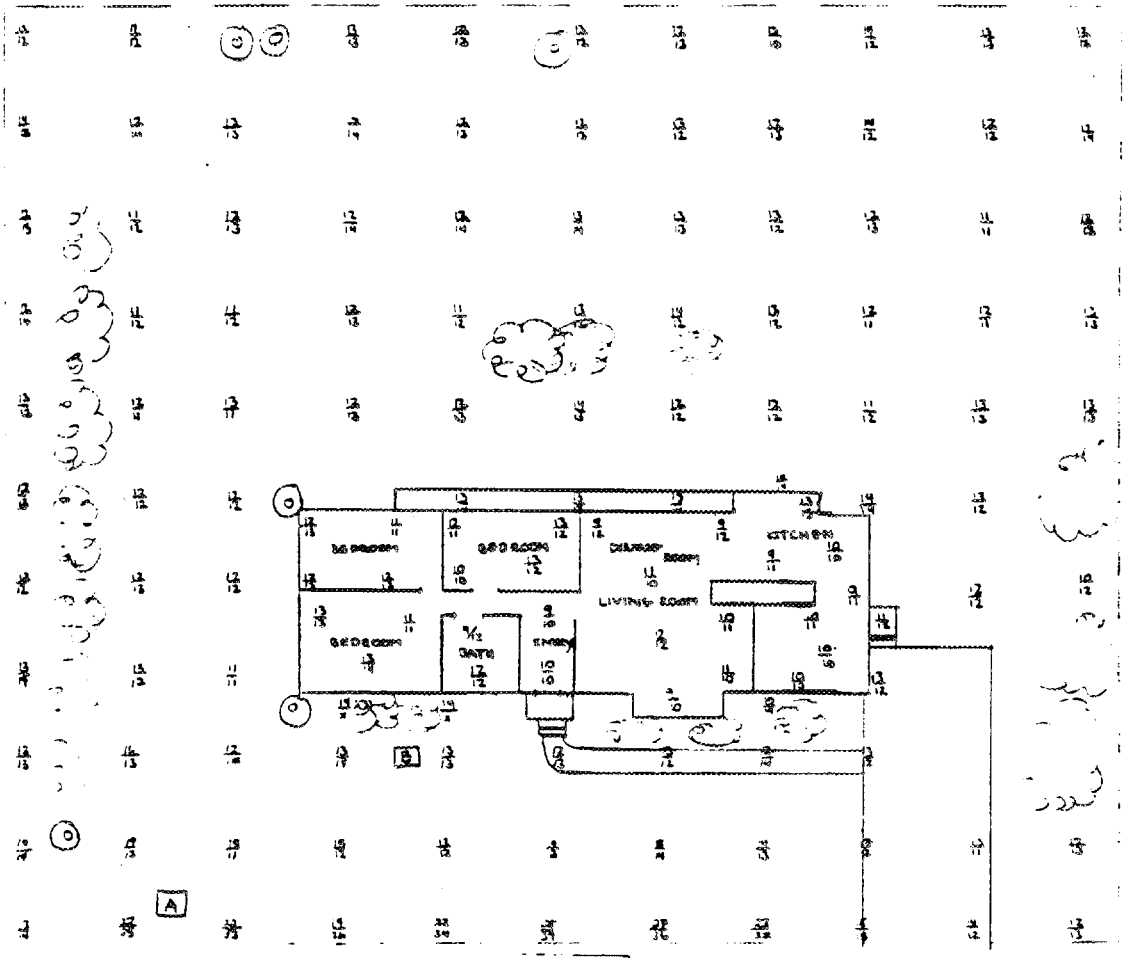
PIC READINGS

A - 16.9

B - 13.8

Trees

SHRUB



GAMMA SURVEY REPORT

Owner: Ruel Randal

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure		Material	
____	Basement	____	Adobe
____	Slab on Grade	____	House Trailer
X	Crawl Space	X	Masonry
____	Unknown	X	Non Masonry

Number of Levels: 2 | Other: ____

Comments: *Fireplace contained one rock which led to 180 micro R/hr reading. Approximate date of original construction was 1946-47.

Elevated reading associated with: Fireplace

Survey No.: 32
Event No.: 1980 - 1971 32
Street Address: 48 West 1st North
City/State: Monticello, Utah
County: San Juan
Date: August 4, 1982
Surveyors: D.T. & F.B.
Meter No.: C.3558.S

	Corrected	Uncorrected
HIG	15*	15
HOG	16	17
LOG	13	11

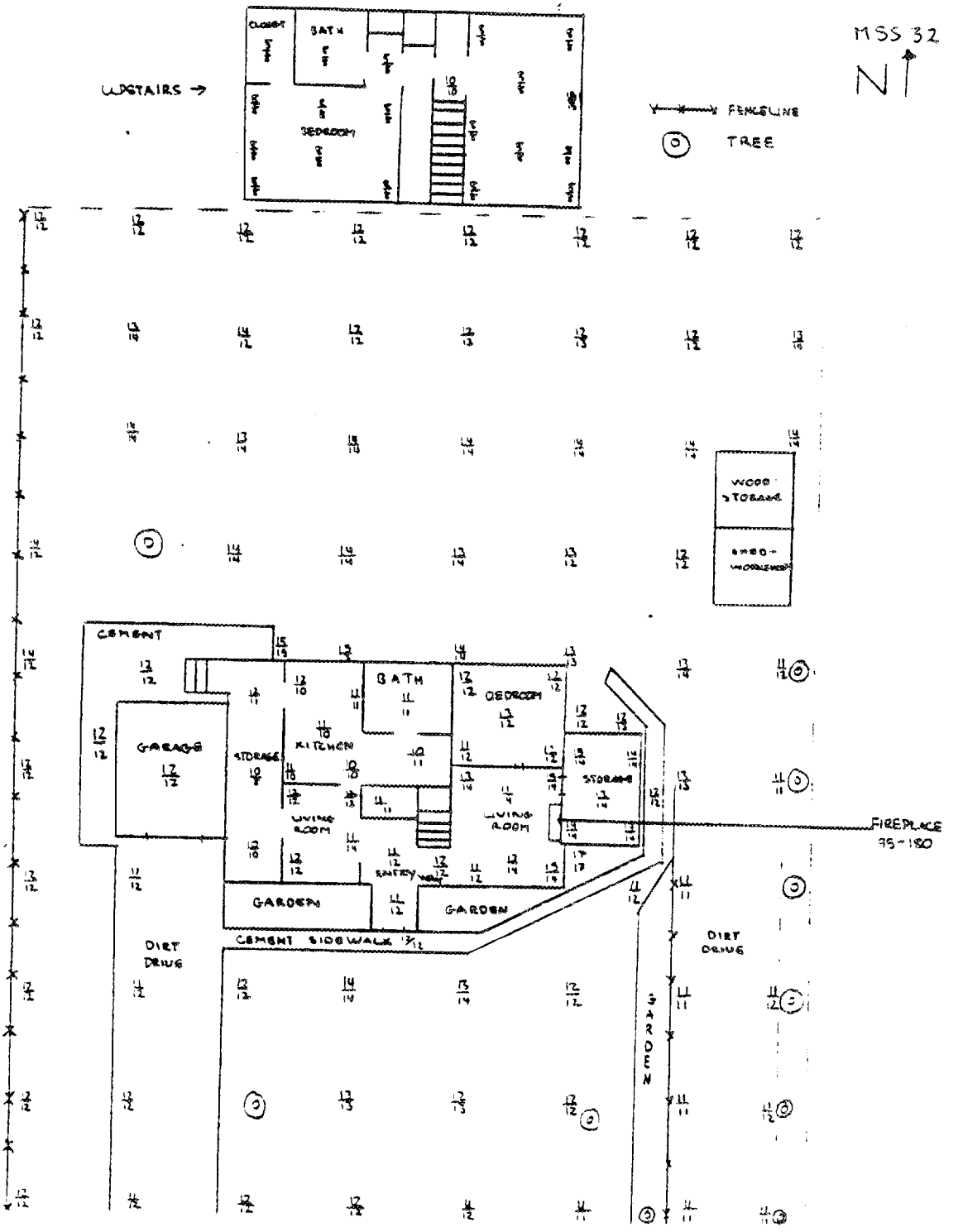
Location HIG: Fireplace, storage

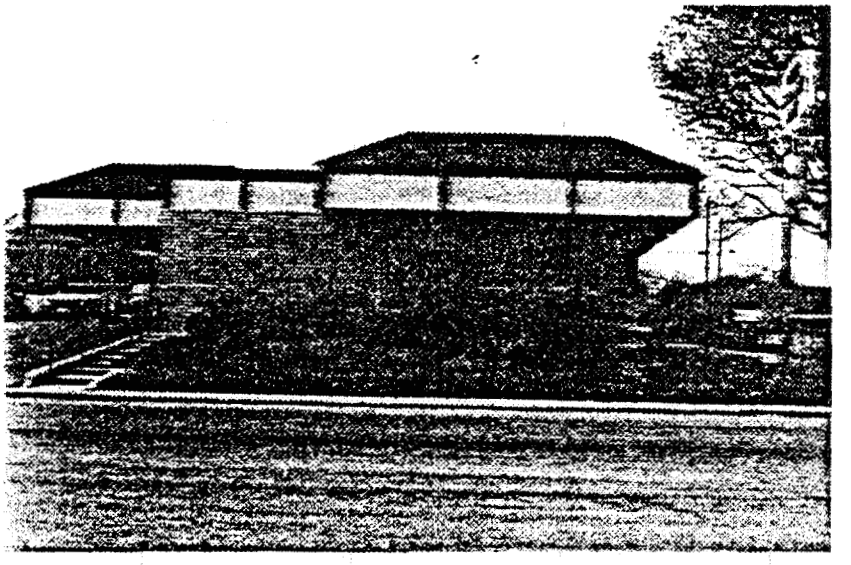
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ____ No X Number 0

Sample Numbers: ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 32
N
UPSTAIRS →
CLOSET
BATH
BEDROOM
FENCELINE
TREE
WOOD STORAGE
CEMENT
GARAGE
STORAGE
KITCHEN
BATH
BEDROOM
LIVING ROOM
STORAGE
FIREPLACE
95-180
GARDEN
GARDEN
CEMENT SIDEWALK
DIRT DRIVE
DIRT DRIVE
NEWARK



GAMMA SURVEY REPORT

Owner: First Security Company

Occupant: Monticello Branch

Property Classification: 5 Gamma Map: 1 Tailings Use: 0

Type of Structure	Material
X Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	___ Non Masonry
Number of Levels: 2	Other: ___

Comments: Approximate date of original construction was November of 1974.

Elevated reading associated with: ___

Survey No.: 33
Event No.: 1980 - 1971 11
Street Address: 16 South Main
City/State: Monticello, Utah
County: San Juan
Date: July 13, 1982
Surveyors: E.B. & D.S.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	15	15
HOG	15	16
LOG	12	9

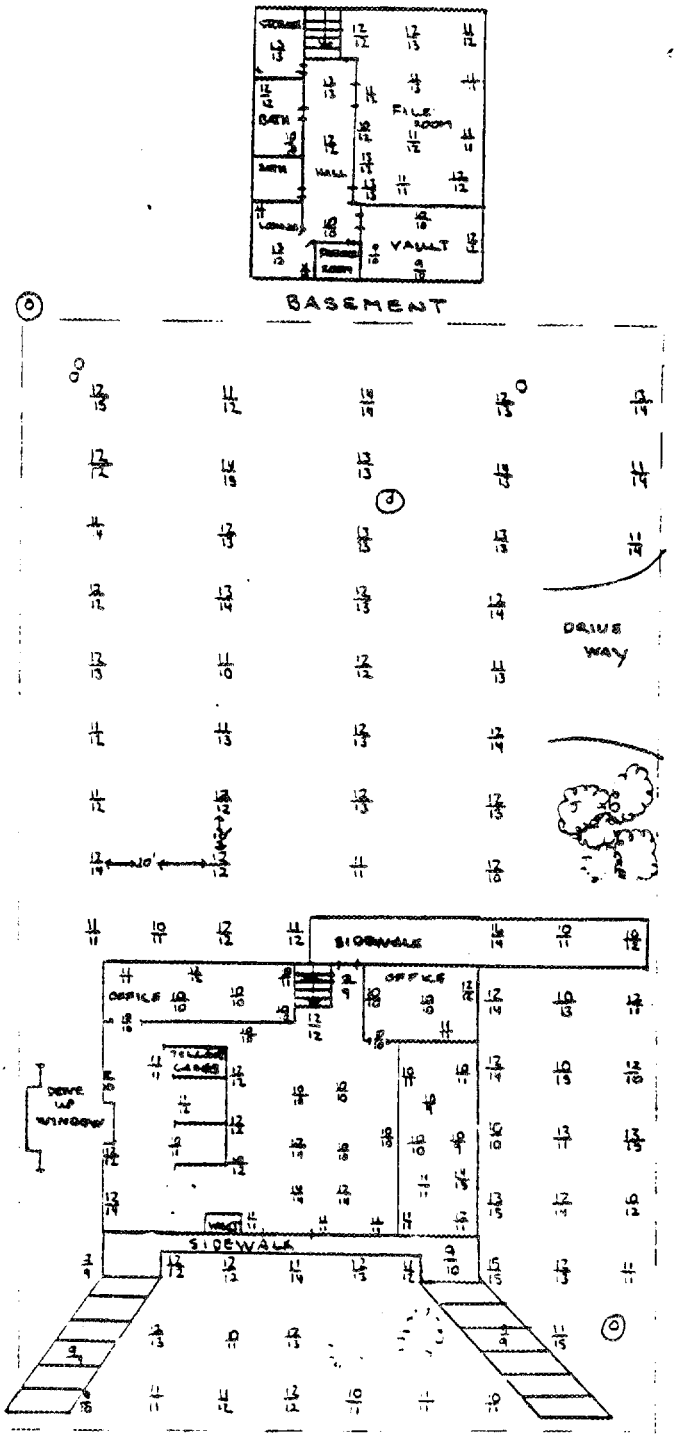
Location HIG: middle of lobby floor

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



MSS 33

N

TREE

SHRUB

POWER POLE

GAMMA SURVEY REPORT

Owner: Lex Pro Corp.

Occupant: Lila Semadini

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 0

Type of Structure		Material	
____	Basement	____	Adobe
____	Slab on Grade	X	House Trailer
X	Crawl Space	____	Masonry
____	Unknown	____	Non Masonry

Number of Levels: 1 | Other: ____

Comments: Neighbor used to bring home ore samples.

Elevated reading associated with: ____

Survey No.: 34
Event No.: 1980 18 1971 -
Street Address: 49 South 1st West
City/State: Monticello, Utah
County: San Juan
Date: August 10, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	14	14
HOG	14	14
LOG	13	11

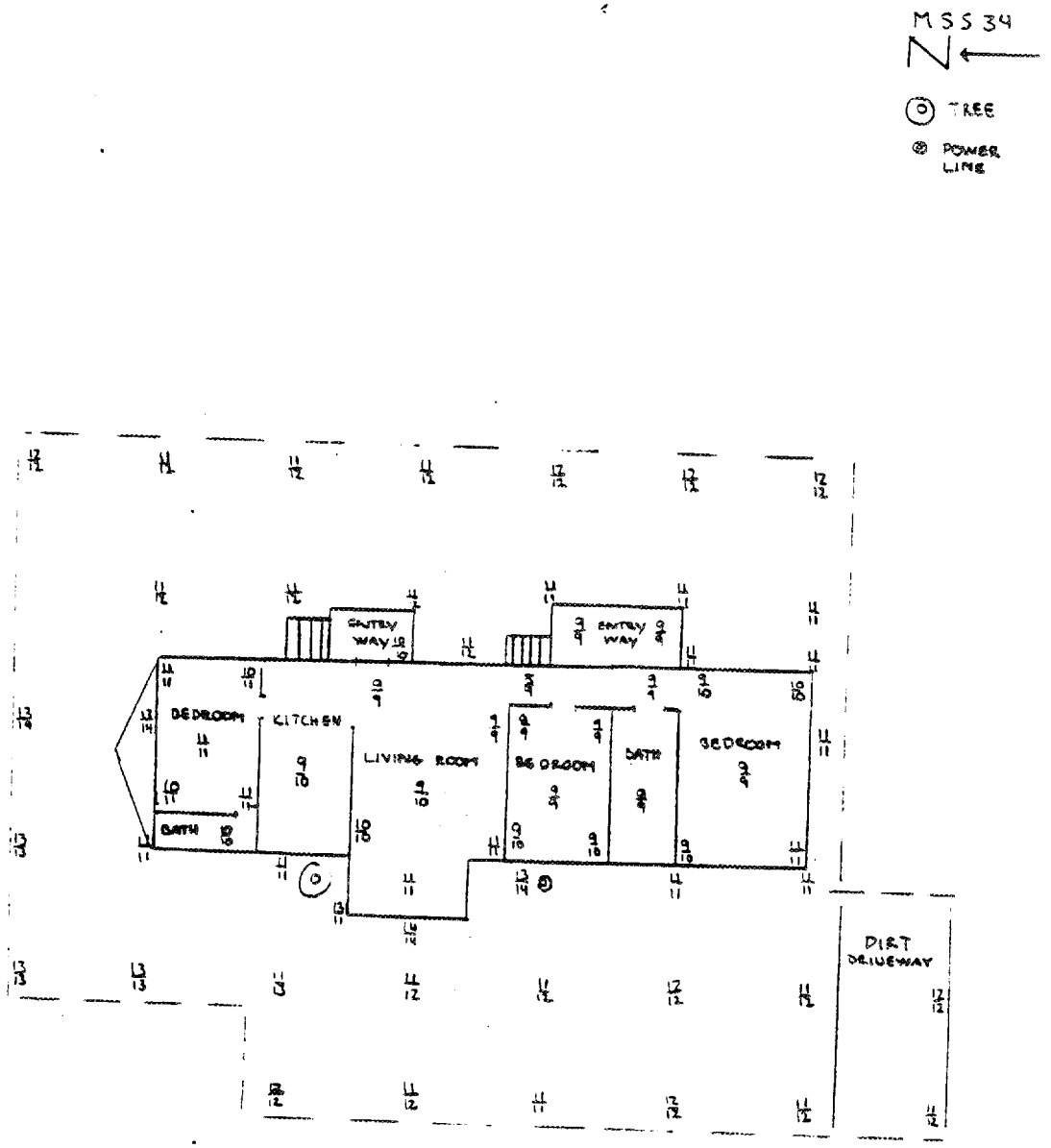
Location HIG: Bedrooms

Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ____ No X Number 0

Sample Numbers: ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 34
N
TREE
POWER LINE
ENTRY WAY
ENTRY WAY
BEDROOM
KITCHEN
LIVING ROOM
BEDROOM
BATH
BEDROOM
BATH
DIRT DRIVEWAY

GAMMA SURVEY REPORT

Owner: Redd Country Enterprise

Occupant: Monticello Mercantile Co.

Property Classification: 6 | Gamma Map: 1 | Tailings Use: 4

Type of Structure	Material
___ Basement	___ Adobe
X Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	___ Non Masonry
Number of Levels: 2	Other: ___

Comments: Multi lease

Elevated reading associated with: Barrel filled with sand (paint shaker base)

Survey No.: 35
Event No.: 1980 +0 1971 -
Street Address: 30 South Main
City/State: Monticello, Utah
County: San Juan
Date: August 5, 1982
Surveyors: E.C., P.B., D.T., & B.F.
Meter No.: C.3557.S & C.3558.S

	Corrected	Uncorrected
HIG	35	60
HOG	16	18
LOG	12	8

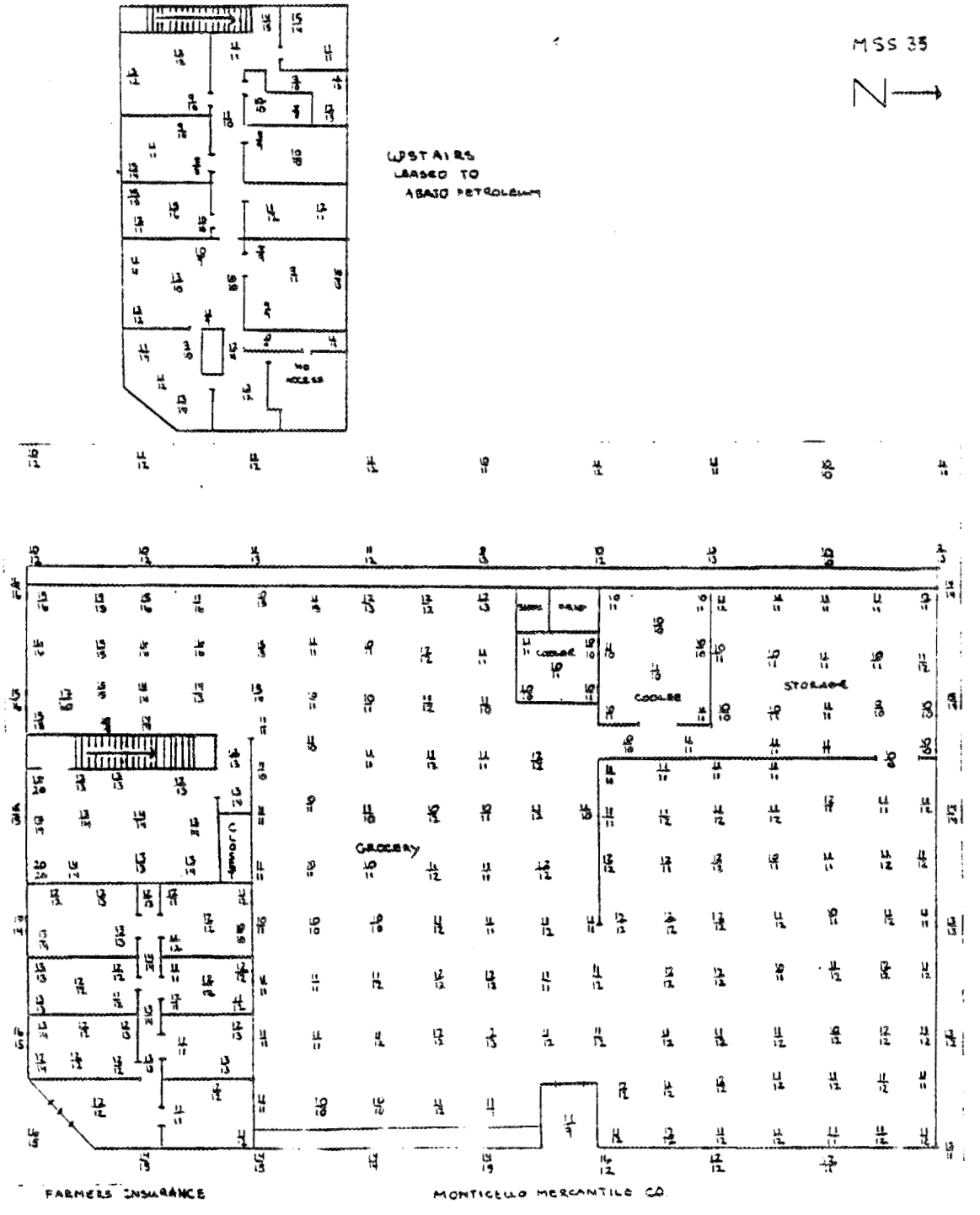
Location HIG: Paint shaker base filled with sand

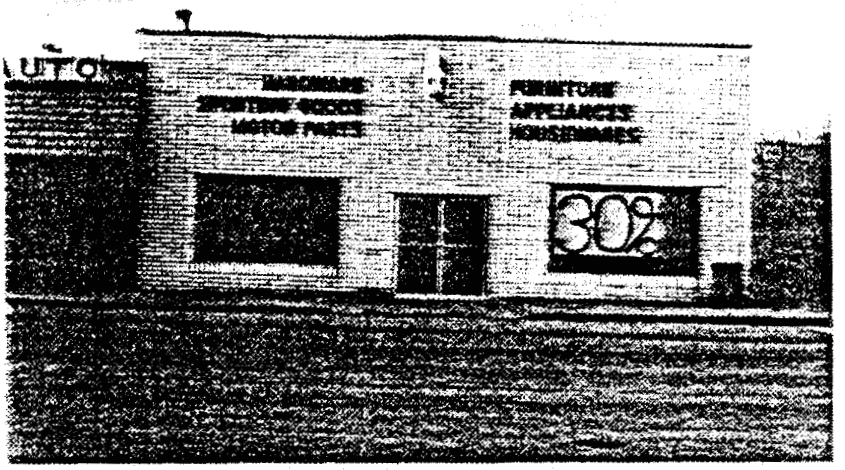
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ___ No X Number 0

Sample Numbers: ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 35
N
UPSTAIRS
LEASED TO
ABASO PETROLEUM
NO ACCESS
COOLER
COOLER
STORAGE
Grocery
FARMERS INSURANCE
MONTICELLO MERCANTILE CO



GAMMA SURVEY REPORT

Owner: Grayson Redd

Occupant: None

Property Classification: 6 Gamma Map: 1 Tailings Use: 4

Type of Structure		Material	
	Basement		Adobe
X	Slab on Grade		House Trailer
	Crawl Space	X	Masonry
	Unknown		Non Masonry
Number of Levels: 1			Other

Comments: Mortar work done by local contractor

Elevated reading associated with: Mortar and/or brick

Survey No.: 36
Event No.: 1980 5 1971 -
Street Address: 116 South Main
City/State: Monticello, Utah
County: San Juan
Date: June 17, 1982
Surveyors: P.B. & F.C.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	24	37
HOG	23	33
LOG	15	16

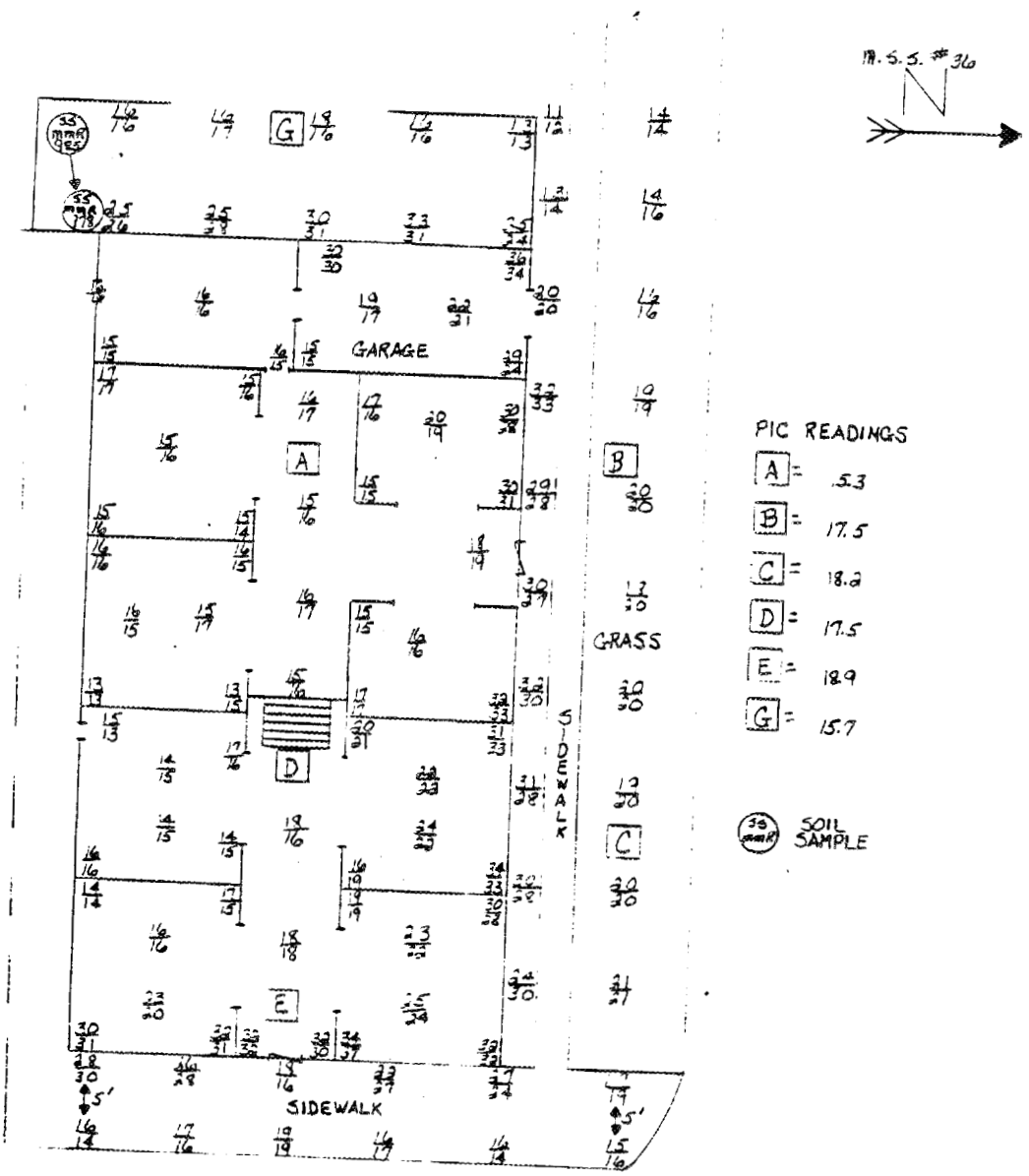
Location HIG: Mortar and/or brick on exterior walls

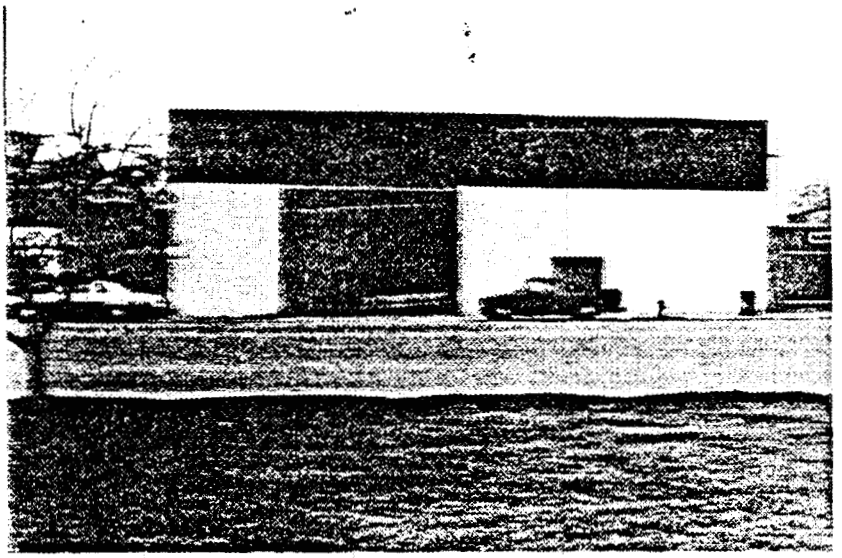
Number of PIC Readings Taken: Inside 3 Outside 3

Soil Samples Taken: Yes X No ___ Number 2

Sample Numbers: MMR 978; MMR 985

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. # 36
GARAGE
GRASS
SIDEWALK
SIDEWALK
5'
5'
A
B
C
D
E
G
PIC READINGS
A = 5.3
B = 17.5
C = 18.2
D = 17.5
E = 18.9
G = 15.7
SOIL SAMPLE



GAMMA SURVEY REPORT

Owner: Grayson Redd

Occupant:

Property Classification: 5 | Gamma Map: 1 | Tailings Use: 1

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	X Masonry
____ Unknown	____ Non Masonry
Number of Levels: 1	Other:

Comments: Structure has dirt floor. East wall is the only brick wall in building.

Elevated reading associated with: Mortar and/or brick

Survey No.: 37
Event No.: 1980 & 1971 -
Street Address: 180 South Main
City/State: Monticello, Utah
County: San Juan
Date: June 22, 1982
Surveyors: P.B. & F.C.
Meter No.: C.3559.S

	Corrected	Uncorrected
HIG	52	100
HOG	20	28
LOG	14	13

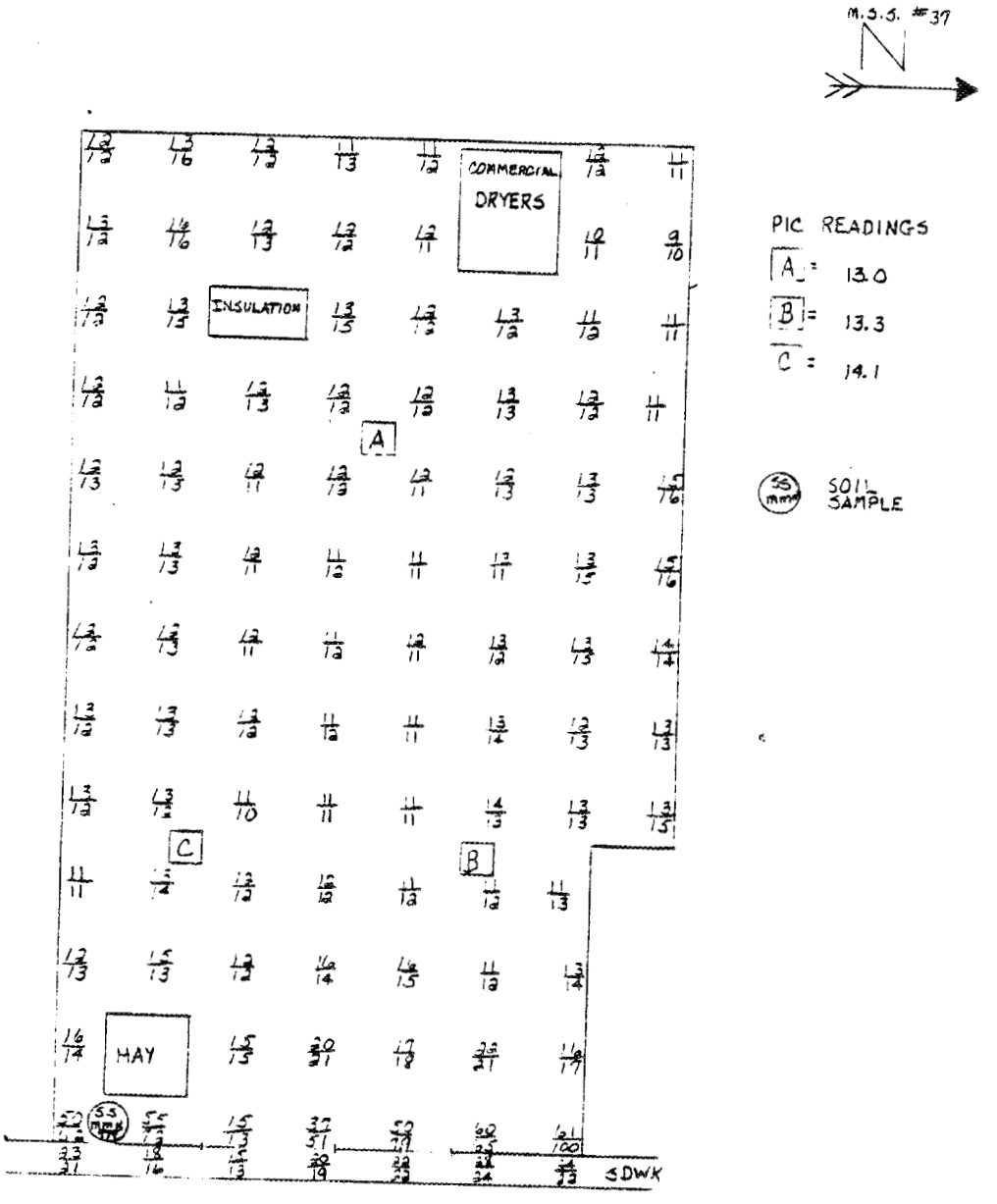
Location HIG: Mortar and/or brick on east wall

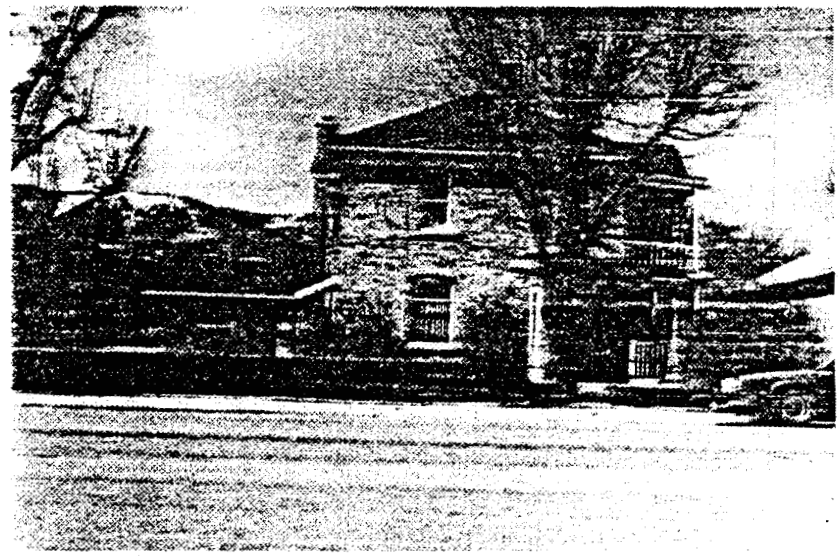
Number of PIC Readings Taken: Inside 3 Outside 0

Soil Samples Taken: Yes X No ____ Number 1

Sample Numbers: MMR 979

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. #37
COMMERCIAL DRYERS
INSULATION
A
B
C
HAY
SDWK
PIC READINGS
A = 13.0
B = 13.3
C = 14.1
SOIL SAMPLE



GAMMA SURVEY REPORT

Owner: D. Adams

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 0

Type of Structure	Material
___ Basement	___ Adobe
X Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	X Non Masonry
Number of Levels: 2	Other:

Comments:

Elevated reading associated with:

Survey No.: 38
Event No.: 1980 - 1971 43
Street Address: 16 West 2nd South
City/State: Monticello, Utah
County: San Juan
Date: August 3, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	15	16
HOG	16	17
LOG	13	11

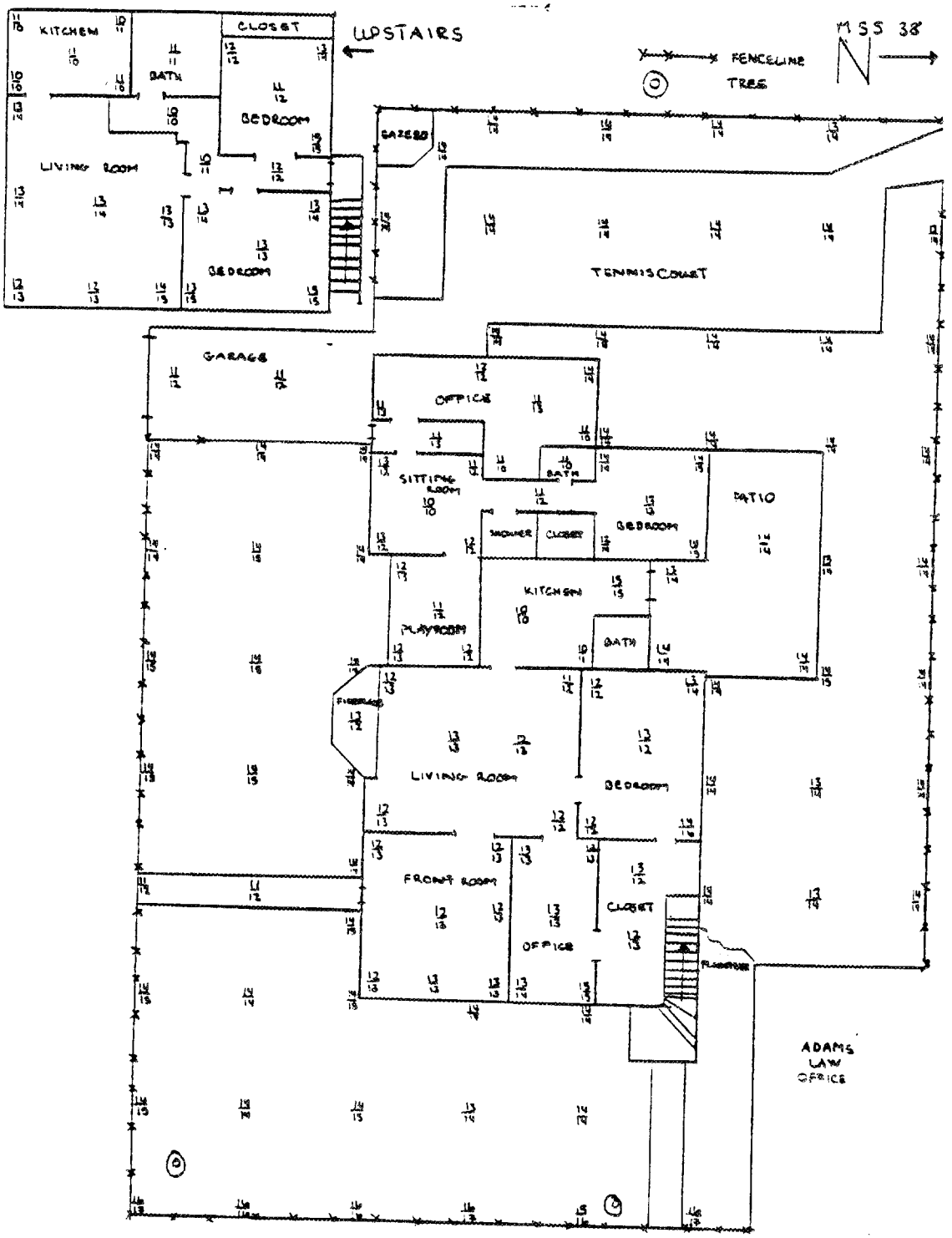
Location HIG: Bedroom

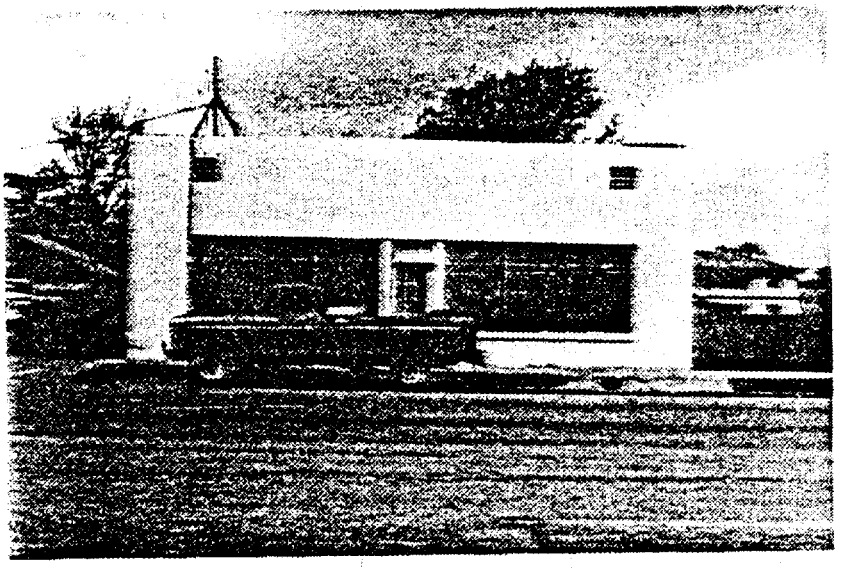
Number of PIC Readings Taken
Inside: 0 Outside: 0

Soil Samples Taken
Yes ___ No X Number: 0

Sample Numbers: ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


KITCHEN
CLOSET
BATH
BEDROOM
LIVING ROOM
BEDROOM
UPSTAIRS
GAZEBO
FENCELINE
TREE
N 55 38
TENNIS COURT
GARAGE
OFFICE
SITTING ROOM
SHOWER
CLOSET
BEDROOM
PATIO
KITCHEN
PLAYROOM
BATH
FIREPLACE
LIVING ROOM
BEDROOM
FRONT ROOM
CLOSET
OFFICE
ADAMS
LAW
OFFICE



GAMMA SURVEY REPORT

Owner Milton Nielson

Occupant Harold Mosher

Property Classification 5 Gamma Map 1 Tailings Use 1

Type of Structure	Material
X Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	___ Non Masonry
Number of Levels 2	Other ___

Comments: Exterior wall by back door read 130 micro R/hr. Approximate date of original construction was in the fifties.

Elevated reading associated with: Basement, shop area.

Survey No. 39
Event No. 1980 7 1971 -
Street 248 South Main
Address
City/State Monticello, Utah
County San Juan
Date July 27, 1982
Surveyors P.B. & F.C.
Meter No. C.3557.S

	Corrected	Uncorrected
HIG	39	70
HOG	65	130
LOG	12	9

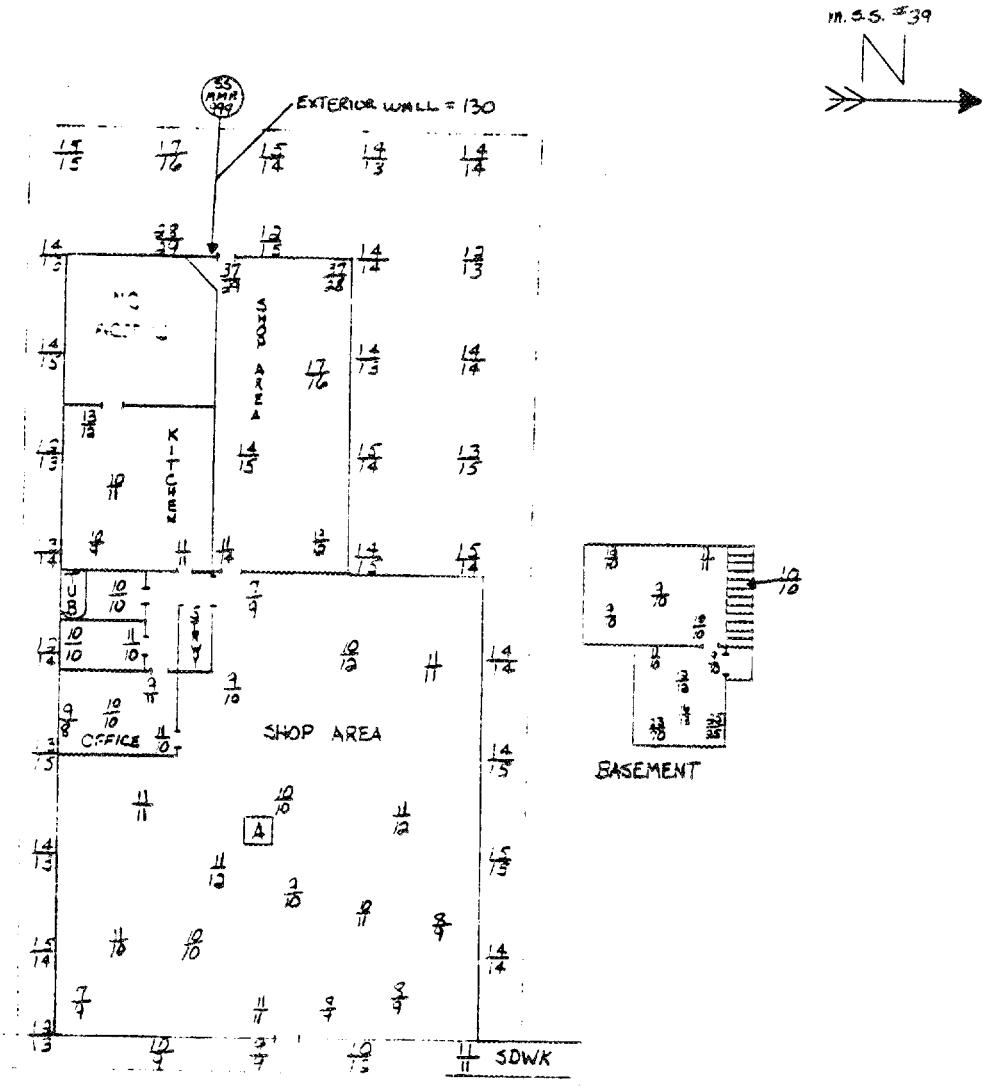
Location HIG Basement

Number of PIC Readings Taken
Inside 1 Outside 0

Soil Samples Taken
Yes X No ___ Number 1

Sample Numbers MMR 999

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



PIC READING

A = 11.3

SS mmr SOIL SAMPLE

GAMMA SURVEY REPORT

Owner: Milton Nielson

Occupant: Vacant Lot

Property Classification: 0 | Gamma Map: 1 | Tailings Use: 2

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry

Number of Levels: 0 | Other: ____

Comments: ____

Elevated reading associated with: Lot

Survey No.: 40
Event No.: 1980 8 1971 -
Street Address: 280 South Main
City/State: Monticello, Utah
County: San Juan
Date: July 29, 1982
Surveyors: P.B. & F.C.
Meter No.: C.3557.S

	Corrected	Uncorrected
HIG	-	
HOG	63	125
LOG	13	10

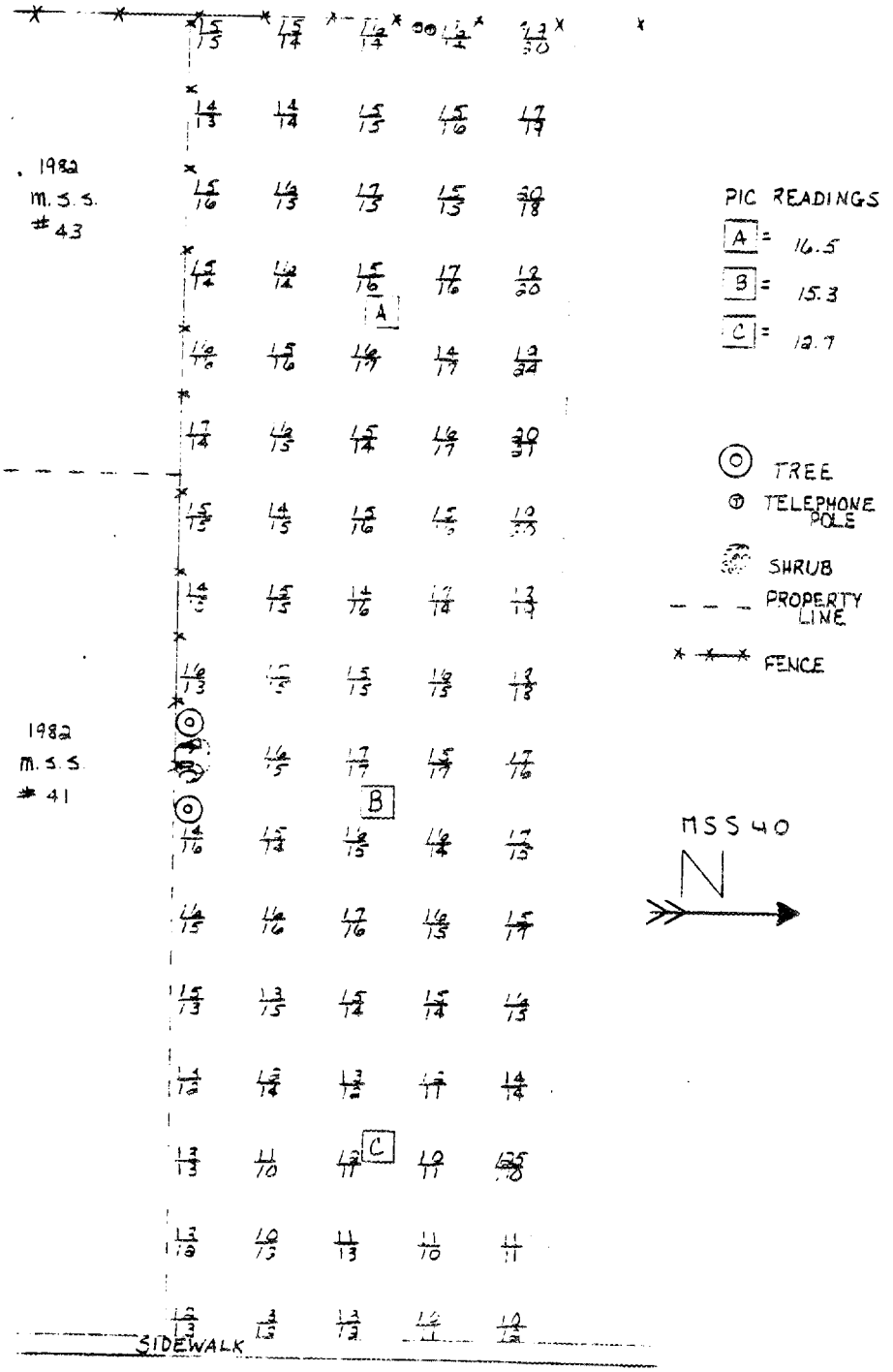
Location HIG: NA

Number of PIC Readings Taken: Inside 0 Outside 3

Soil Samples Taken: Yes ____ No X Number 0

Sample Numbers: ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


1982
M.S.S.
#43
1982
M.S.S.
#41
A
B
C
SIDEWALK
PIC READINGS
A = 16.5
B = 15.3
C = 12.7
TREE
TELEPHONE POLE
SHRUB
PROPERTY LINE
FENCE
MSS 40
N

GAMMA SURVEY REPORT

Owner Milton Nielson

Occupant

Property Classification 5 | Gamma Map 1 | Tailings Use 1

Type of Structure		Material	
___	Basement	___	Adobe
X	Slab on Grade	___	House Trailer
___	Crawl Space	___	Masonry
___	Unknown	X	Non Masonry

Number of Levels 1 Other

Comments: Building being used for storage.

Elevated reading associated with: Exterior walls or foundation

Survey No. 41
Event No. 1980 - 1971 12
Street Address 286 South Main
City/State Monticello, Utah
County San Juan
Date July 28, 1982
Surveyors P.B. & F.C.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	14	13
HOG	54	105
LOG	13	11

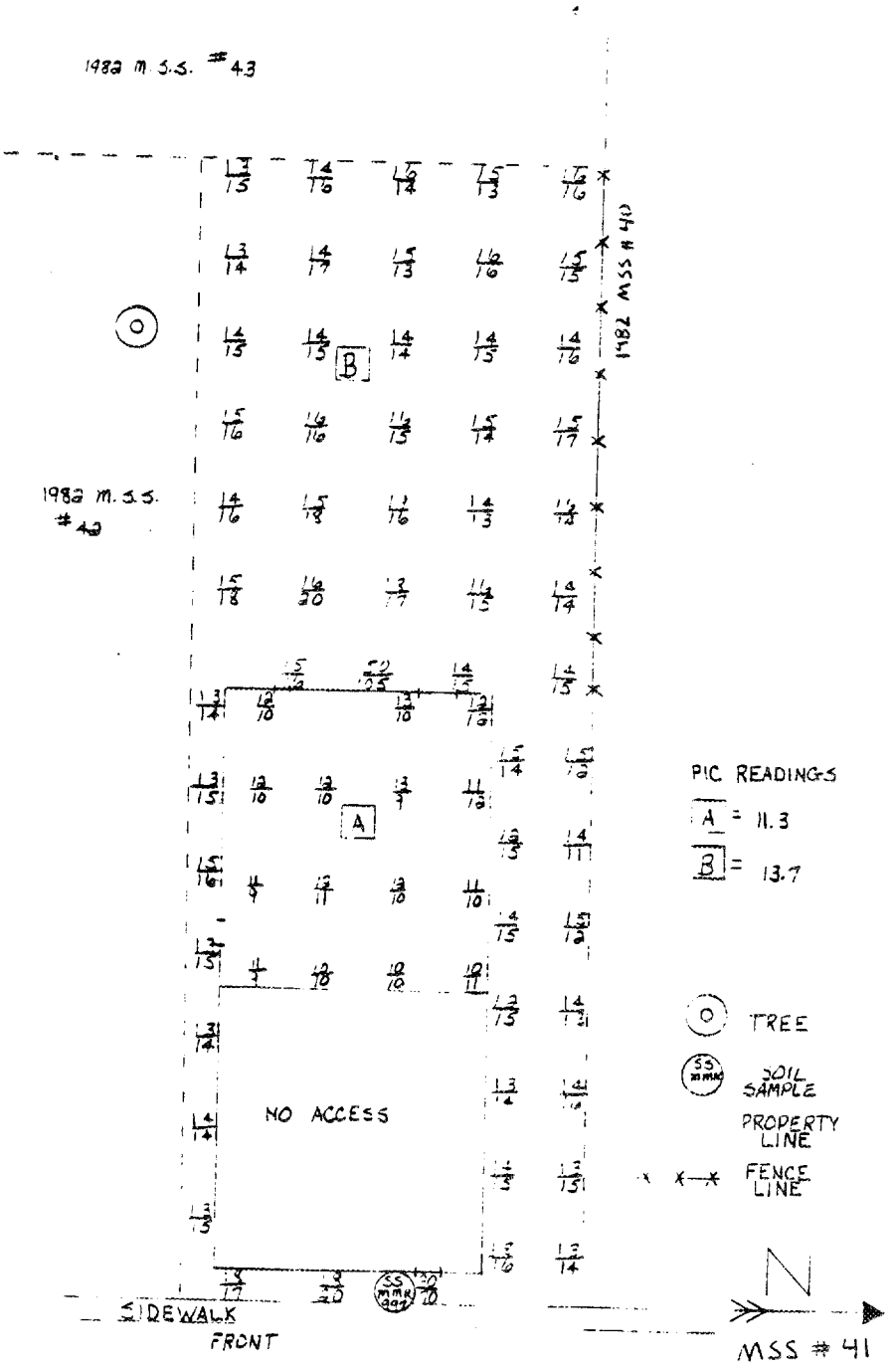
Location HIG Work Shop

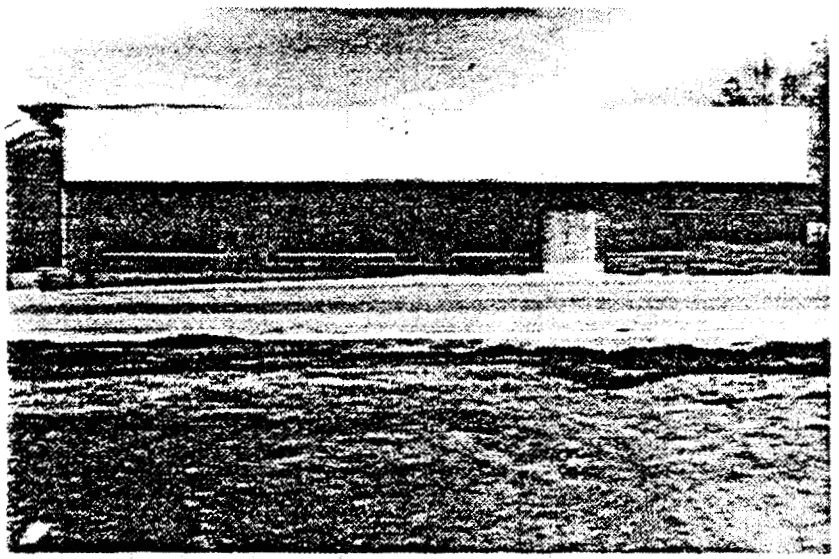
Number of PIC Readings Taken
Inside 1 Outside 1

Soil Samples Taken
Yes X No ___ Number 1

Sample Numbers YMR 997

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


1982 M.S.S. #43
1982 M.S.S. #42
1982 MSS # 40
B
A
NO ACCESS
SIDEWALK
FRONT
PIC READINGS
A = 11.3
B = 13.7
TREE
SOIL SAMPLE
PROPERTY LINE
FENCE LINE
N
MSS # 41



GAMMA SURVEY REPORT

Owner Milton Nielson

Occupant _____

Property Classification 5 | Gamma Map 1 | Tailings Use 1

Type of Structure		Material	
____	Basement	____	Adobe
x	Slab on Grade	____	House Trailer
____	Crawl Space	x	Masonry
____	Unknown	____	Non Masonry

Number of Levels 1 | Other _____

Comments: _____

Survey No. 42
Event No. 1980 9 1971 13
Street Address 296 South Main
City/State Monticello, Utah
County San Juan
Date July 28, 1982
Surveyors P.B. & F.C.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	17	21
HOG	24	37
LOG	13	11

Location HIG _____

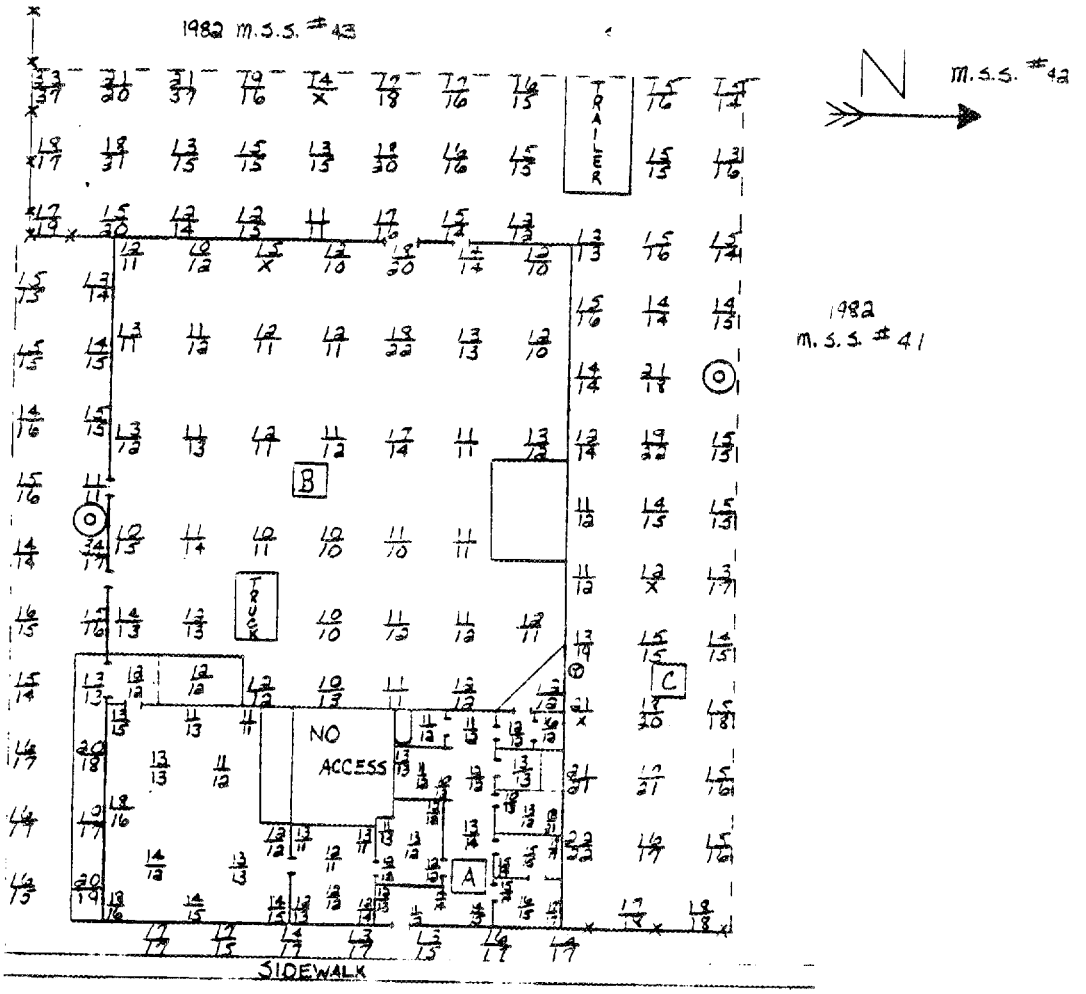
Number of PIC Readings Taken
Inside 2 Outside 1

Elevated reading associated with: Office space, and lot

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers _____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



PIC READINGS

A = 12.2

B = 12.5

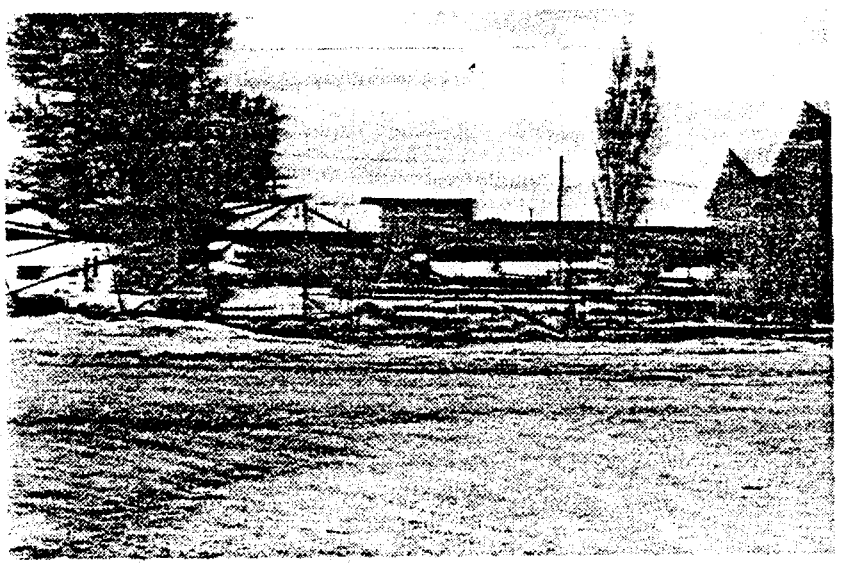
C = 15.8

TREE

PROPERTY LINE

FENCE

TELEPHONE POLE



GAMMA SURVEY REPORT

Owner Milton Nielson

Occupant Vacant Lot

Property Classification 0 | Gamma Map 1 | Tailings Use 2

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: Lot

Survey No. 43
Event No. 1980 53 1971 40
Street 296 South Main
Address ____
City/State Monticello, Utah
County San Juan
Date July 28, 1982
Surveyors P.B. & F.C.
Meter No. C-3557-S (Corrected / Uncorrected)

	Corrected	Uncorrected
HIG	____	____
HOG	87	180
LOG	13	10

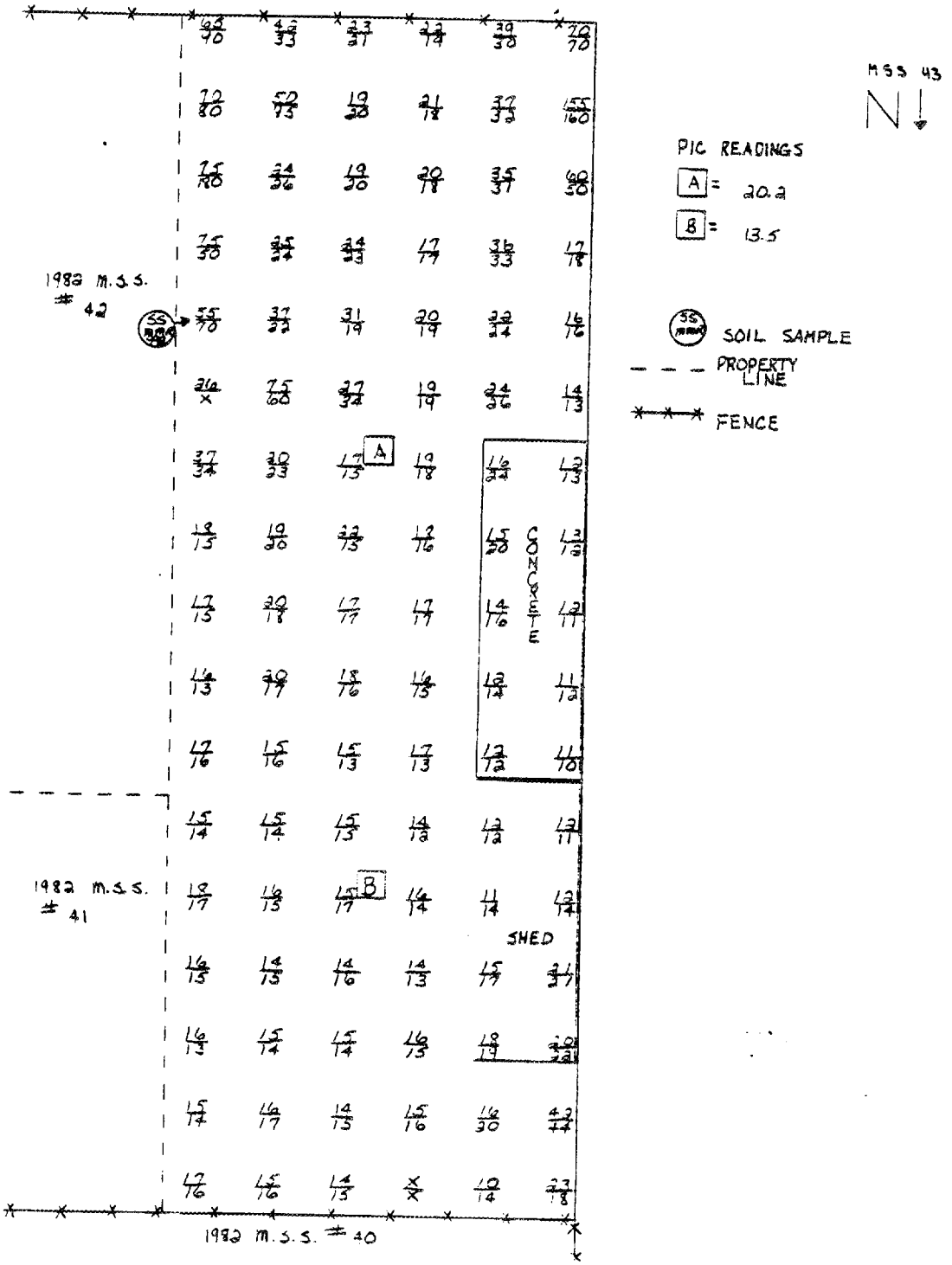
Location HIG N/A

Number of PIC Readings Taken
Inside 0 Outside 2

Soil Samples Taken
Yes X No ____ Number 1

Sample Numbers MMR 998

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 43
N
PIC READINGS
A = 20.2
B = 13.5
SS SOIL SAMPLE
PROPERTY LINE
FENCE
1982 M.S.S. # 42
1982 M.S.S. # 41
1982 M.S.S. # 40
CONCRETE
SHED
A
B

GAMMA SURVEY REPORT

Owner: Doug Whipple

Occupant: Vacant Lot

Property Classification: 0 | Gamma Map: 1 | Tailings Use: 0

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels: 0	Other:

Comments: No significant elevated readings

Elevated reading associated with:

Survey No.: 44
Event No.: 1980 - 1971 14
Street Address: 364 South Main
City/State: Monticello, Utah
County: San Juan
Date: July 30, 1982
Surveyors: P.B. & F.C.
Meter No.: C-3557-S

	Corrected	Uncorrected
HIG		
HOG	16	17
LOG	13	11

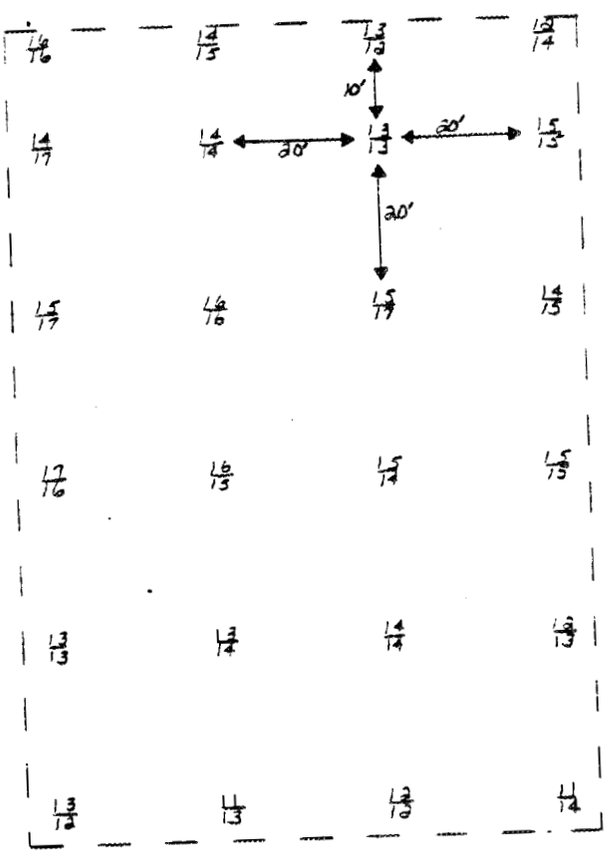
Location HIG: N/A

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


10'
30'
20'
20'


m.s.s. #44
N

GAMMA SURVEY REPORT

Owner R. Martinez

Occupant Vacant Lot

Property Classification 0 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 45
Event No. 1980 - 1971 30
Street Address 80 West 4th South
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors R.B. & F.C.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG		
HOG	16	18
LOG	14	13

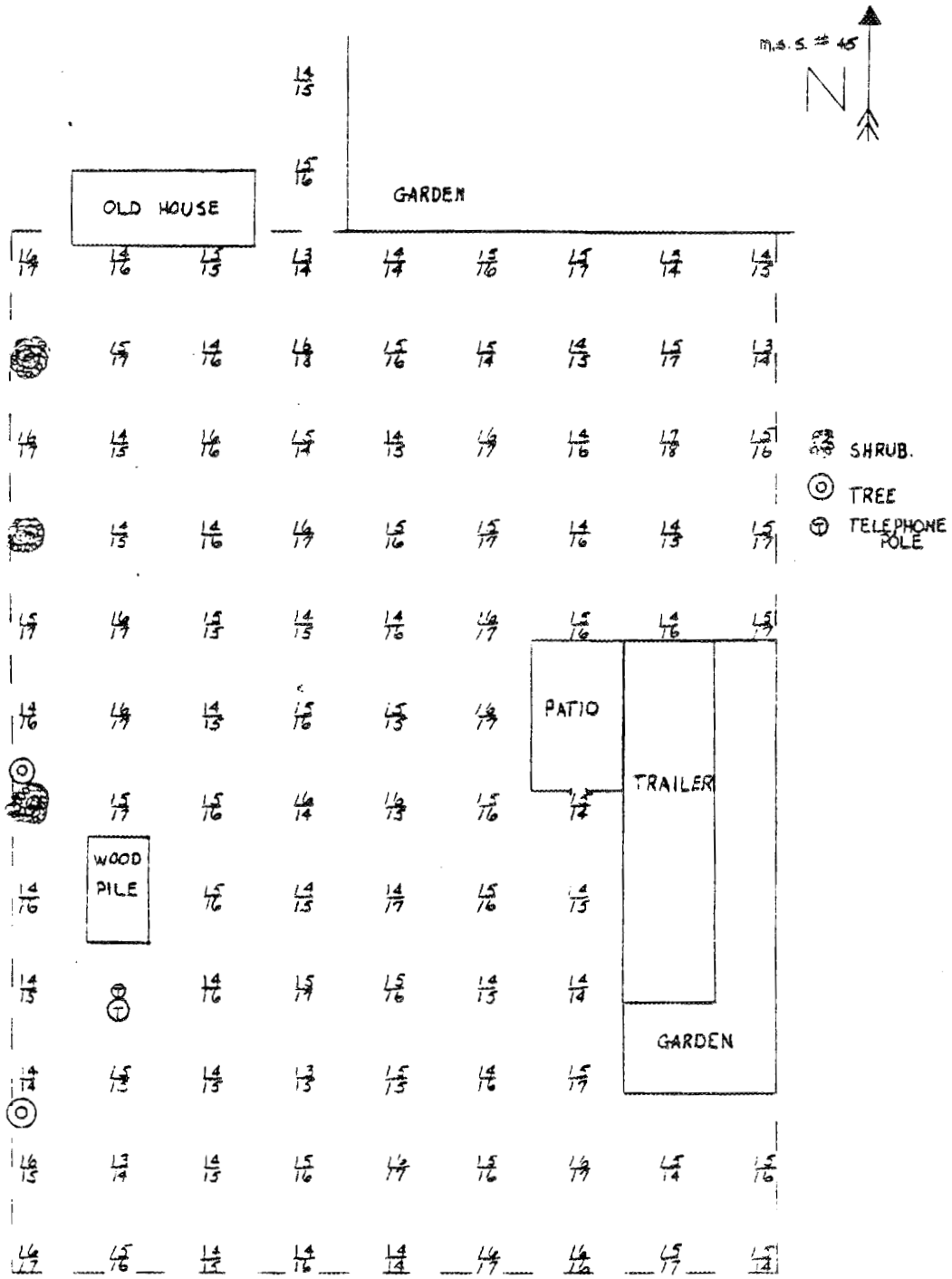
Location HIG N/A

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated. and the uncorrected readings are recorded on the gamma map.)


M.S.S. = 45
N
OLD HOUSE
GARDEN
PATIO
TRAILER
WOOD PILE
GARDEN
SHRUB.
TREE
TELEPHONE POLE

GAMMA SURVEY REPORT

Owner Doug Whipple

Occupant Vacant Lot

Property Classification 0 Gamma Map 1 Tailings Use 0

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 46
Event No. 1980 - 1971 49
Street 390 South Main
Address ____
City/State Monticello, Utah
County San Juan
Date August 3, 1982
Surveyors P.B. & F.C.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	____	____
HOG	16	18
LOG	14	13

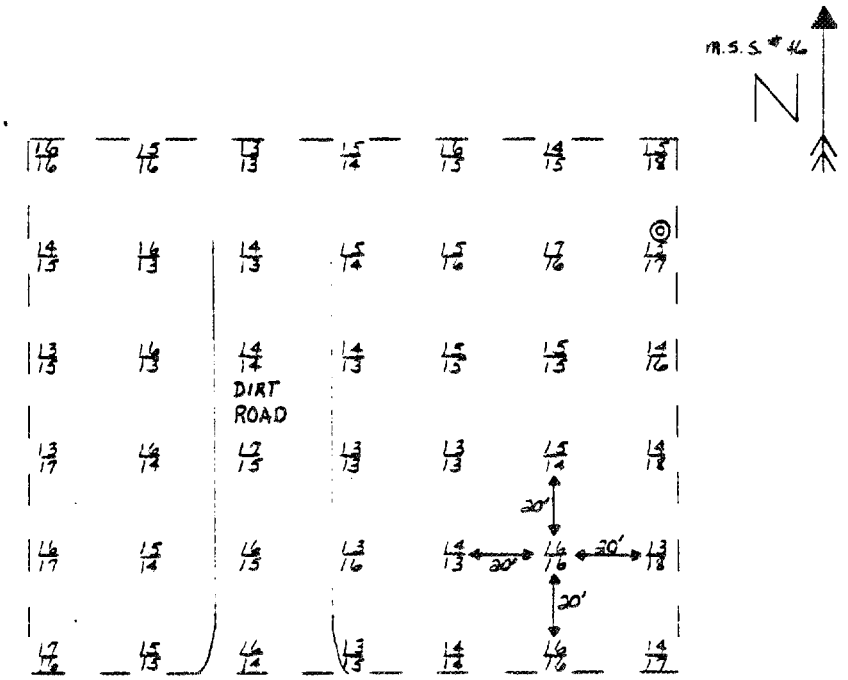
Location HIG N/A

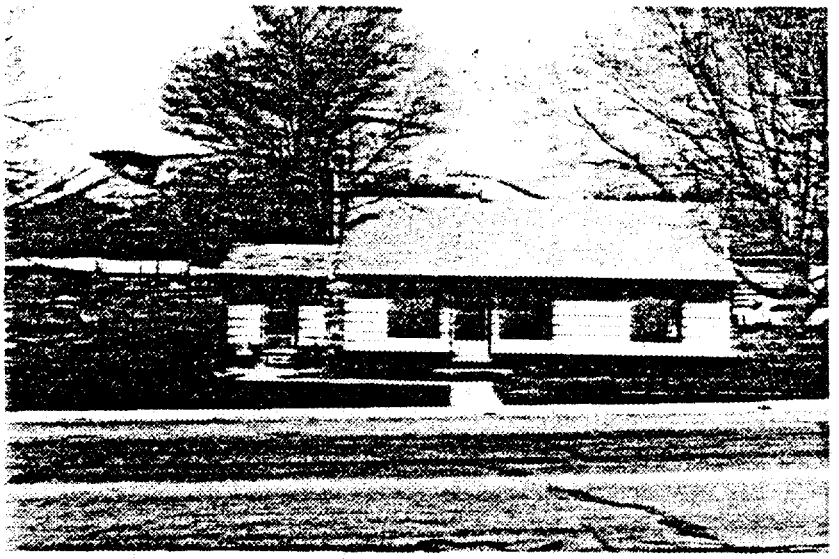
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. # 46
N
DIRT ROAD
20'
20'
20'
20'
TREE



GAMMA SURVEY REPORT

Owner Hazel French

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure		Material	
___	Basement	___	Adobe
___	Slab on Grade	___	House Trailer
x	Crawl Space	___	Masonry
___	Unknown	x	Non Masonry

Number of Levels 1 | Other ___

Comments: Approximate date of original construction was 1940. Conditions too windy for PIC readings.

Elevated reading associated with: ___

Survey No. 47
Event No. 1980 10 1971 -
Street Address 432 South Main
City/State Monticello, Utah
County San Juan
Date June 22, 1982
Surveyors M.B. & E.B.
Meter No. C-3560-S

	Corrected	Uncorrected
HIG	14	14
HOG	15	16
LOG	13	12

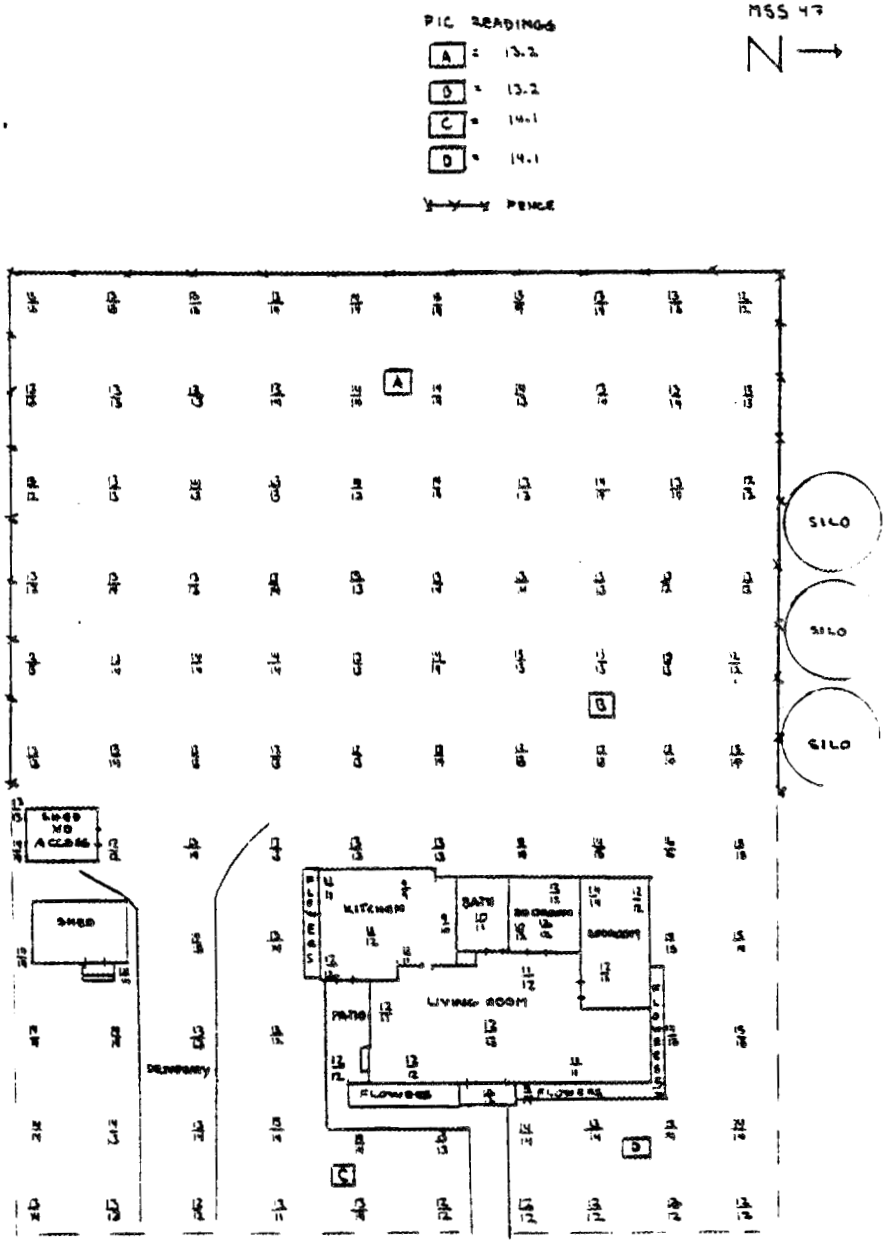
Location HIG Bedroom

Number of PIC Readings Taken
Inside 0 Outside 4

Soil Samples Taken
Yes ___ No x Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


PIC READINGS
A = 13.2
B = 13.2
C = 14.1
D = 14.1
FENCE
MSS 43
N
SILO
SILO
SILO
SHED
KITCHEN
LIVING ROOM
DRIVEWAY

GAMMA SURVEY REPORT

Owner Clair Topance

Occupant Sue Maten

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
___ Basement	_x_ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	___ Masonry
_x_ Unknown	___ Non Masonry
Number of Levels 1	Other ___

Comments: Yellowish dirt was found in the vacant lot to the west of the house. (Sample MMR 851)

Elevated reading associated with: Lot, Hallway

Survey No. 48
Event No. 1980 - 1971 15
Street 464 South Main
Address
City/State Monticello, Utah
County San Juan
Date August 4, 1982
Surveyors D.T. & E.B.
Meter No. C-3560-S

	Corrected	Uncorrected
HIG	66	131
HOG	360	800
LOG	13	12

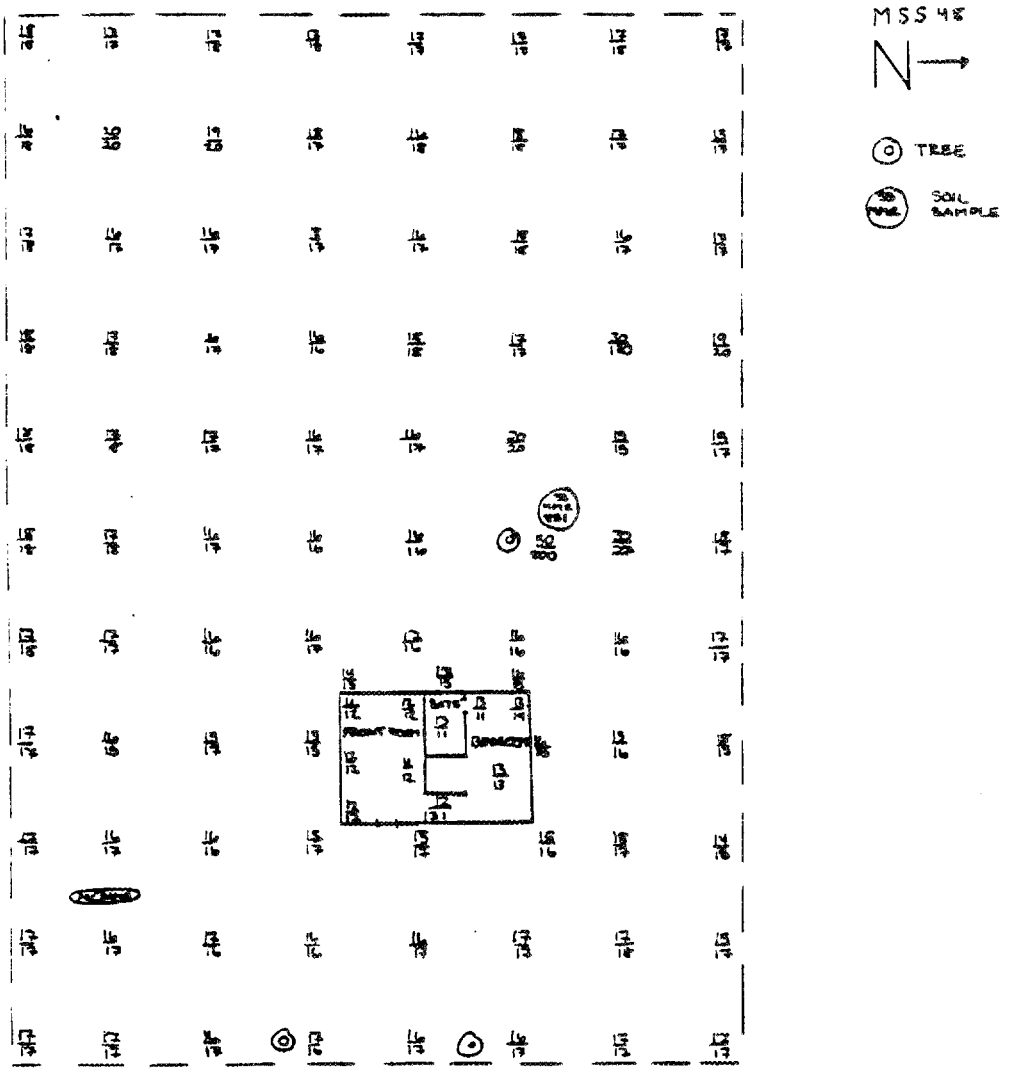
Location HIG Livingroom

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes _x_ No ___ Number 1

Sample Numbers MMR 851

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 4%
N
TREE
SOIL SAMPLE

GAMMA SURVEY REPORT

Owner: William Dalton

Occupant: Vacant Lot

Property Classification: 0 | Gamma Map: 1 | Tailings Use: 4

Type of Structure	Material
____ Basement	____ Adobe
_x_ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels: 0	Other: ____

Comments: ____

Elevated reading associated with: Lot

Survey No.: 49
Event No.: 1980 - 1971 16
Street: 480 South Main
Address: ____
City/State: Monticello, Utah
County: San Juan
Date: August 11, 1982
Surveyors: D.T. & E.B.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	____	____
HOG	34	39
LOG	13	10

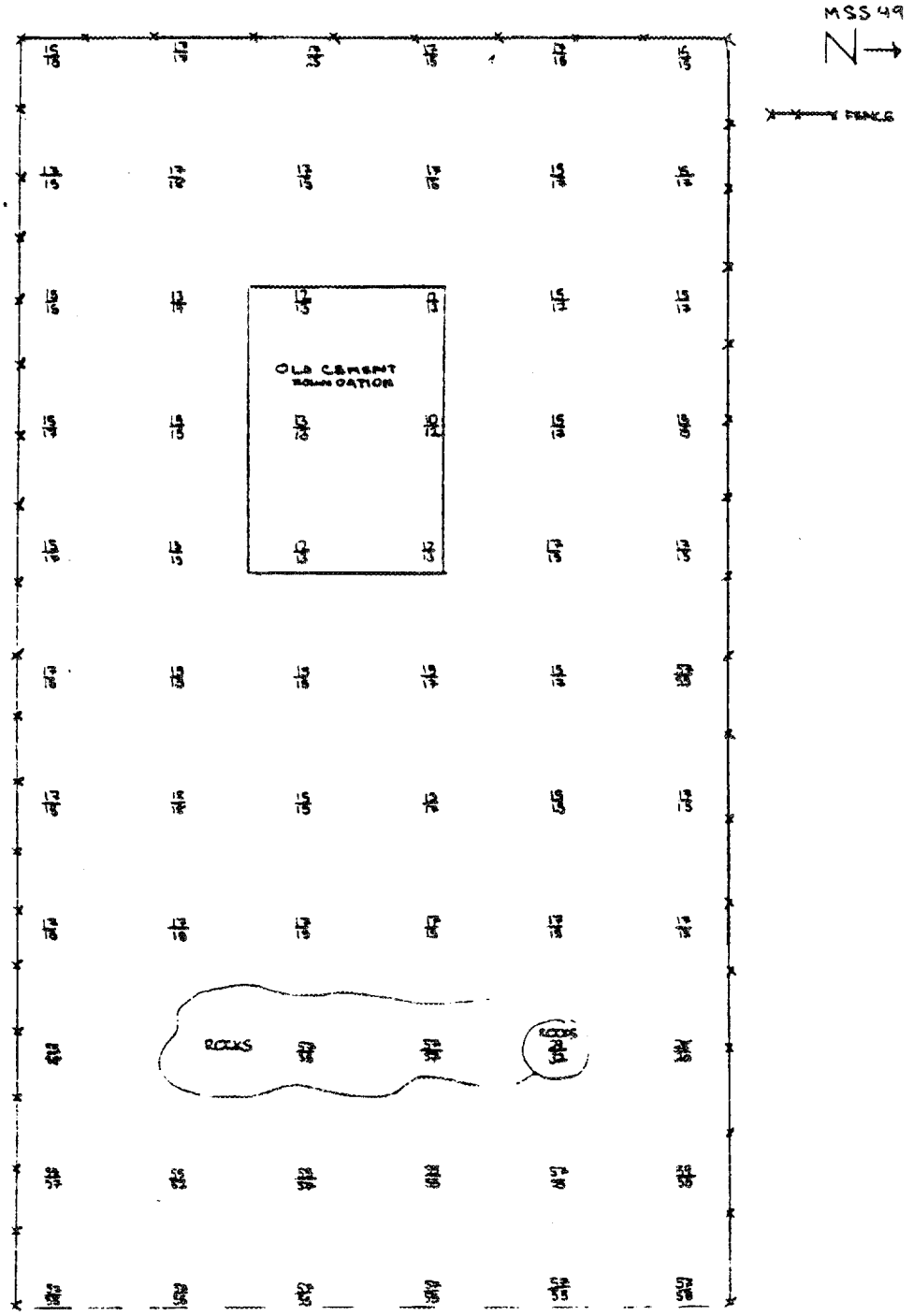
Location HIG: N/A

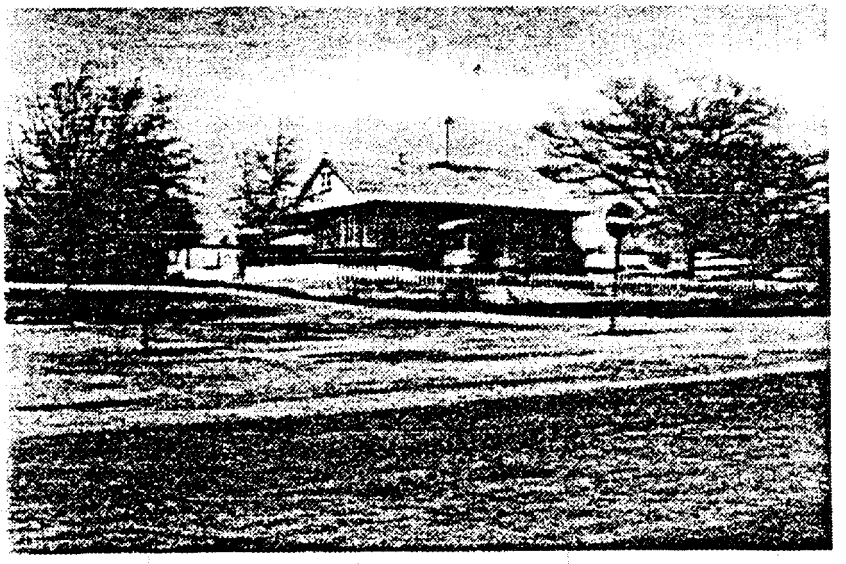
Number of PIC Readings Taken
Inside: 0 Outside: 0

Soil Samples Taken
Yes: ____ No: x Number: 0

Sample Numbers: ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated. and the uncorrected readings are recorded on the gamma map.)


MSS 49
N
FENCE
OLD CEMENT FOUNDATION
ROCKS



GAMMA SURVEY REPORT

Owner William Dalton

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 4

Type of Structure	Material
x Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	x Masonry
___ Unknown	___ Non Masonry
Number of Levels 2	Other ___

Comments: Approximate date of original construction was about 1948.

Elevated reading associated with: Yard-parking space

Survey No. 50
Event No. 1980 11 1971 17
Street 496 South Main
Address
City/State Monticello, Utah
County San Juan
Date July 20, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	17	20
HOG	76	155
LOG	14	13

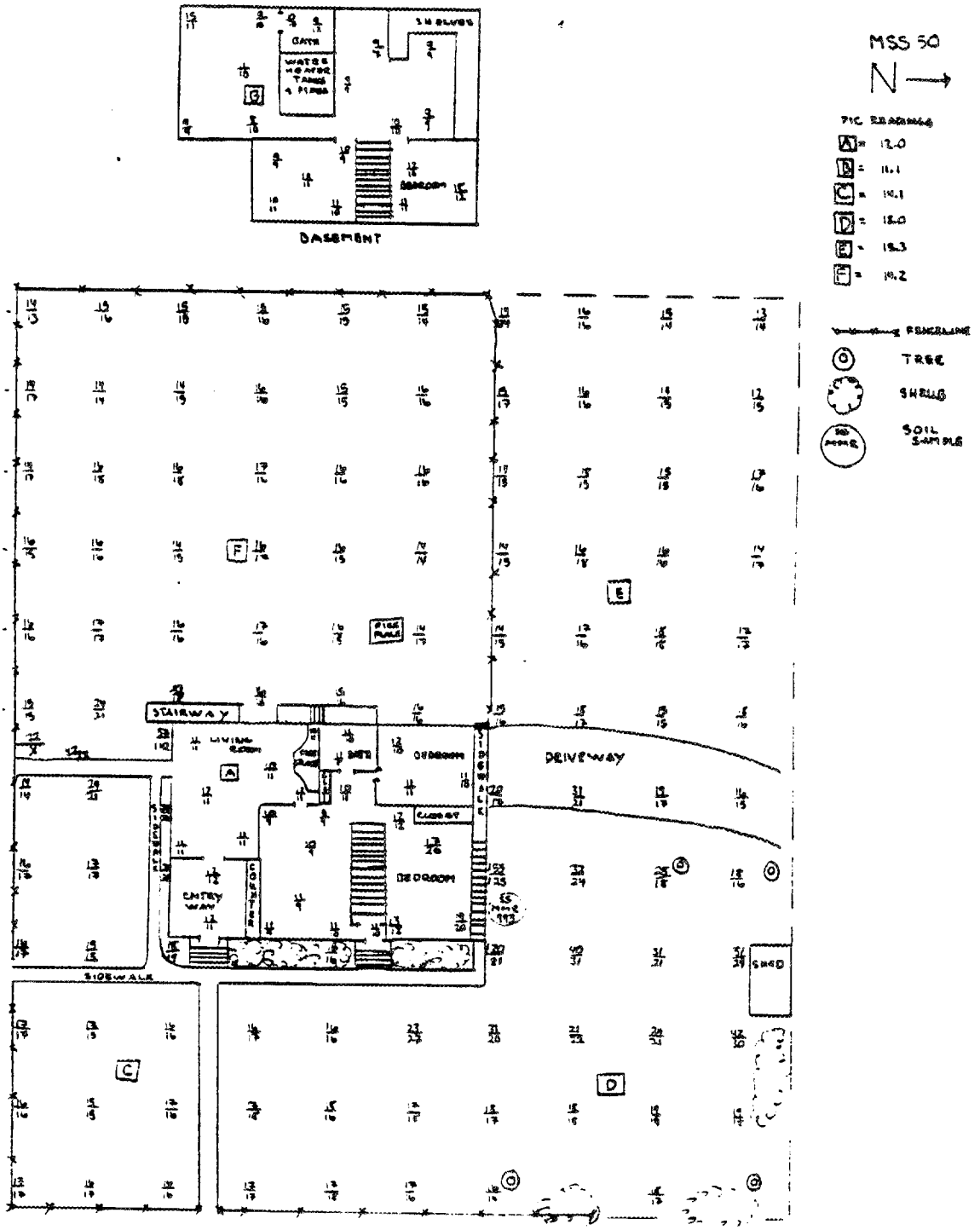
Location HIG Bedroom

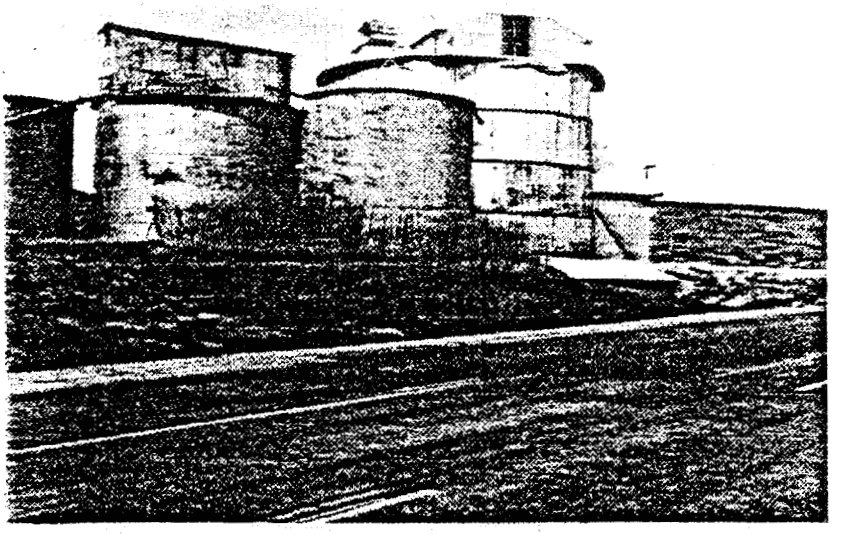
Number of PIC Readings Taken
Inside 2 Outside 4

Soil Samples Taken
Yes x No ___ Number 1

Sample Numbers MMR 993

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 50
N
PIC READINGS
A = 12.0
B = 11.1
C = 10.1
D = 12.0
E = 13.3
F = 13.2
FENCELINE
TREE
SHRUB
SOIL SAMPLE
BASEMENT
GATE
WATER HEATER
FURNACE
BEDROOM
STAIRWAY
LIVING ROOM
DINING AREA
KITCHEN
CLOSET
BEDROOM
ENTRY WAY
PORCH
SIDEWALK
DRIVEWAY
SHED



GAMMA SURVEY REPORT

Owner Bill Dunow

Occupant J.B. Grain & Bean Plant

Property Classification 5 | Gamma Map 1 | Tailings Use 2

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
x Unknown	____ Non Masonry
Number of Levels 2	Other ____

Comments: Used to be used as the weigh station for the mill. Approximate date of original construction was 1940.

Elevated reading associated with: Lot

Survey No. 51
Event No. 1980 12 1971 19
Street 533 South Main
Address
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors F.C. & P.B.
Meter No. C-3557.S

	Corrected	Uncorrected
HIG	16	18
HOG	105	220
LOG	13	11

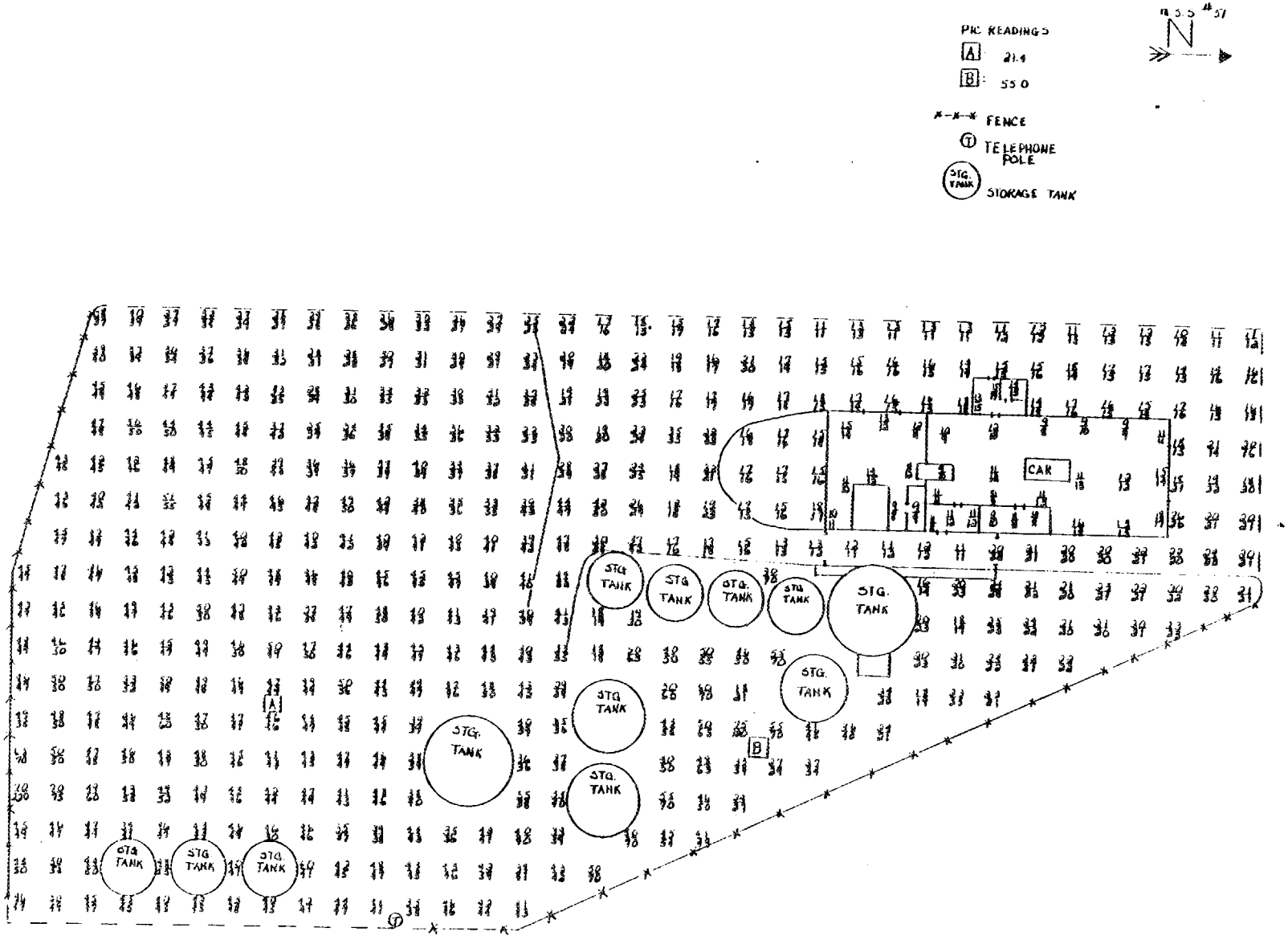
Location HIG

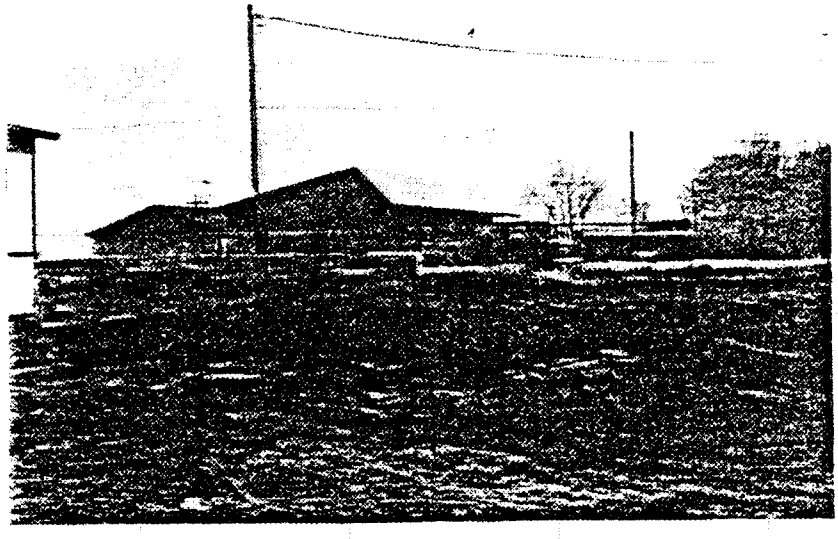
Number of PIC Readings Taken
Inside 0 Outside 2

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


PIC READINGS
A 21.4
B 55.0
FENCE
TELEPHONE POLE
STG. TANK
STORAGE TANK
N
CAR
STG. TANK
A
B



GAMMA SURVEY REPORT

Owner David Christensen

Occupant Vacant Lot

Property Classification 0 | Gamma Map 1 | Tailings Use 9

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 52
Event No. 1980 - 1971 10
Street Address 62 East 6th North
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	____	____
HOG	15	16
LOG	13	12

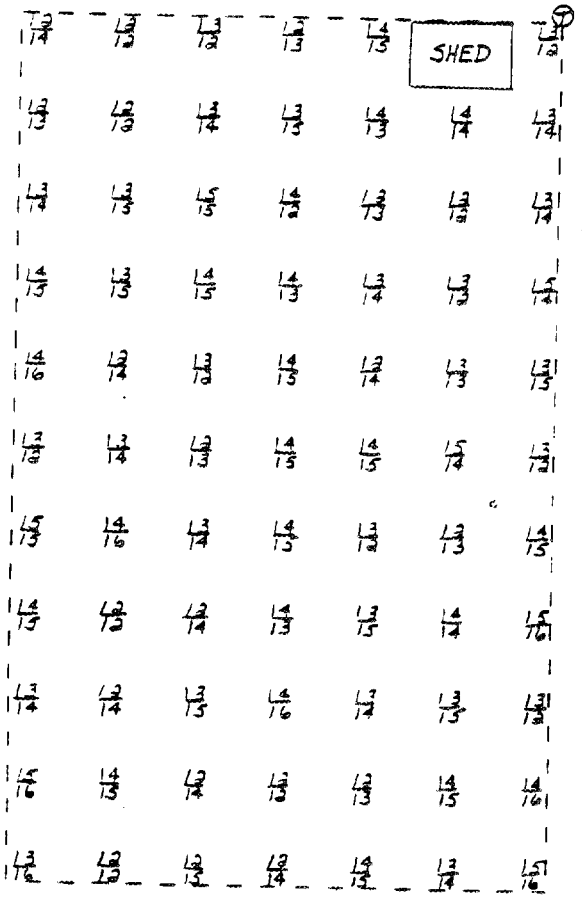
Location HIG N/A

Number of PIC Readings Taken
Inside 0 Outside 0

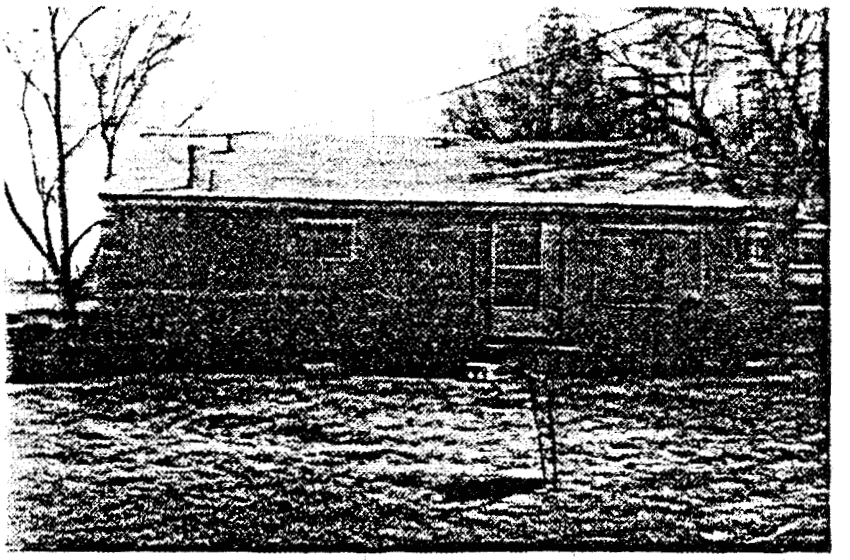
Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



Ⓣ TELEPHONE POLE



GAMMA SURVEY REPORT

Owner Juan Hansen

Occupant Carol Weaver

Property Classification 1 | Gamma Map 1 | Tailings Use 4

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
_x_ Crawl Space	____ Masonry
____ Unknown	_x_ Non Masonry
Number of Levels 1	Other ____

Comments: Previous owner trucked ore and left a stock pile of ore by the fence on the east side. Approximate date of original construction was 1958.

Elevated reading associated with: Yard

Survey No. 53
Event No. 1980 - 1971 8
Street Address 64 East 5th North
City/State Monticello, Utah
County San Juan
Date August 2, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	14	13
HOG	149	320
LOG	13	10

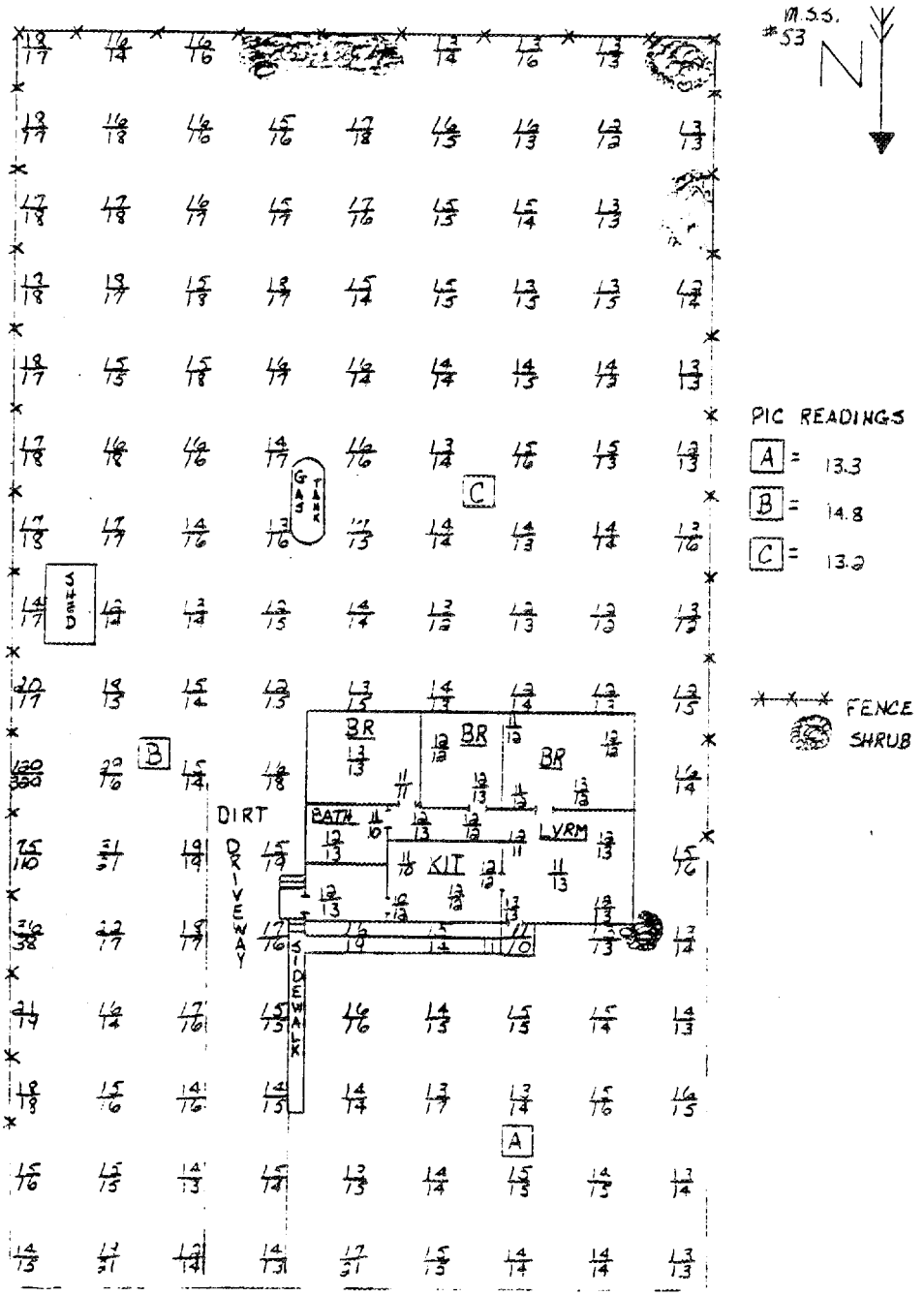
Location HIG Bathroom, bedroom, and livingroom

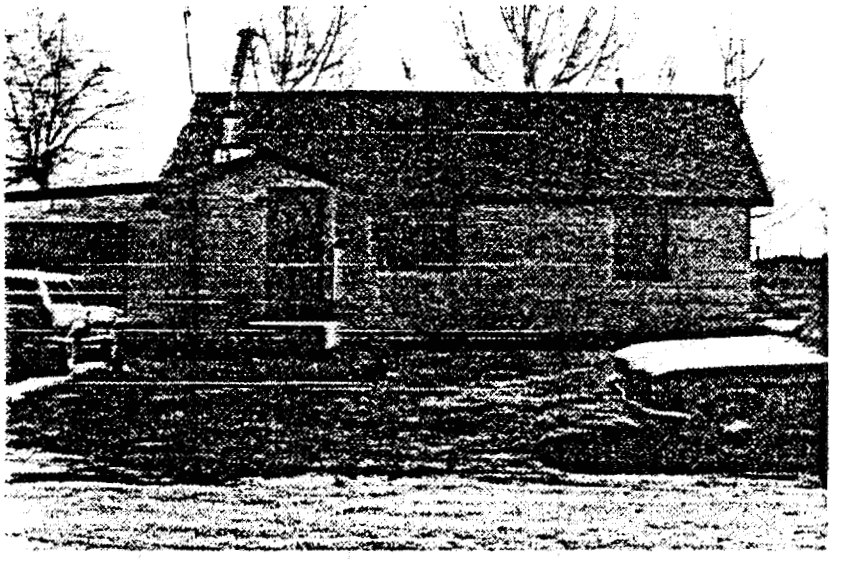
Number of PIC Readings Taken
Inside 0 Outside 3

Soil Samples Taken
Yes ____ No _x_ Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. #53
N
PIC READINGS
A = 13.3
B = 14.8
C = 13.2
FENCE
SHRUB
GAS TANK
SAND
DIRT
DRIVEWAY
SIDEWALK
BR
BR
BR
BATH
LVRM
KIT



GAMMA SURVEY REPORT

Owner Leland Alba

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 4

Type of Structure	Material
___ Basement	___ Adobe
___ Slab on Grade	___ House Trailer
x Crawl Space	___ Masonry
___ Unknown	x Non Masonry
Number of Levels 1	Other ___

Comments: ___

Elevated reading associated with: Yard

Survey No. 54
Event No. 1980 - 1971 9
Street Address 164 East 5th North
City/State Monticello, Utah
County San Juan
Date August 3, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	13	12
HOG	48	90
LOG	13	10

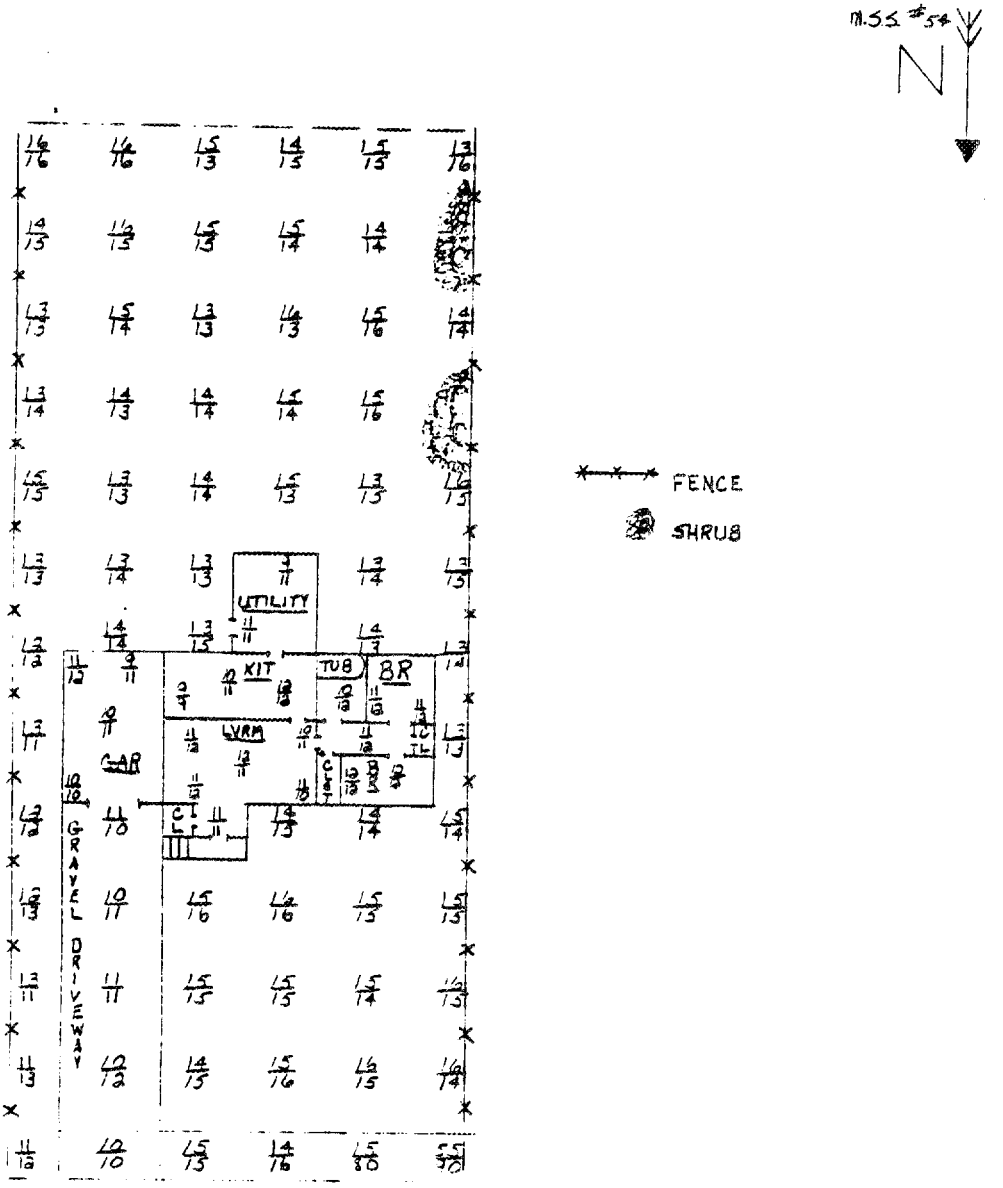
Location HIG Livingroom, bathroom, two bedrooms, Garage

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No x Number 0

Sample Numbers ___ ___ ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. #54
N
FENCE
SHRUB
UTILITY
KIT
TUB
BR
LVRM
CAR
GRAVEL DRIVEWAY

GAMMA SURVEY REPORT

Owner Alan Roger

Occupant Same

Property Classification 1 — Gamma Map 1 — Tailings Use 0

Type of Structure		Material	
___	Basement	___	Adobe
x	Slab on Grade	___	House Trailer
___	Crawl Space	x	Masonry
___	Unknown	x	Non Masonry

Number of Levels 1 — Other ___

Comments: Approximate date of original construction was in the nineteen fifties.

Elevated reading associated with: ___

Survey No. 55
Event No. 1980 - 1971 7
Street Address 432 North Main
City/State Monticello, Utah
County San Juan
Date August 3, 1982
Surveyors D.T. & E.B.
Meter No. C-3558-S

	Corrected	Uncorrected
HIG	14	14
HOG	15	16
LOG	13	11

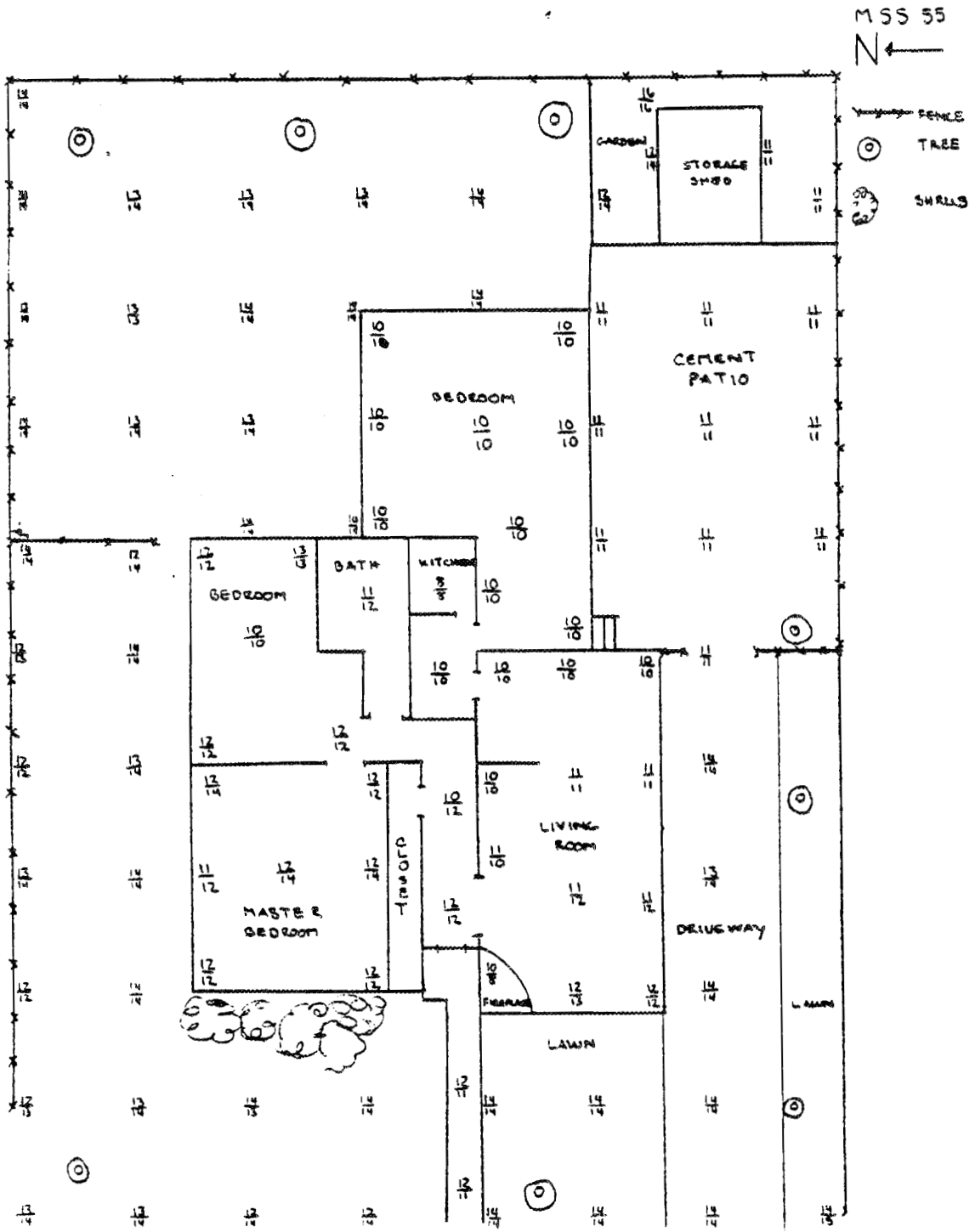
Location HIG Bedroom

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No x Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 55
N
FENCE
TREE
SHRUB
STORAGE SHED
CEMENT PATIO
BEDROOM
BATH
KITCHEN
SINK
BEDROOM
HALLWAY
MASTER BEDROOM
LIVING ROOM
FIREPLACE
DRIVEWAY
LAWN
LAWN

GAMMA SURVEY REPORT

Owner David Christensen

Occupant Beverly Nye

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
x Basement	x Adobe
x Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 2	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 56
Event No. 1980 17 1971
Street Address 132 North Main
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors E.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	15	15
HOG	16	17
LOG	13	12

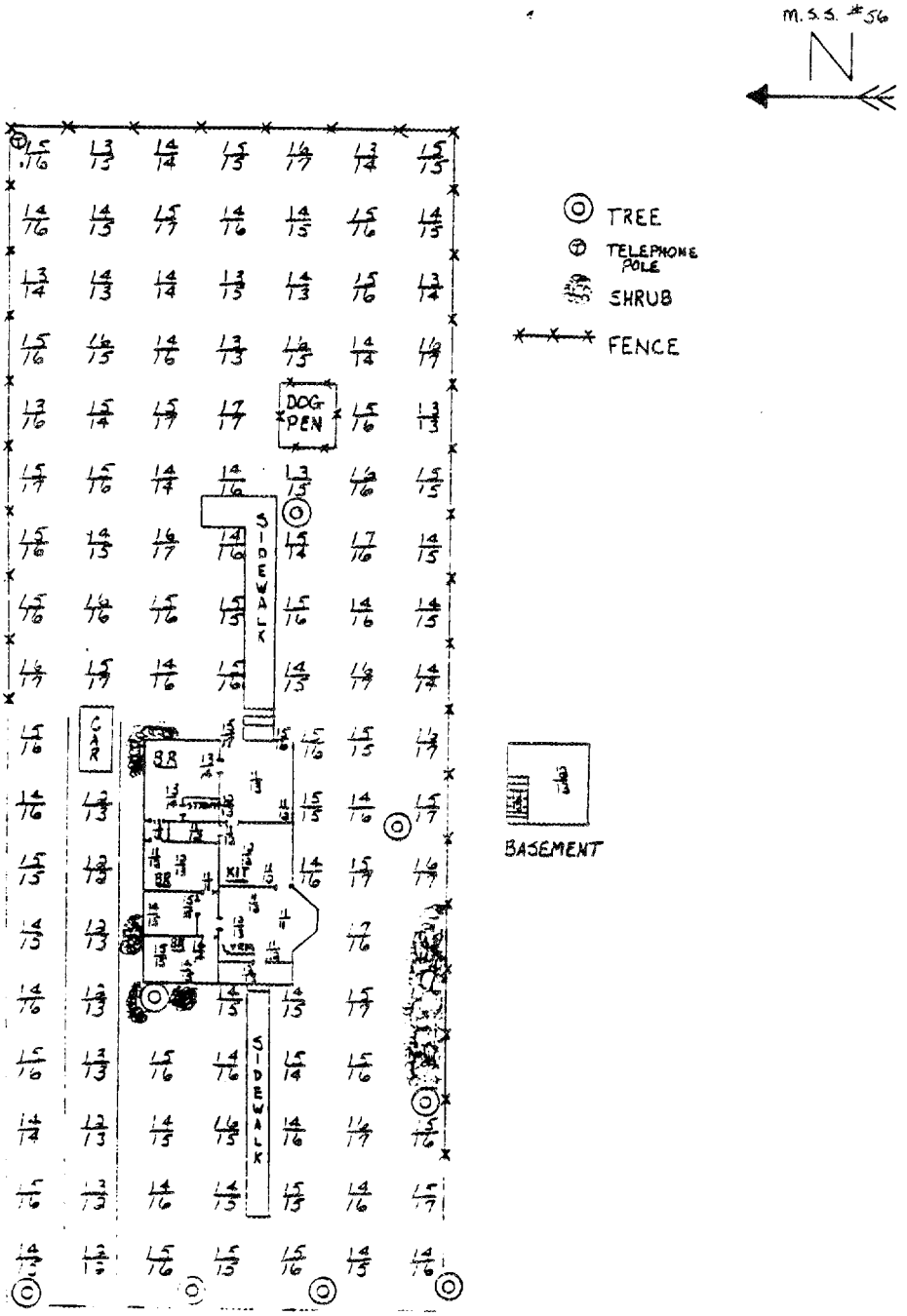
Location HIG Bedroom and Bathroom

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


M.S.S. #56
N
TREE
TELEPHONE POLE
SHRUB
FENCE
DOG PEN
SIDEWALK
CAR
KIT
SIDEWALK
BASEMENT

GAMMA SURVEY REPORT

Owner Rex Jensen

Occupant Twelve tenant families

Property Classification 3 Gamma Map 1 Tailings Use 9

Type of Structure		Material	
____	Basement	____	Adobe
____	Slab on Grade	____	House Trailer
x	Crawl Space	x	Masonry
____	Unknown	x	Non Masonry

Number of Levels 2 Other ____

Comments: 12 unit apartment house. Brick facing. Approximate date of construction was 1978.

Elevated reading associated with: Mortar and/or brick in exterior wall.

Survey No. 57
Event No. 1980 41 1971 -
Street Address 65 East 1st North
City/State Monticello, Utah
County San Juan
Date July 30, 1982
Surveyors D.T. & E.B.
Meter No. C-3558-S

	Corrected	Uncorrected
HIG	41	75
HOG	35	62
LOG	12	8

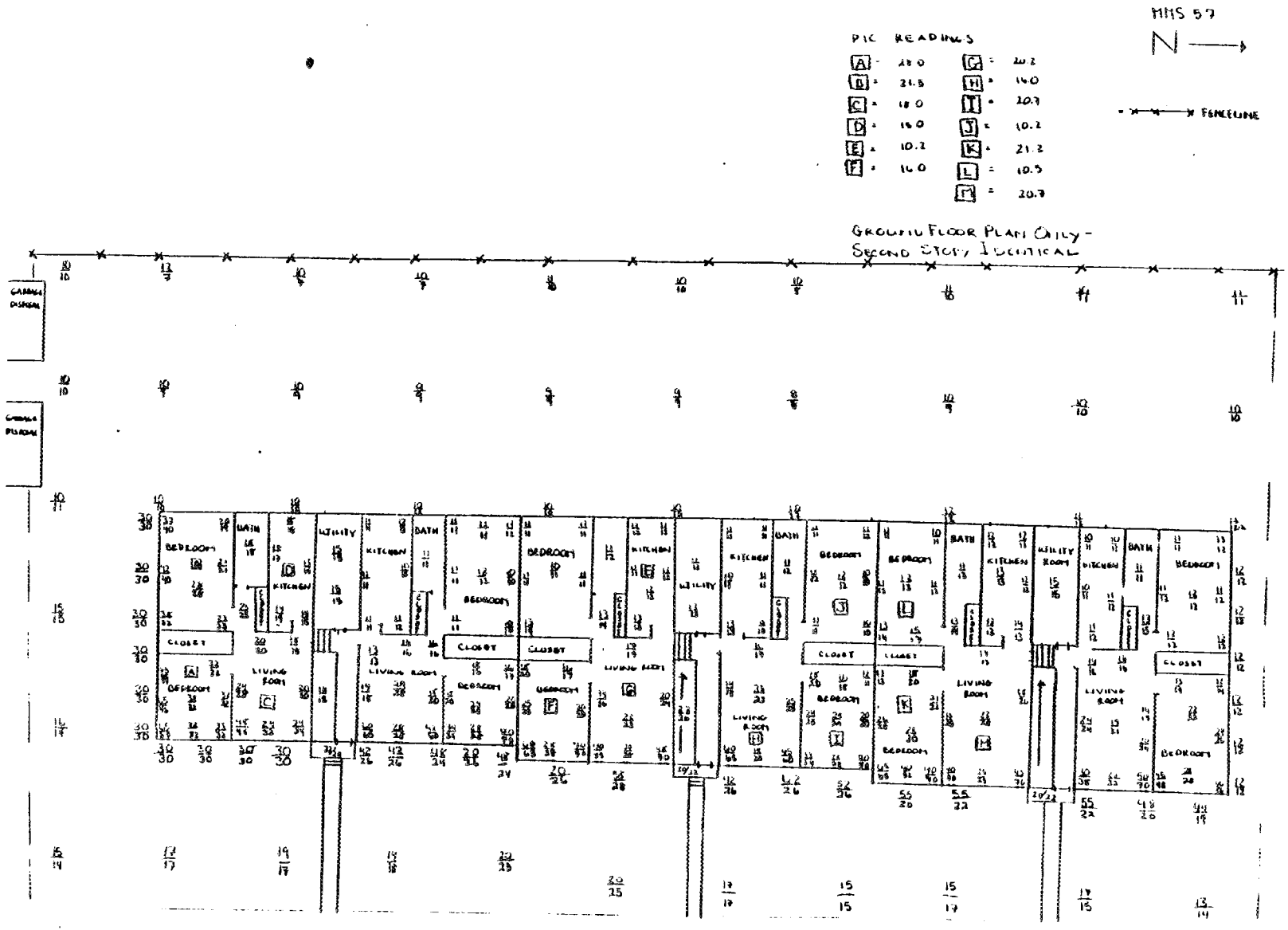
Location HIG Along the brick-work

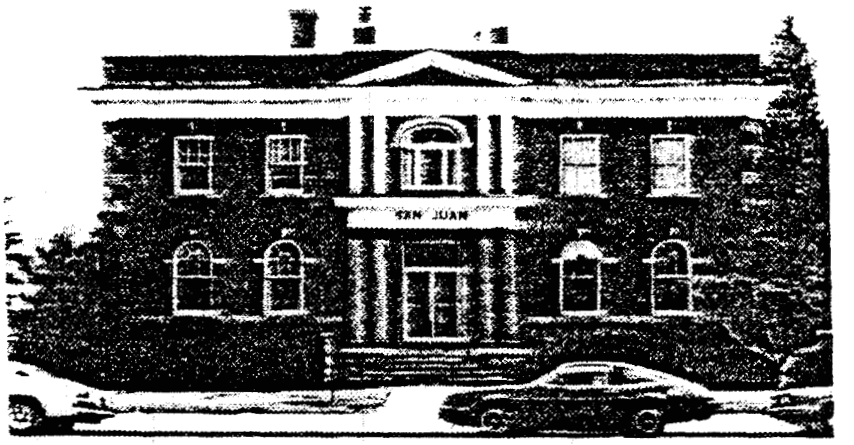
Number of PIC Readings Taken
Inside 13 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MMS 57
N
PIC READINGS
A = 28.0
B = 21.5
C = 18.0
D = 15.0
E = 10.2
F = 16.0
G = 20.2
H = 14.0
I = 20.7
J = 10.2
K = 21.2
L = 10.5
M = 20.7
FENCELINE
GROUND FLOOR PLAN ONLY - SECOND STORY IDENTICAL
BEDROOM
BATH
KITCHEN
UTILITY
CLOSET
LIVING ROOM



GAMMA SURVEY REPORT

Owner County Courthouse

Occupant Same

Property Classification 9 | Gamma Map 1 | Tailings Use 9

Type of Structure		Material	
X	Basement		Adobe
	Slab on Grade		House Trailer
X	Crawl Space	X	Masonry
	Unknown		Non Masonry

Number of Levels 3 | Other

Comments: Approximate date of original construction is 1930. Additions were constructed between 1956 and 1968.

Elevated reading associated with: Mortar and/or brick, and also ore sample.

Survey No. 58
Event No. 1980 16 1971 -
Street Address 117 South Main
City/State Monticello, Utah
County San Juan
Date June 29, 1982
Surveyors P.B., F.C., E.B., M.B.
Meter No. C-3558-S & C-3557-S

	Corrected	Uncorrected
HIG	57	110
HOG	17	20
LOG	13	10

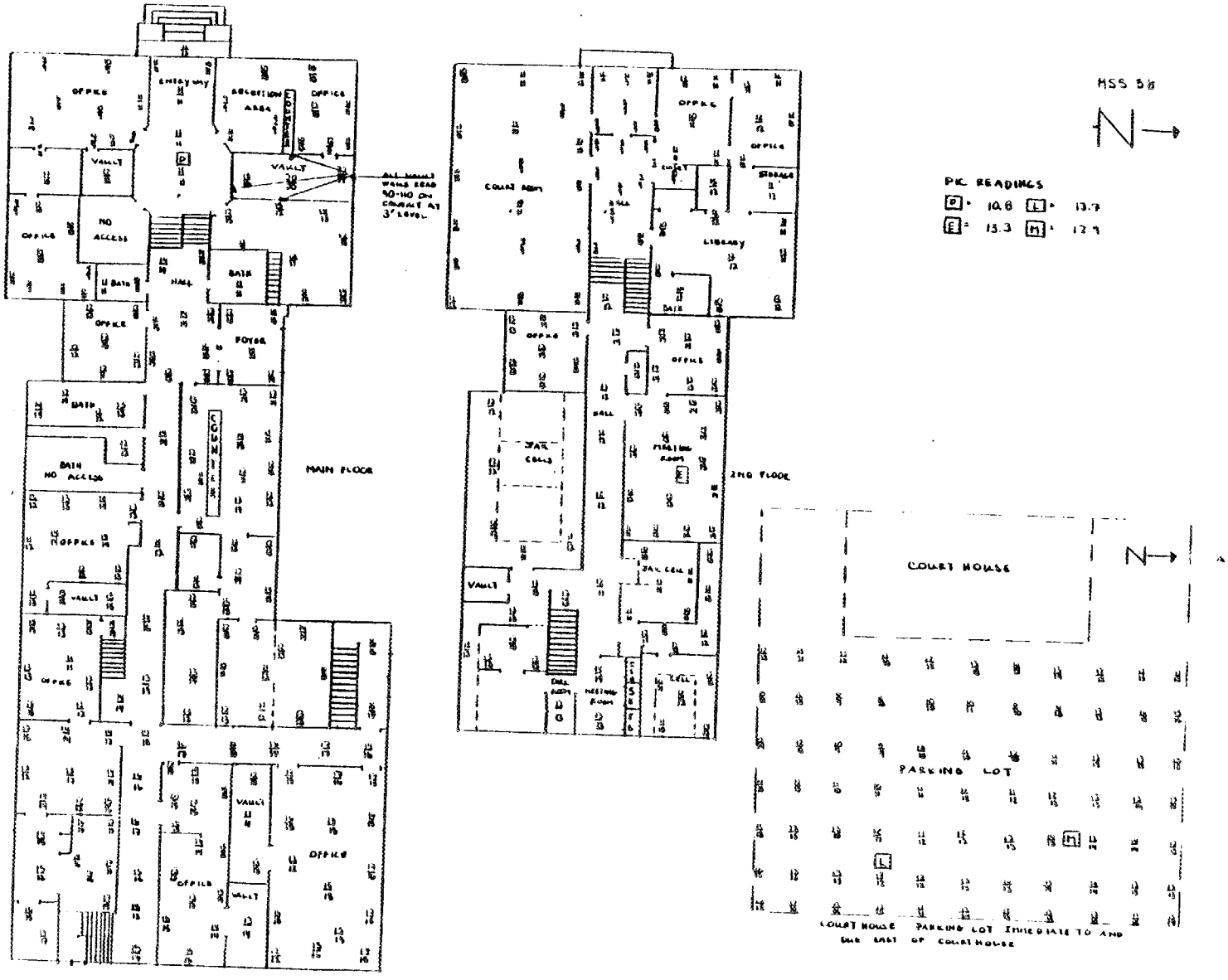
Location HIG Vault

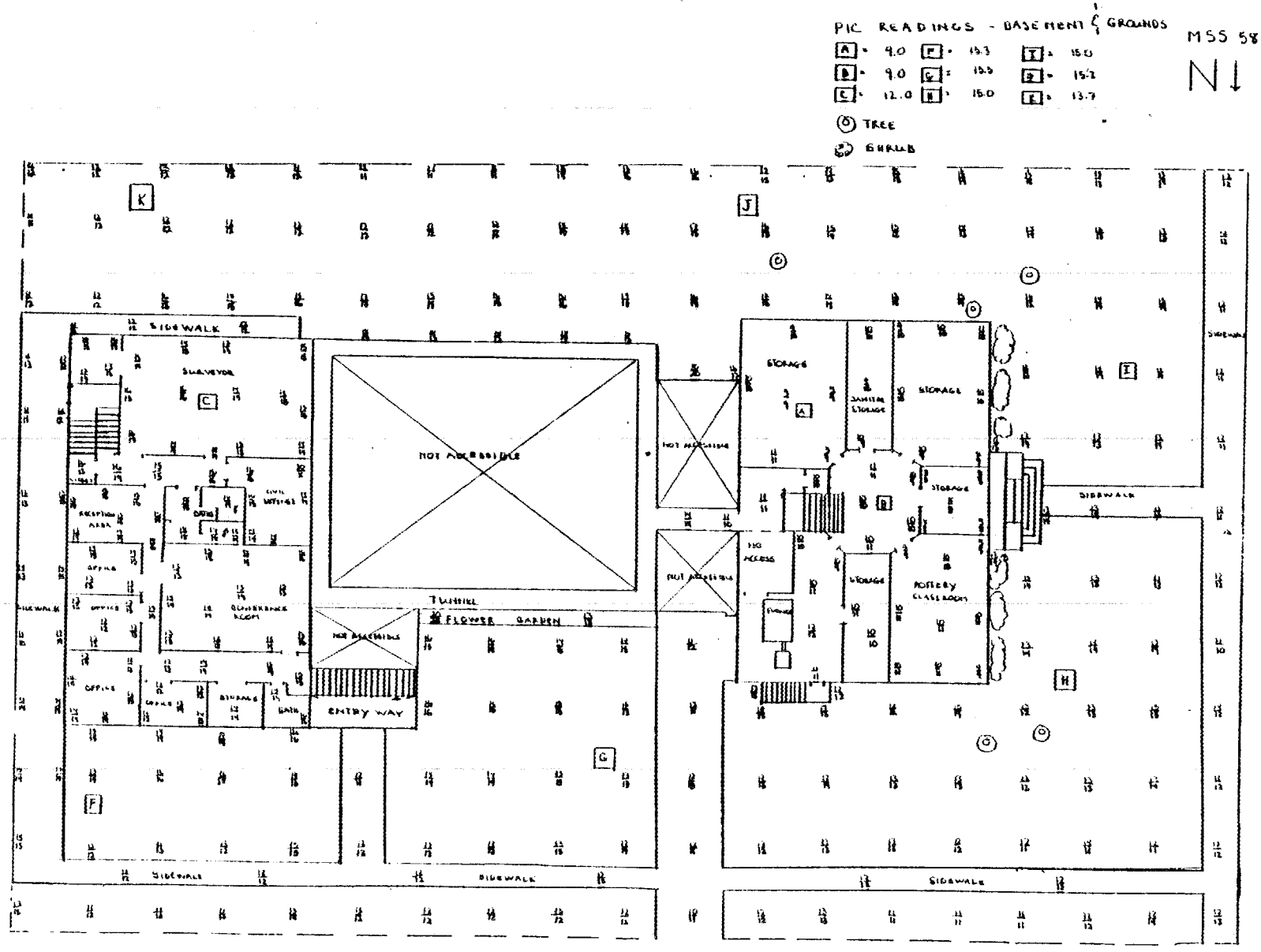
Number of PIC Readings Taken
Inside 7 Outside 6

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MAIN FLOOR
2ND FLOOR
COURT HOUSE
PARKING LOT
COURT HOUSE PARKING LOT IMMEDIATE TO AND
SOUTH EAST OF COURTHOUSE
MSS 58
PIC READINGS
10.8
13.7
13.3
12.9


PIC READINGS - BASEMENT & GROUNDS
A = 9.0
B = 9.0
C = 12.0
F = 15.3
G = 15.5
H = 15.0
I = 15.0
J = 15.2
K = 13.7
TREE
SHRUB
MSS 58
N
SIDEWALK
SURVEYOR
NOT ACCESSIBLE
STORAGE
JANITOR STORAGE
TUNNEL
FLOWER GARDEN
ENTRY WAY
POTTERY CLASSROOM
NO ACCESS

GAMMA SURVEY REPORT

Owner H. Young

Occupant Montgomery Ward Store

Property Classification 5 Gamma Map 10 Tailings Use

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels ____	Other ____

Comments: This event has been completely surveyed and the Remedial Action Engineering Assessment completed prior to the 1982 survey.

Elevated reading associated with: ____

Survey No. 59
Event No. 1980 15 1971 -
Street Address 181 South Main
City/State Monticello, Utah
County San Juan
Date ____
Surveyors ____
Meter No. ____ (Corrected) (Uncorrected)

HIG ____ ____

HOG ____ ____

LOG ____ ____

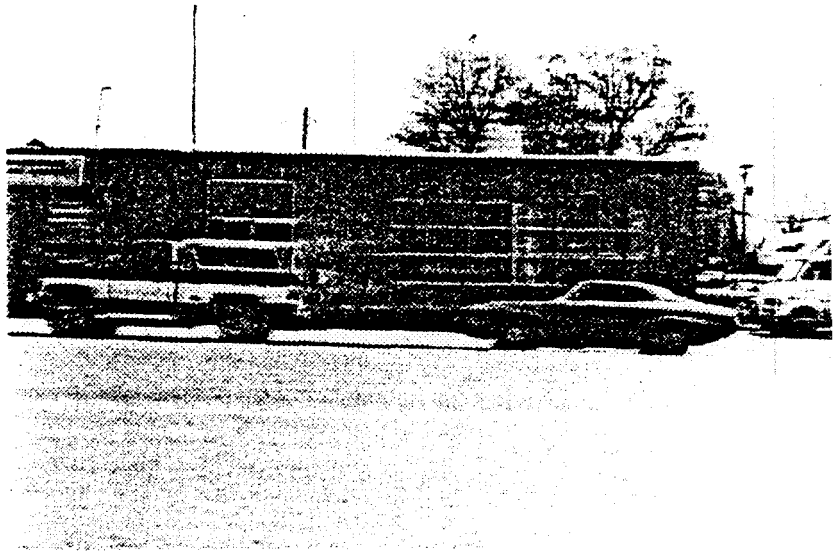
Location HIG ____

Number of PIC Readings Taken
Inside ____ Outside ____

Soil Samples Taken
Yes ____ No ____ Number ____

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



GAMMA SURVEY REPORT

Owner H. Young

Occupant U.S. Post Office

Property Classification 9 | Gamma Map 10 | Tailings Use ____

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels ____	Other ____

Comments: This event has been completely surveyed and the Remedial Action Engineering Assessment completed prior to the 1982 survey.

Elevated reading associated with: ____

Survey No. 60
Event No. 1980 14 1971 6
Street Address 197 South Main
City/State Monticello, Utah
County San Juan
Date ____
Surveyors ____
Meter No. ____

	Corrected	Uncorrected
HIG	____	____
HOG	____	____
LOG	____	____

Location HIG ____

Number of PIC Readings Taken
Inside ____ Outside ____

Soil Samples Taken
Yes ____ No ____ Number ____

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

GAMMA SURVEY REPORT

Owner Brent & Rita Bryan

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
x	Crawl Space		Masonry
	Unknown	x	Non Masonry

Number of Levels 1 Other

Comments: Vacant lot, survey #63 is also shown as part of this map. Approximate date of original construction was the early twenties.

Elevated reading associated with:

Survey No. 61
Event No. 1980 - 1971 5
Street 317 South Main
Address
City/State Monticello, Utah
County San Juan
Date August 4, 1982
Surveyors F.C. & P.B.
Meter No. C·3557·S

	Corrected	Uncorrected
HIG	15	15
HOG	17	19
LOG	14	14

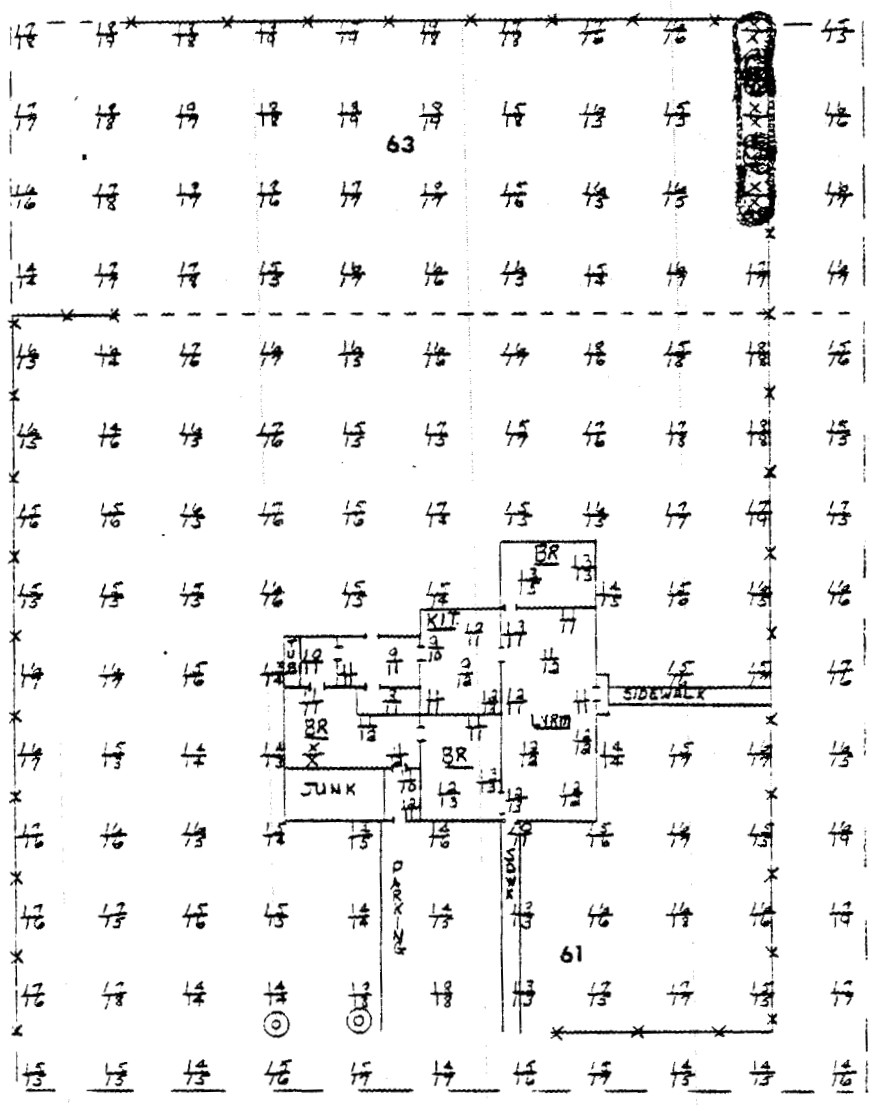
Location HIG Two bedrooms, kitchen, and livingroom

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes No x Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 61 & 63
N
63
61
BR
KIT
LRM
SIDEWALK
JUNK
PARKING
SIDEWALK
TREE
SHRUB
PROPERTY LINE
FENCE LINE

GAMMA SURVEY REPORT

Owner Eva Black

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 3

Type of Structure	Material
x Basement	x Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	___ Masonry
___ Unknown	___ Non Masonry

Number of Levels 2 Other ___

Comments: Owner told us that her husband and son used to work in the mining business and on occasion, used to park ore trucks around the house.

Elevated reading associated with: Yard

Survey No. 62
Event No. 1980 - 1971 41
Street 316 South 1st East
Address ___
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	13	12
HOG	109	230
LOG	15	16

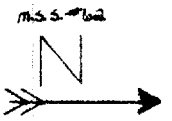
Location HIG Bedroom and Livingroom

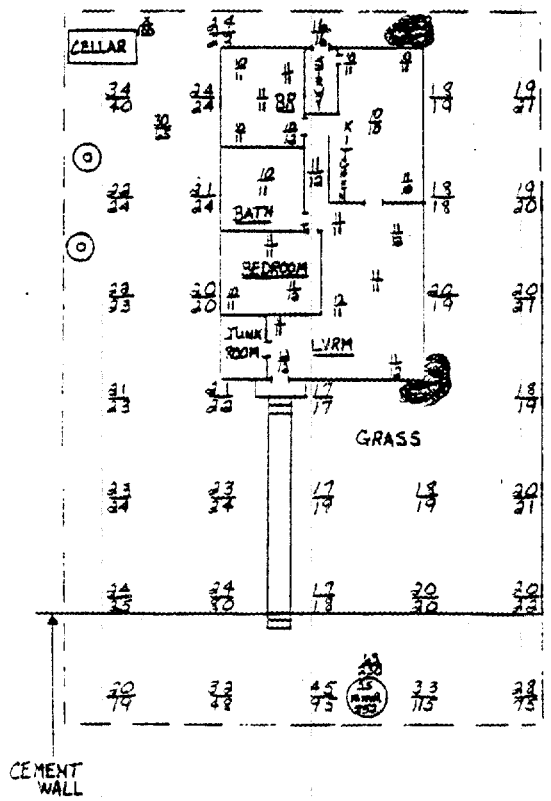
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes x No ___ Number 1

Sample Numbers WMR 852

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

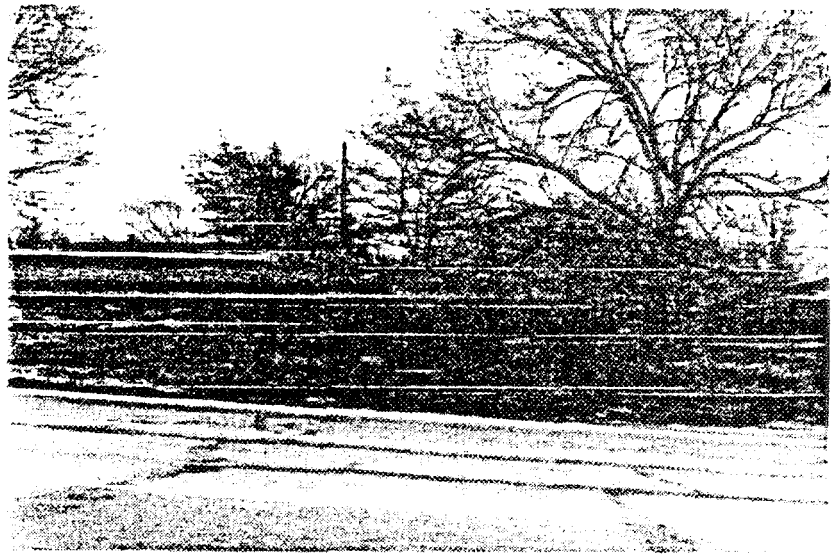




SHRUB

TREE

SOIL SAMPLE



GAMMA SURVEY REPORT

Owner Brent & Rita Bryan

Occupant Vacant Lot

Property Classification	Gamma Map	Tailings Use
0	2	0

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 0	Other ____

Comments: See survey no. 61 for gamma map.

Elevated reading associated with: ____

Survey No. 63
Event No. 1980 - 1971 4
Street 323 South Main
Address ____
City/State Monticello, Utah
County San Juan
Date August 10, 1982
Surveyors F.C. & P.B.
Meter No. C-3557-S

	Corrected	Uncorrected
HIG	____	____
HOG	16	19
LOG	14	14

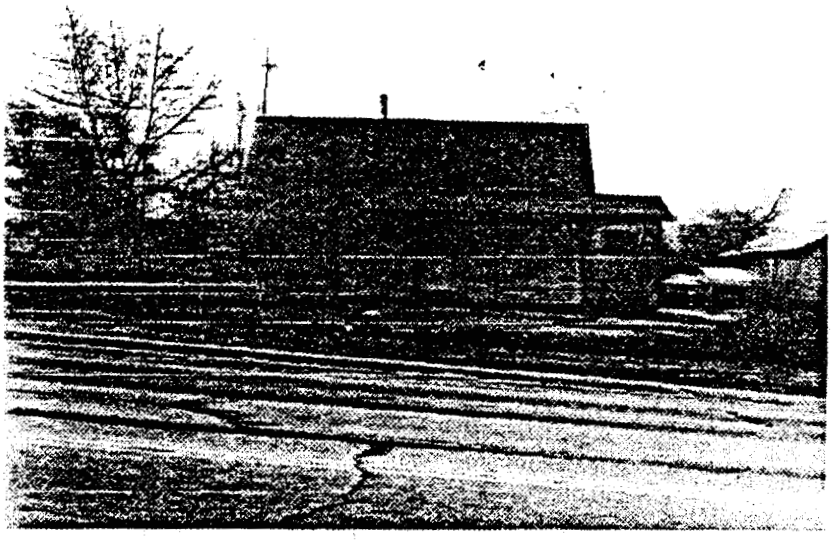
Location HIG N/A

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No X Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)



GAMMA SURVEY REPORT

Owner Leroy Romero

Occupant Same

Property Classification 1 Gamma Map 1 Tailings Use 9

Type of Structure		Material	
____	Basement	____	Adobe
x	Slab on Grade	____	House Trailer
____	Crawl Space	____	Masonry
____	Unknown	x	Non Masonry

Number of Levels 1 Other ____

Comments: Rock in garden read 180 micro R/hr.

Elevated reading associated with: Ore sample in rock garden.

Survey No. 64
Event No. 1980 - 1971 3
Street Address 333 South Main
City/State Monticello, Utah
County San Juan
Date August 11, 1982
Surveyors E.B. & D.T.
Meter No. C.3560-S

	Corrected	Uncorrected
HIG	13	11
HOG	16	18
LOG	12	10

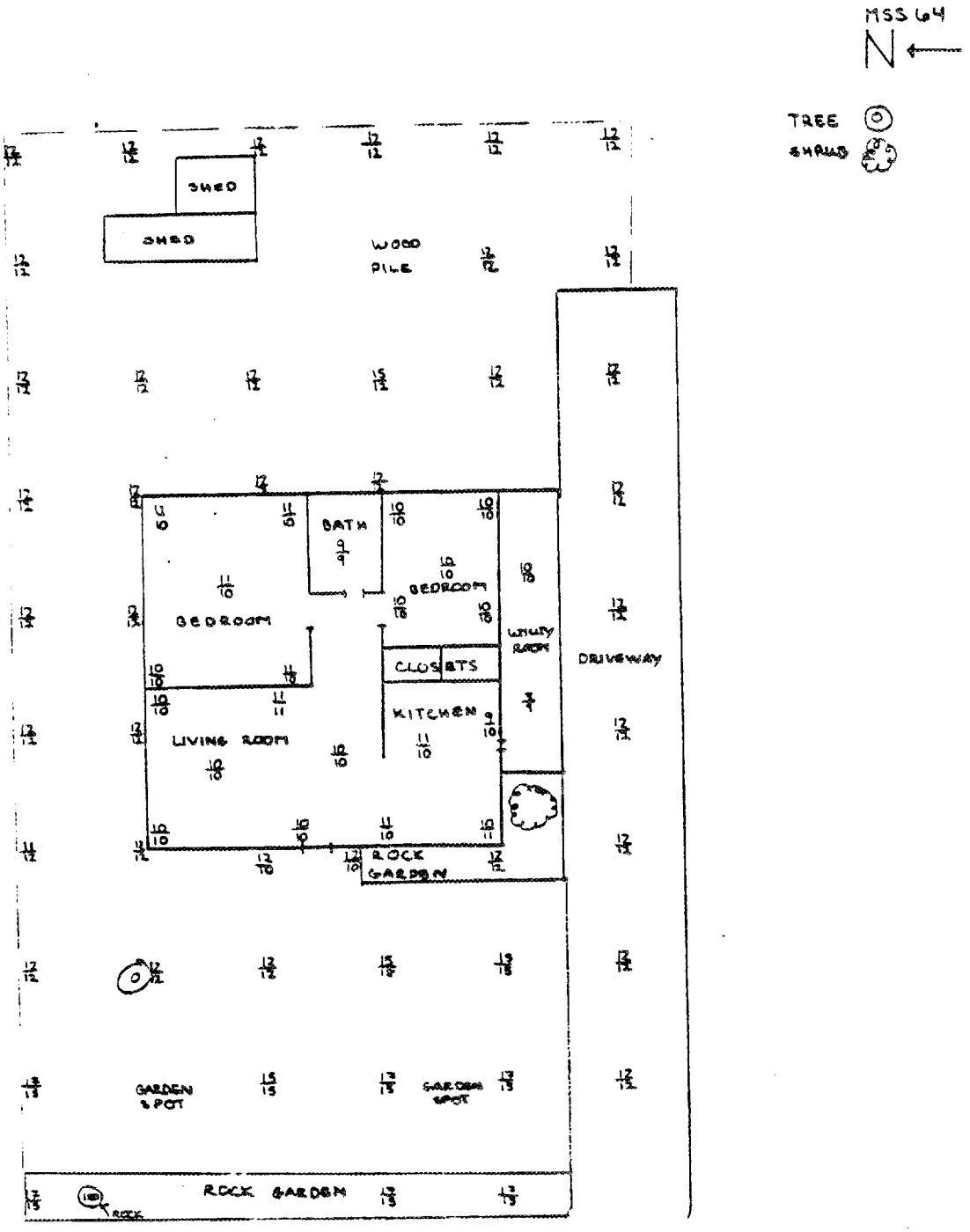
Location HIG Bedroom, kitchen, and livingroom

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____ ____ ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 64
N
TREE
SHRUB
SHED
SHED
WOOD PILE
BATH
BEDROOM
BEDROOM
LAUNDRY
CLOSETS
KITCHEN
LIVING ROOM
DRIVEWAY
ROCK GARDEN
GARDEN SPOT
GARDEN SPOT
ROCK GARDEN
ROCK

GAMMA SURVEY REPORT

Owner Bill Francom

Occupant Same

Property Classification 0 | Gamma Map 5 | Tailings Use ____

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels ____	Other ____

Comments: REFUSAL - Owner is a miner and knows that there are ore samples on the property (See MSS #17)

Elevated reading associated with: ____

Survey No. 65
Event No. 1980 - 1971 2
Street Address 359 South Main
City/State Monticello, Utah
County San Juan
Date ____
Surveyors ____
Meter No. ____ (Corrected) ____ (Uncorrected)

HIG ____ ____
HOG ____ ____
LOG ____ ____

Location HIG ____

Number of PIC Readings Taken
Inside ____ Outside ____

Soil Samples Taken
Yes ____ No ____ Number ____

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

GAMMA SURVEY REPORT

Owner Anita Freeman

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 9

Type of Structure	Material
x Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	___ Masonry
___ Unknown	x Non Masonry
Number of Levels 2	Other ___

Comments: ___

Elevated reading associated with: ___

Survey No. 66
Event No. 1980 - 1971 1
Street Address 417 South Main
City/State Monticello, Utah
County San Juan
Date July 15, 1982
Surveyors E.B.
Meter No. C-3558.S

	Corrected	Uncorrected
HIG	15	16
HOG	16	19
LOG	13	12

Location HIG Utility room

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ___ No x Number 0

Sample Numbers ___ ___

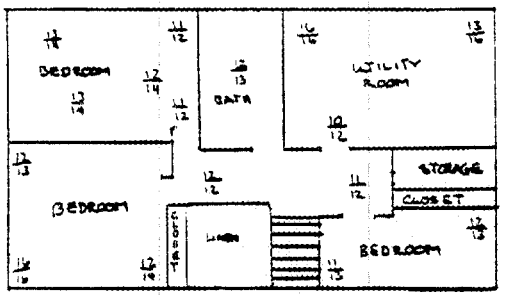
(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

MSS 66

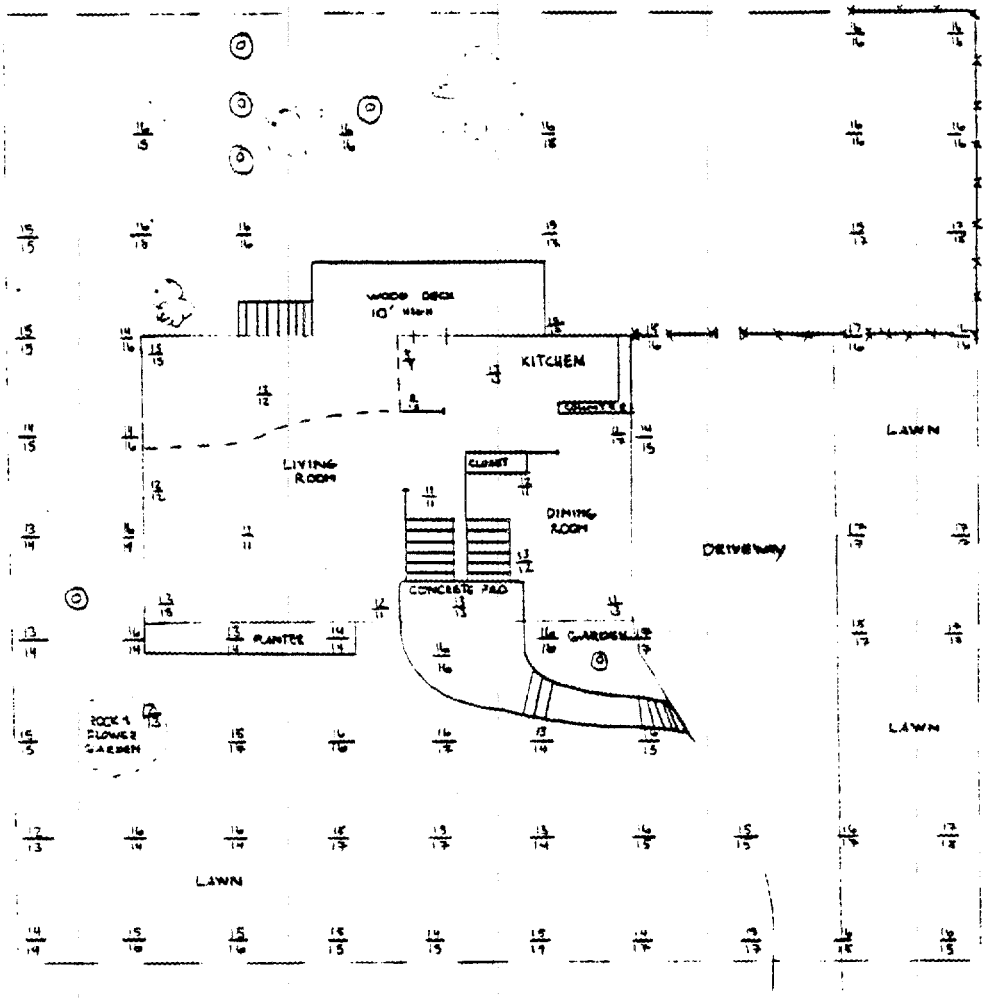
N

FENCELINE

TREE



BASEMENT



GAMMA SURVEY REPORT

Owner Marguerite Pehrson

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 9

Type of Structure	Material
X Basement	___ Adobe
___ Slab on Grade	___ House Trailer
___ Crawl Space	X Masonry
___ Unknown	X Non Masonry
Number of Levels 2	Other ___

Comments: Approximate date of original construction was 1940. Separate garage on property.

Elevated reading associated with: Yard

Survey No. 67 (Requested)
Event No. 1980 - 1971 -
Street Address 48 East 4th South
City/State Monticello, Utah
County San Juan
Date July 22, 1982
Surveyors D.T. & E.B.
Meter No. C-3560-S

	Corrected	Uncorrected
HIG	14	14
HOG	17	21
LOG	13	12

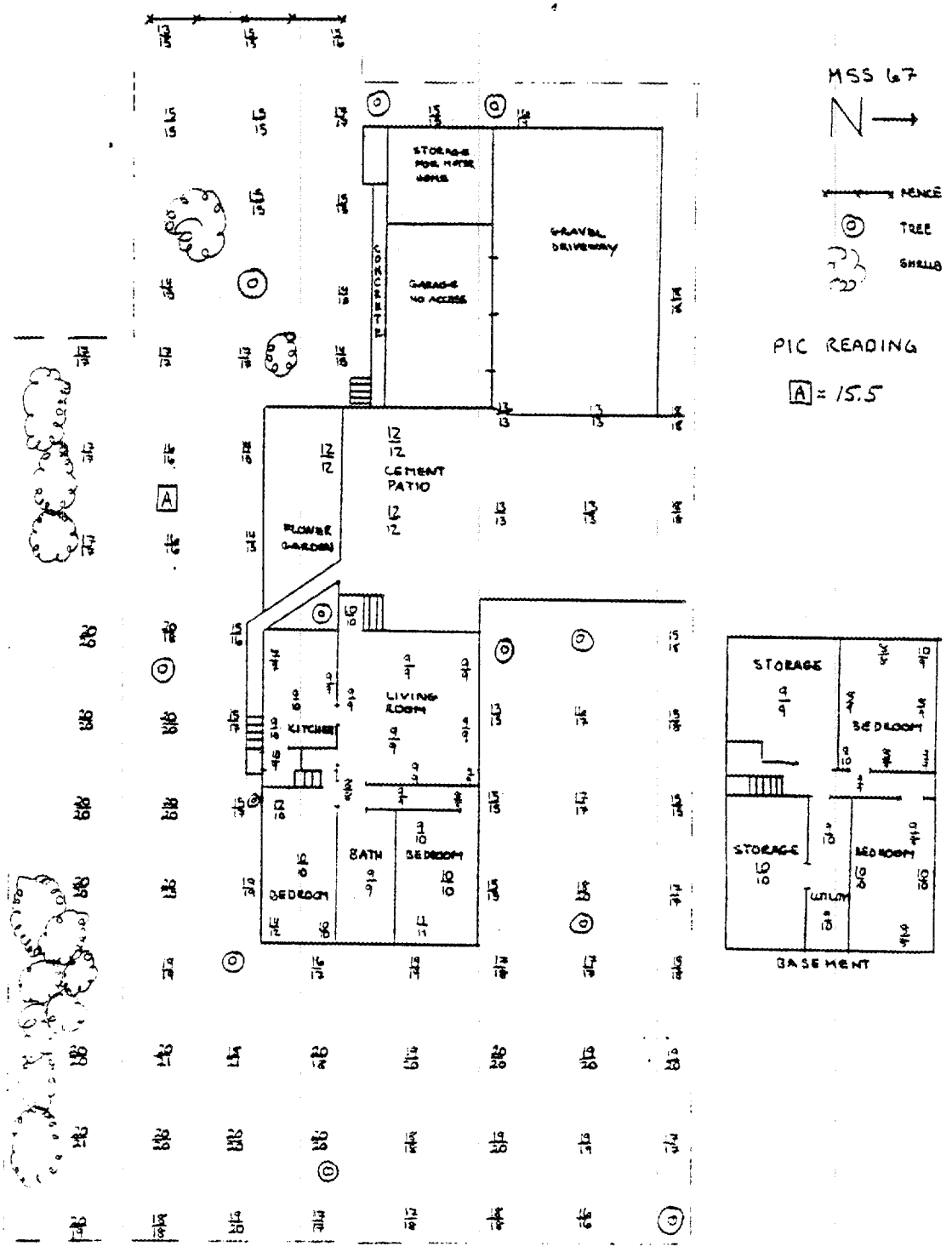
Location HIG Upper bedroom

Number of PIC Readings Taken
Inside 0 Outside 1

Soil Samples Taken
Yes ___ No X Number 0

Sample Numbers ___ ___

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 67
N
FENCE
TREE
SHRUB
PIC READING
A = 15.5
STORAGE FOR MOTOR HOME
GRAVEL DRIVEWAY
GARAGE NO ACCESS
BREEZEWAY
12/12
CEMENT PATIO
FLOWER GARDEN
A
KITCHEN
LIVING ROOM
BATH
BEDROOM
BEDROOM
STORAGE
BEDROOM
STORAGE
BEDROOM
BASEMENT

GAMMA SURVEY REPORT

Owner Robert Bryan

Occupant Same

Property Classification	Gamma Map	Tailings Use
1	1	3

Type of Structure		Material	
x	Basement		Adobe
	Slab on Grade		House Trailer
	Crawl Space		Masonry
	Unknown	x	Non Masonry

Number of Levels 2 Other

Comments:

Elevated reading associated with:

Survey No. 68
Event No. 1980 13 1971
Street 449 South Main
Address
City/State Monticello, Utah
County San Juan
Date July 27, 1982
Surveyors E.B. & D.T.
Meter No. C-3560-S

	Corrected	Uncorrected
HIG	14	14
HOG	17	20
LOG	12	8

Location HIG Back door area

Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes No x Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

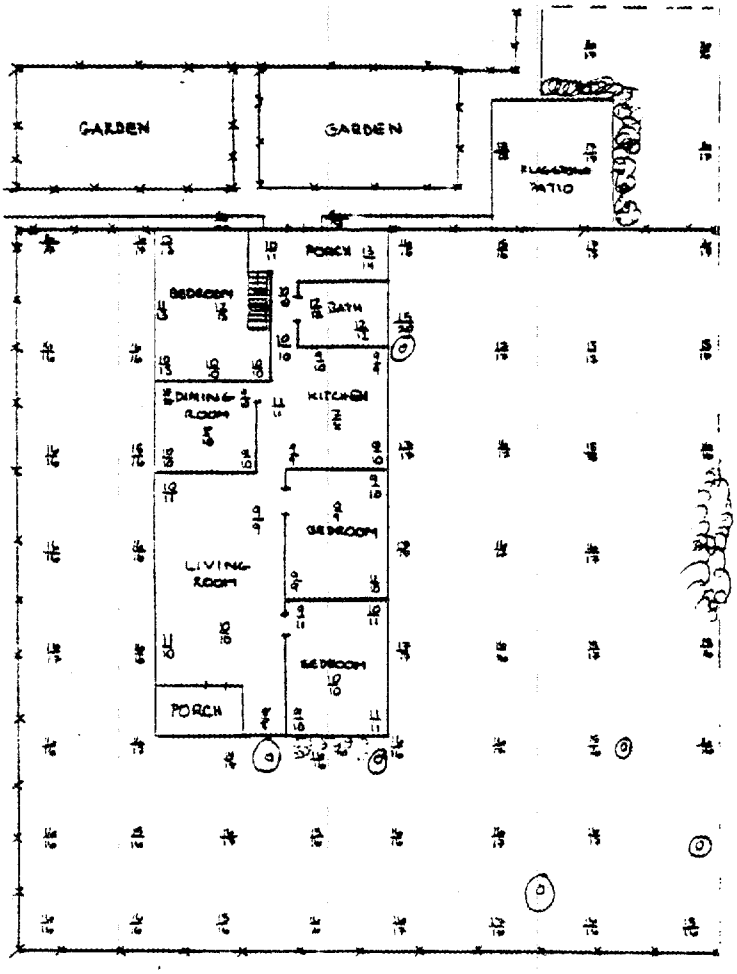
MSS 68

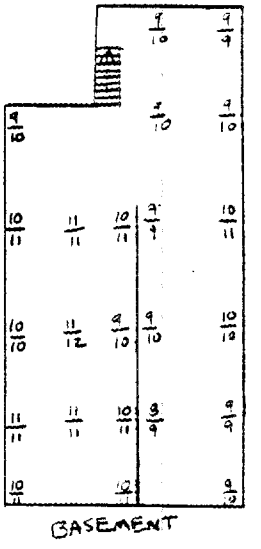
N

FENCELINE

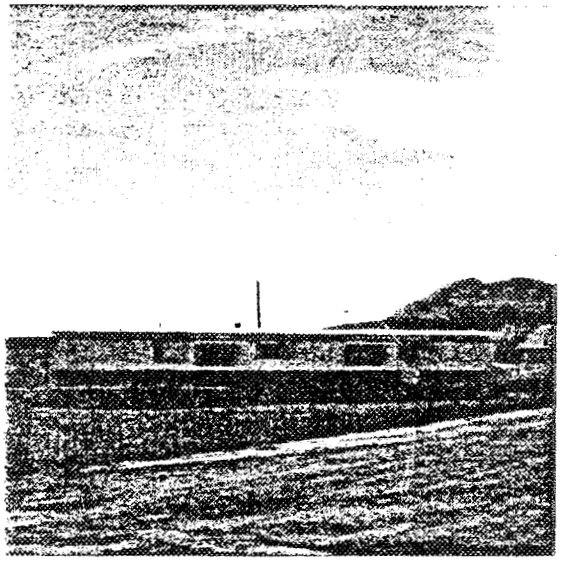
TREE

SHRUB





BASEMENT



GAMMA SURVEY REPORT

Owner Doug Pehrson

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 9

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade	x	House Trailer
x	Crawl Space		Masonry
	Unknown		Non Masonry

Number of Levels 1 | Other

Comments: Mobile home is on uneven ground - lots of fill dirt in back to the south and southwest. Approximate date of original construction was 1980.

Elevated reading associated with:

Survey No. 69
Event No. 1980 - 1971 36A
Street Address 96 East 4th South
City/State Monticello, Utah
County San Juan
Date July 21, 1982
Surveyors E.B. & D.T.
Meter No. C-3560-S

	Corrected	Uncorrected
HIG	19	25
HCG	19	24
LOG	14	14

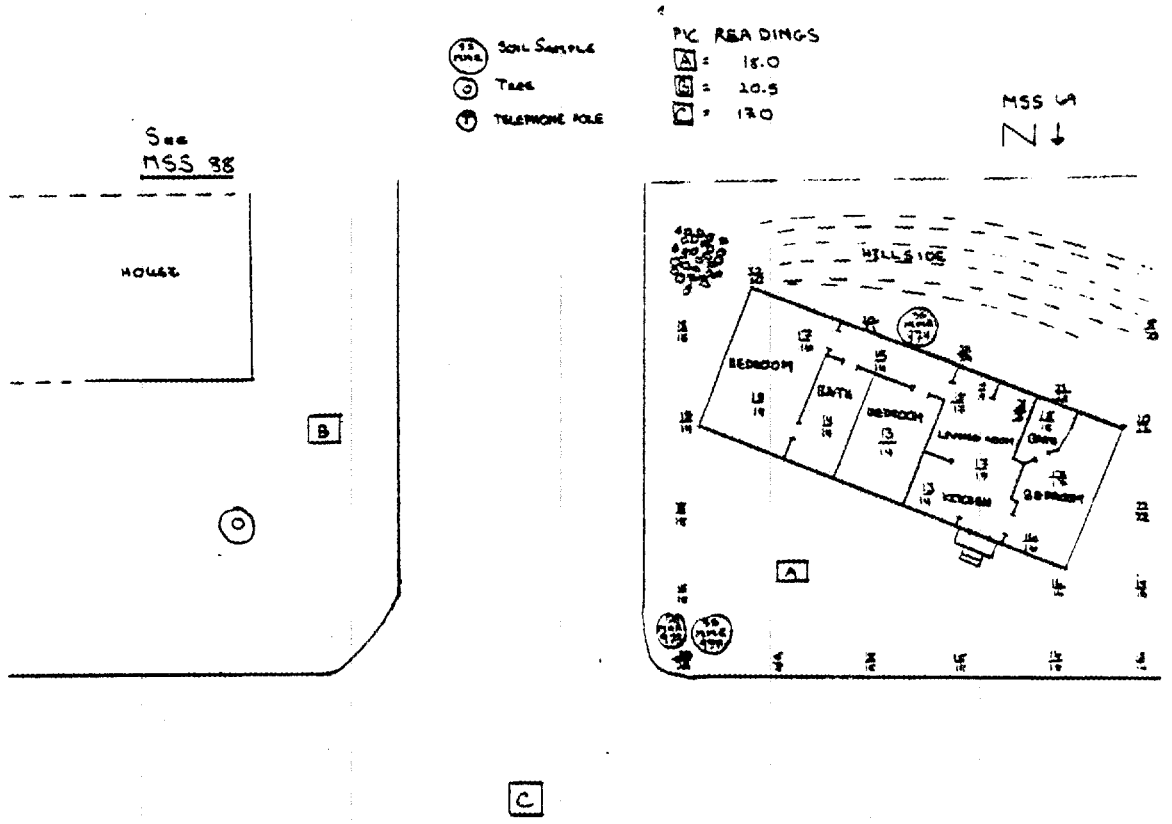
Location HIG Livingroom

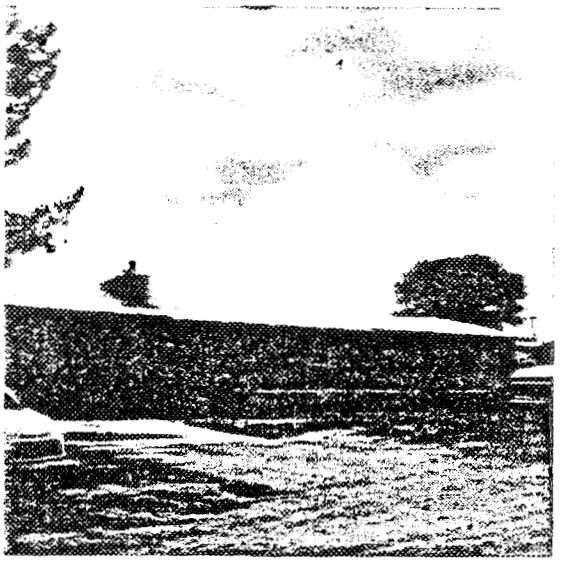
Number of PIC Readings Taken
Inside 0 Outside 3

Soil Samples Taken
Yes x No Number 4

Sample Numbers	
MMR	956
MMR	957
MMR	973
MMR	974

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


Soil Sample
Trees
Telephone Pole
PVC Readings
A = 18.0
B = 20.5
C = 13.0
MSS 5
N
See MSS 38
HOUSE
B
HILLSIDE
BEDROOM
BATH
BEDROOM
LIVING ROOM
DINING
KITCHEN
BEDROOM
A
C
HOUSE
HOUSE



GAMMA SURVEY REPORT

Owner Mike Pehrson

Occupant Same

Property Classification 1 Gamma Map 1 Tailings Use 9

Type of Structure		Material	
	Basement		Adobe
	Slab on Grade		House Trailer
x	Crawl Space		Masonry
	Unknown	x	Non Masonry

Number of Levels 1 Other

Comments:

Elevated reading associated with: Yard

Survey No. 70 (Requested)
Event No. 1980 - 1971 -
Street Address 432 South 1st East
City/State Monticello, Utah
County San Juan
Date July 30, 1982
Surveyors D.T. & E.B.
Meter No. C.3558.S

	Corrected	Uncorrected
HIG	16	19
HOG	20	28
LOG	14	13

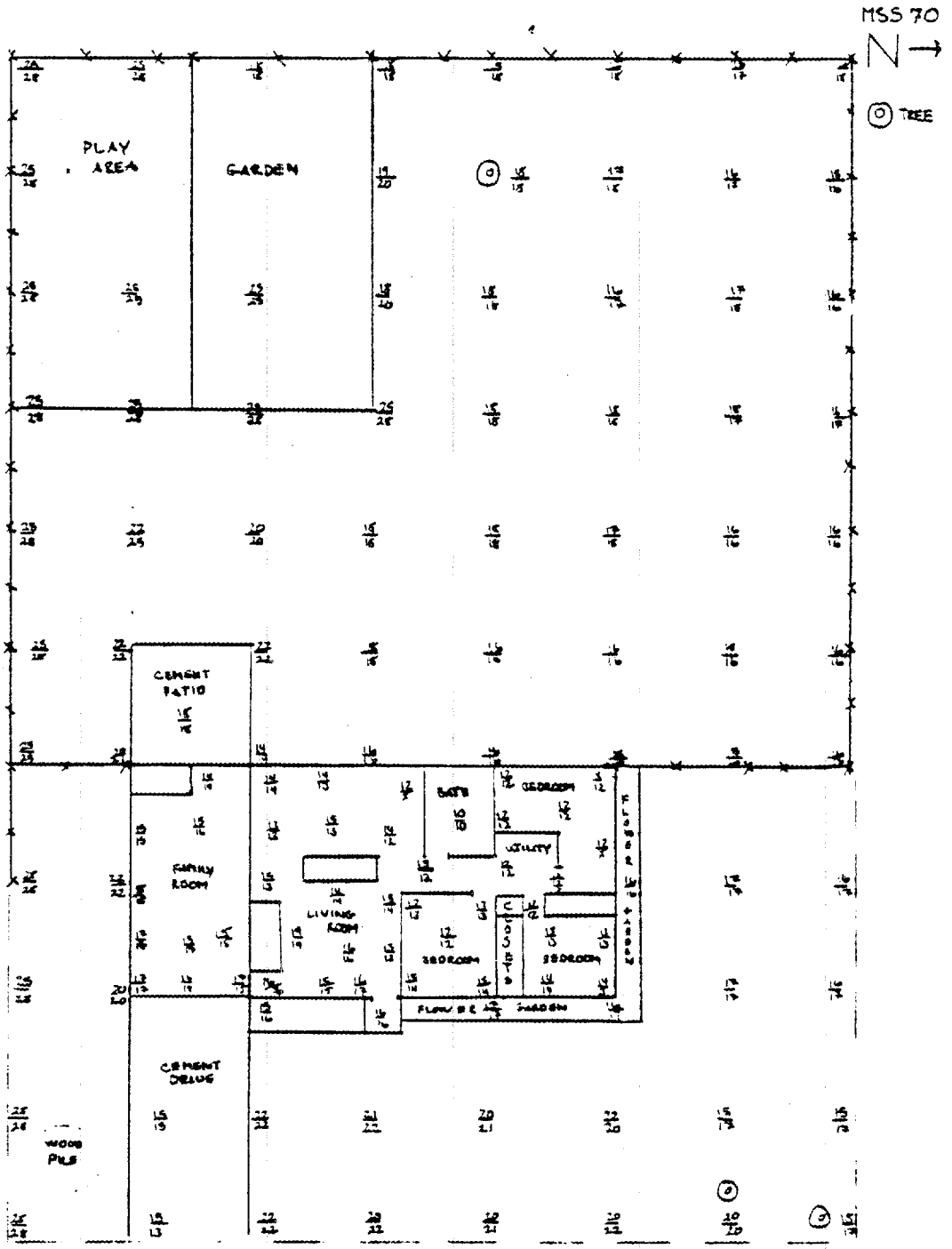
Location HIG Near fireplace

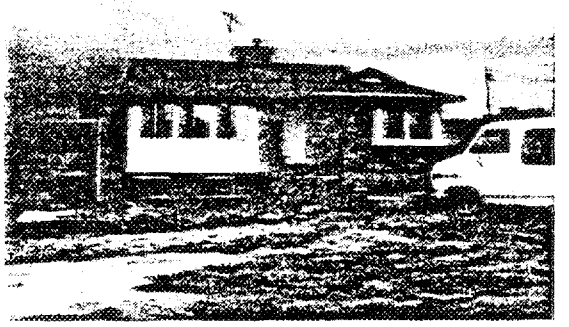
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes No x Number 0

Sample Numbers

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 70
N
TREE
PLAY AREA
GARDEN
CEMENT PATIO
FAMILY ROOM
LIVING ROOM
BEDROOM
BEDROOM
BEDROOM
UTILITY
CEMENT DRIVE
WOOD PILE



GAMMA SURVEY REPORT

Owner: Lloyd Blake

Occupant: Same

Property Classification: 1 | Gamma Map: 1 | Tailings Use: 9

Type of Structure	Material
X Basement	____ Adobe
____ Slab on Grade	____ House Trailer
____ Crawl Space	X Masonry
____ Unknown	X Non Masonry
Number of Levels: 2	Other: ____

Comments: * PIC not operating properly

Elevated reading associated with: Yard

Survey No.: 71 (Requested)
Event No.: 1980 - 1971 -
Street Address: 464 South 1st East
City/State: Monticello, Utah
County: San Juan
Date: July 27, 1982
Surveyors: E.B. & D.T.
Meter No.: C.3558.S

	Corrected	Uncorrected
HIG	18	22
HOG	39	70
LOG	12	10

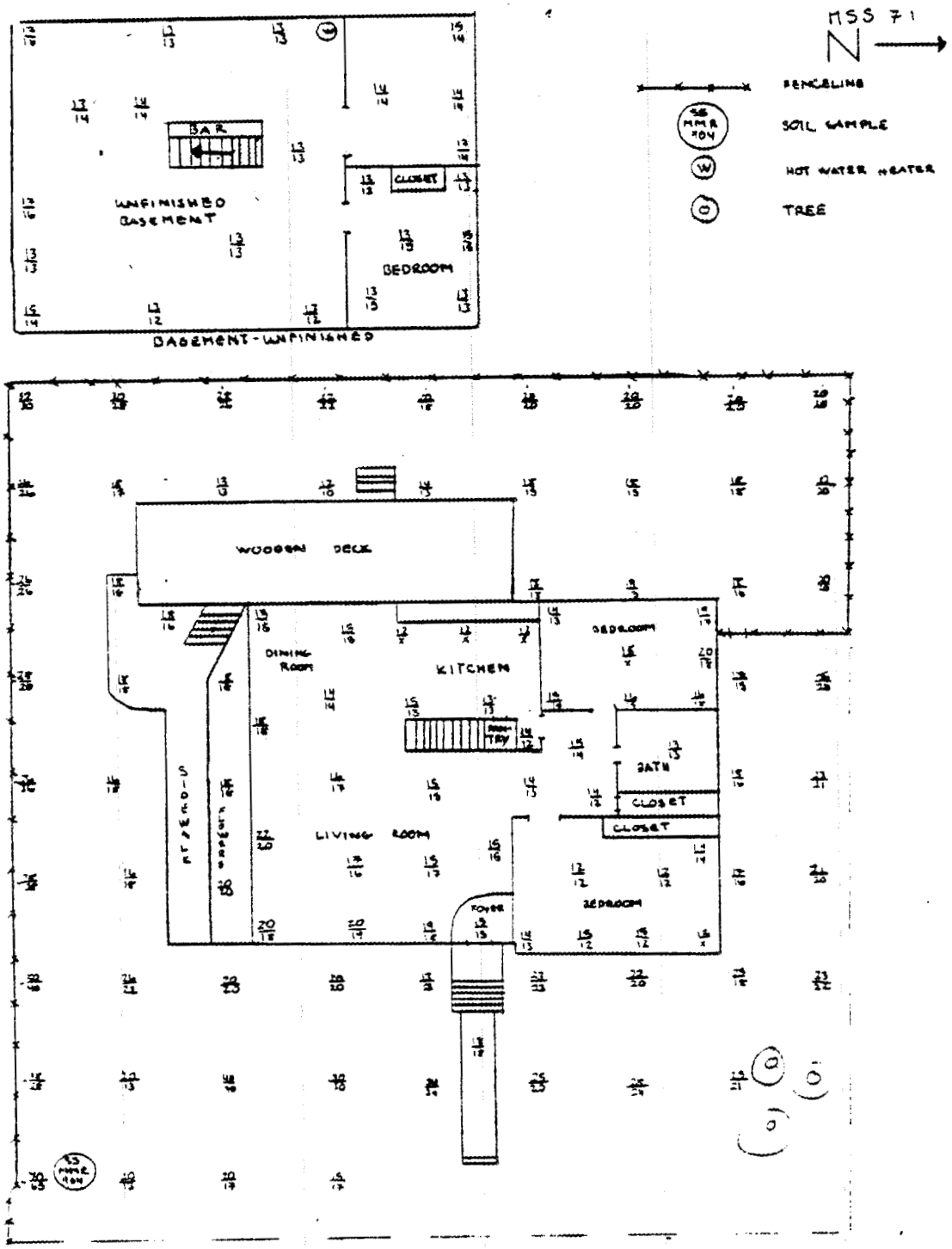
Location HIG: Livingroom (S.E. Corner)

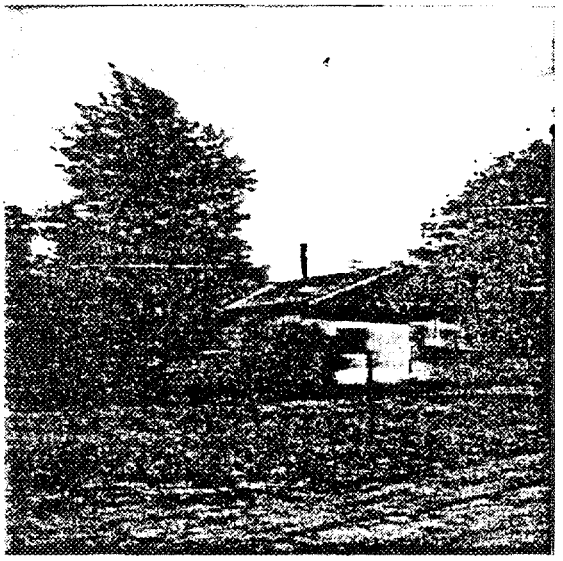
Number of PIC Readings Taken
Inside: 0 Outside: 0 *

Soil Samples Taken
Yes: X No: ____ Number: 1

Sample Numbers: MMR 904

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


N 55° 7' E
FENCELINE
SOIL SAMPLE
HOT WATER HEATER
TREE
BAR
UNFINISHED BASEMENT
CLOSET
BEDROOM
BASEMENT - UNFINISHED
WOODEN DECK
DINING ROOM
KITCHEN
BEDROOM
BATH
CLOSET
CLOSET
LIVING ROOM
FOYER
BEDROOM



GAMMA SURVEY REPORT

Owner Raymond Arballo

Occupant Same

Property Classification 1 | Gamma Map 1 | Tailings Use 0

Type of Structure	Material
____ Basement	____ Adobe
x Slab on Grade	____ House Trailer
____ Crawl Space	x Masonry
x Unknown	x Non Masonry
Number of Levels 1	Other ____

Comments: ____

Elevated reading associated with: ____

Survey No. 72 (Requested)
Event No. 1980 - 1971 -
Street Address 493 South Main
City/State Monticello, Utah
County San Juan
Date August 2, 1982
Surveyors E.B. & D.T.
Meter No. C.3558.S

	Corrected	Uncorrected
HIG	15	15
HOG	16	19
LOG	13	12

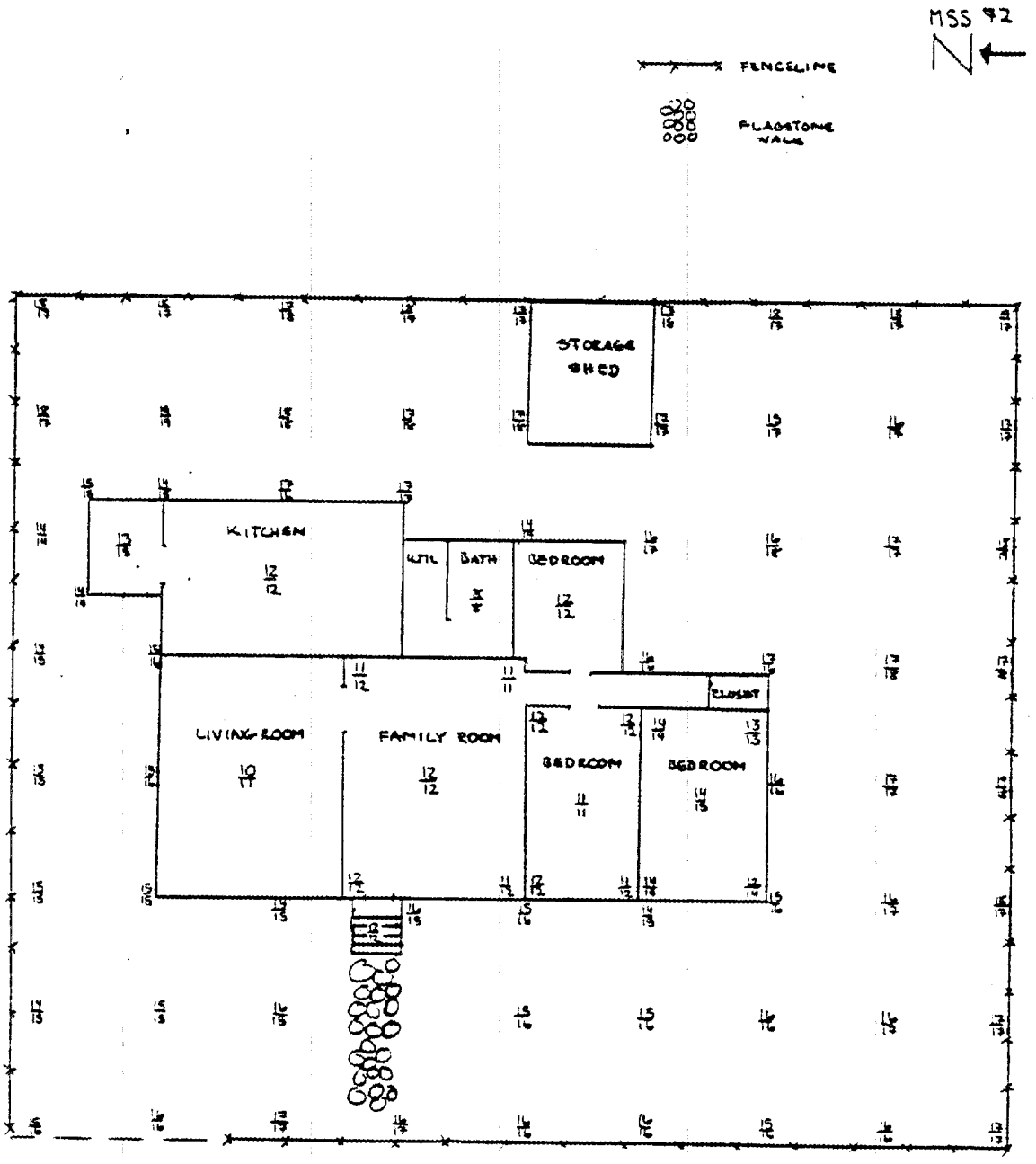
Location HIG Bedroom

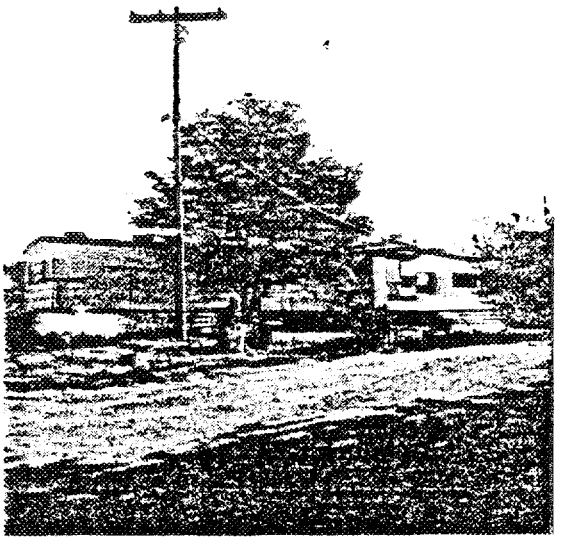
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes ____ No x Number 0

Sample Numbers ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 92
FENCELINE
FLAGSTONE WALK
STORAGE SHED
KITCHEN
KITC
BATH
BEDROOM
CLOSET
LIVING ROOM
FAMILY ROOM
BEDROOM
BEDROOM



GAMMA SURVEY REPORT

Owner: Juan Valdez

Occupant: Same

Property Classification: 1 Gamma Map: 1 Tailings Use: 9

Type of Structure	Material
___ Basement	___ Adobe
___ Slab on Grade	_x_ House Trailer
___ Crawl Space	___ Masonry
_x_ Unknown	___ Non Masonry
Number of Levels: 1	Other:

Comments:

Elevated reading associated with:

Survey No.: 73 (Requested)
Event No.: 1980 - 1971 -
Street Address: 65 East 5th South
City/State: Monticello, Utah
County: San Juan
Date: July 26, 1982
Surveyors: E.B. & D.T.
Meter No.: C.3560.S

	Corrected	Uncorrected
HIG	19	25
HOG	21	29
LOG	15	16

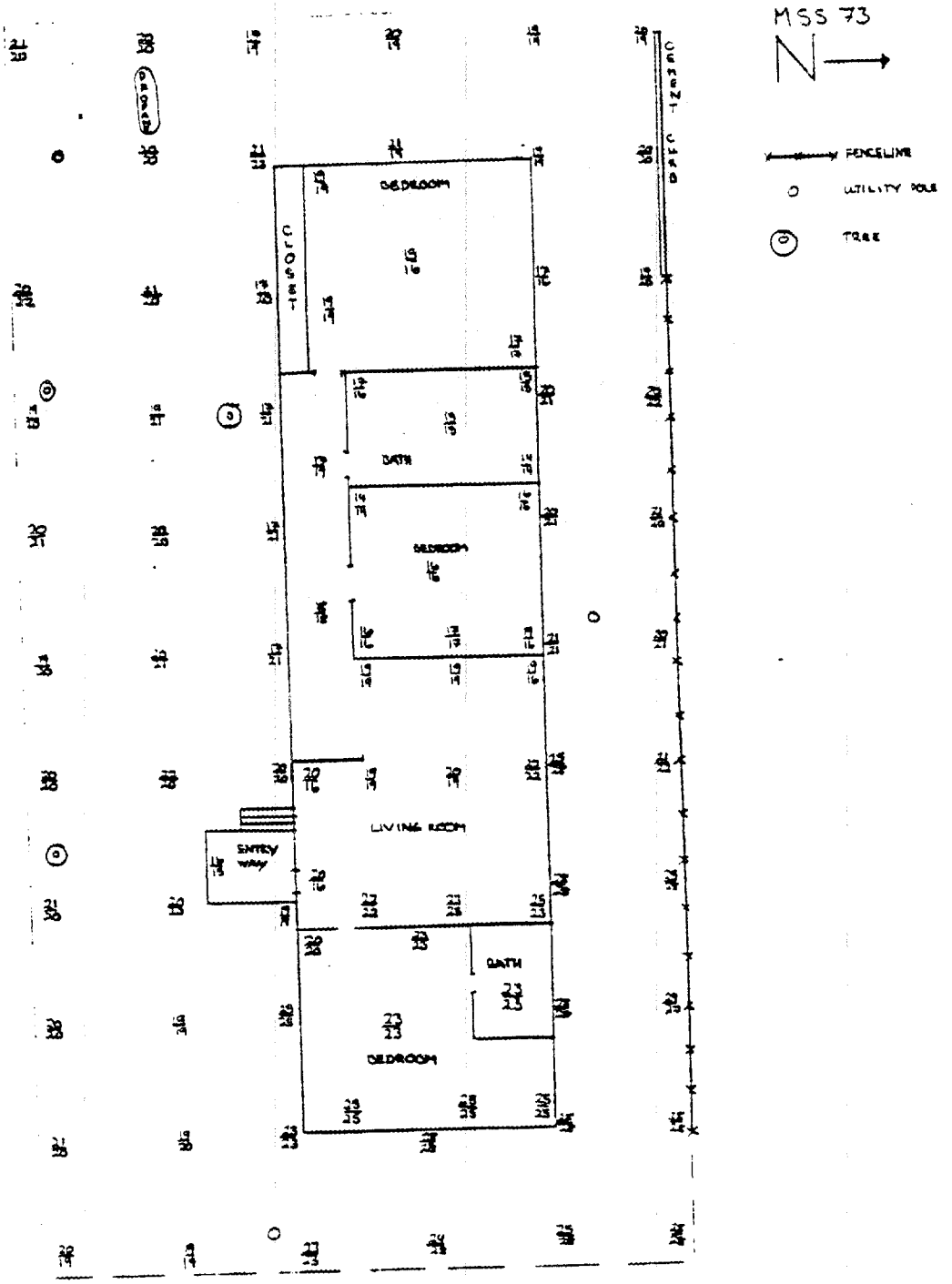
Location HIG: Bedroom and livingroom

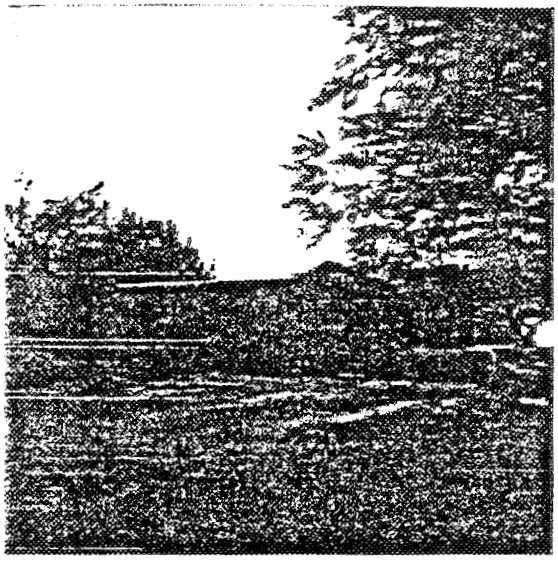
Number of PIC Readings Taken: Inside 0 Outside 0

Soil Samples Taken: Yes ___ No x Number 0

Sample Numbers:

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 73
N
FENCELINE
UTILITY POLE
TREE
BEDROOM
BATH
BEDROOM
LIVING ROOM
ENTRY WAY
BATH
BEDROOM



GAMMA SURVEY REPORT

Owner Emma Butterfield

Occupant Same

Property Classification	Gamma Map	Tailings Use
1	1	4

Type of Structure	Material
____ Basement	____ Adobe
____ Slab on Grade	_x_ House Trailer
_x_ Crawl Space	____ Masonry
____ Unknown	____ Non Masonry
Number of Levels 1	Other ____

Comments: Approximate date of original construction was July of 1973.

Elevated reading associated with: Yard

Survey No.	74 (Requested)
Event No.	1980 - 1971 -
Street Address	87 East 5th South
City/State	Monticello, Utah
County	San Juan
Date	July 27, 1982
Surveyors	P.S. & F.C.
Meter No.	C.3557.S

	Corrected	Uncorrected
HIG	19	24
HOG	47	88
LOG	16	17

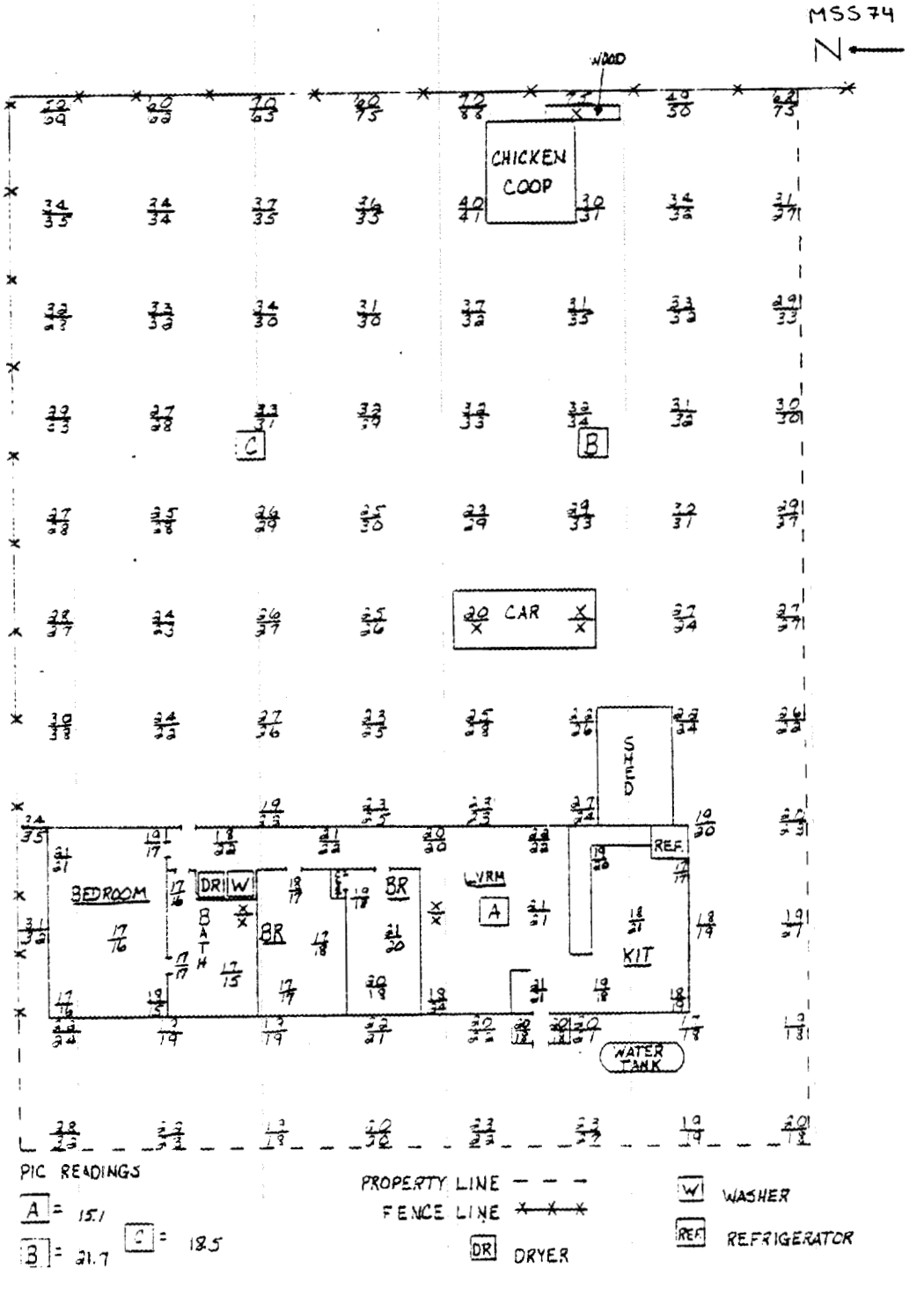
Location HIG Livingroom

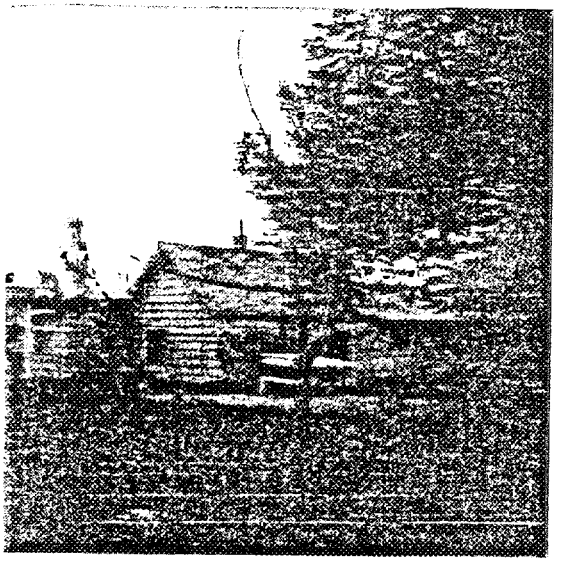
Number of PIC Readings Taken
Inside 1 Outside 2

Soil Samples Taken
Yes ____ No _x_ Number 0

Sample Numbers ____ ____

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)


MSS 74
N
WOOD
CHICKEN COOP
C
B
20 CAR X
SHED
REF.
BEDROOM
DR
W
BATH
BR
BR
VRM
A
KIT
WATER TANK
PIC READINGS
A = 15.1
B = 21.7
C = 18.5
PROPERTY LINE
FENCE LINE
DR DRYER
W WASHER
REF REFRIGERATOR



GAMMA SURVEY REPORT

Owner G. Atencio

Occupant Same

Property Classification	Gamma Map	Tailings Use
1	1	9

Type of Structure		Material	
	Basement		Adobe
X	Slab on Grade		House Trailer
	Crawl Space		Masonry
X	Unknown	X	Non Masonry
Number of Levels 1		Other	

Comments:

Elevated reading associated with: Yard

Survey No.	75 (Requested)	
Event No.	1980 - 1971 -	
Street Address	16 East 5th South	
City/State	Monticello, Utah	
County	San Juan	
Date	August 3, 1982	
Surveyors	D.T. & E.B.	
Meter No.	C.3558.S	
	Corrected	Uncorrected
HIG	16	17
HOG	19	25
LOG	15	15

Location HIG Livingroom

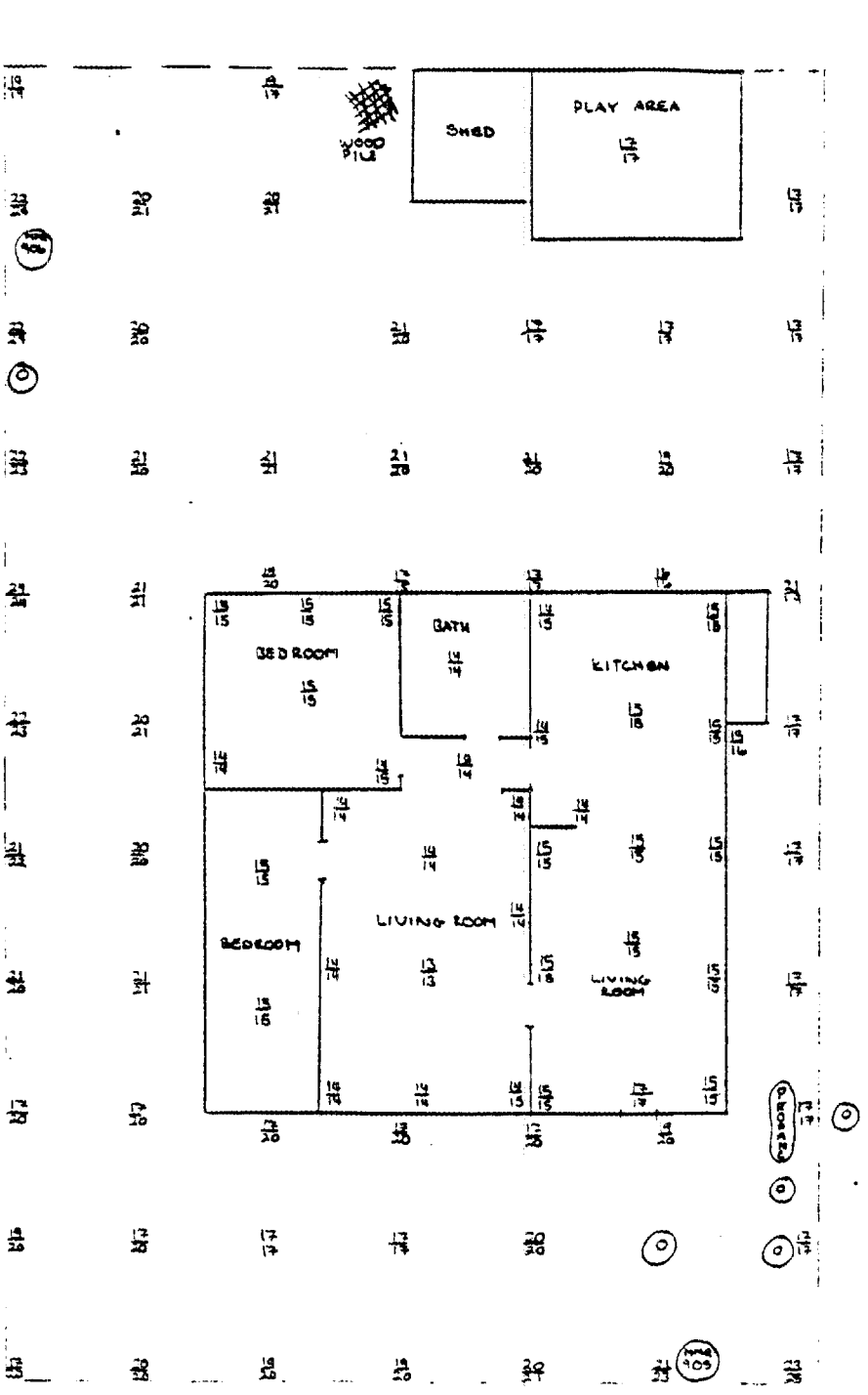
Number of PIC Readings Taken
Inside 0 Outside 0

Soil Samples Taken
Yes X No ____ Number 2

Sample Numbers MMR 905

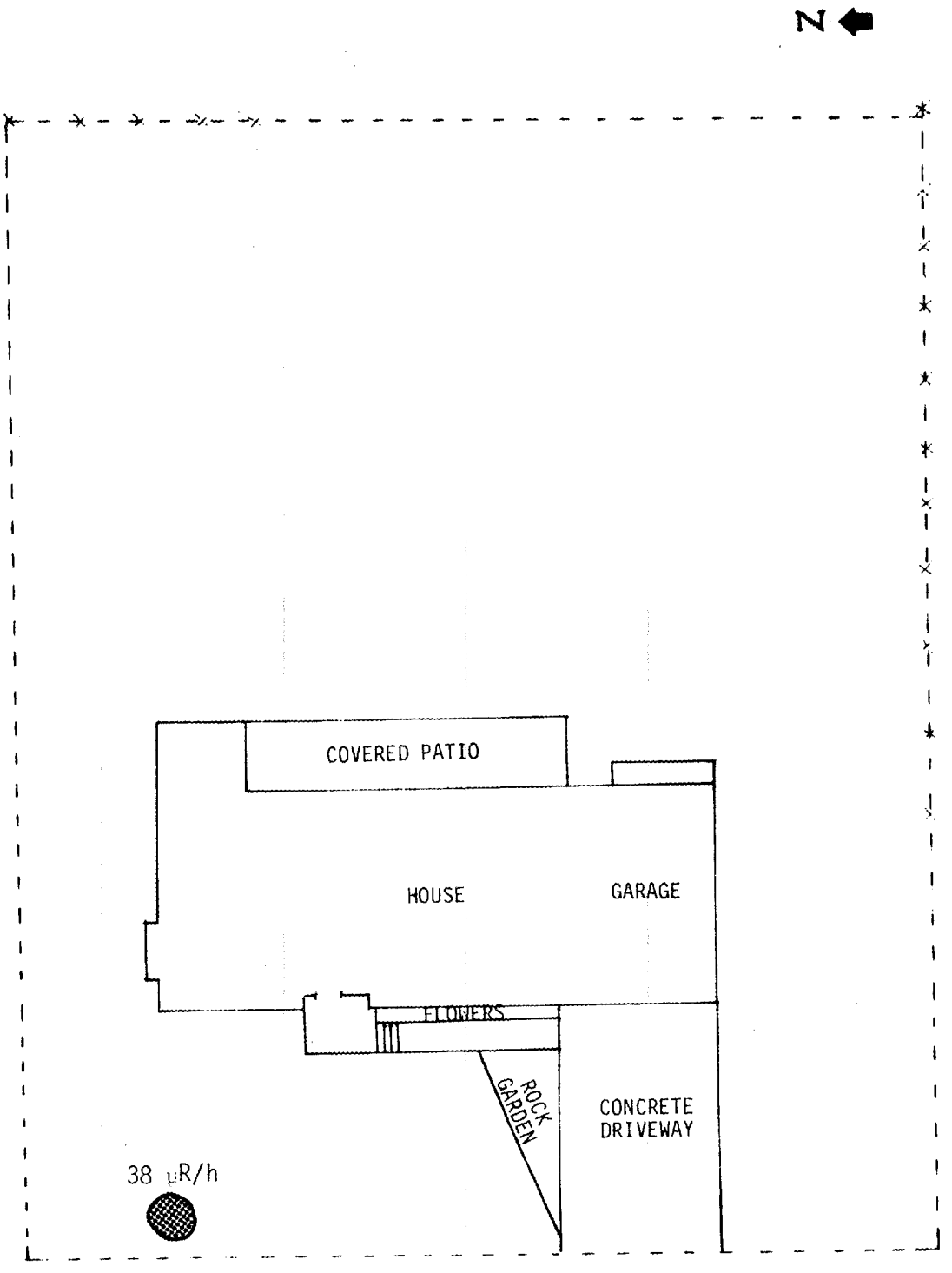
MMR 906

(Scintillometer readings taken on a 10-foot grid unless otherwise indicated, and the uncorrected readings are recorded on the gamma map.)

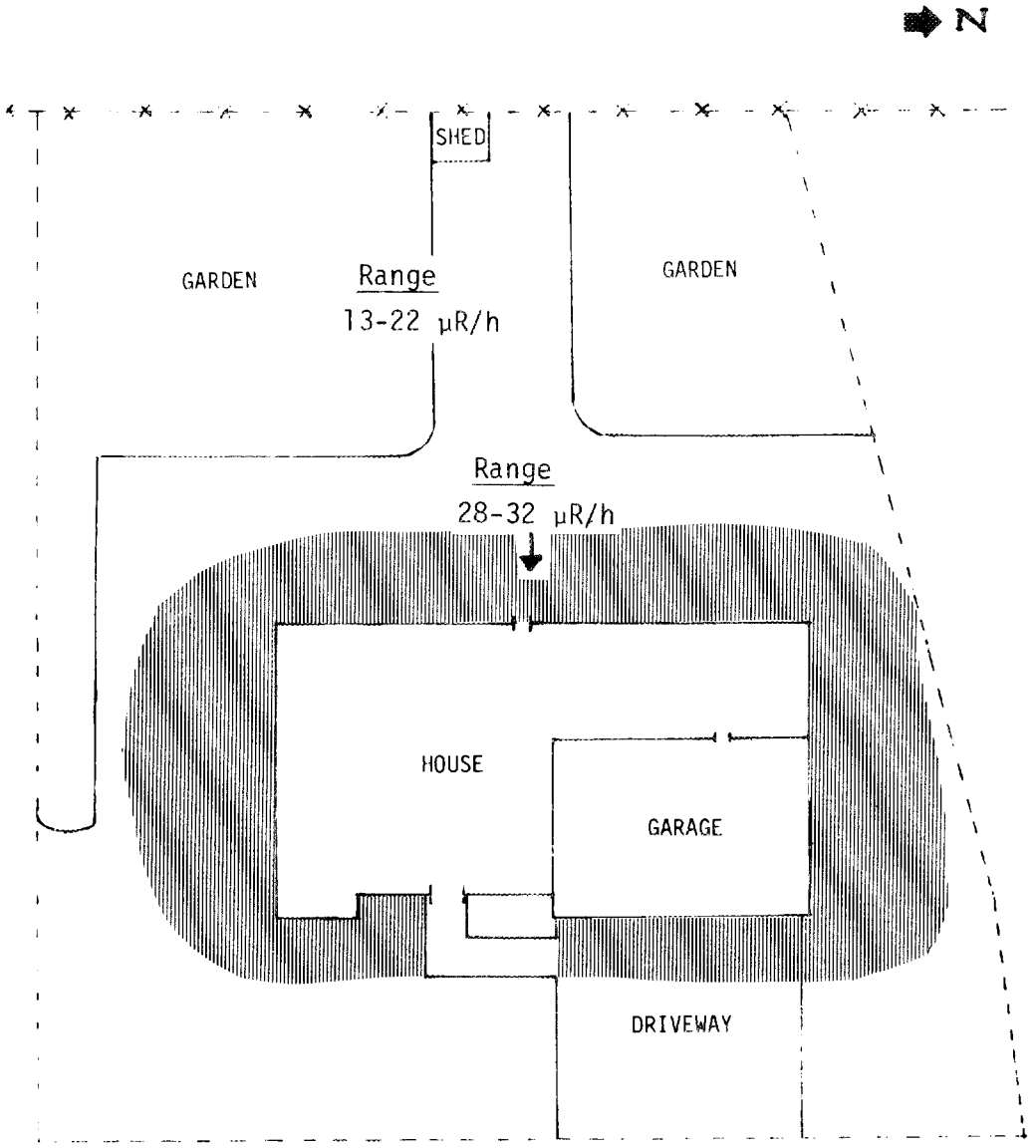

MSS 75
N
TREE
SOIL SAMPLE
SHED
PLAY AREA
BED ROOM
BATH
KITCHEN
LIVING ROOM
BEDROOM
LIVING ROOM
PASSAGE

APPENDIX II

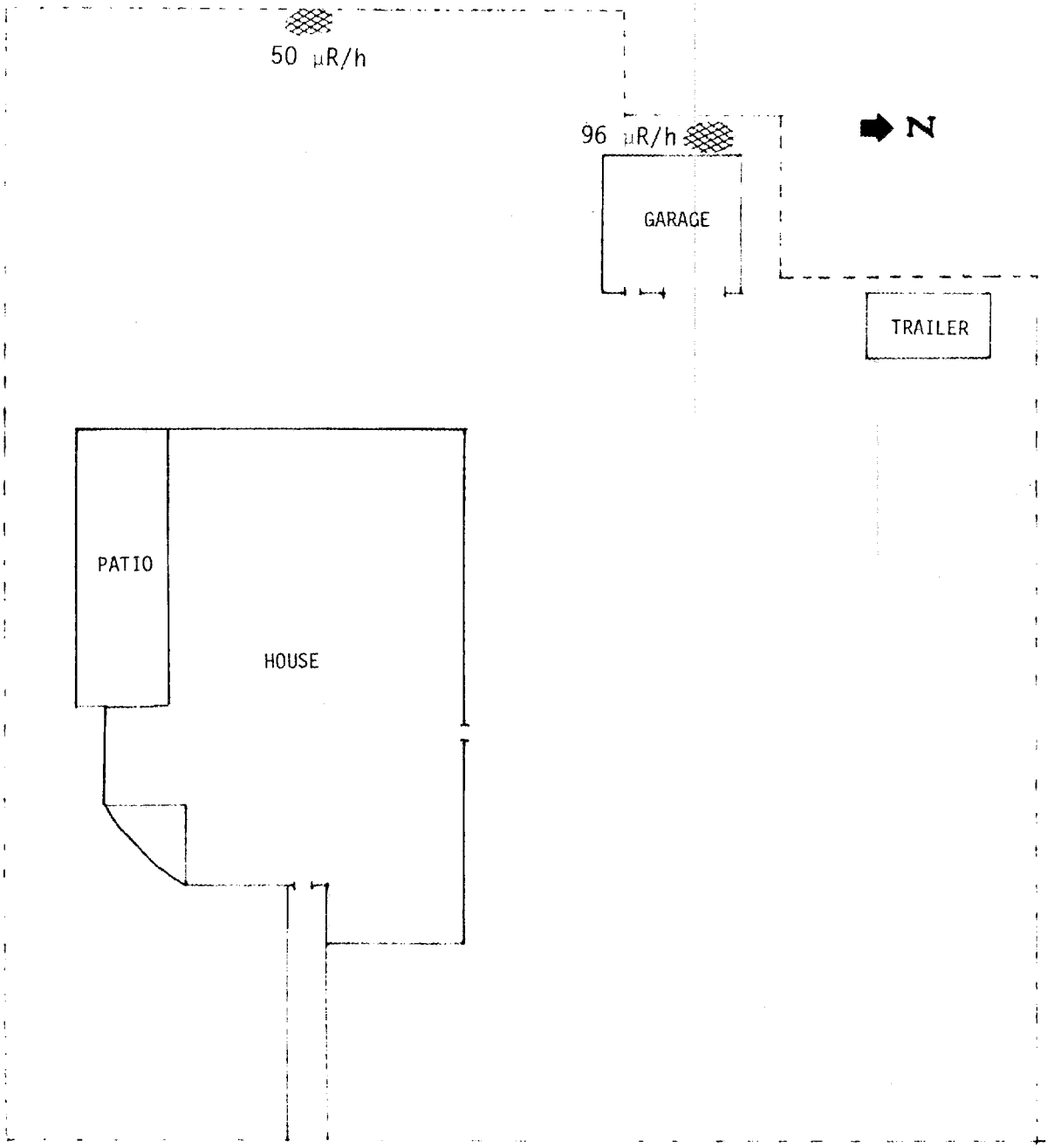
DRAWINGS OF CONTAMINATED PROPERTIES



M-6
333 Silverstone E.

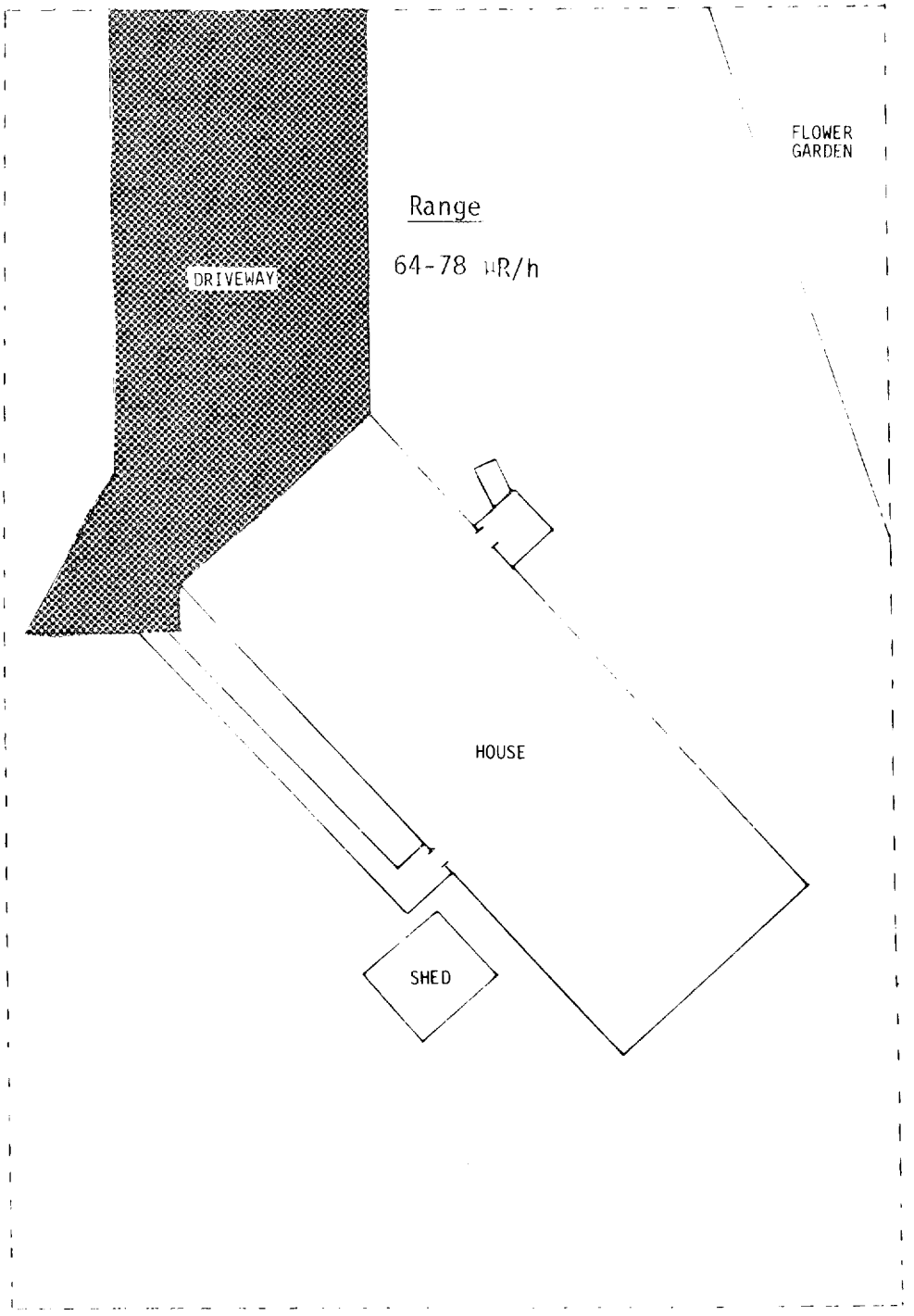


M-10
32 Parkview Dr.

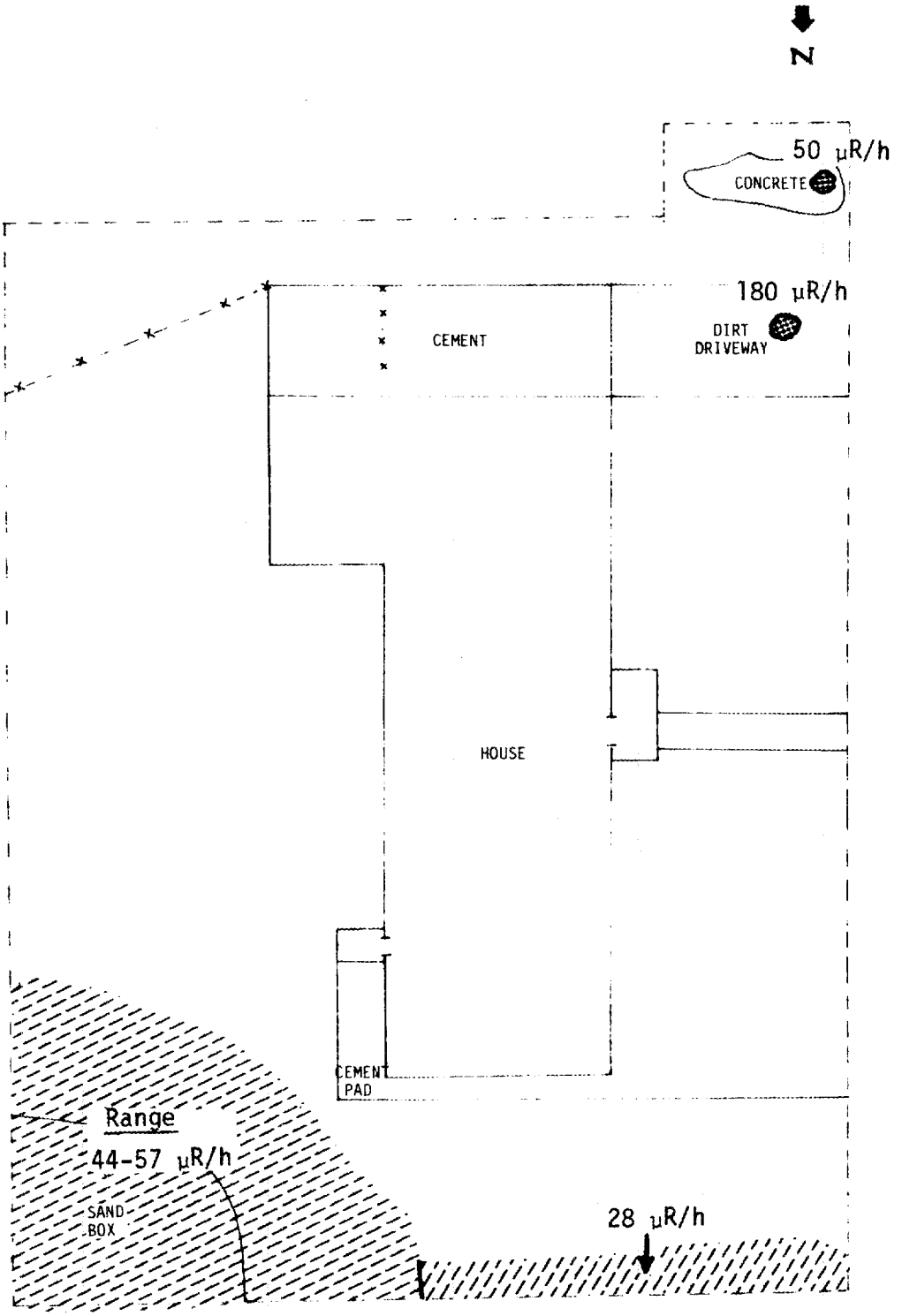


M-12

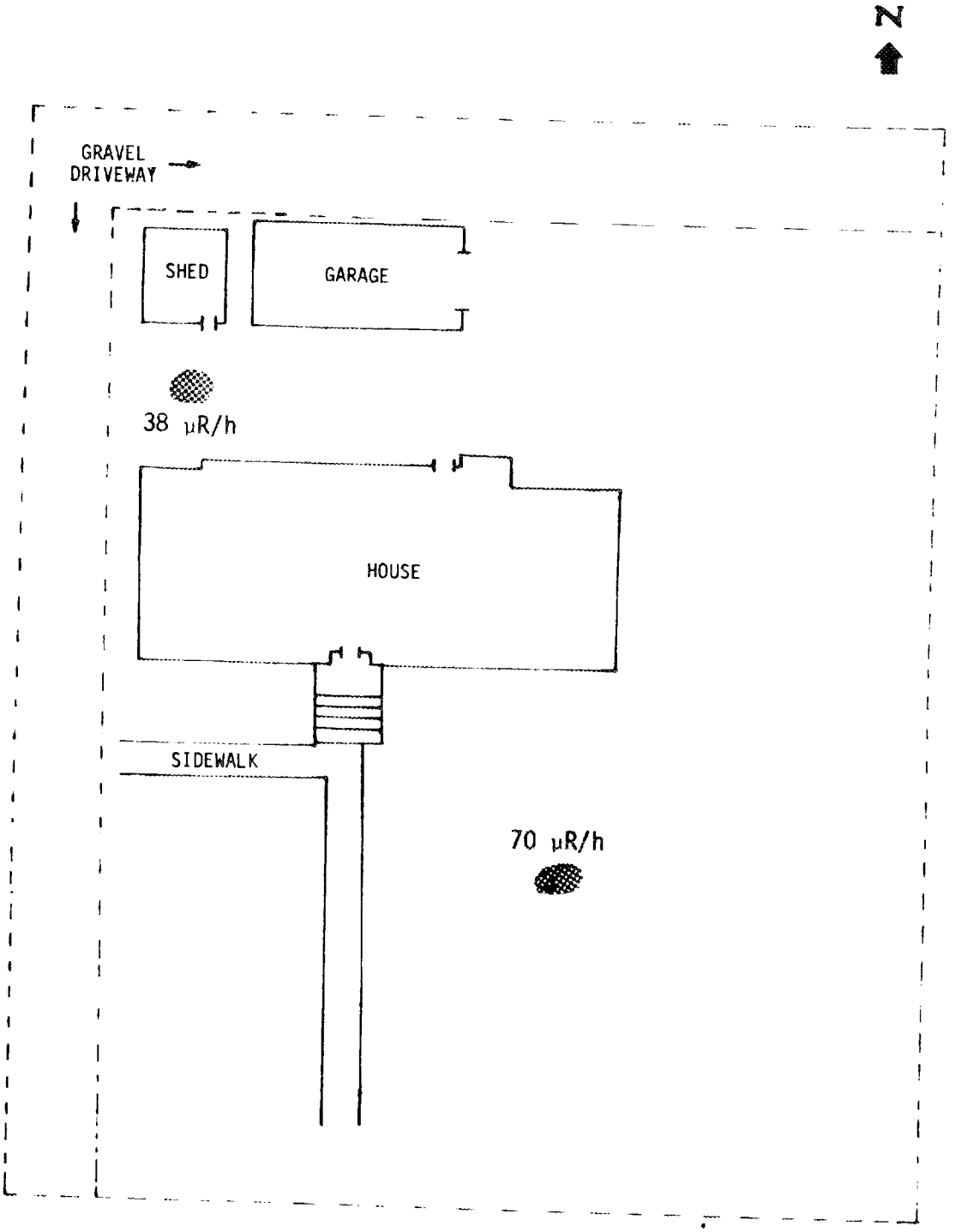
380 Abajo



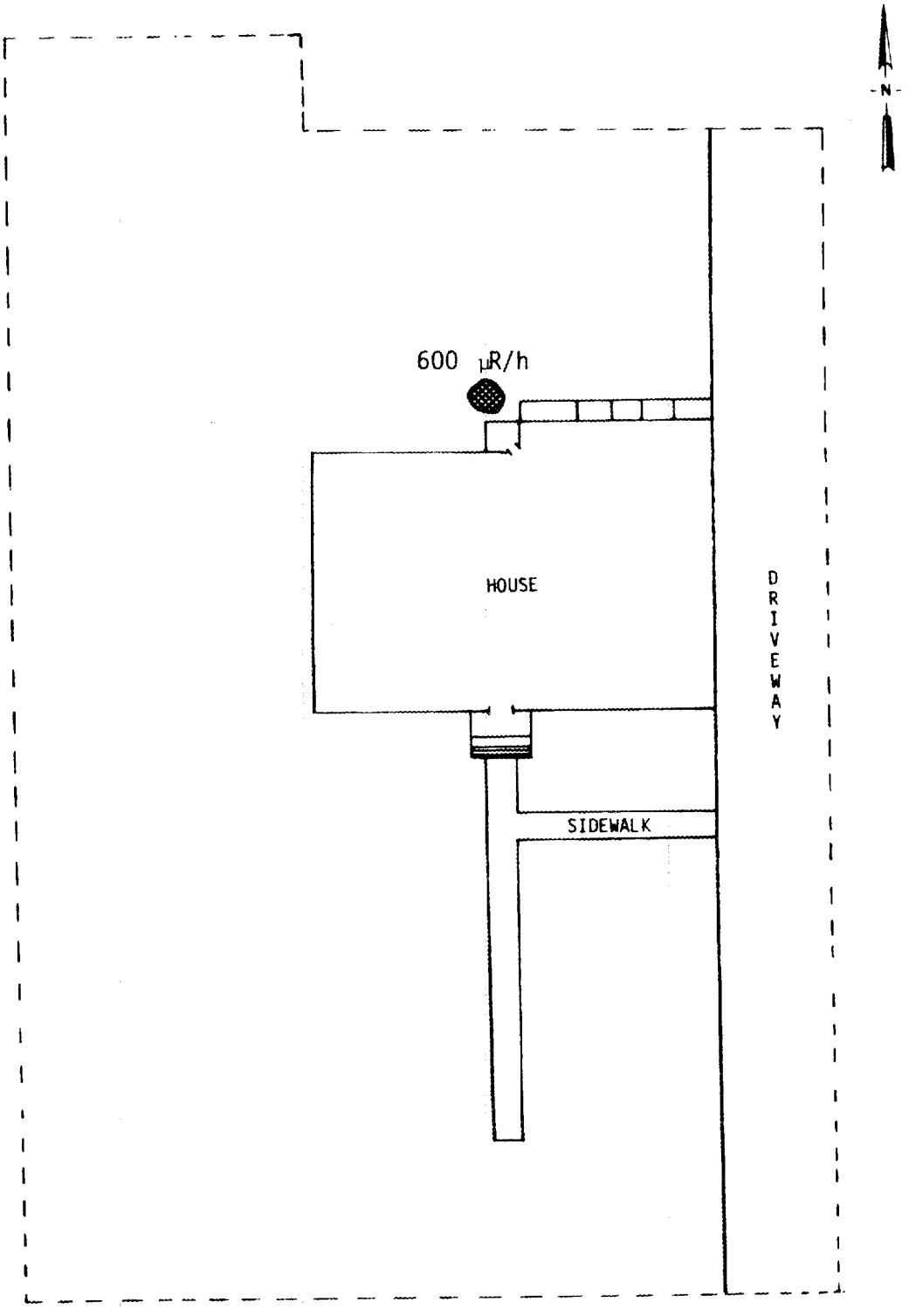
M-14
165 N. 1st W.


N
50 µR/h
CONCRETE
180 µR/h
CEMENT
DIRT
DRIVEWAY
HOUSE
CEMENT
PAD
Range
44-57 µR/h
SAND
BOX
28 µR/h

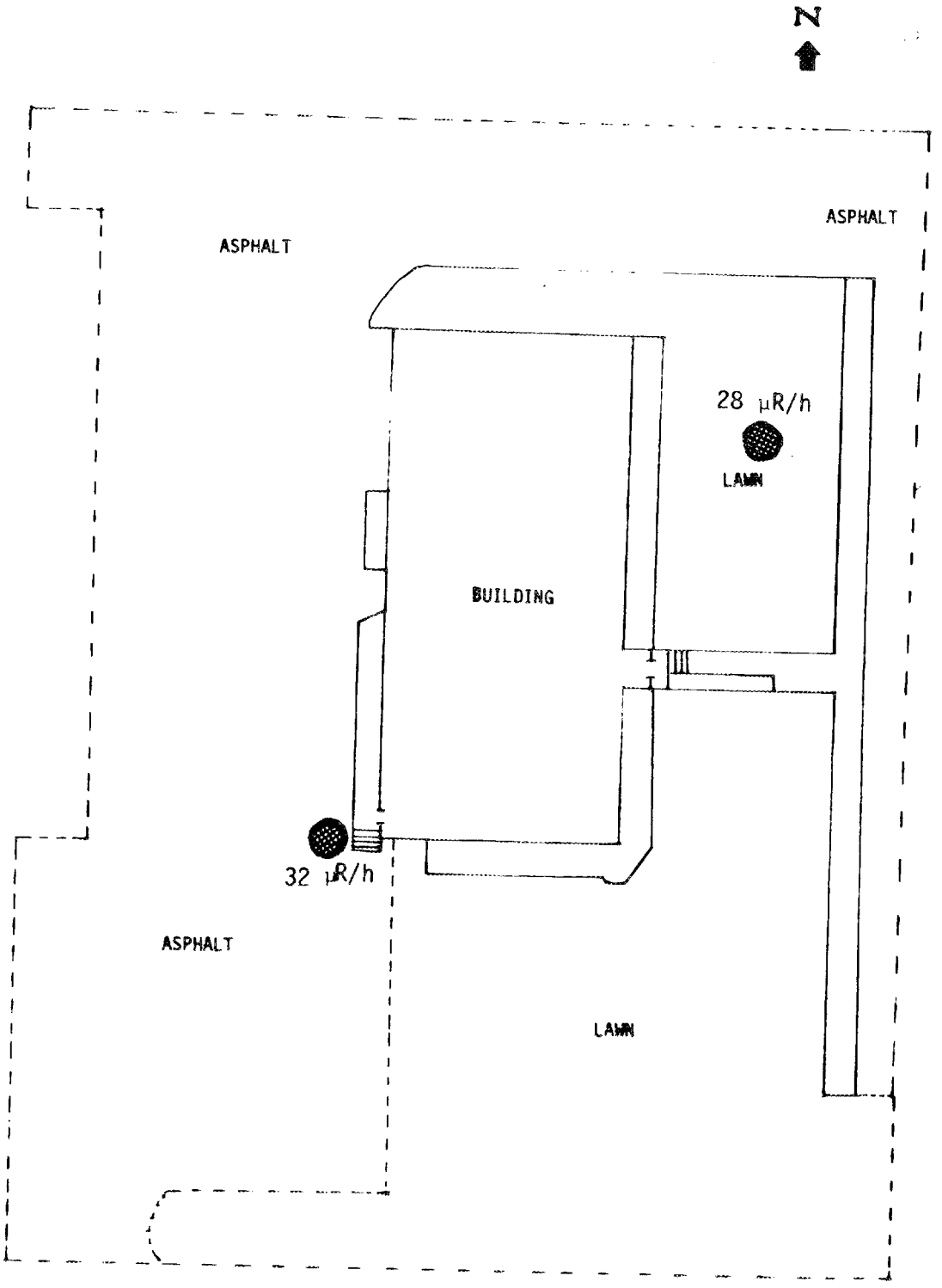
M-16
65 S. 2nd W.



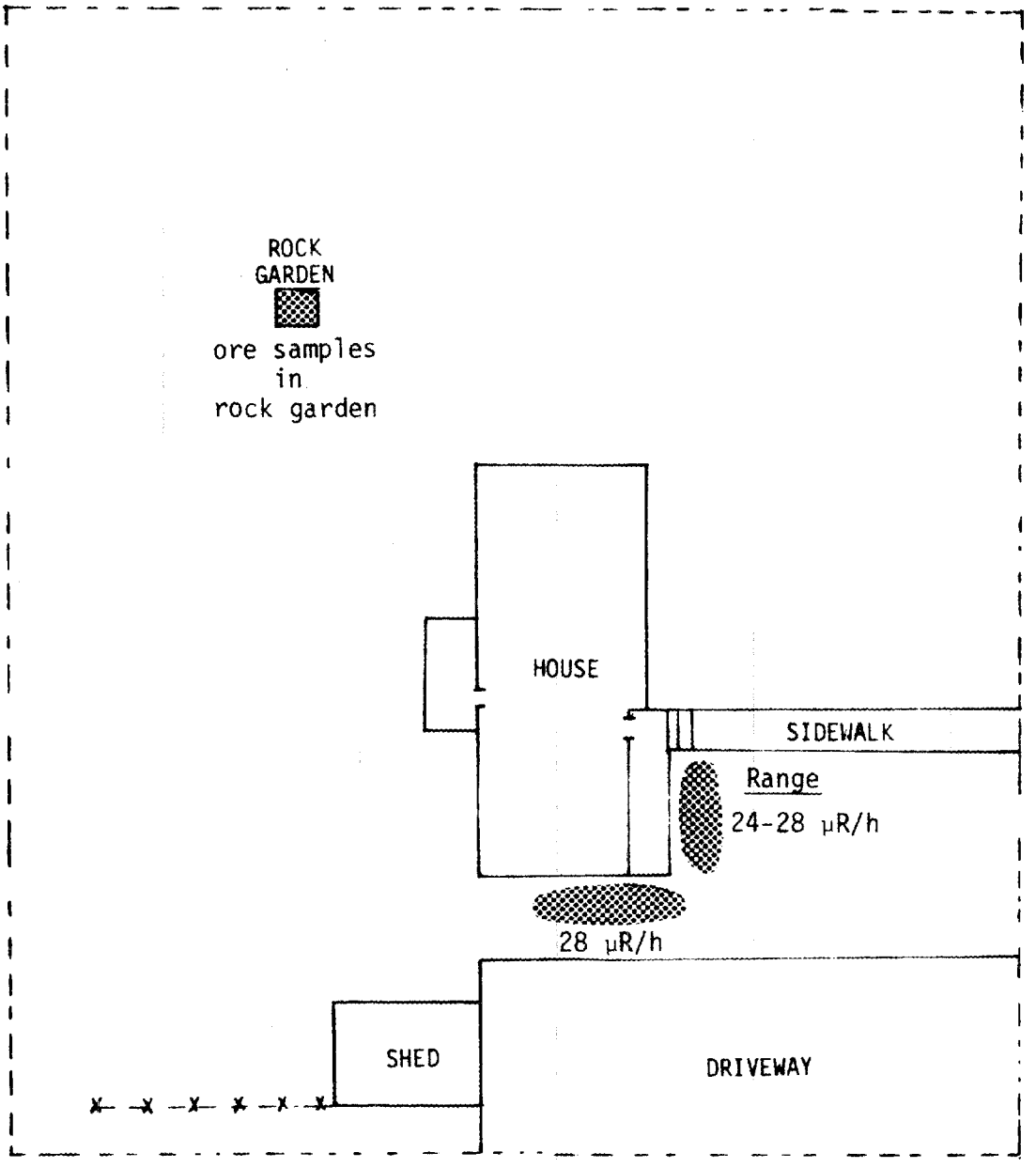
M-22
216 Uranium Dr.



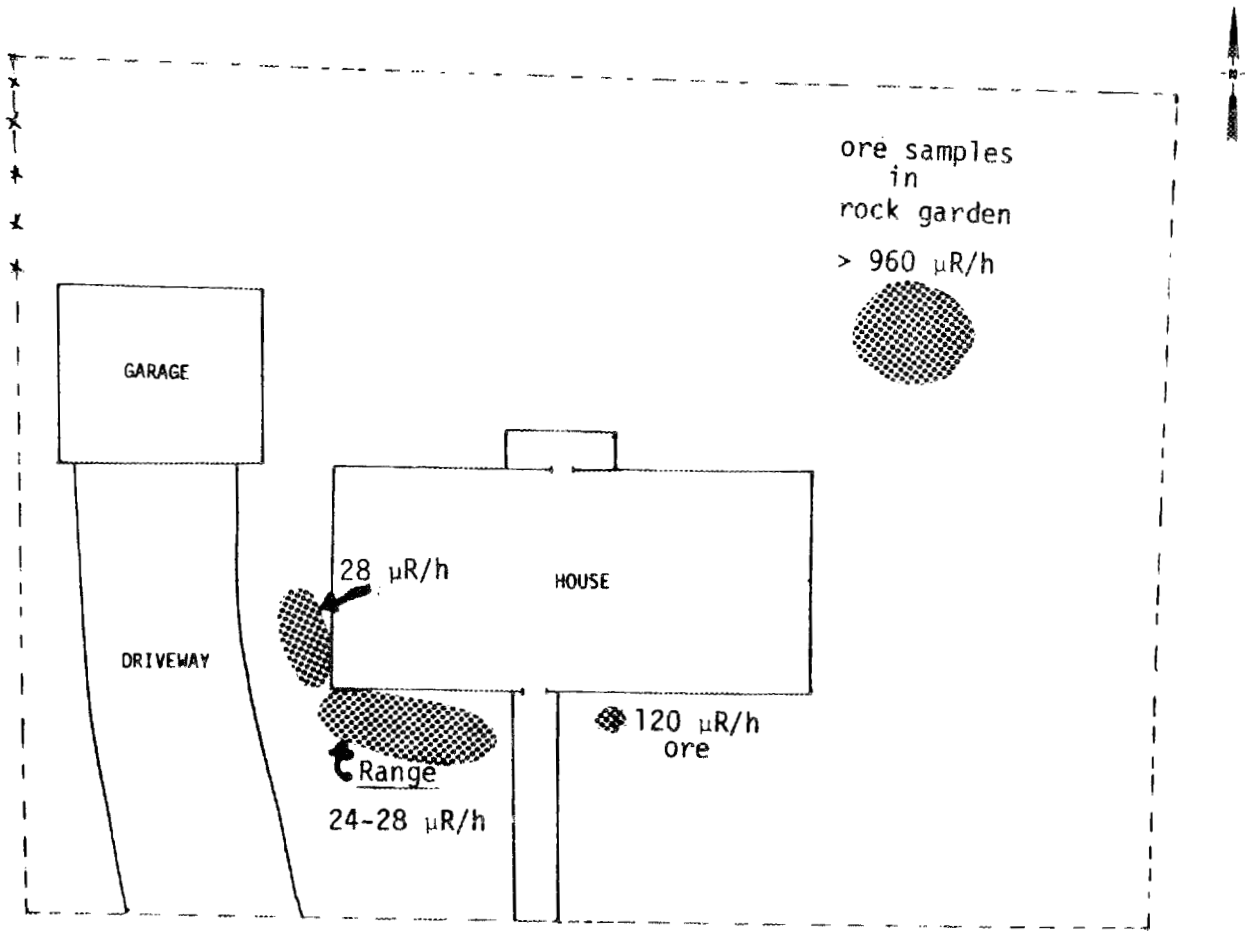
M-23
196 Uranium Dr.



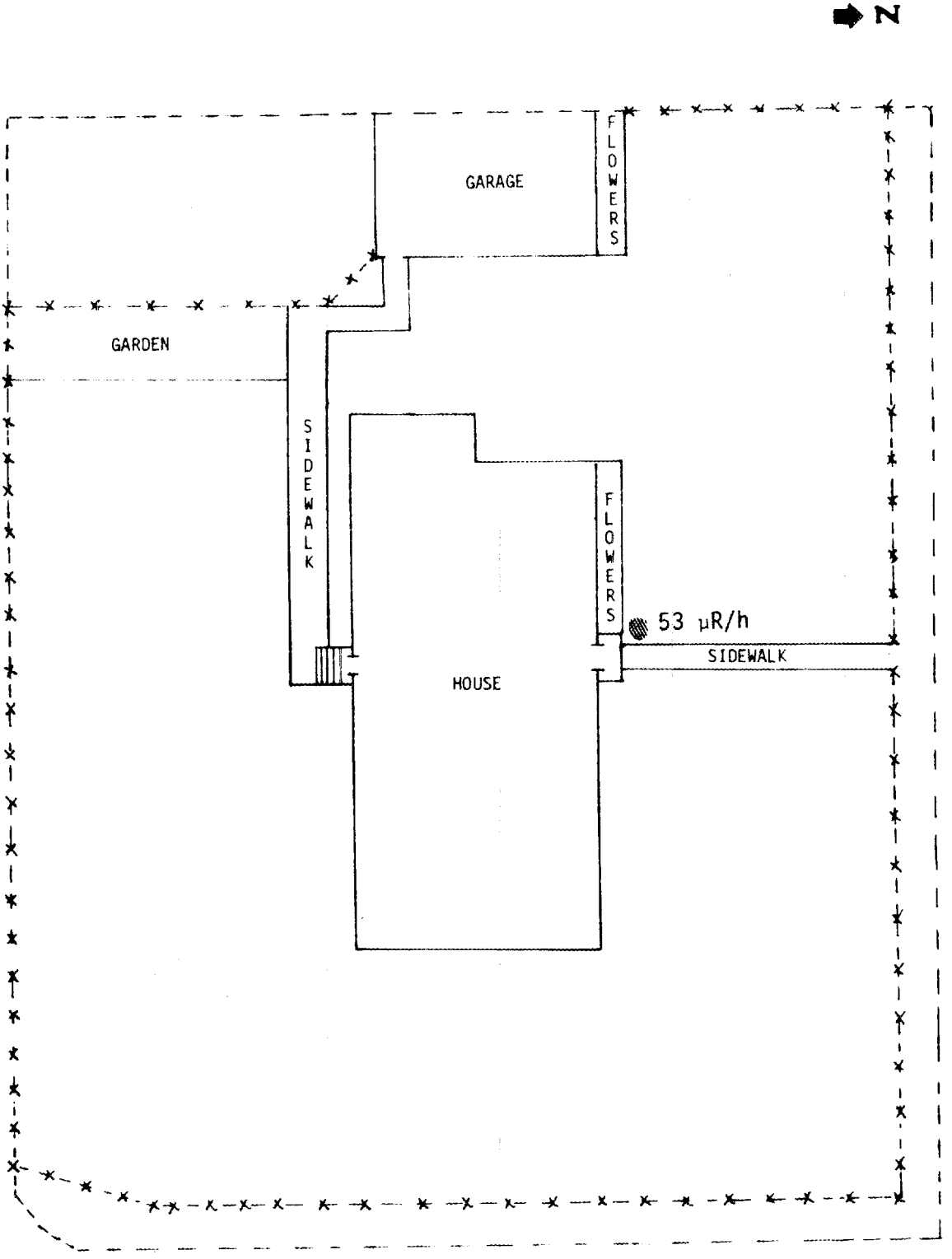
M-24
480 S. 1st W.



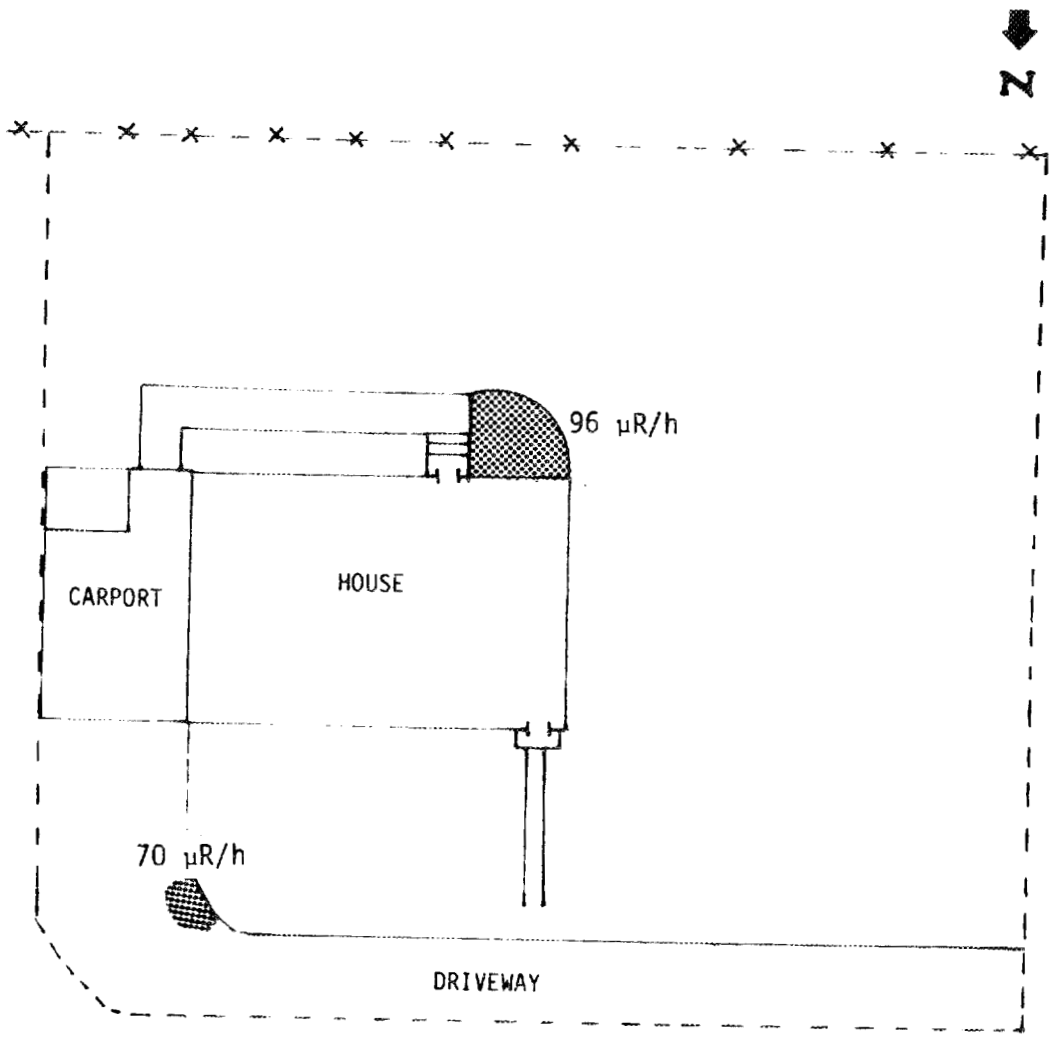
M-25
516 Circle Drive



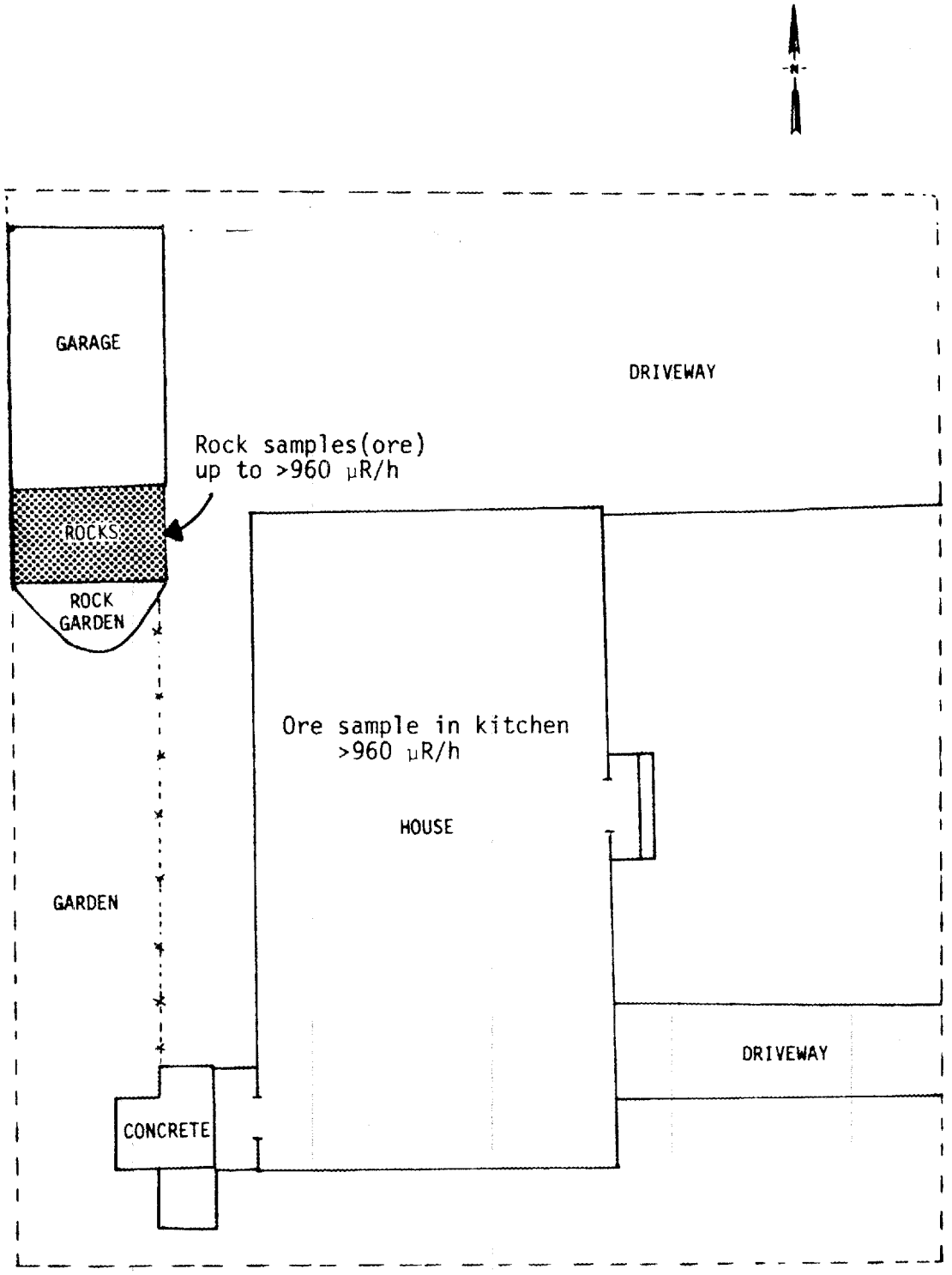
M-25
516 Circle Drive



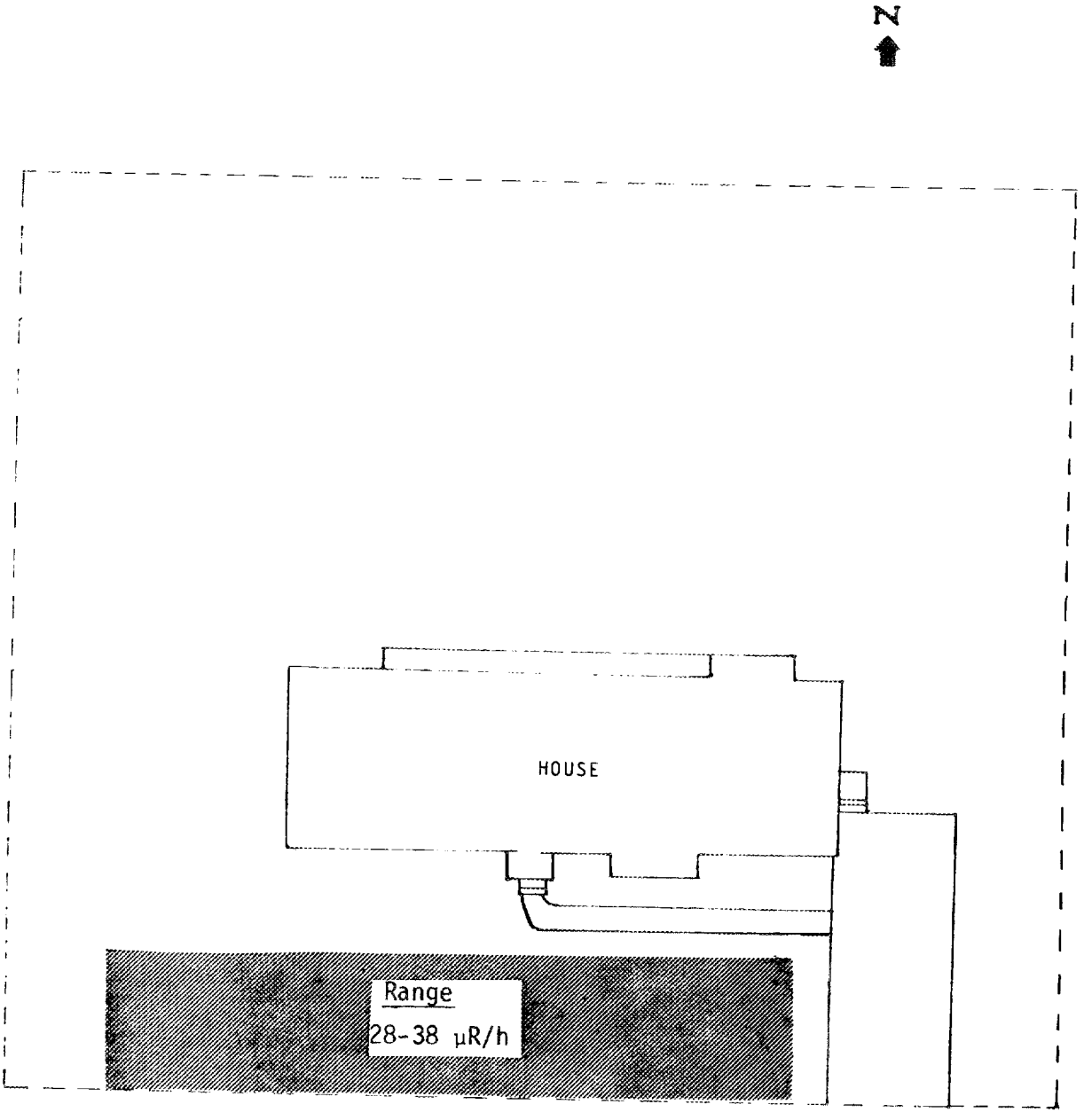
M-26
233 Uranium Dr.



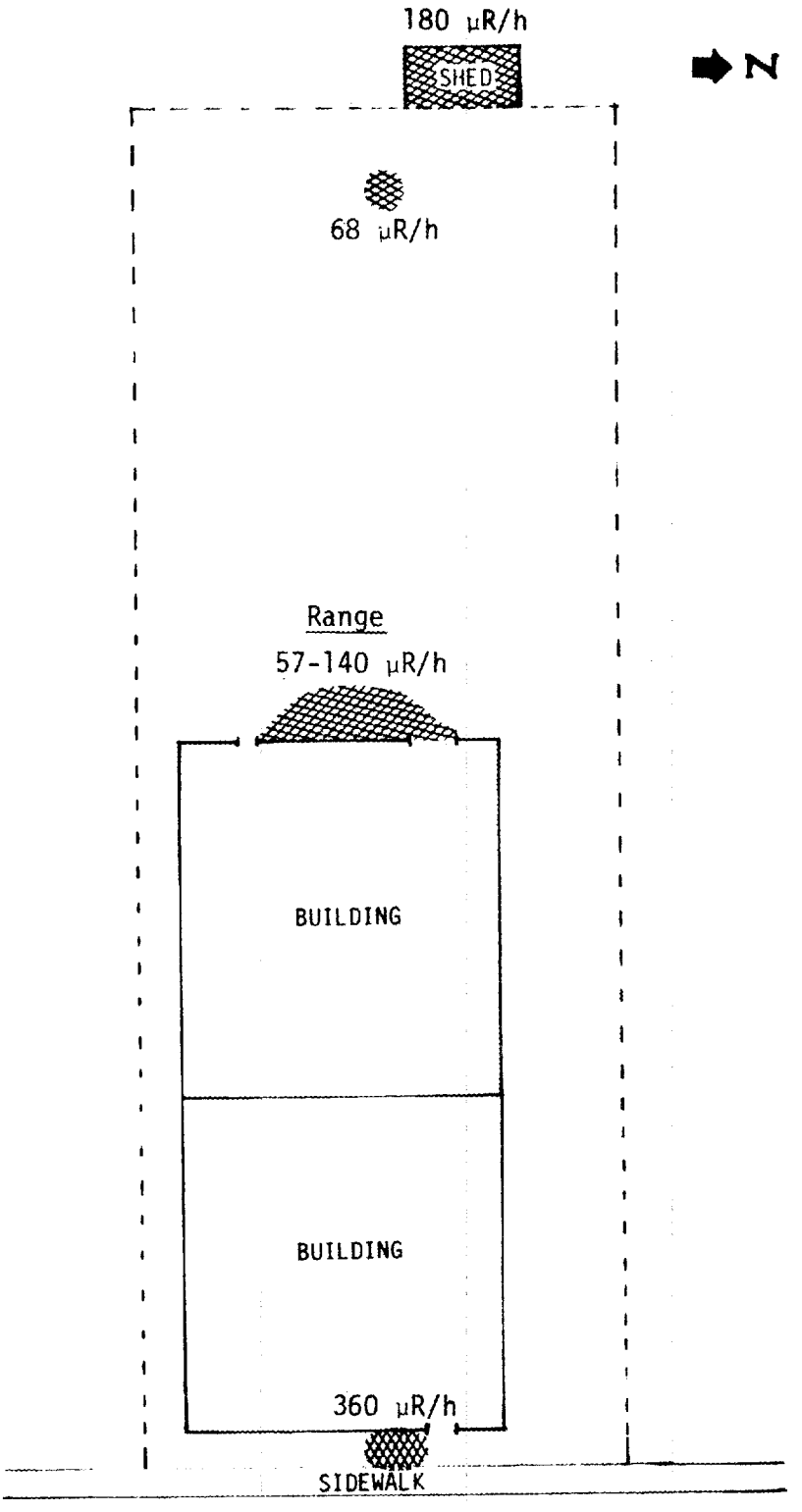
M-28
197 S. Uranium Dr.



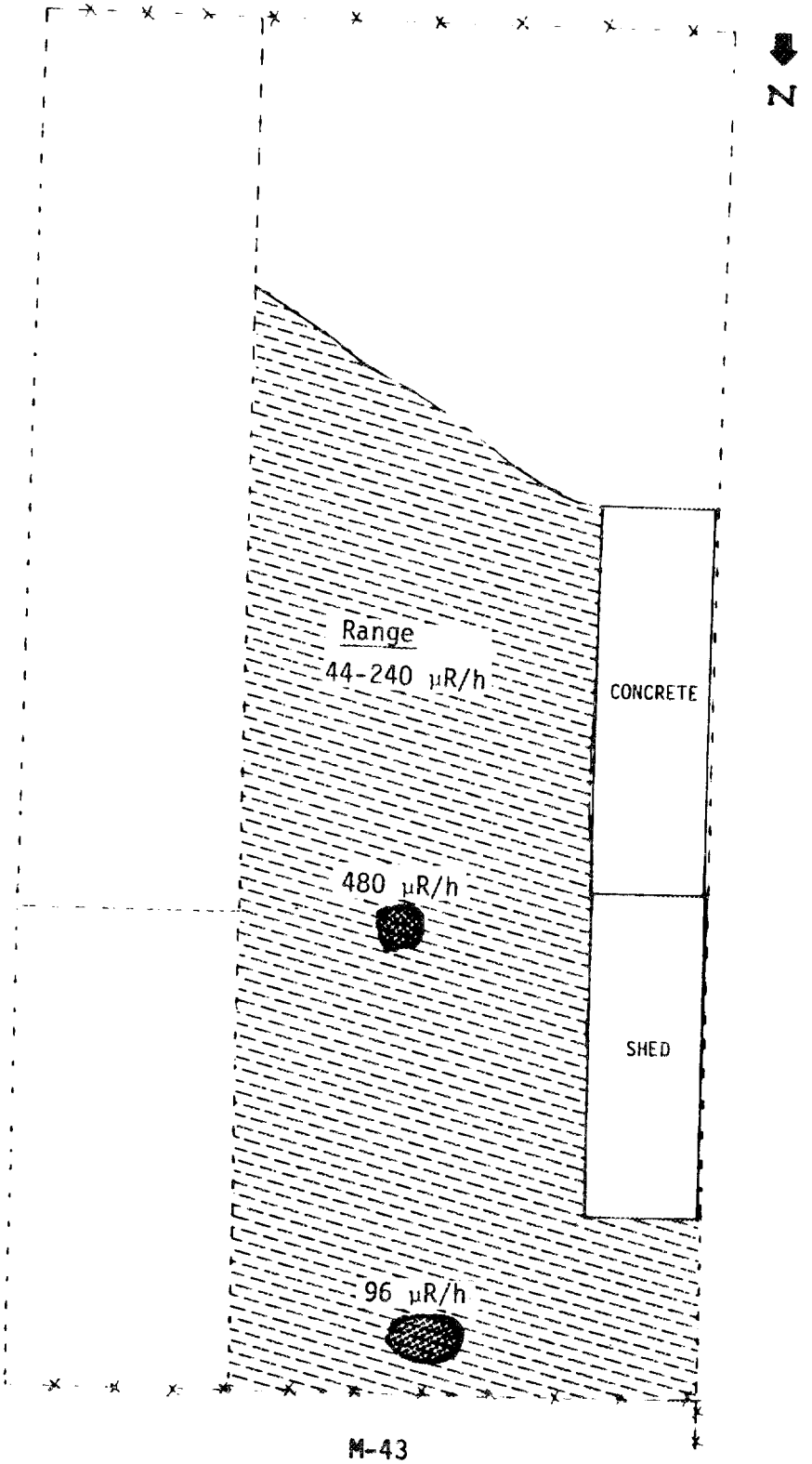
M-30
564 Circle Drive



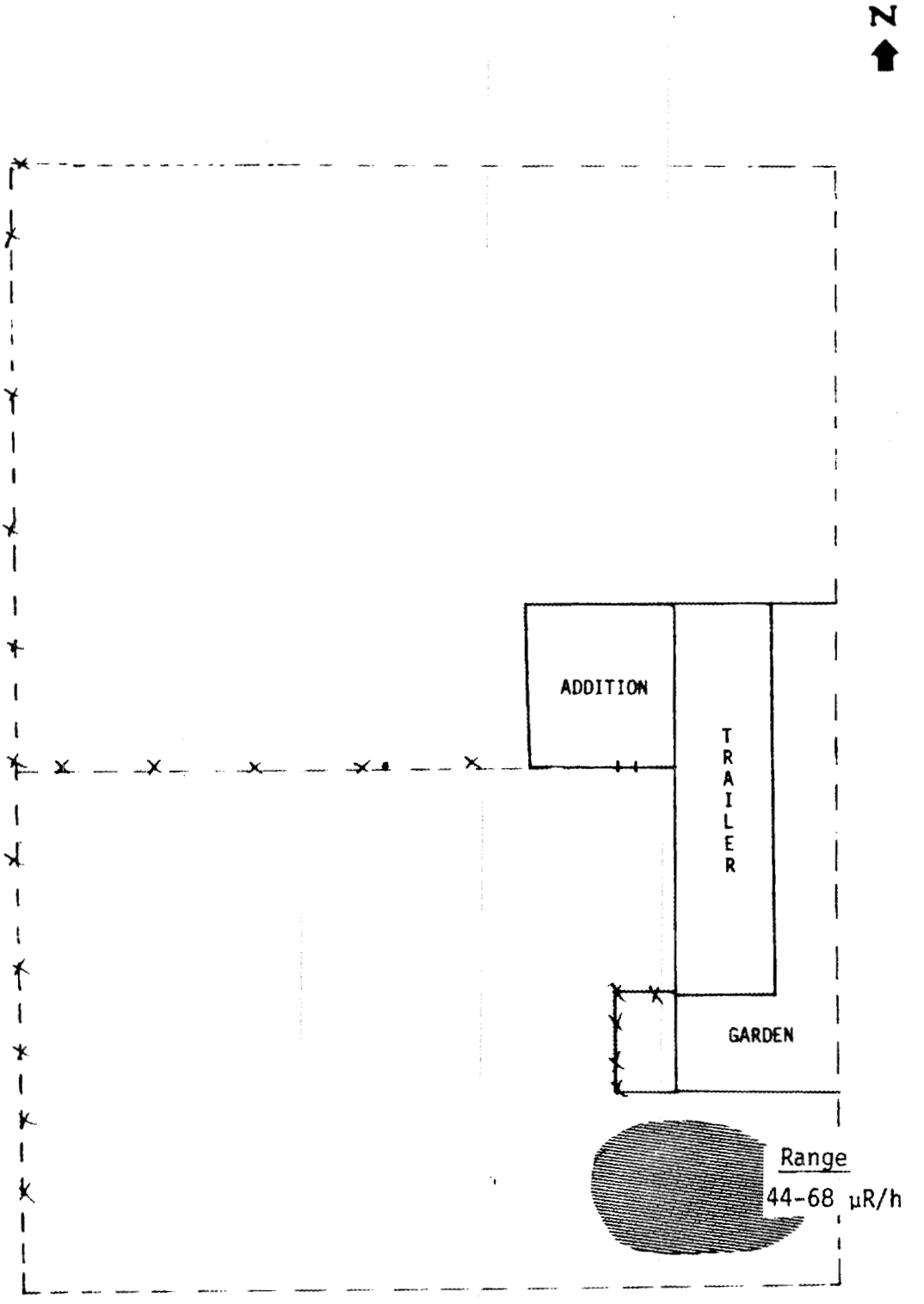
M-31
96 W. 2nd N.



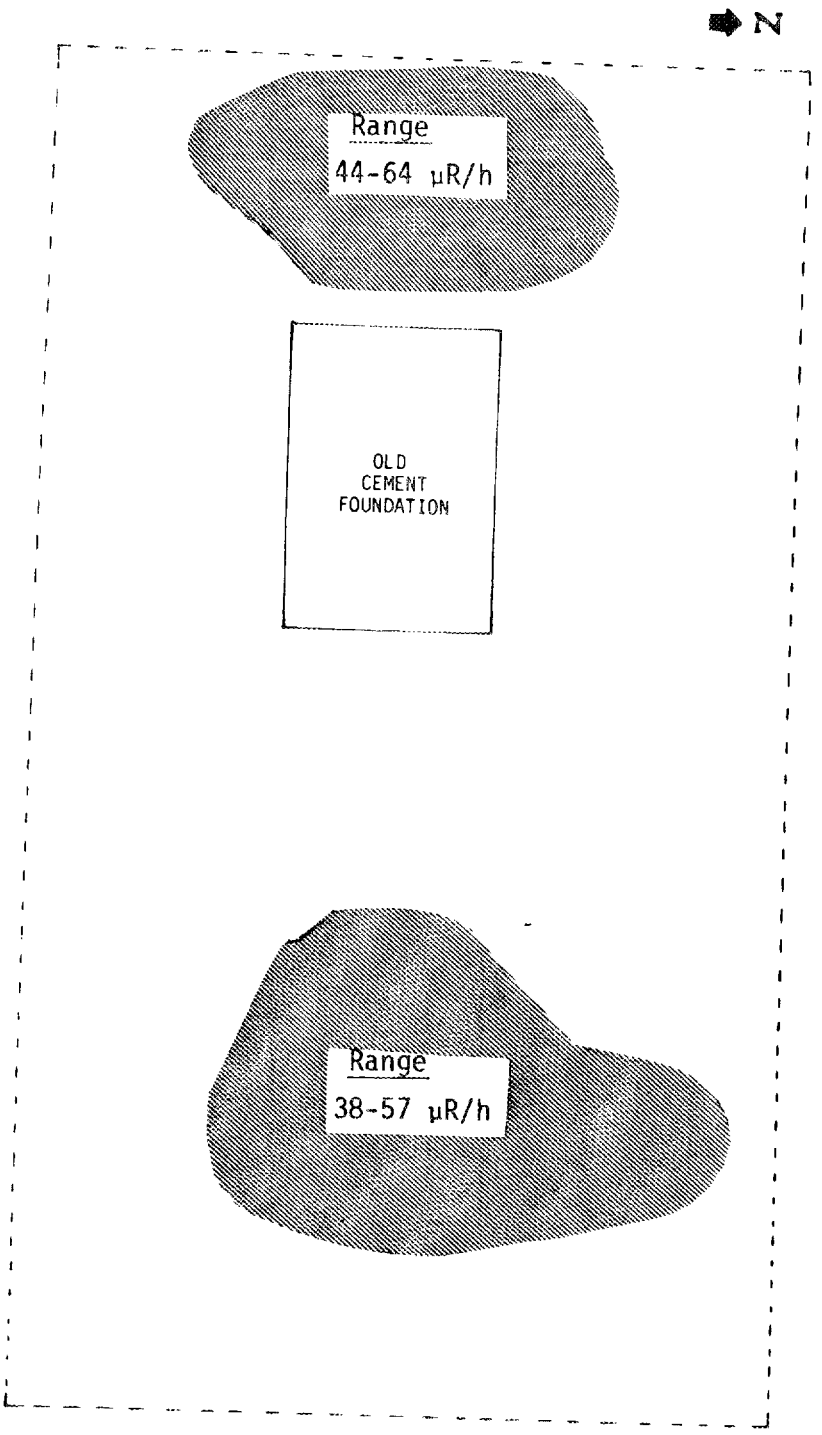
M-41
286 S. Main



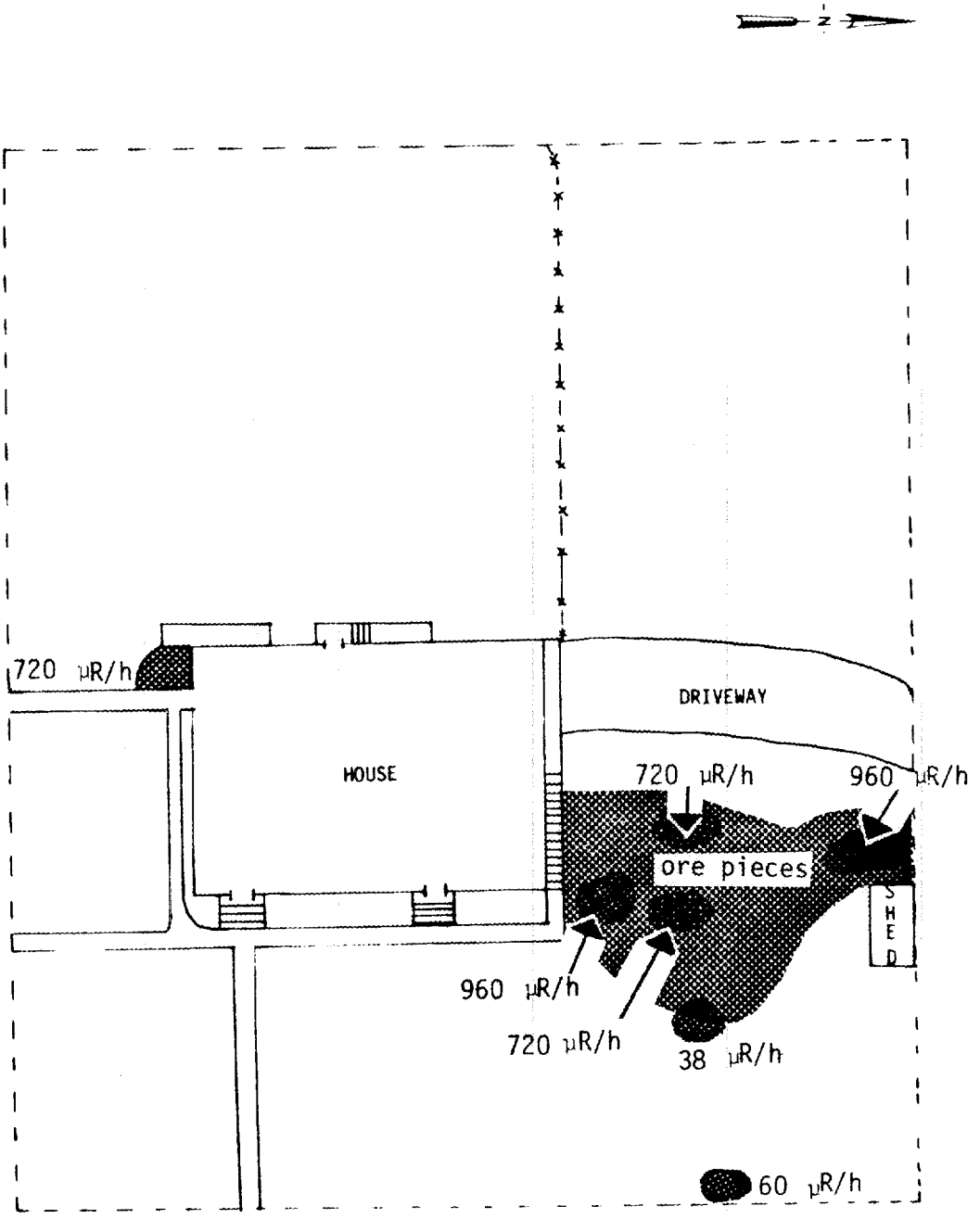
M-43
296 S. Main



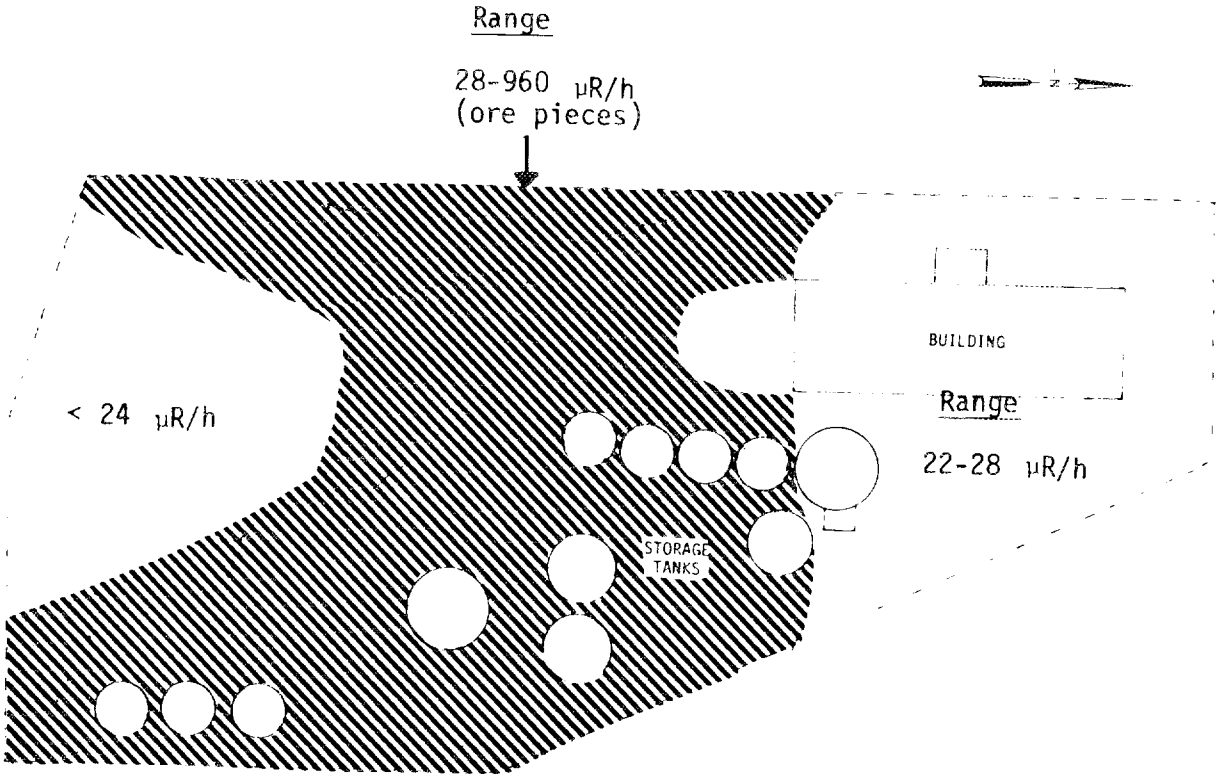
M-45
80 W. 4th S.



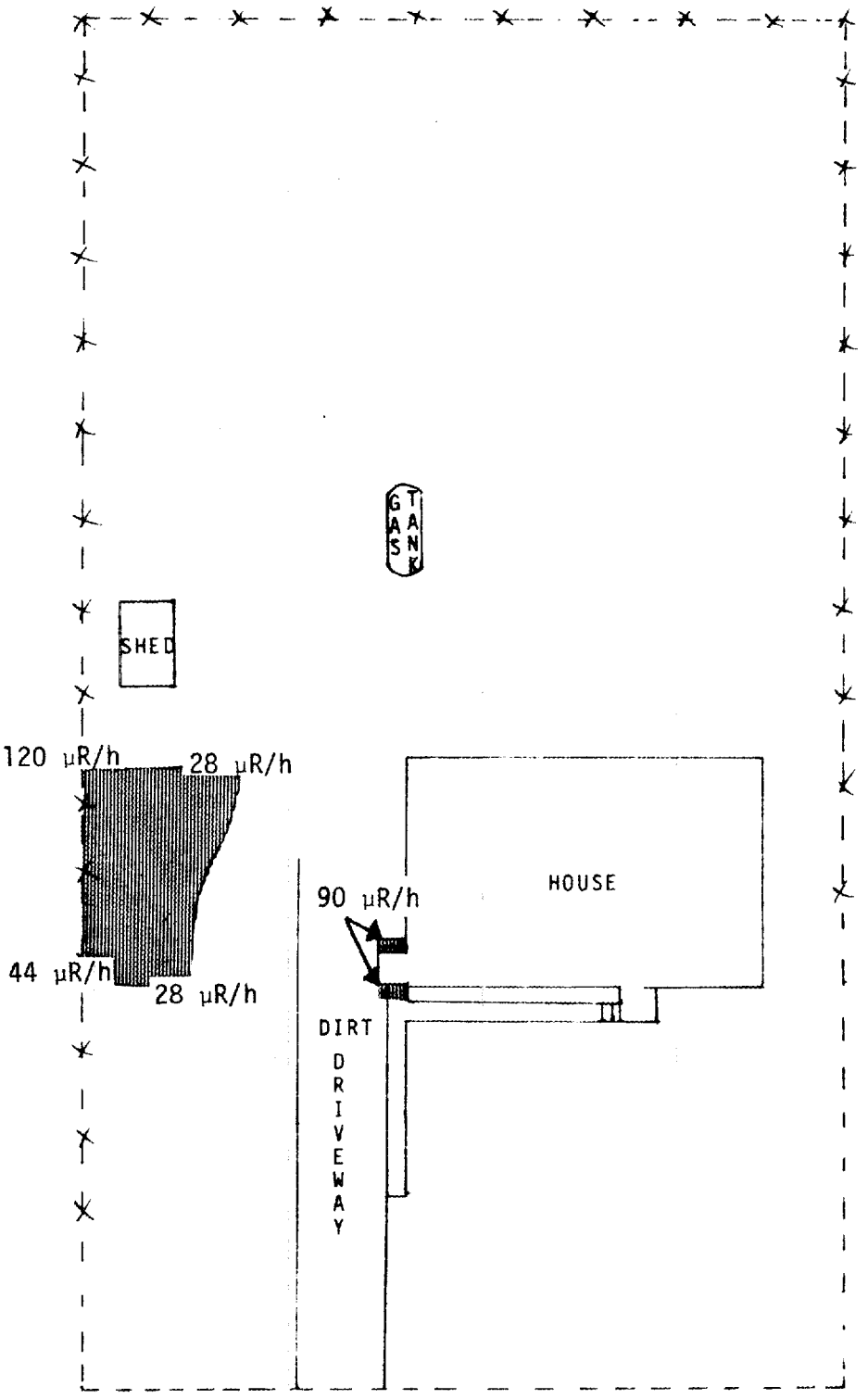
M-49
480 S. Main



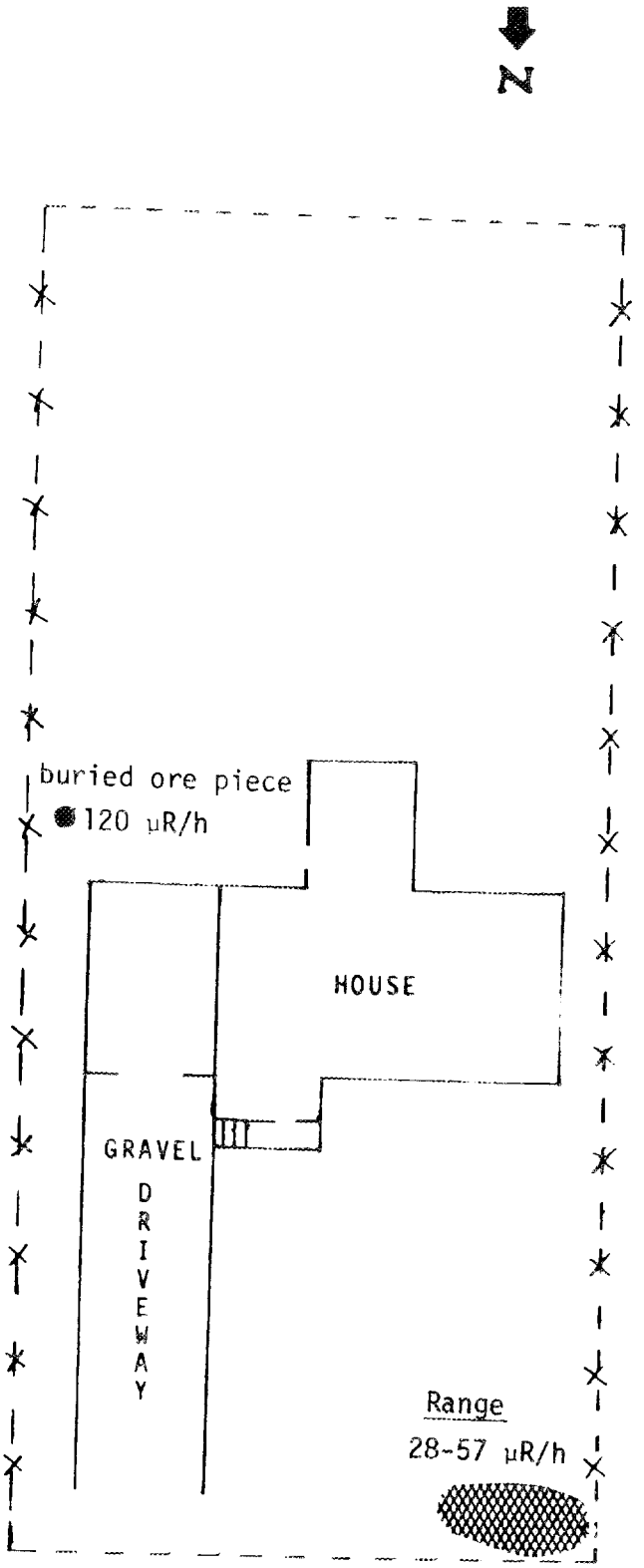
M-50
496 S. Main



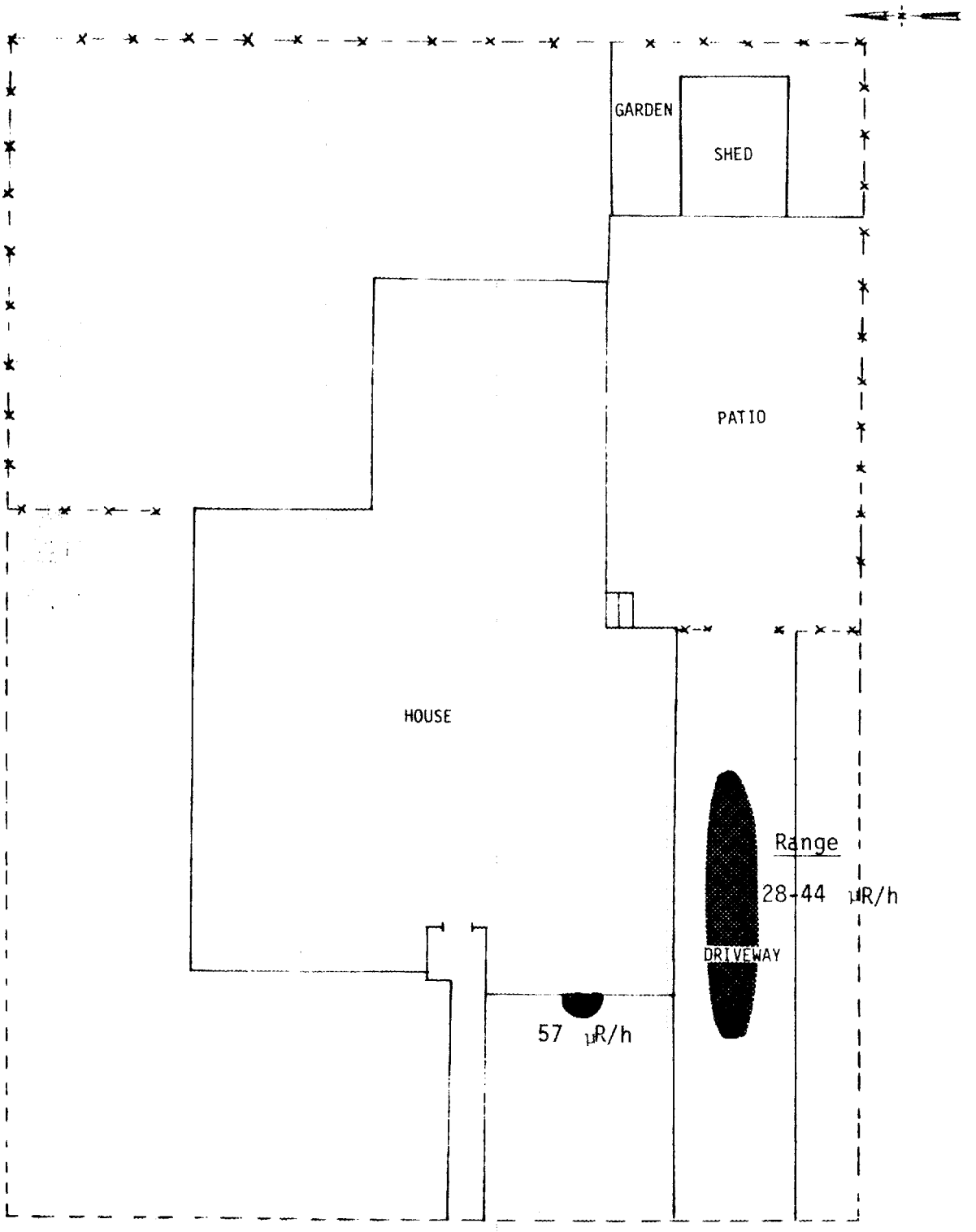
M-51
533 S. Main


GAS TANK
SHED
120 µR/h
28 µR/h
44 µR/h
28 µR/h
90 µR/h
HOUSE
DIRT
DRIVEWAY

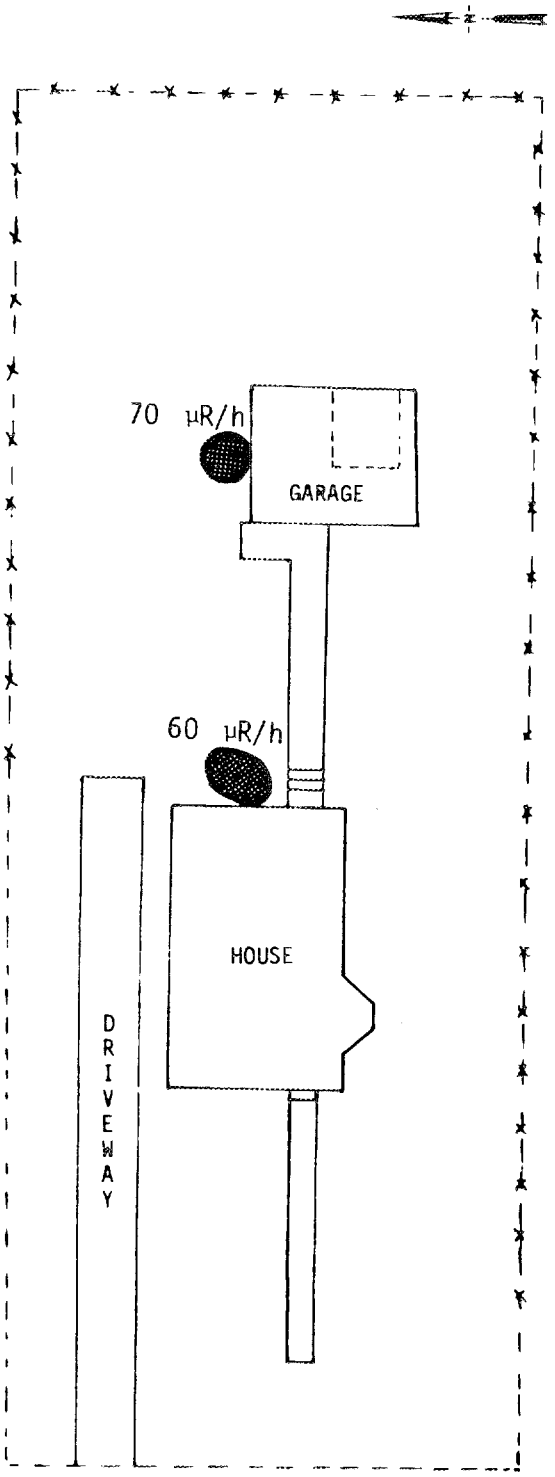
M-53
64 E. 5th N.



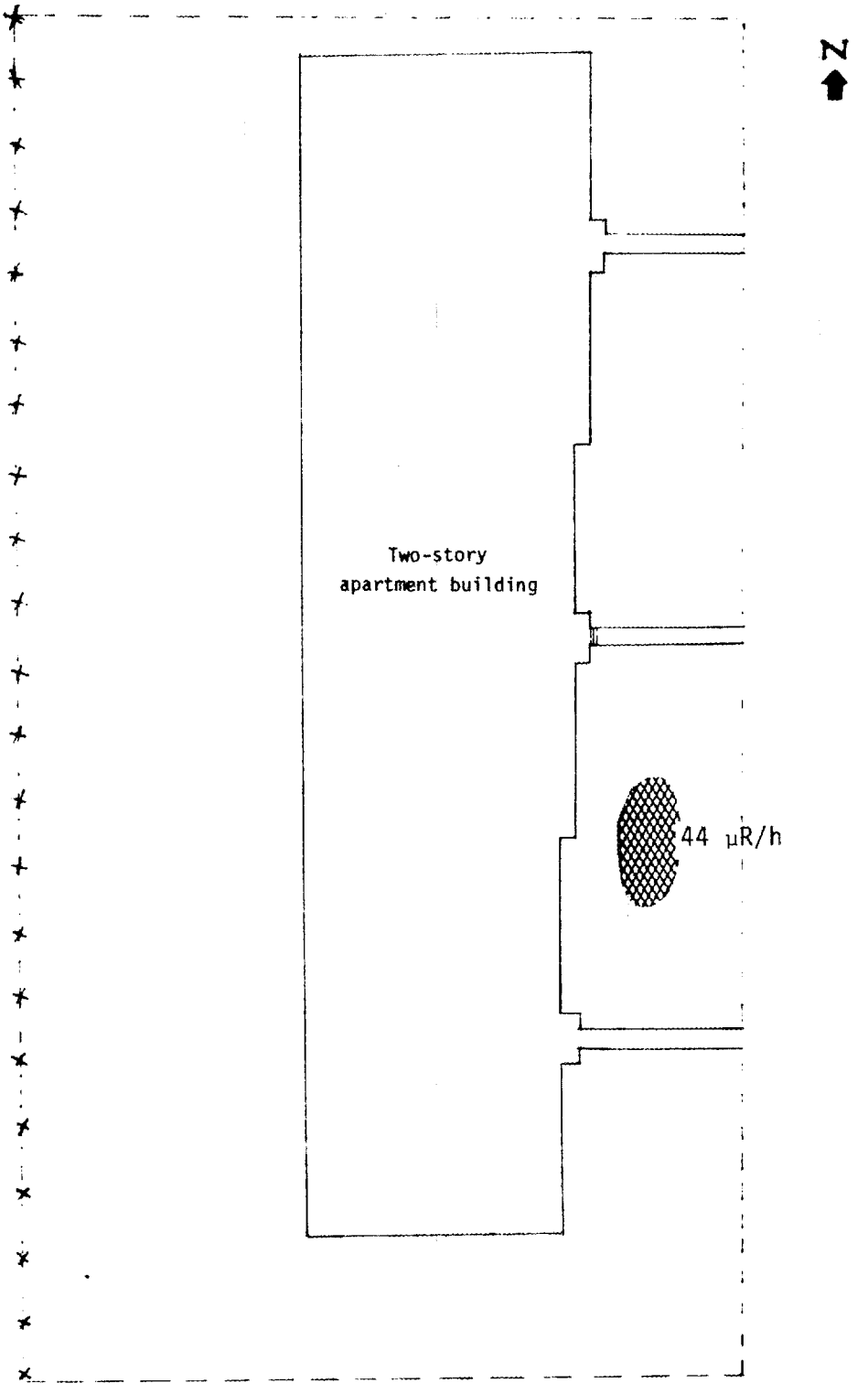
M-54
164 E 5th N.



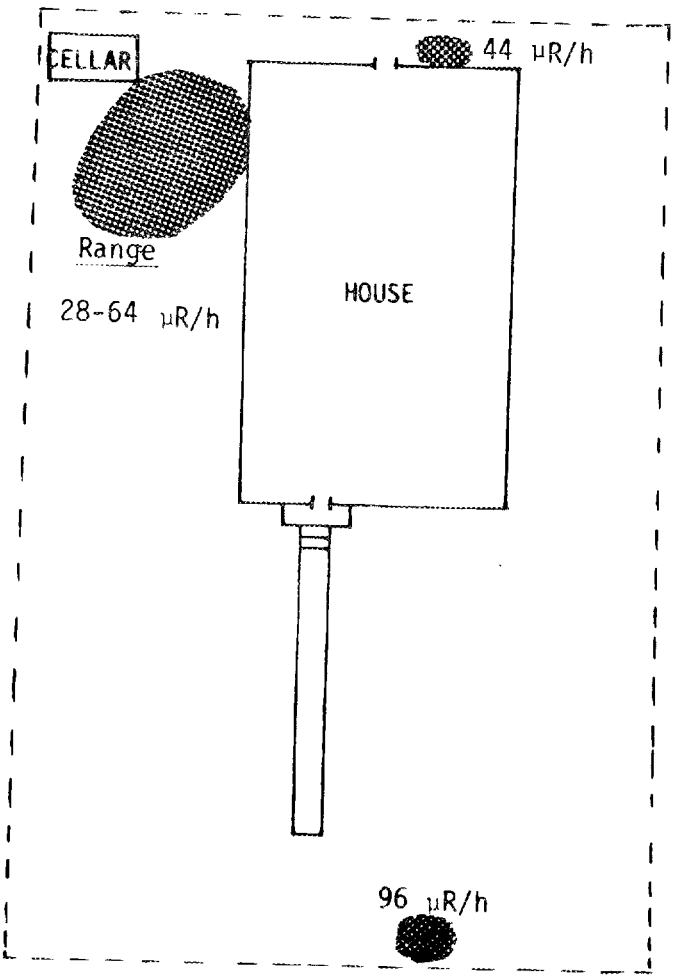
M-55
432 N. Main



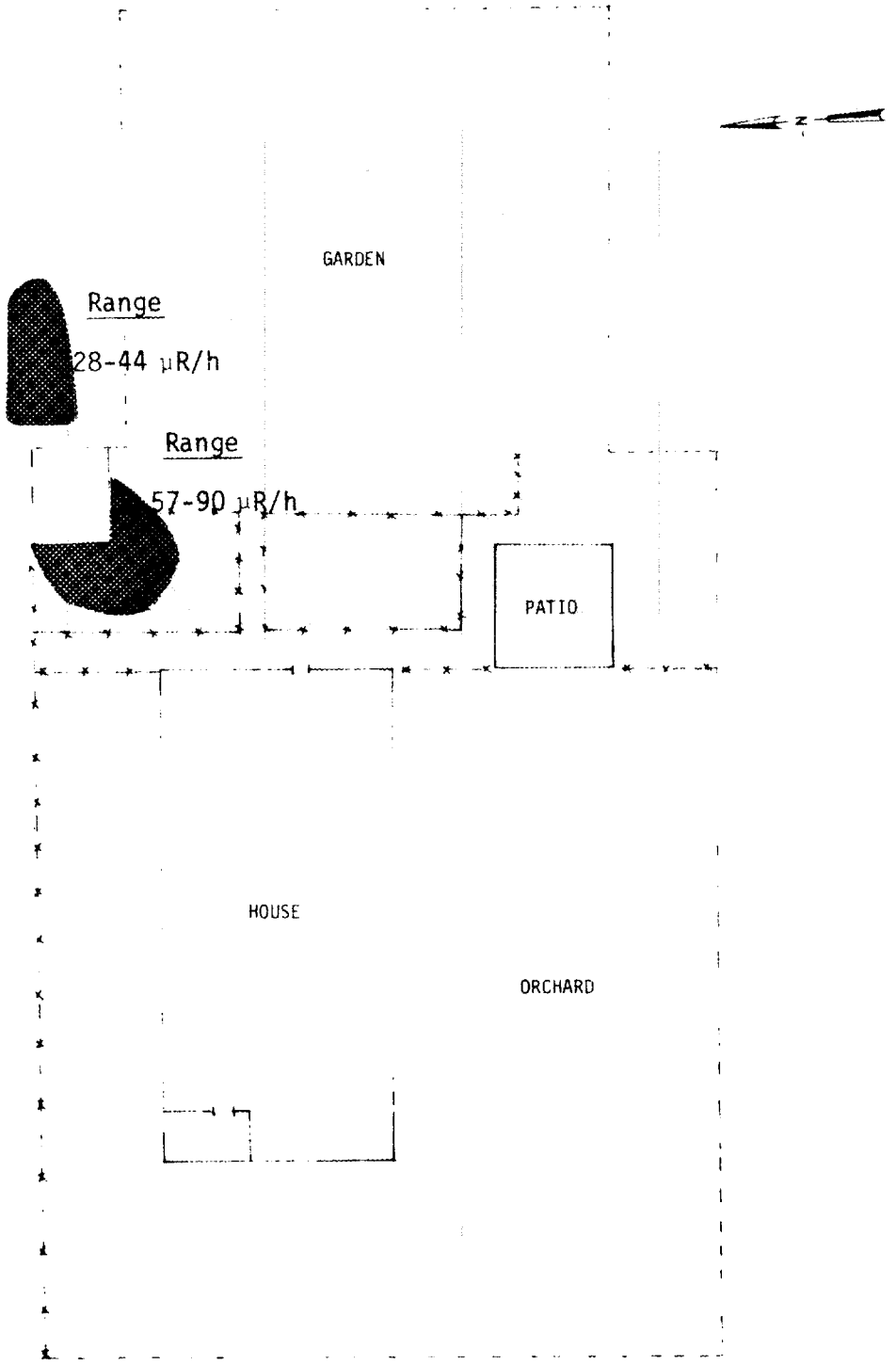
M-56
132 N. Main



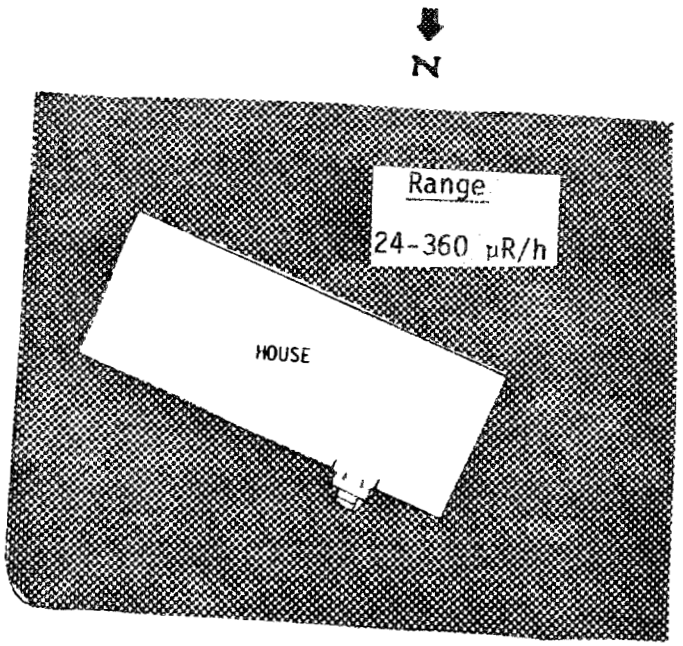
M-57
65 E. 1st N.

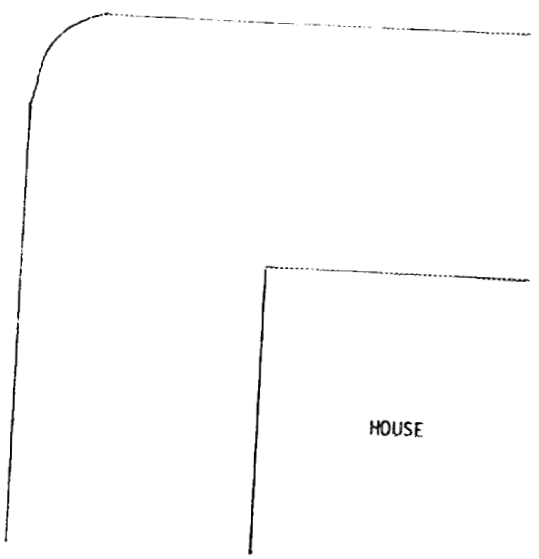


M-62
316 S. 1st E.

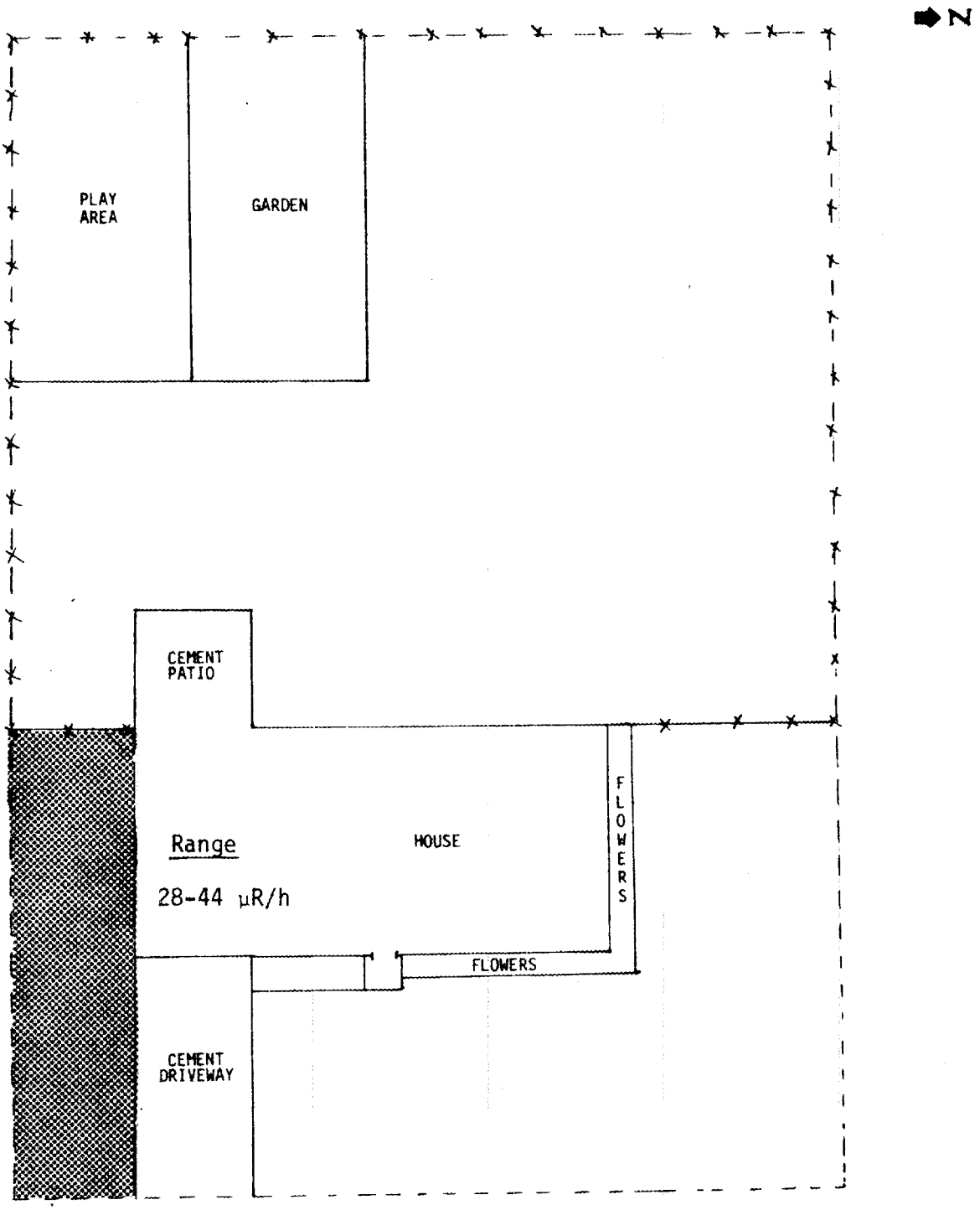


M-68
449 S. Main

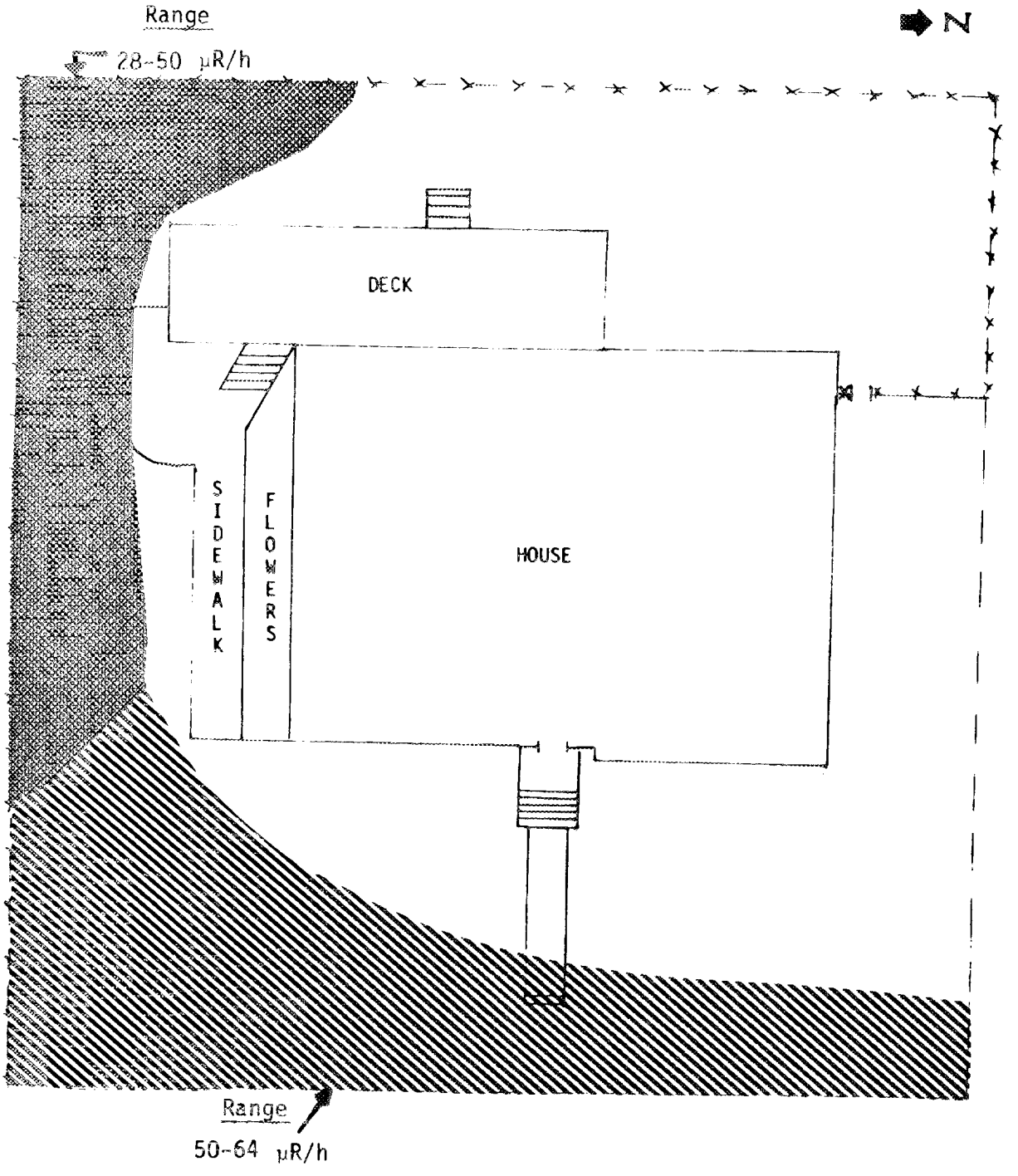




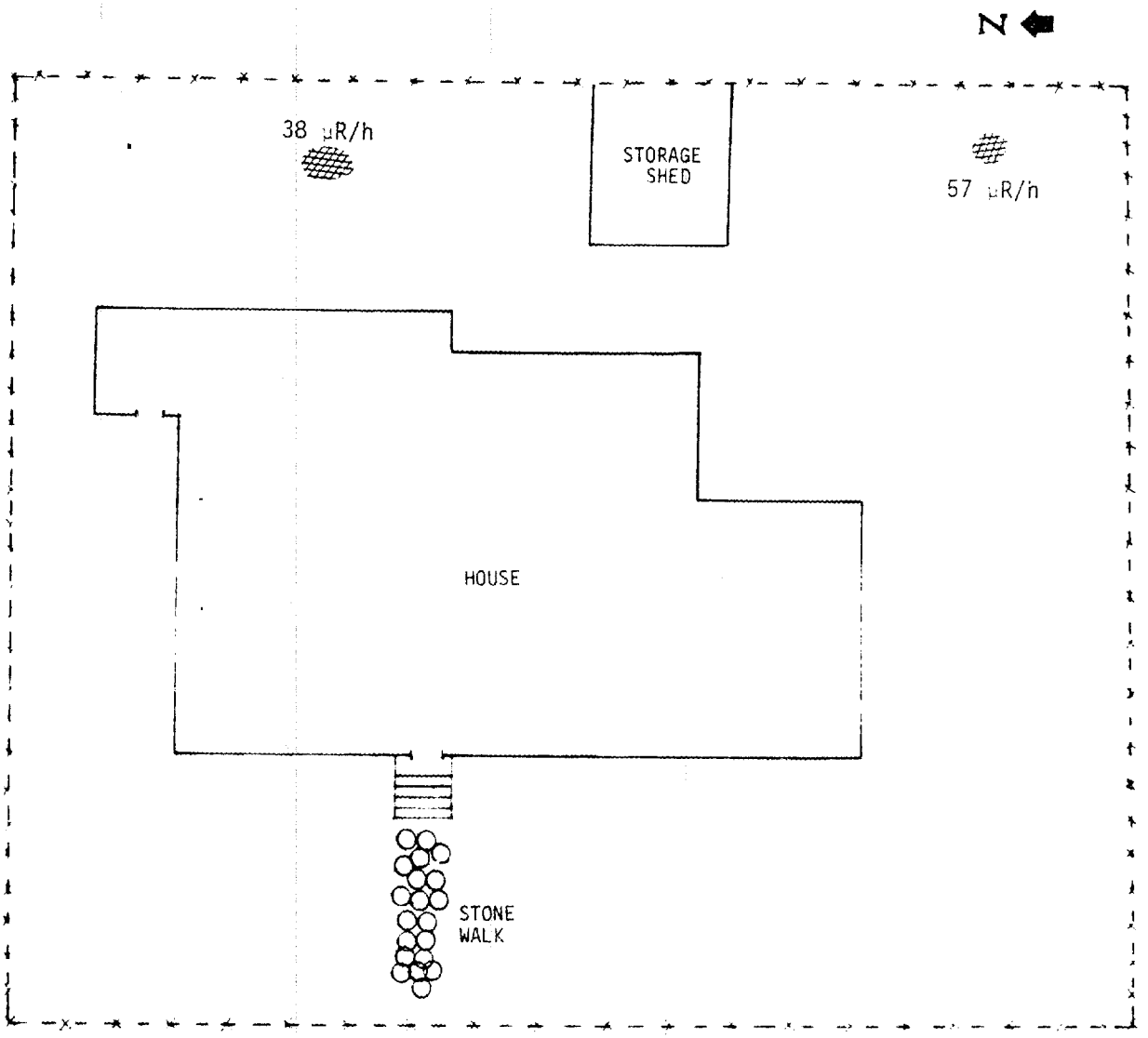
M-69
96 E. 4th S.



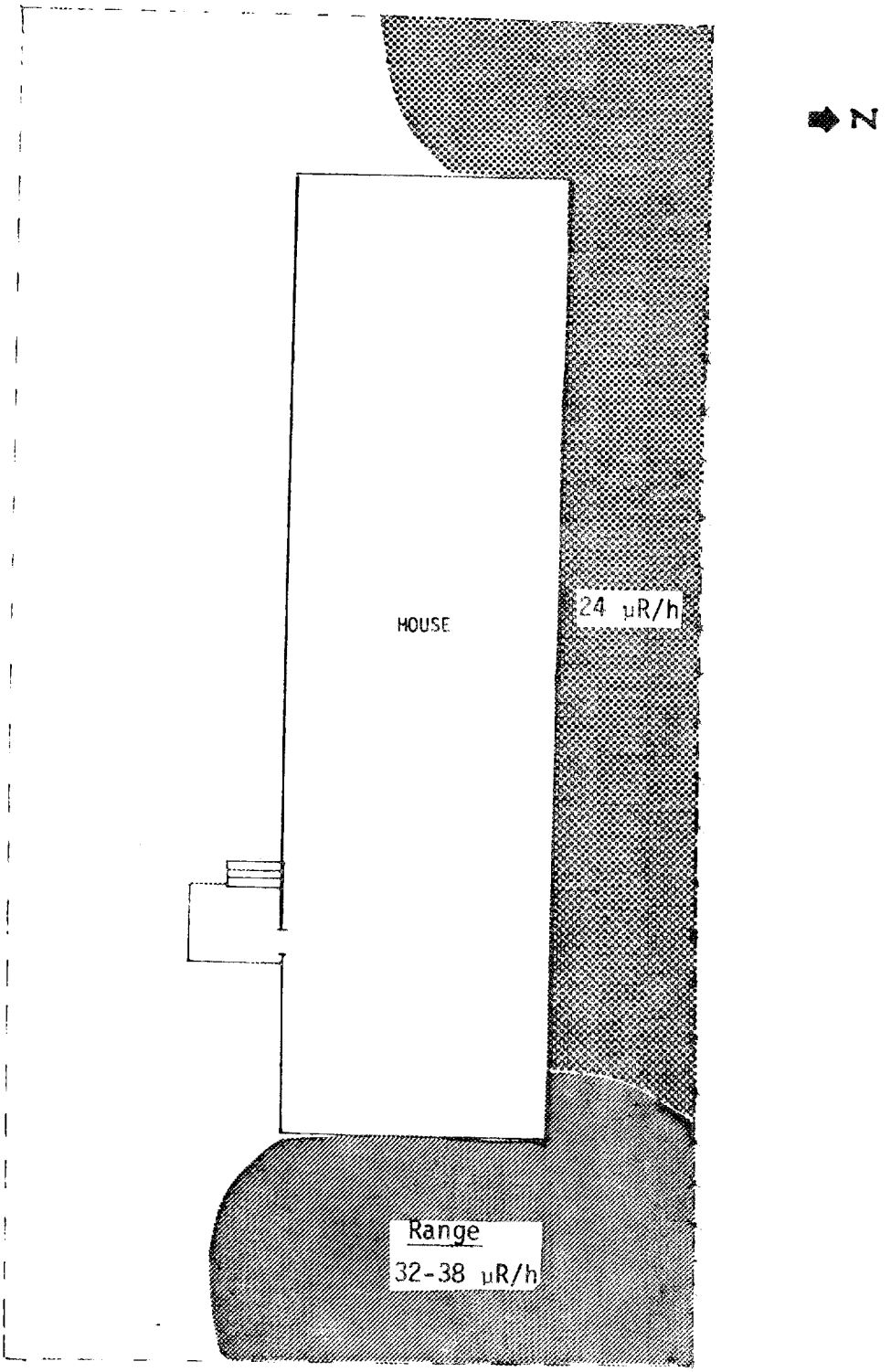
M-70
432 S. 1st. E.



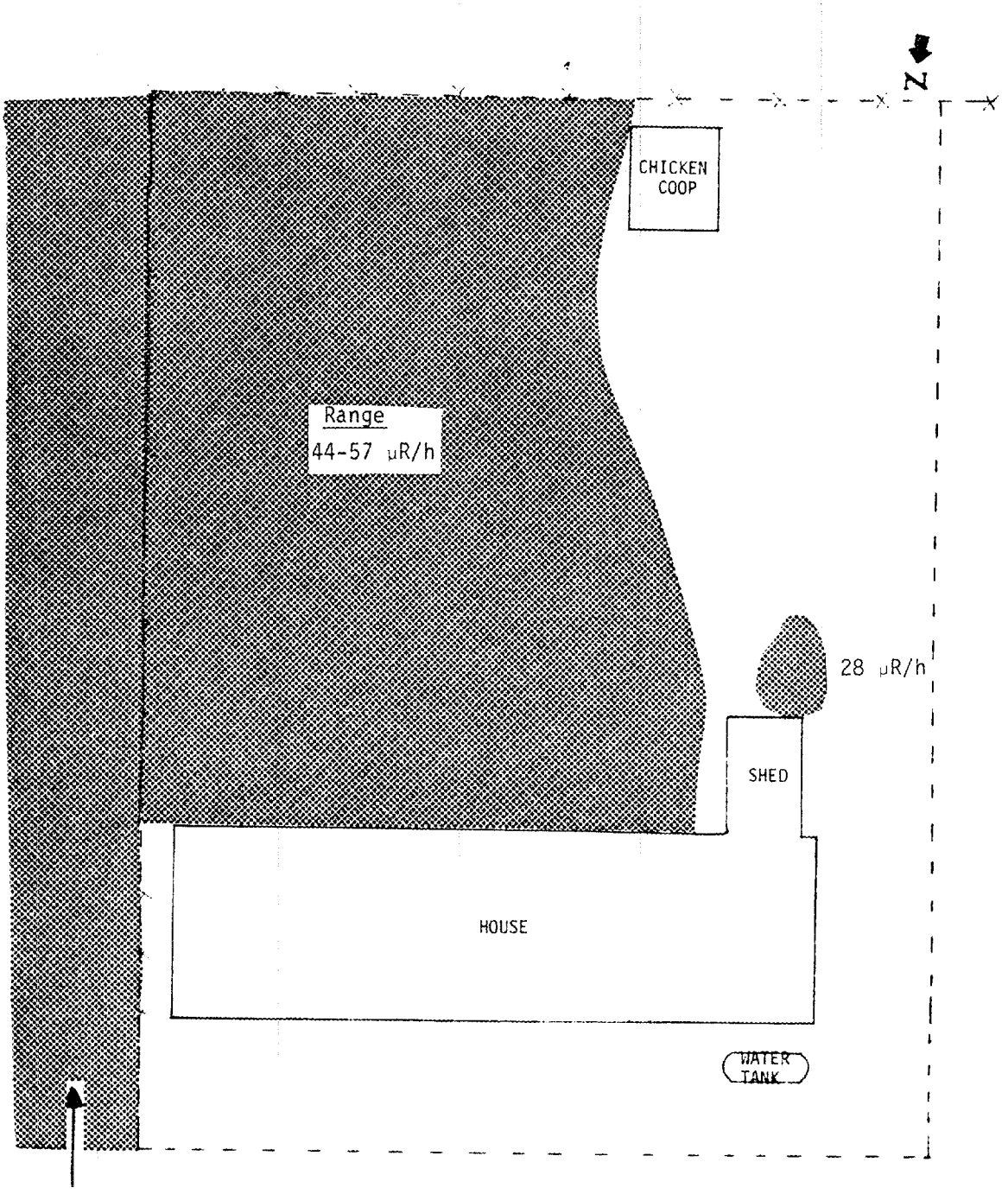
M-71
464 S. 1st E.



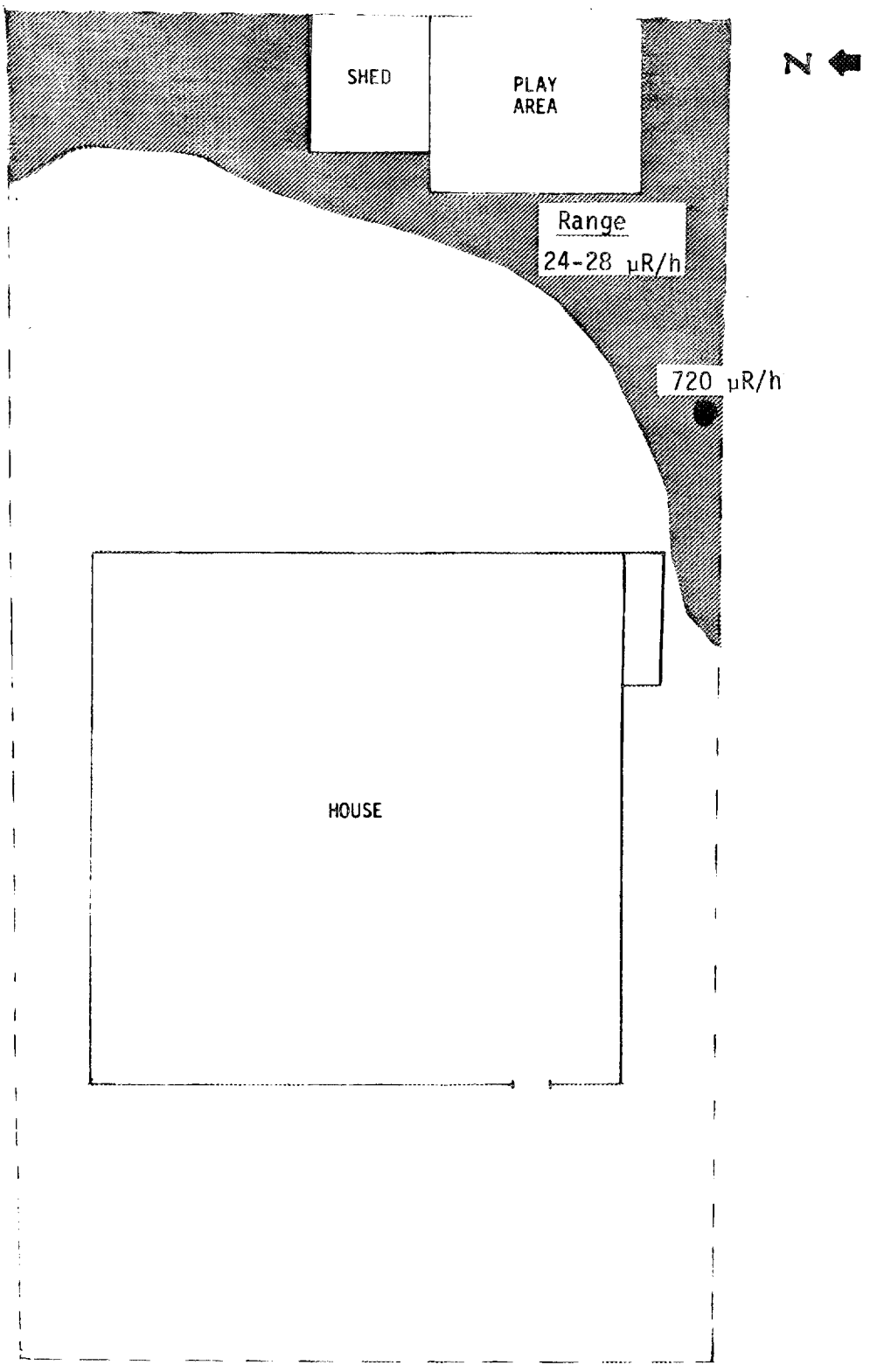
M-72
493 S. Main



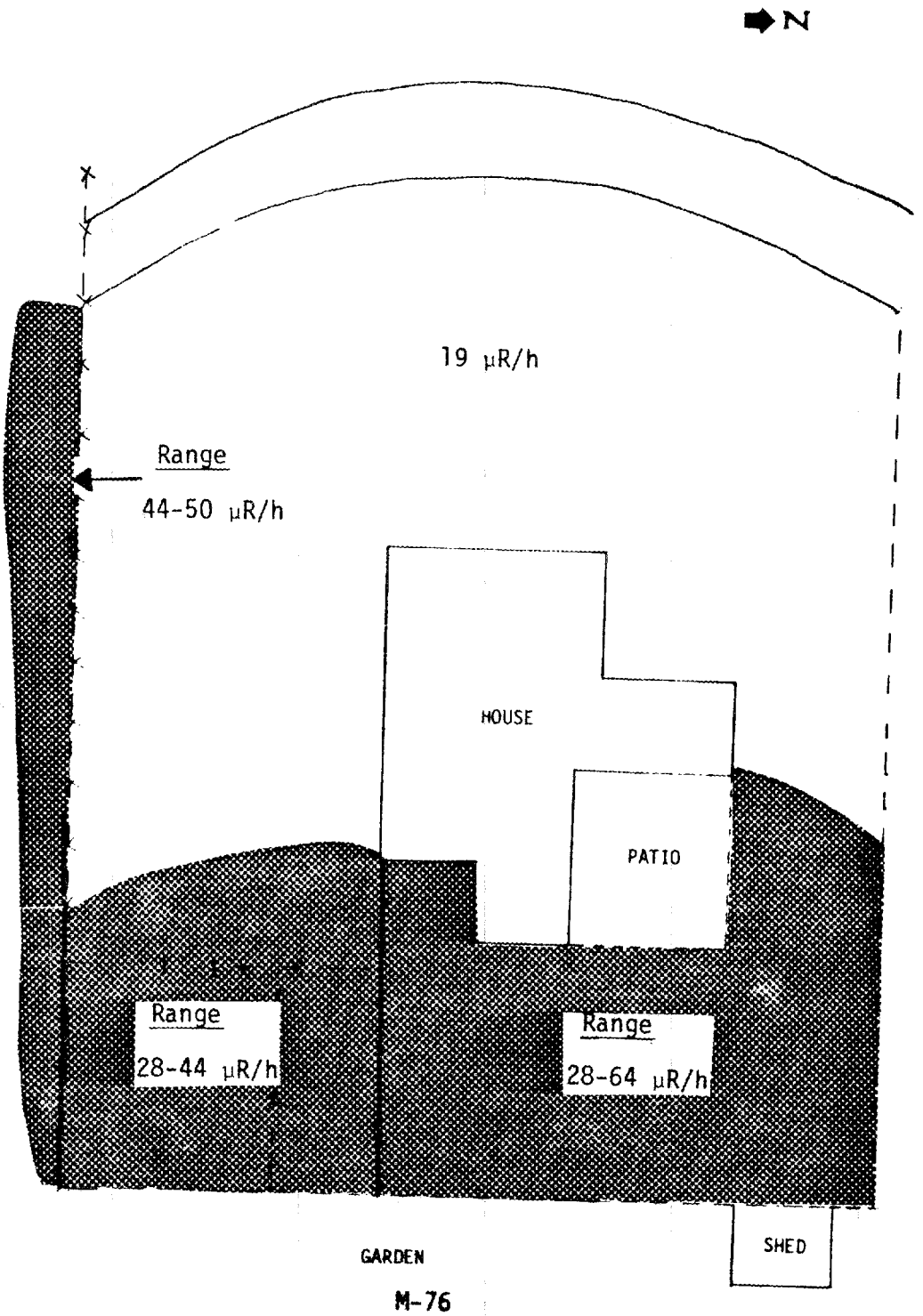
M-73
65 E. 5th S.


N
CHICKEN COOP
Range
44-57 µR/h
28 µR/h
SHED
HOUSE
WATER TANK
>> 57 µR/h

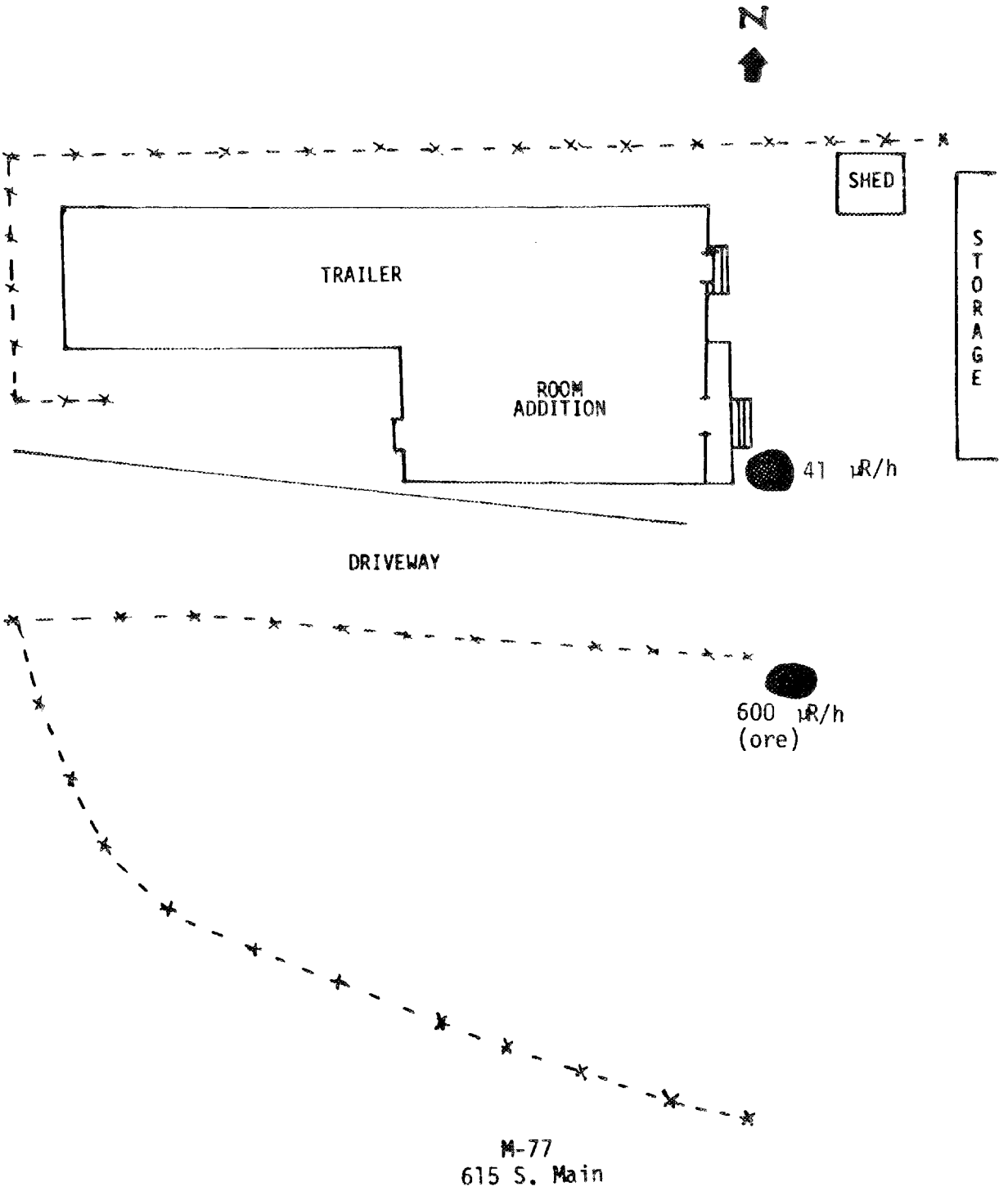
M-74
87 E. 5th S.

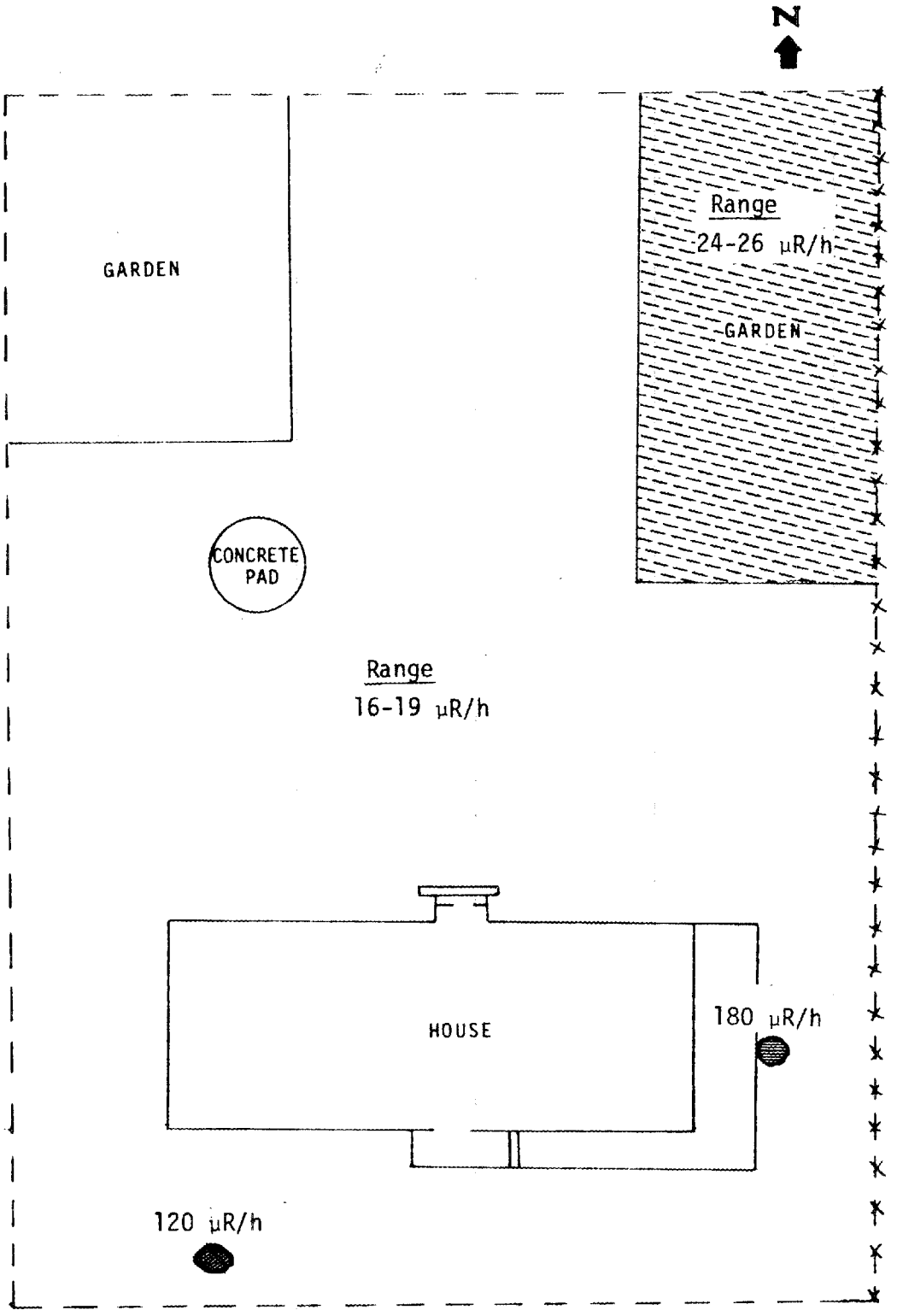


M-75
16 E 5th S.

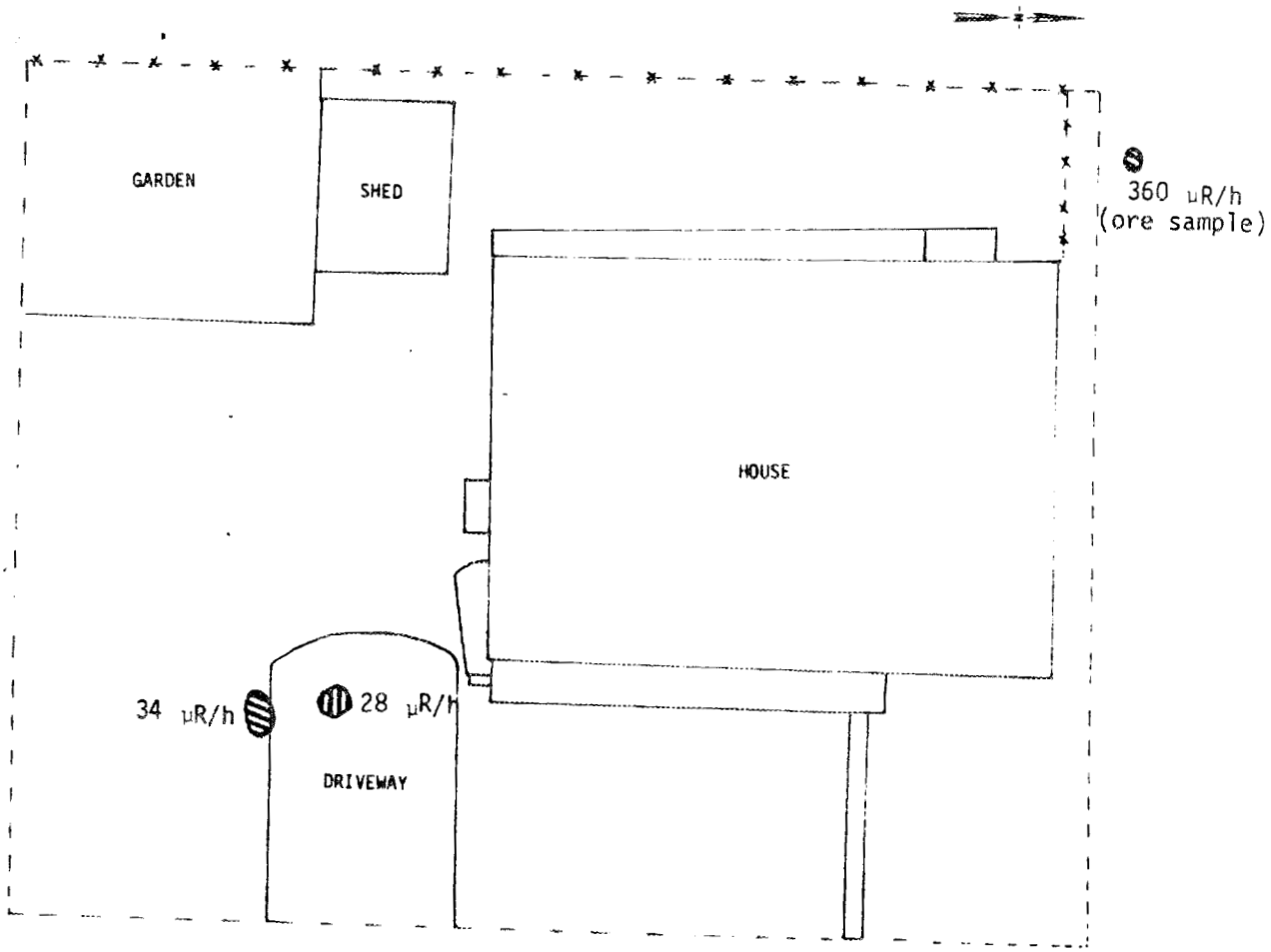

N
19 µR/h
Range
44-50 µR/h
HOUSE
PATIO
Range
28-44 µR/h
Range
28-64 µR/h
GARDEN
SHED

M-76
98 E. 5th S.

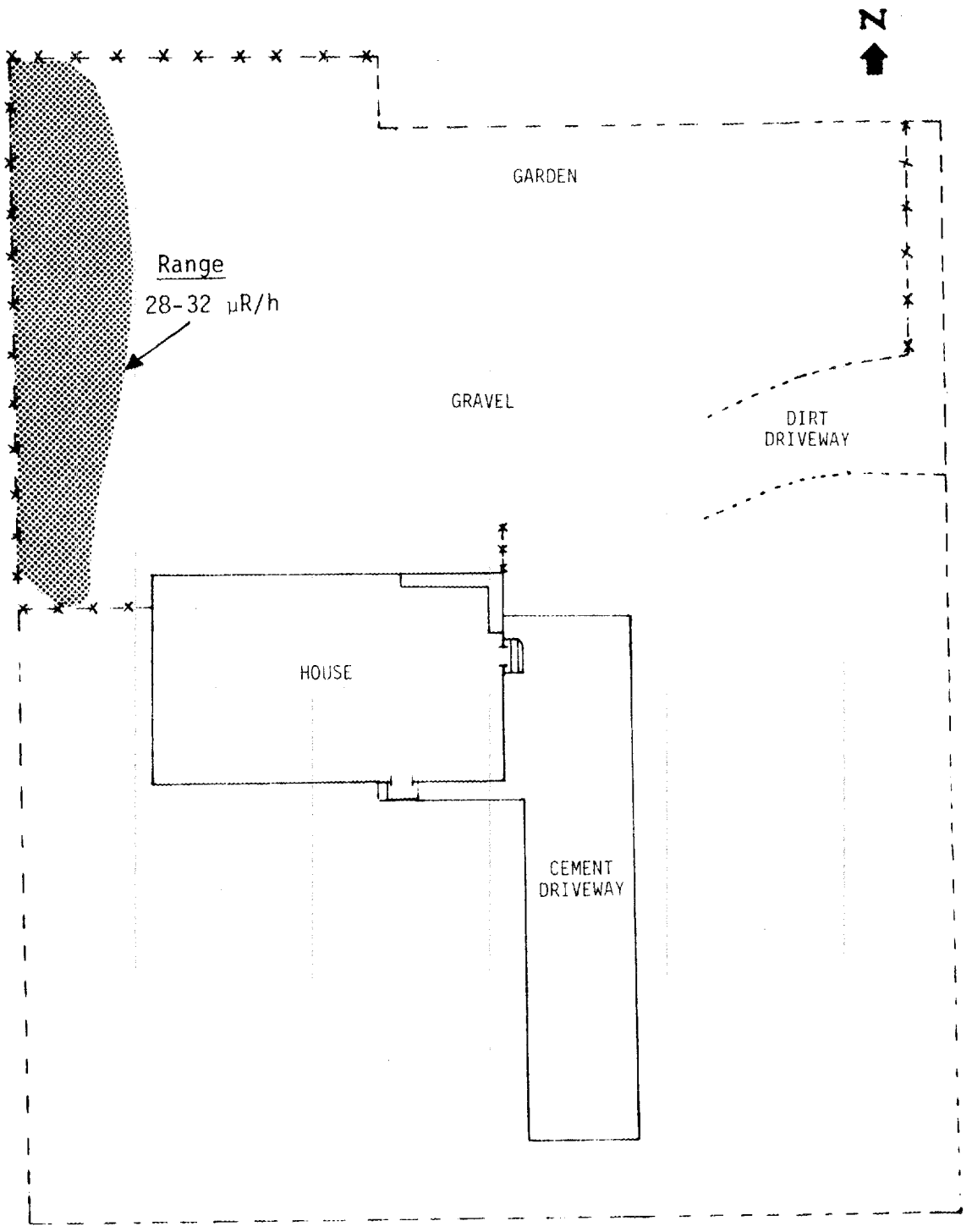

N
SHED
STORAGE
TRAILER
ROOM
ADDITION
41 µR/h
DRIVEWAY
600 µR/h
(ore)
M-77
615 S. Main



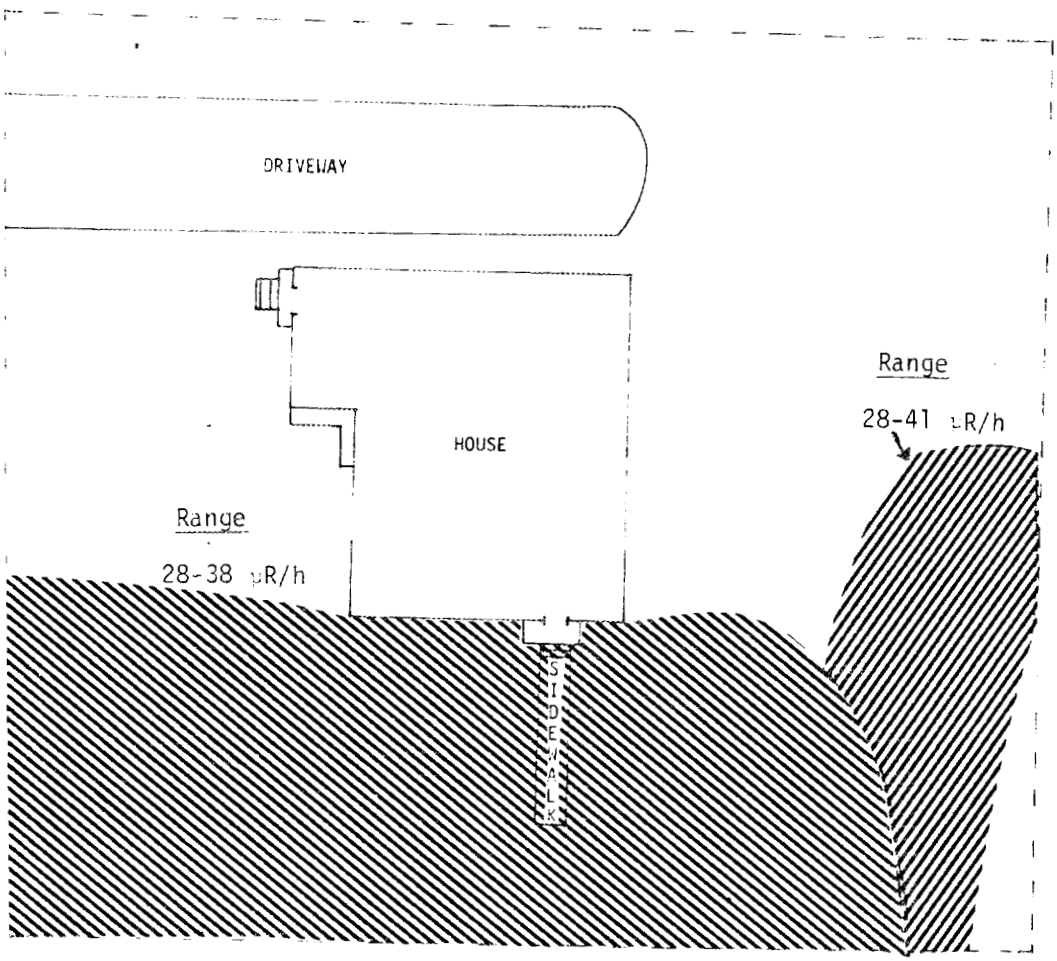
M-79
181 E. 1st S.



M-80
80 S. 2nd E.

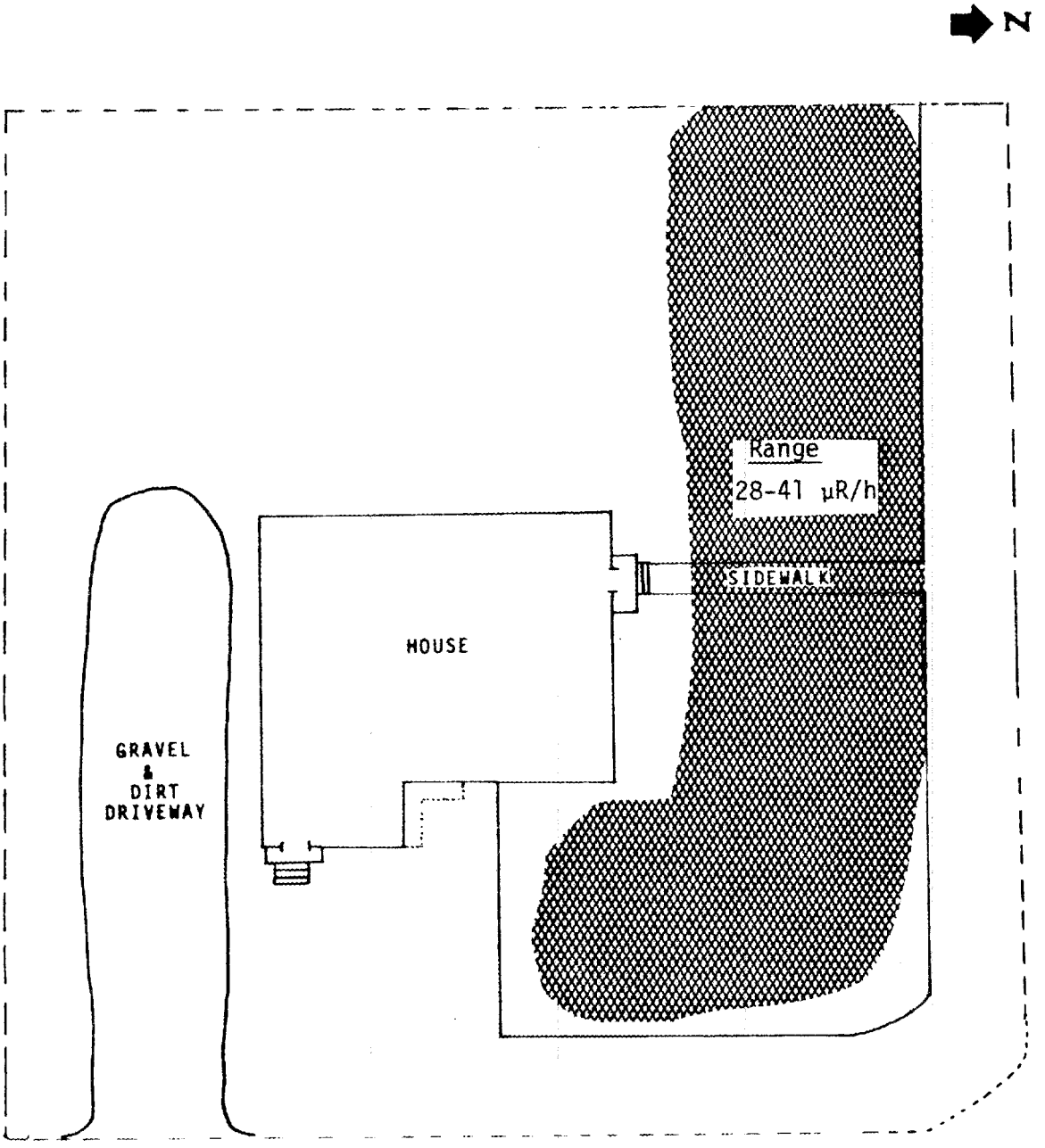


M-81
197 E. 2nd S.

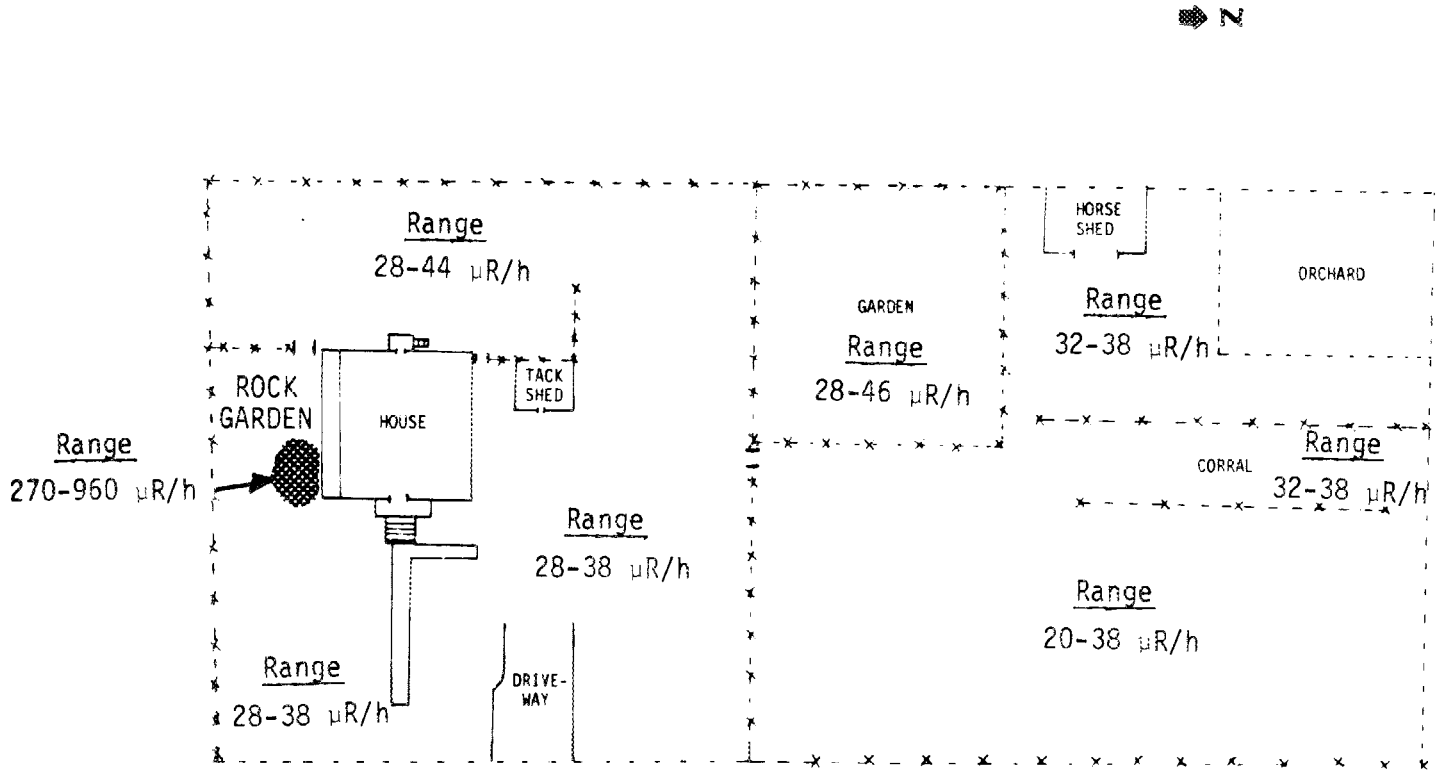


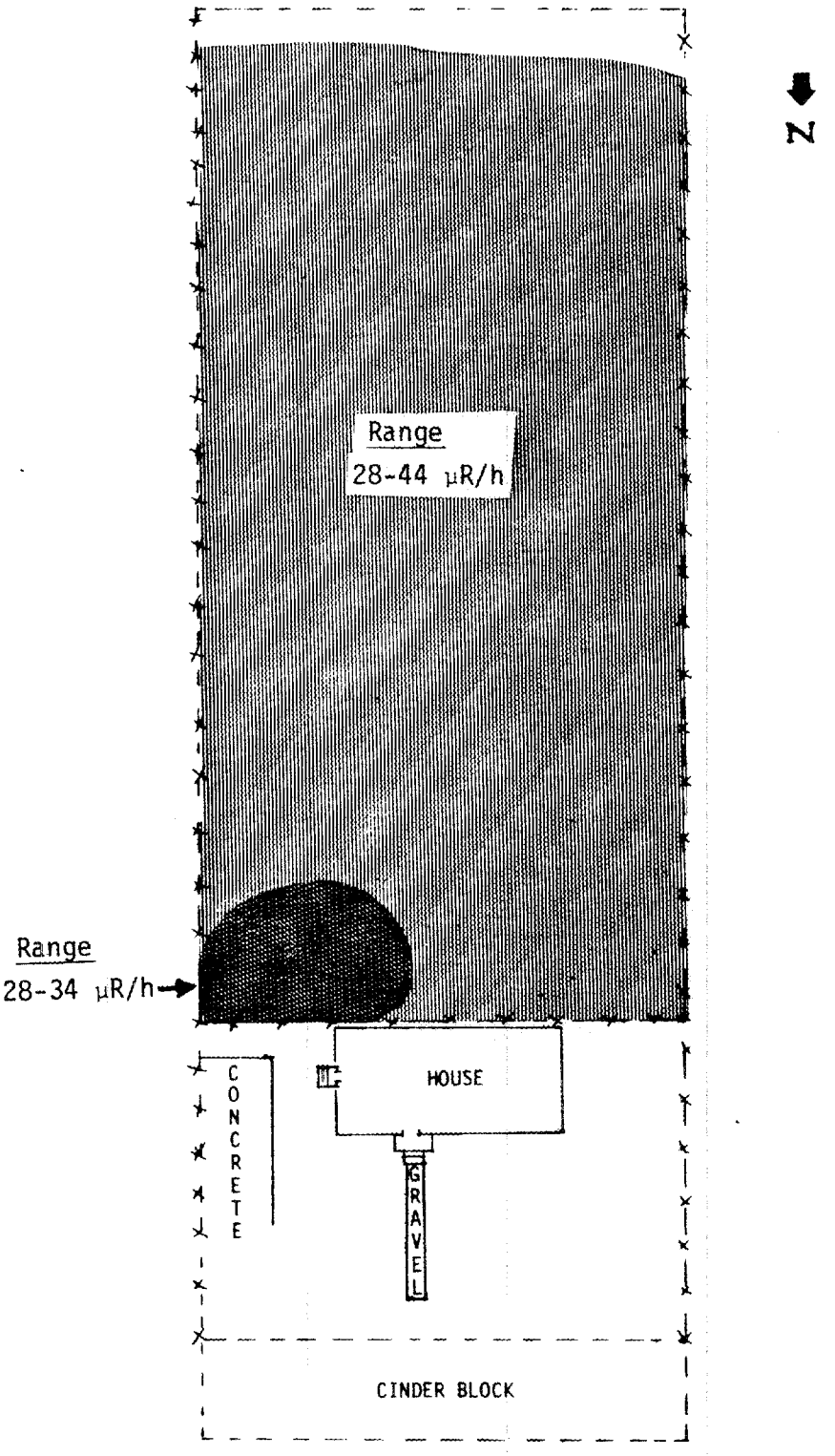
M-83

196 E. 3rd S.

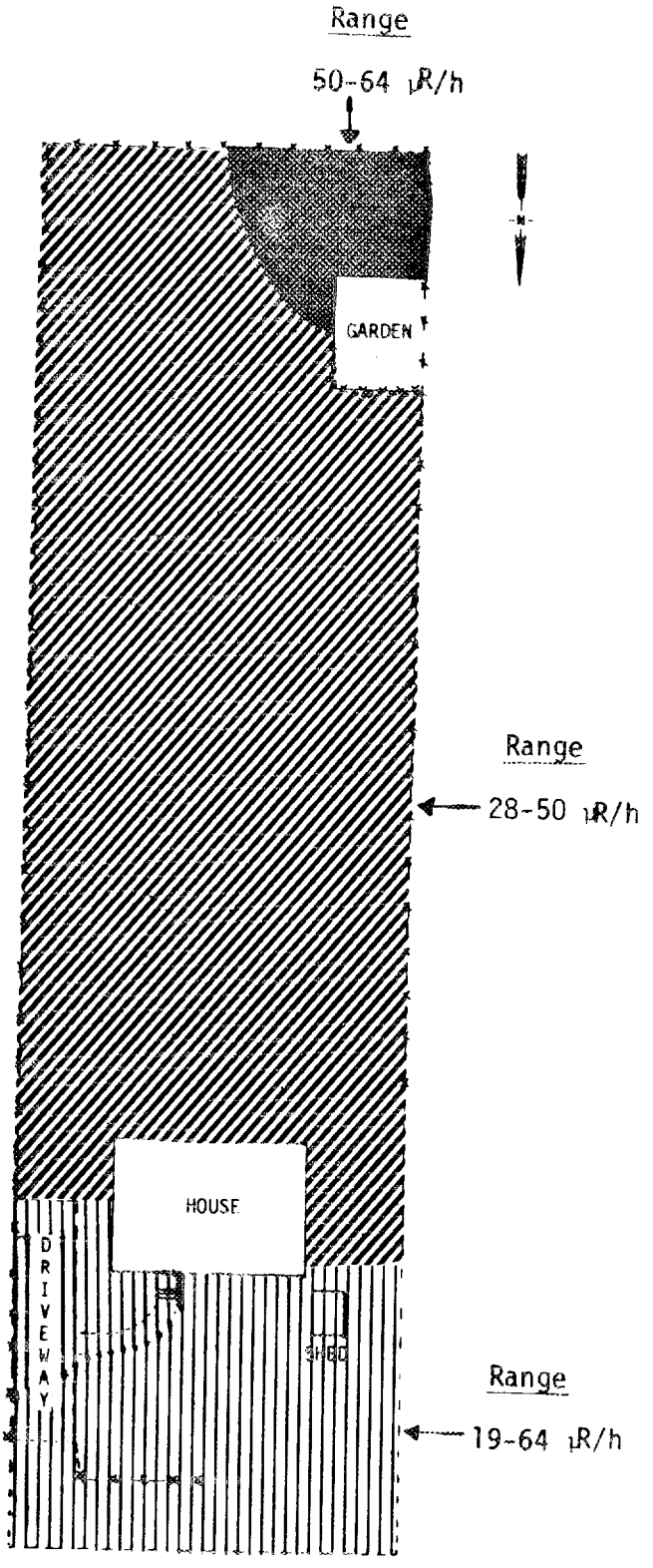


M-83
196 E. 3rd S.

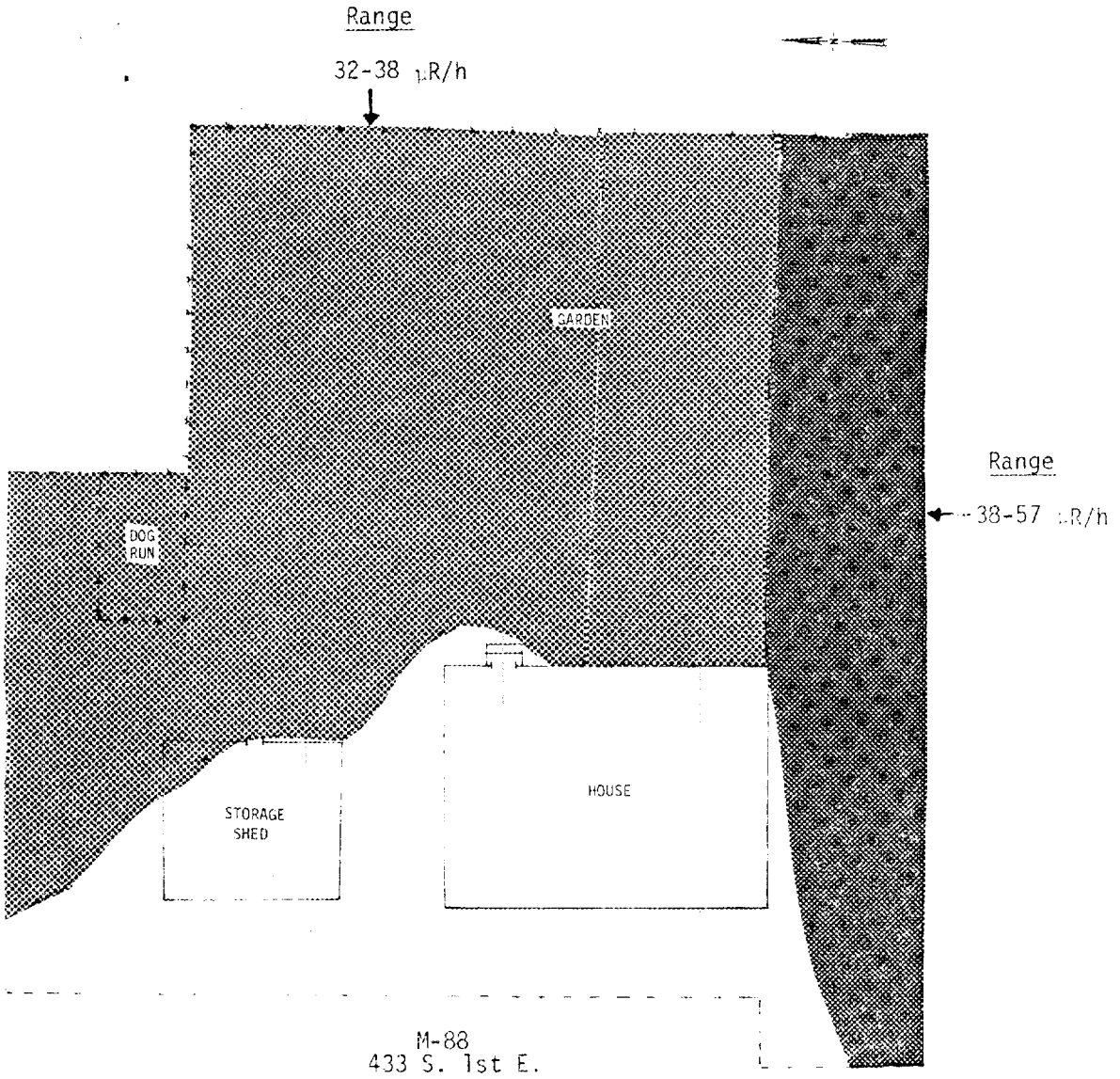

N
Range
28-44 µR/h
ROCK
GARDEN
HOUSE
TACK
SHED
Range
270-960 µR/h
Range
28-38 µR/h
Range
28-38 µR/h
DRIVE-
WAY
GARDEN
Range
28-46 µR/h
HORSE
SHED
ORCHARD
Range
32-38 µR/h
CORRAL
Range
32-38 µR/h
Range
20-38 µR/h
M-85
396 S. 2nd E.
M-84
384 S. 2nd E.

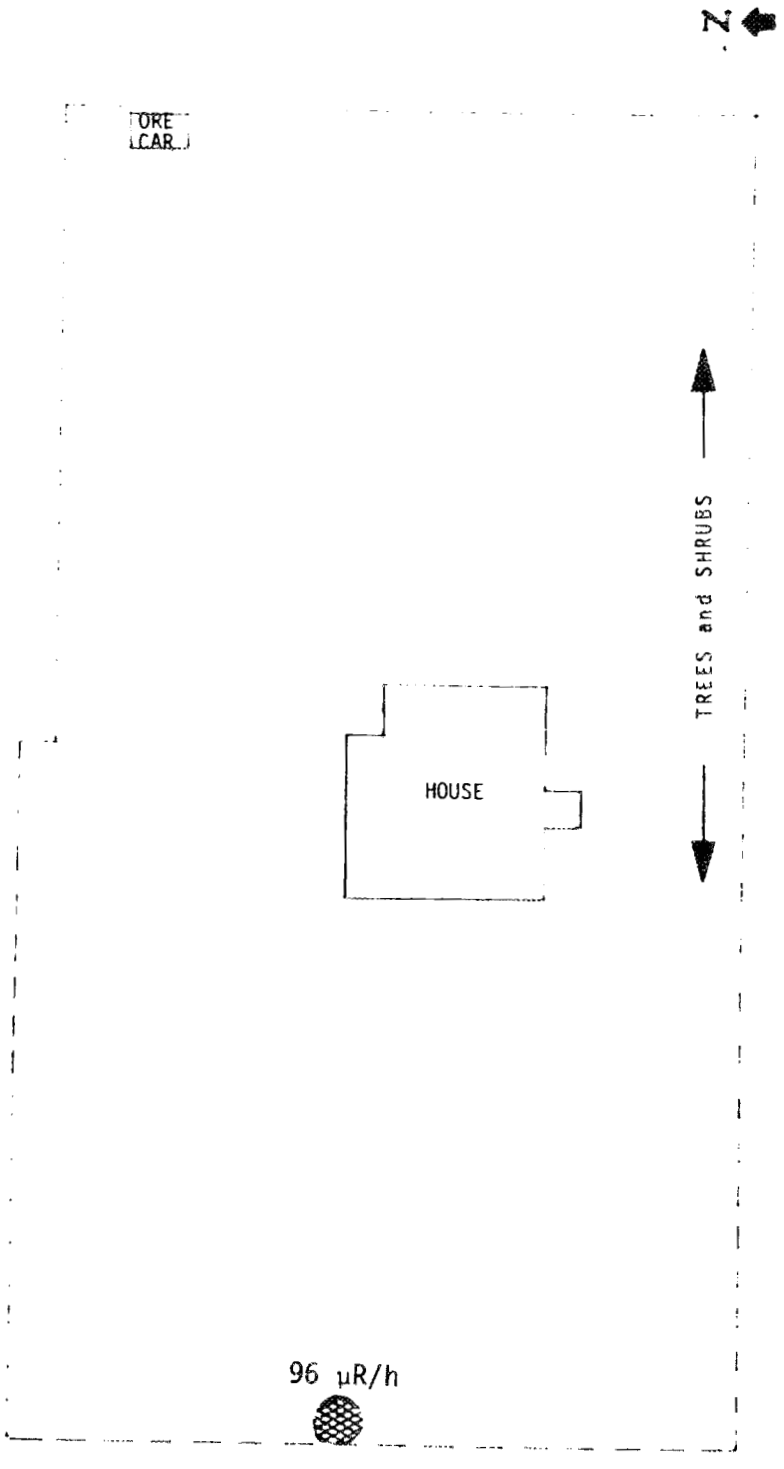


M-86
164 E. 4th S.

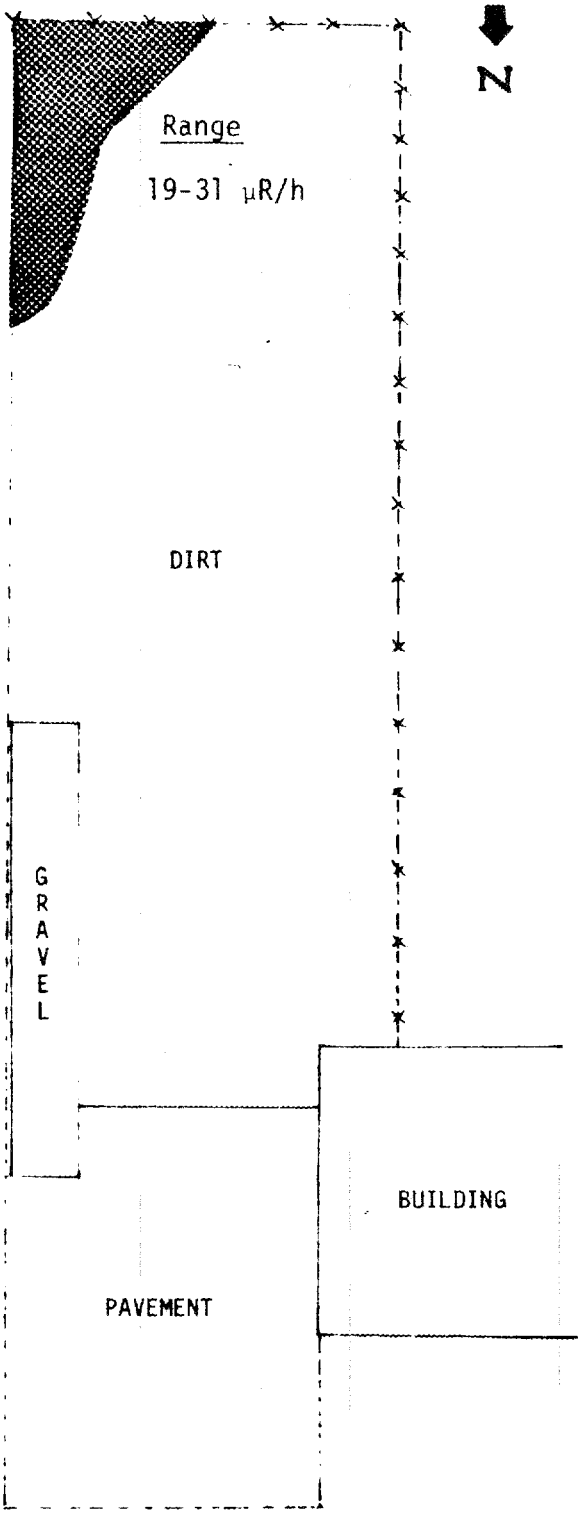


M-87
148 E. 4th S.

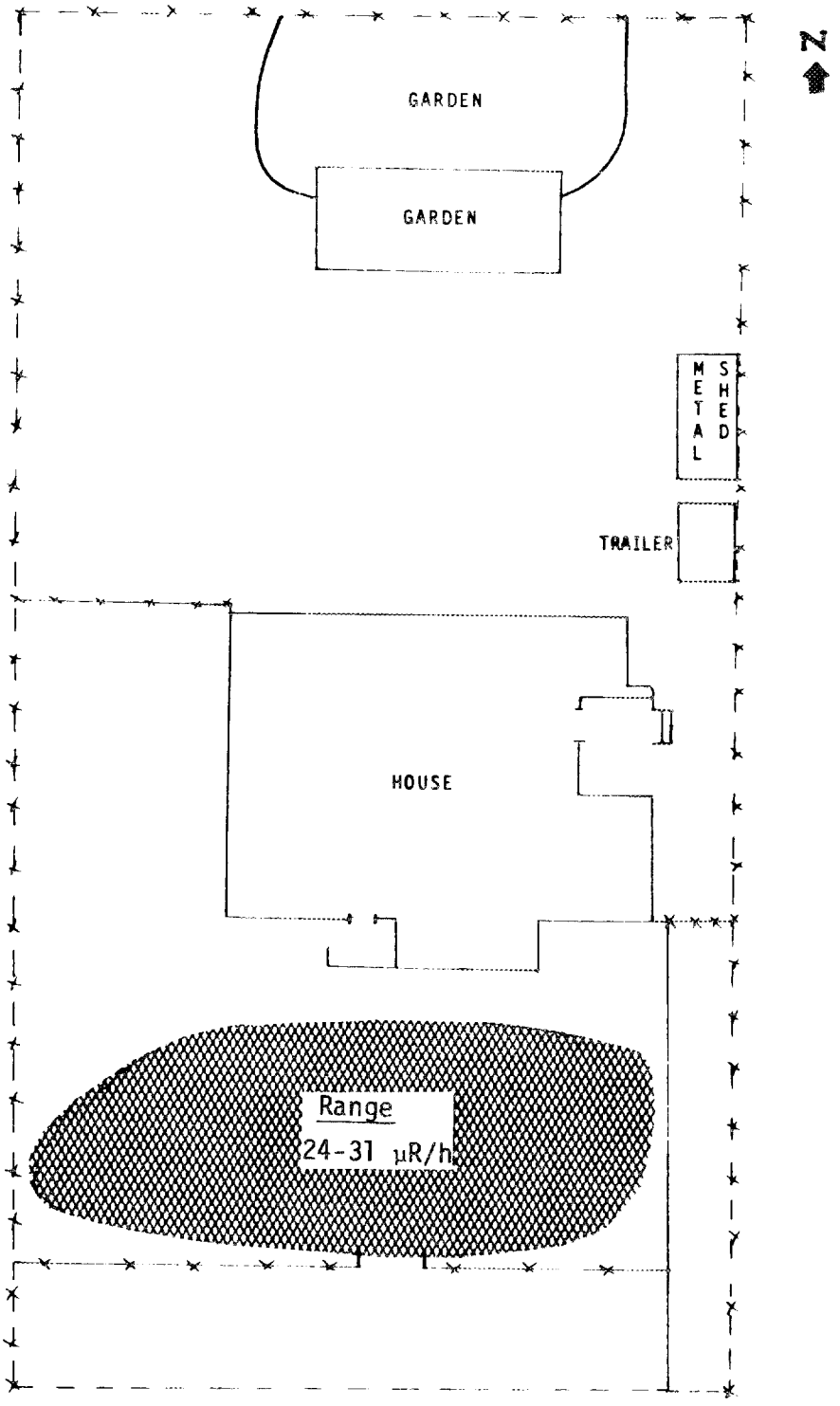

Range
32-38 μR/h
GARDEN
Range
38-57 μR/h
DOG RUN
HOUSE
STORAGE SHED
M-88
433 S. 1st E.



M-89
164 E. 1st N.

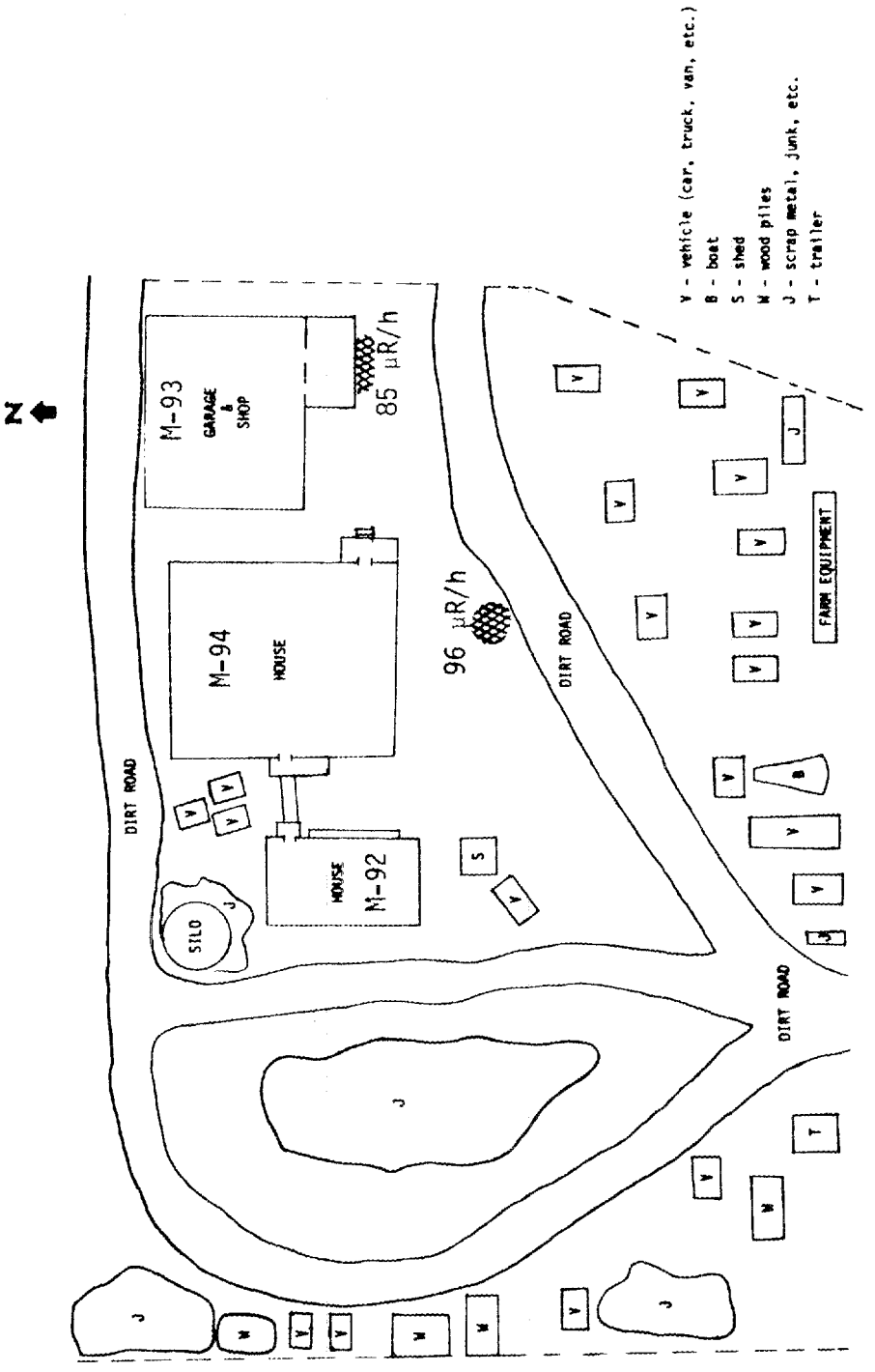


M-90
260 E. Central

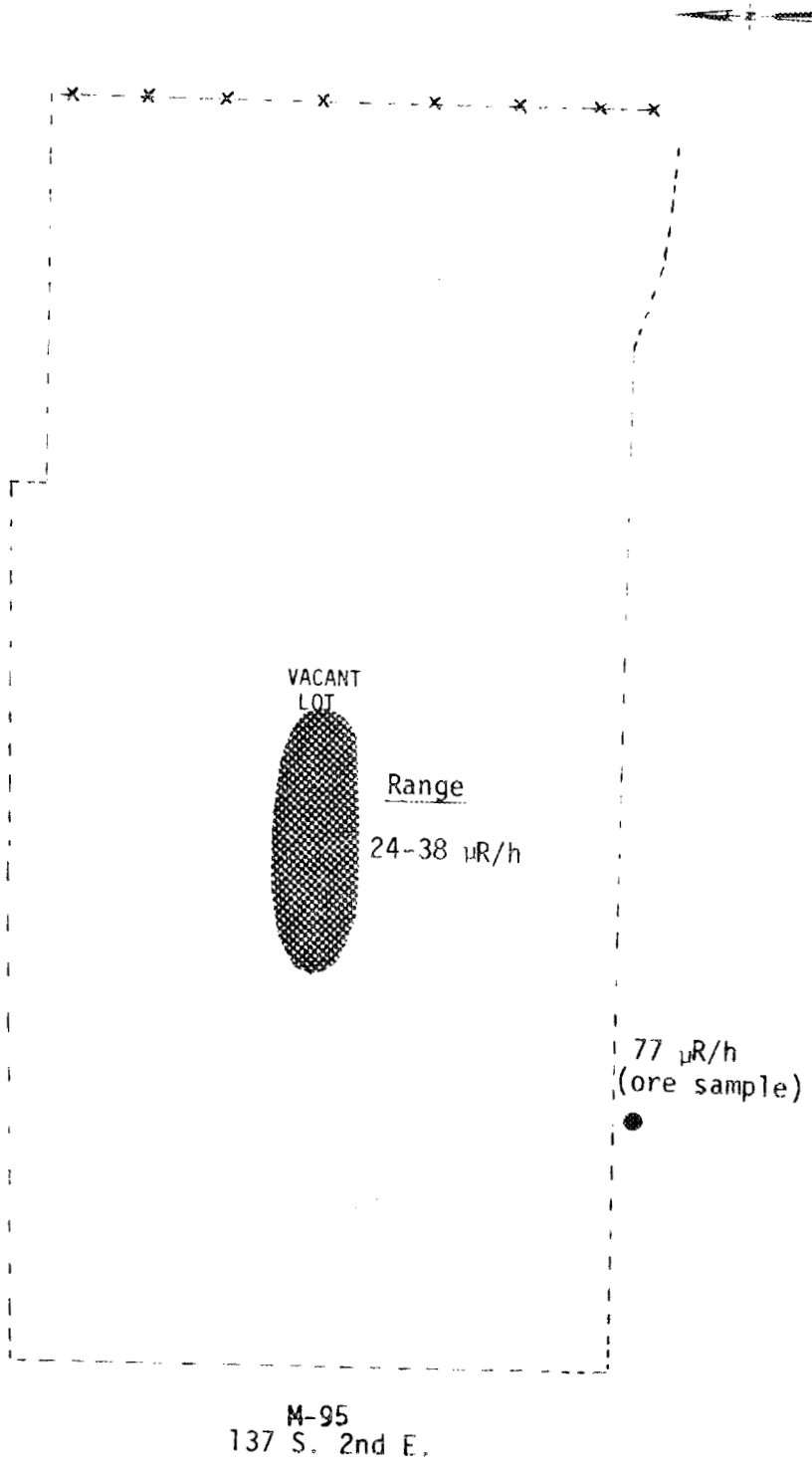


M-91

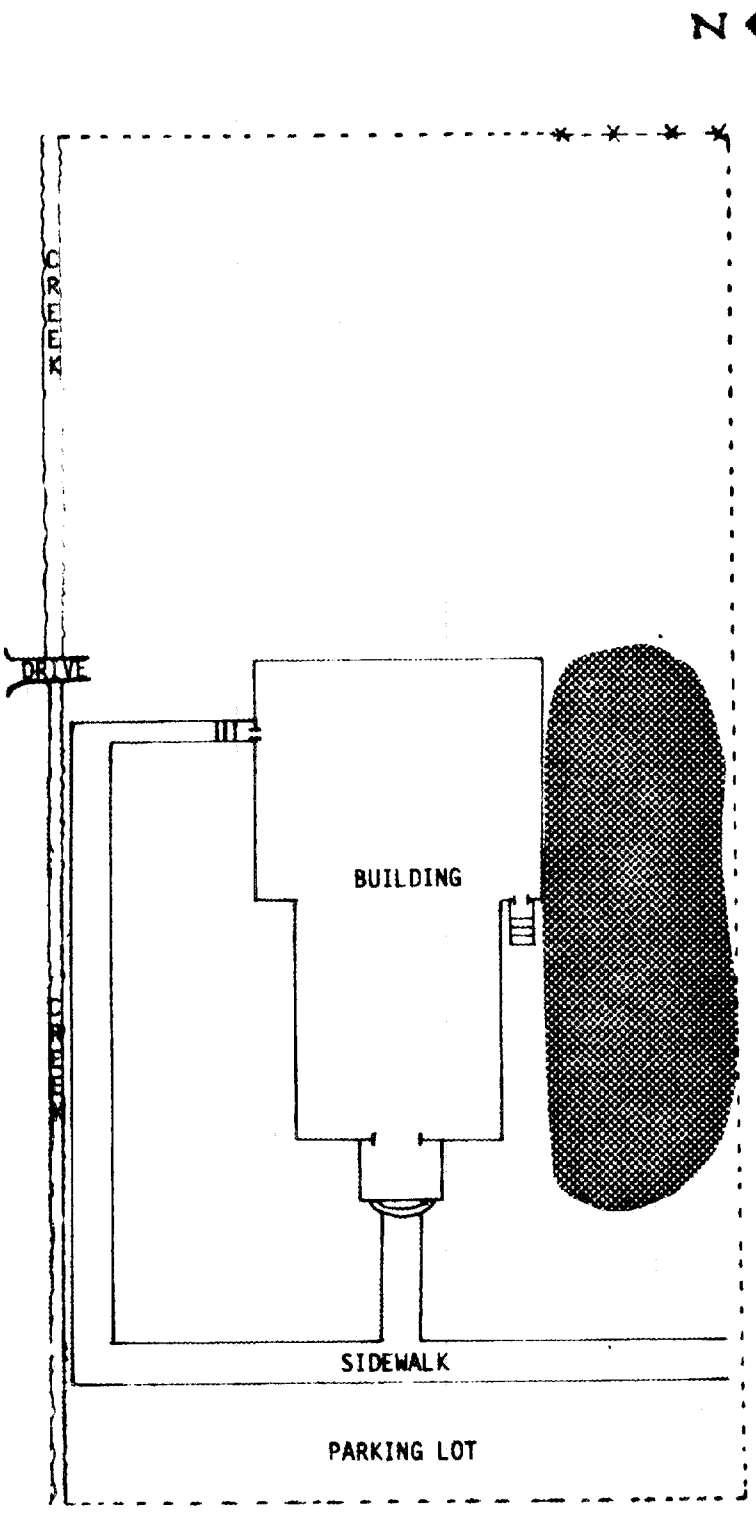
265 E. 1st S.



80 S. 3rd E. (M-93)
273 E. 1st S. (M-92)
281 E. 1st S. (M-94)



M-95
137 S. 2nd E.

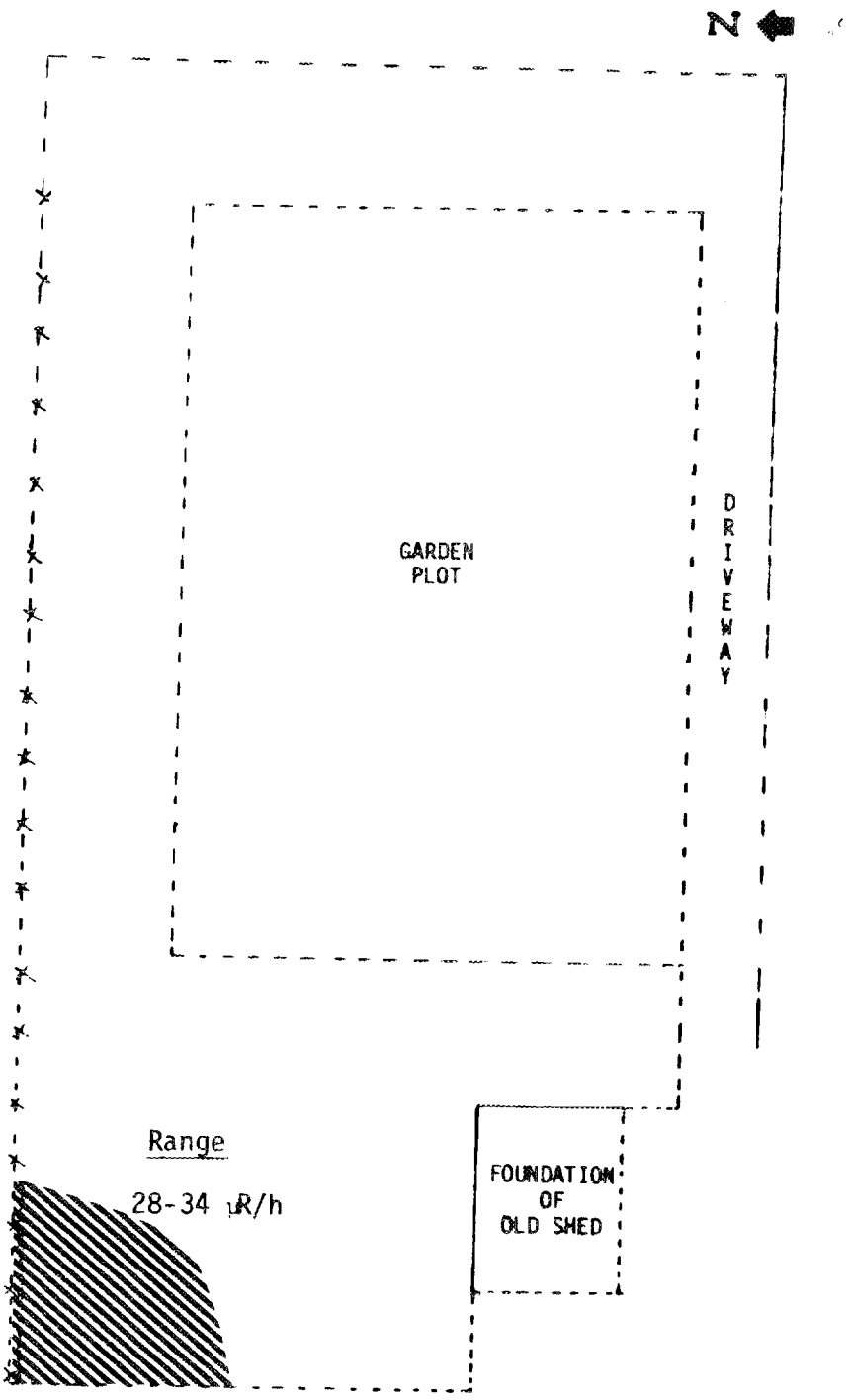


Range

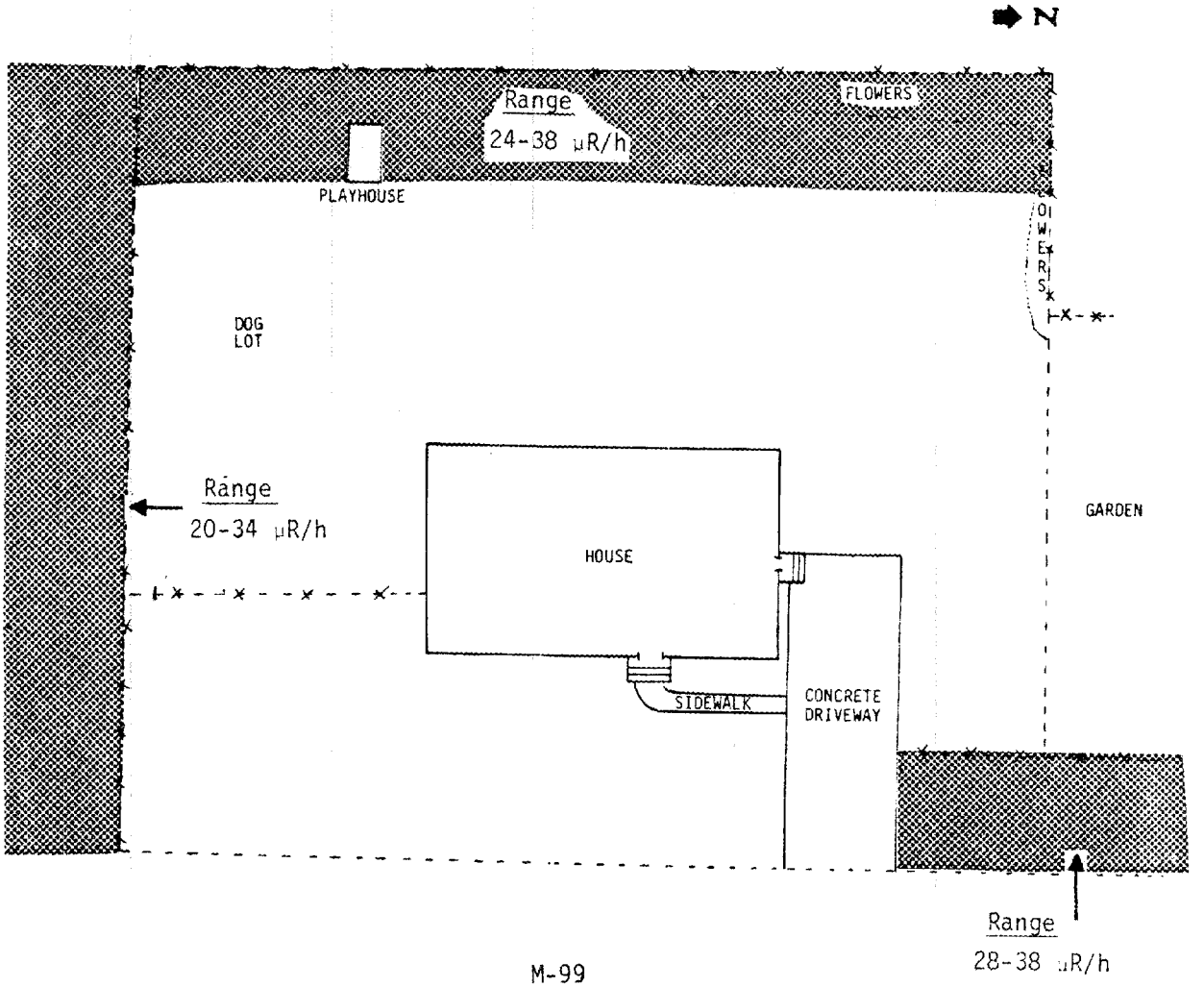
44-240 μR/h

M-97

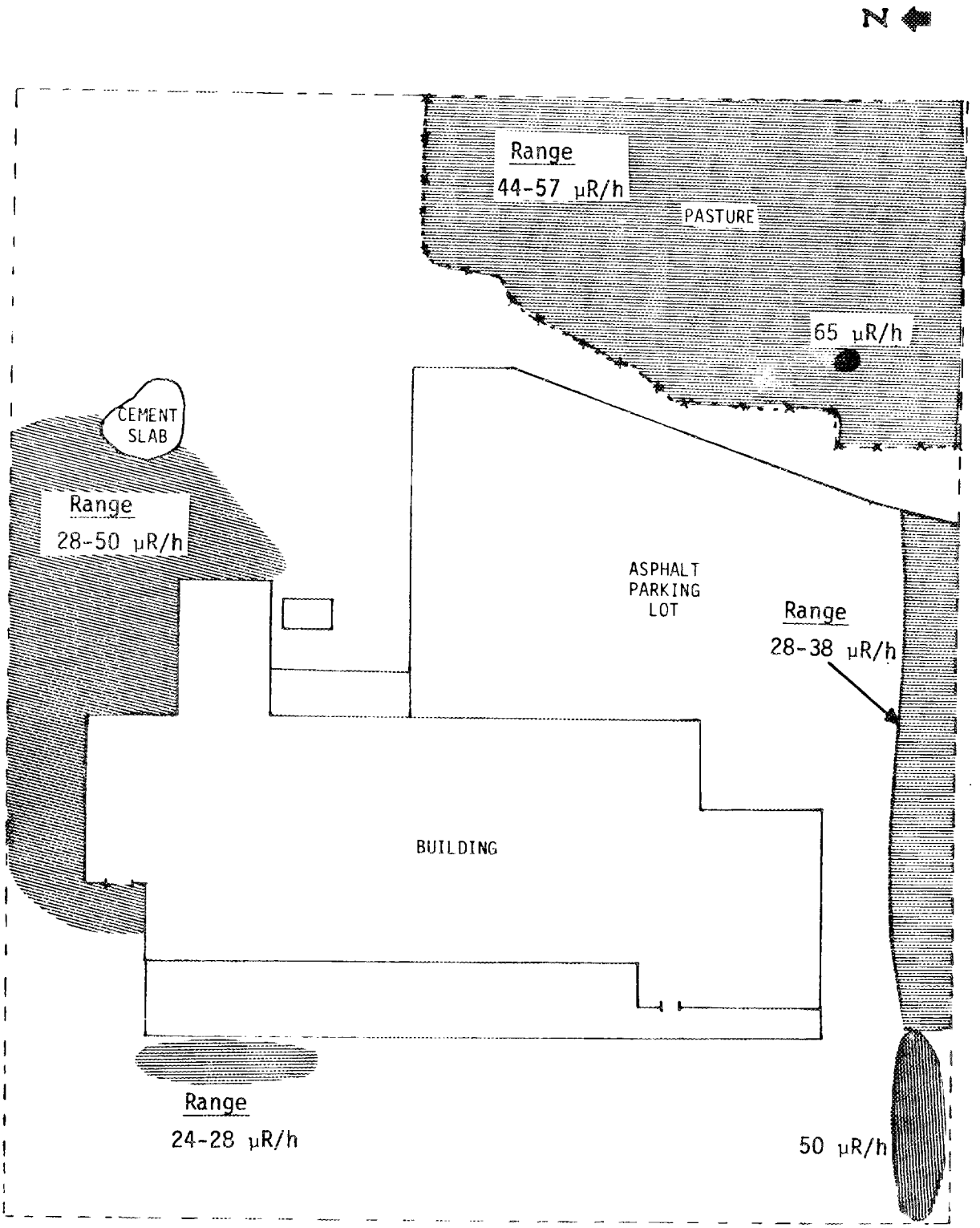
217 S. 2nd. E.



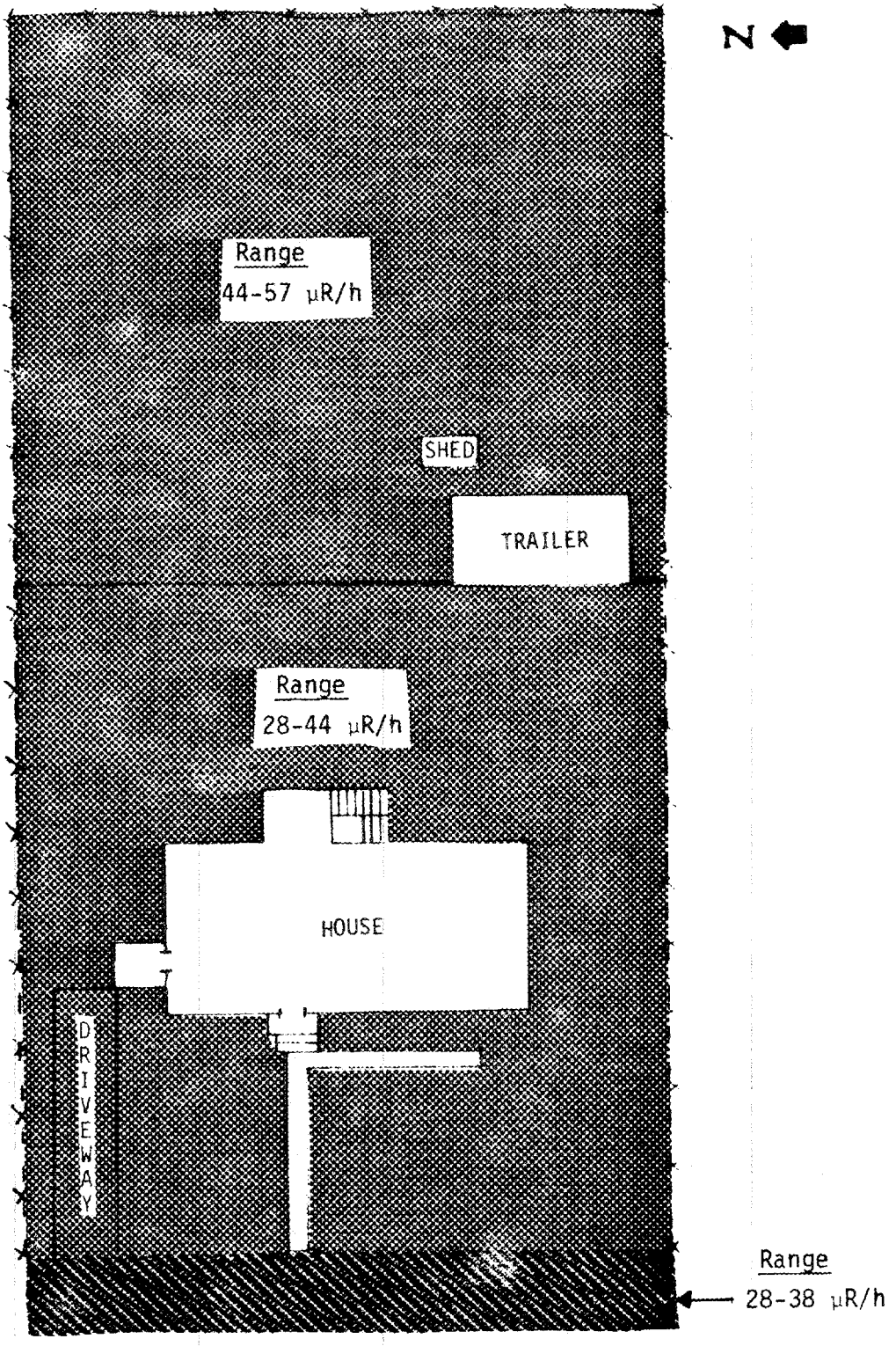
M-98
248 S. 3rd E.



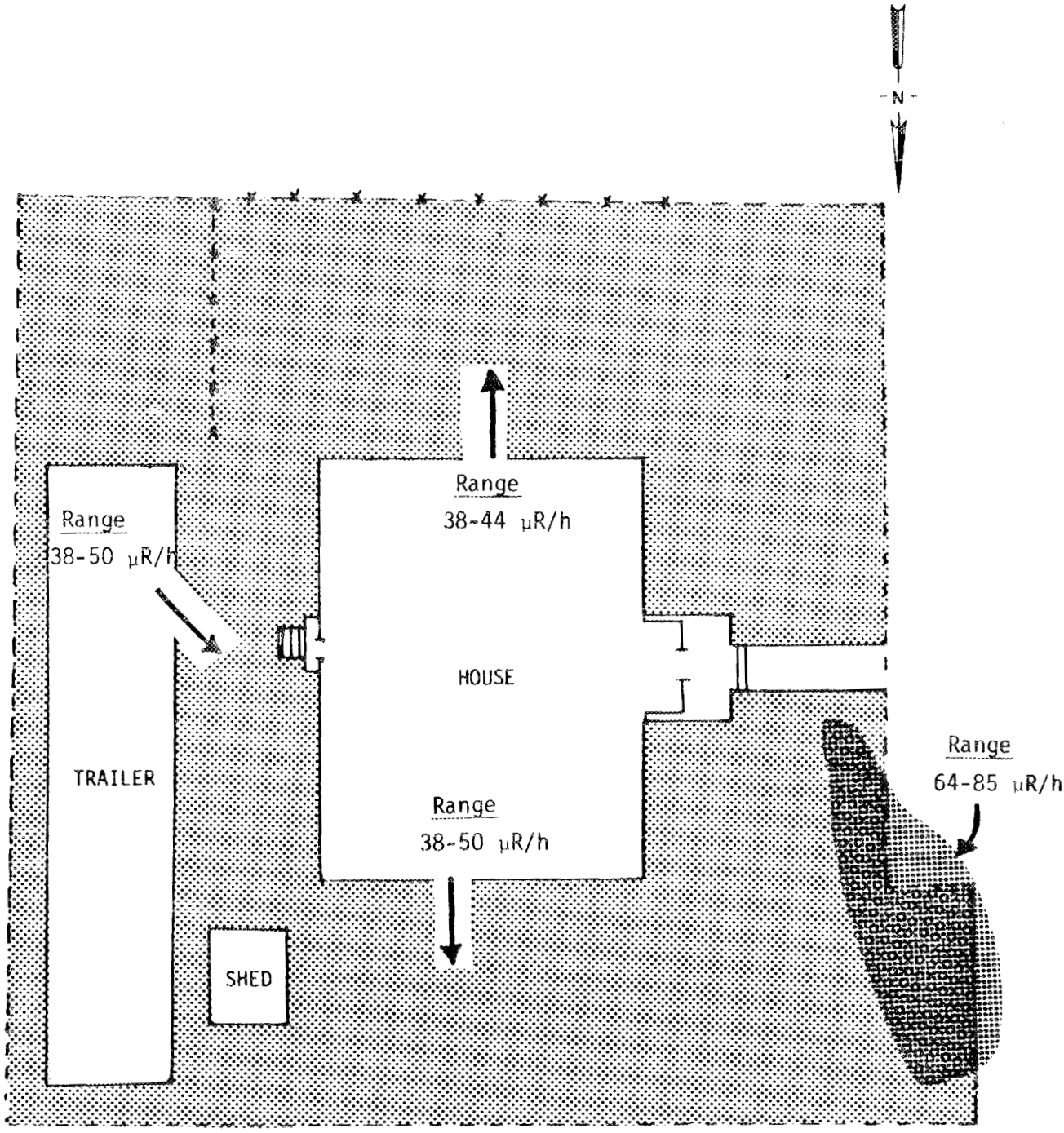
M-99
280 S. 3rd E.



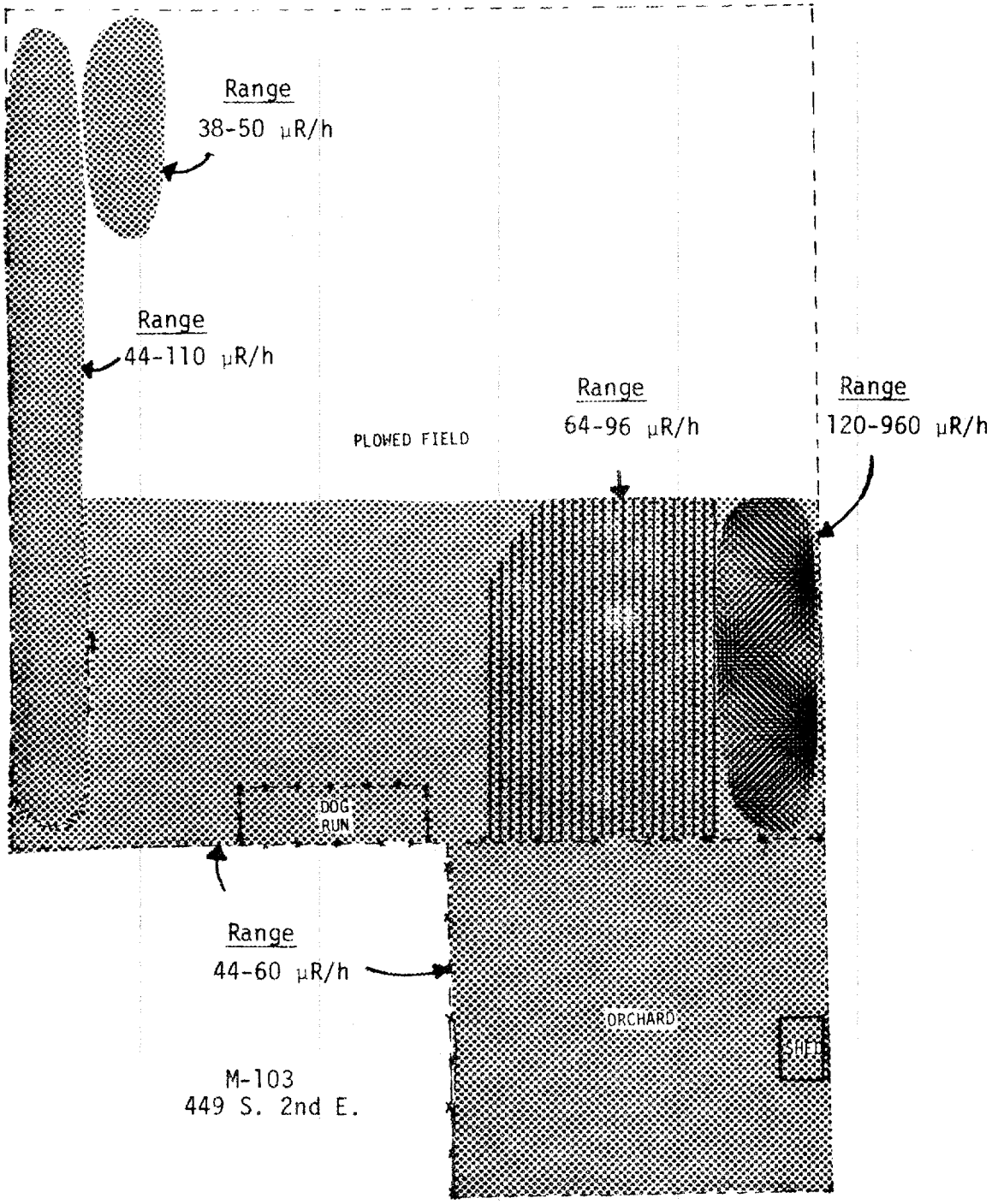
M-100
333 S. 2nd E.

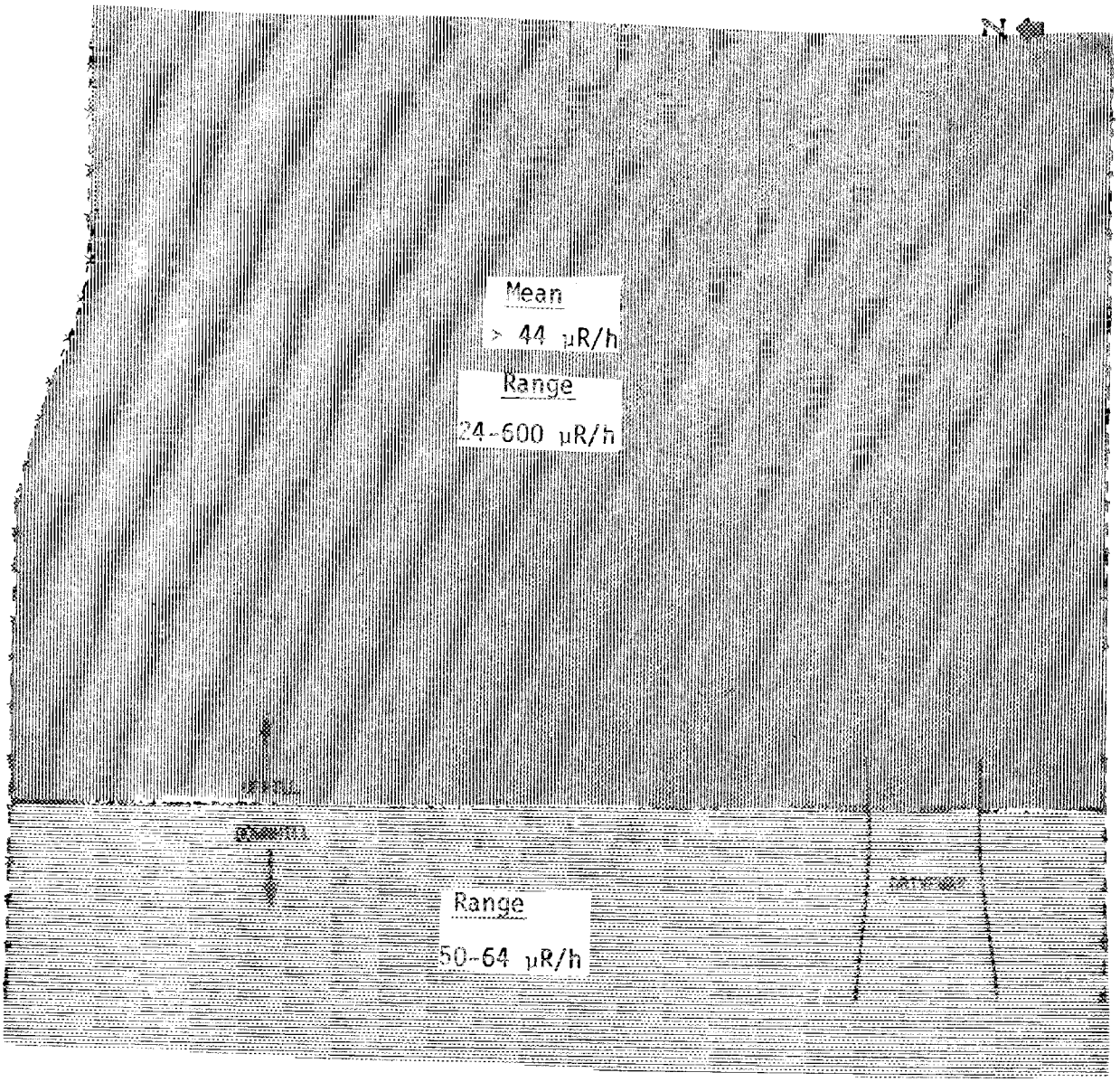


M-101
389 S. 2nd E.

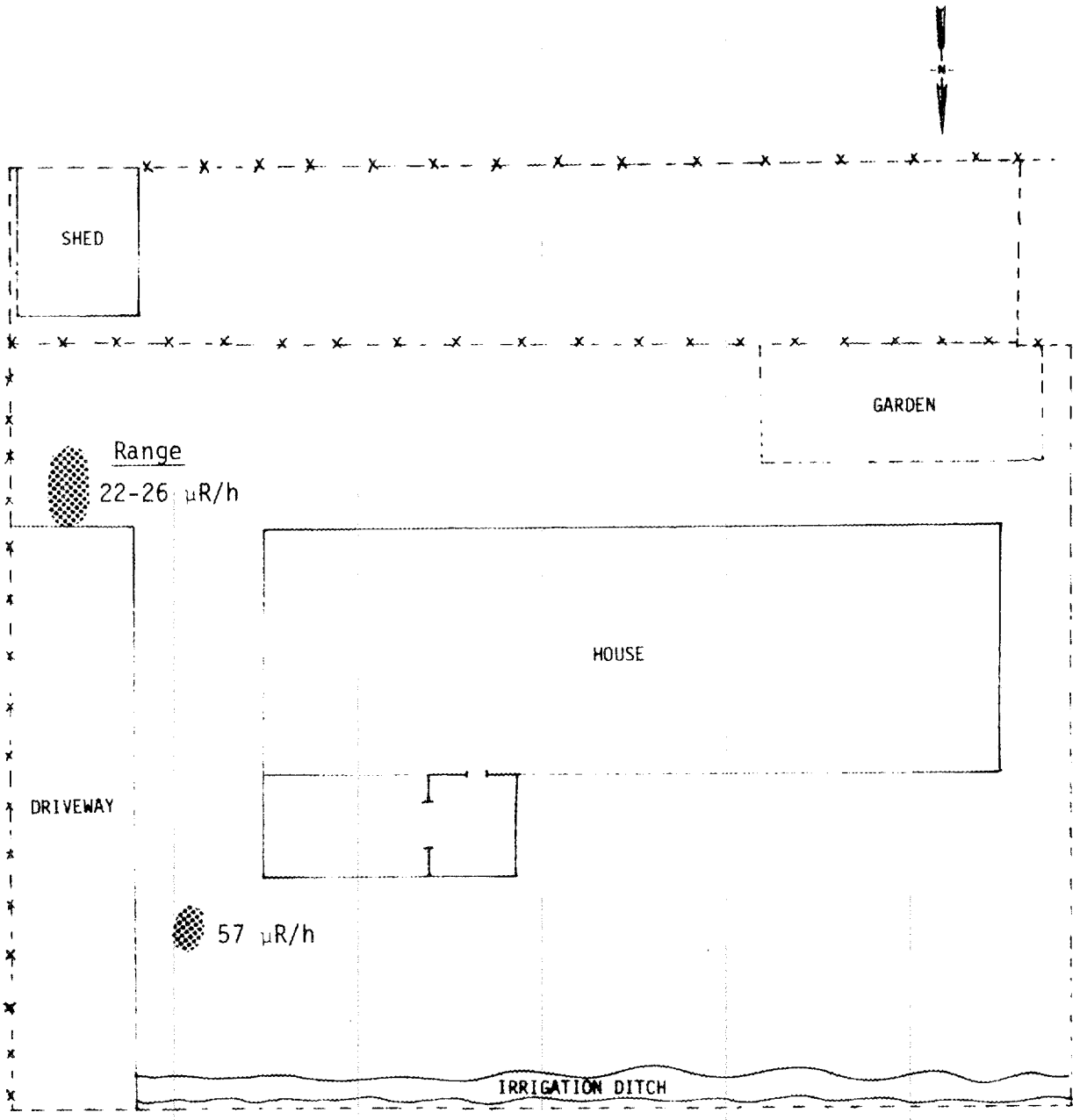


M-102
417 S. 2nd E.

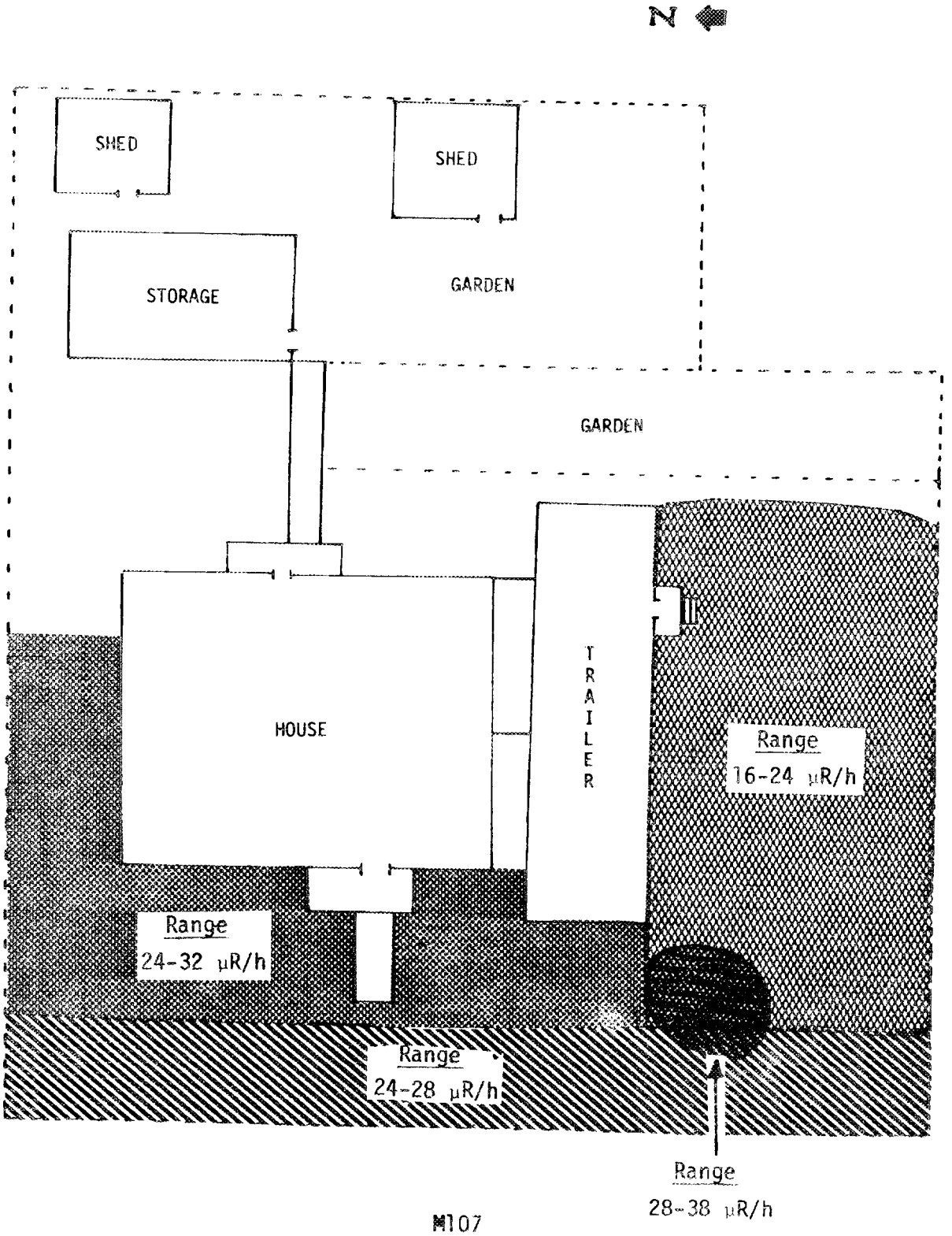

Range
38-50 µR/h
Range
44-110 µR/h
PLOWED FIELD
Range
64-96 µR/h
Range
120-960 µR/h
DOG RUN
Range
44-60 µR/h
ORCHARD
SHED
M-103
449 S. 2nd E.



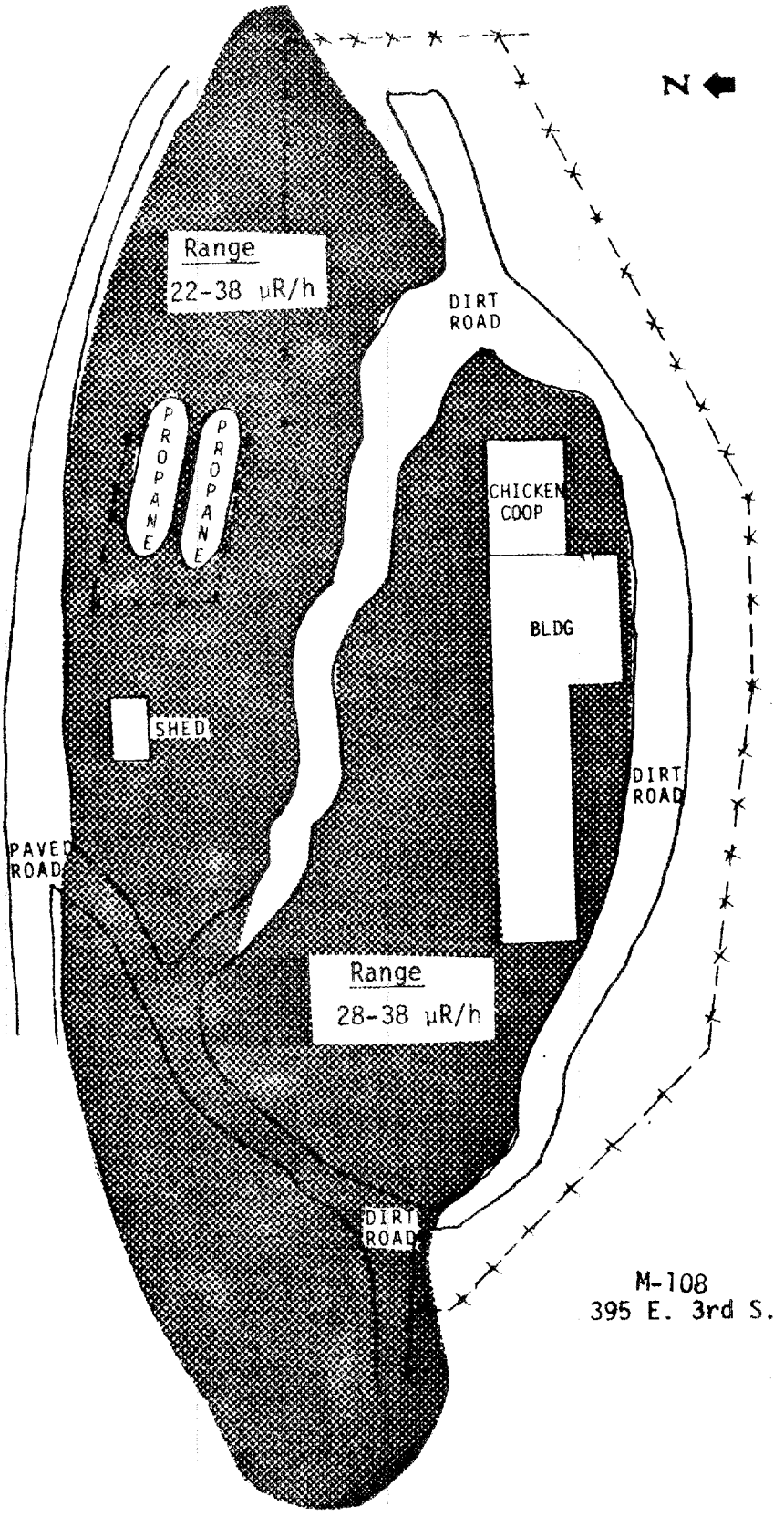
M-105
South of Mill Site on hill

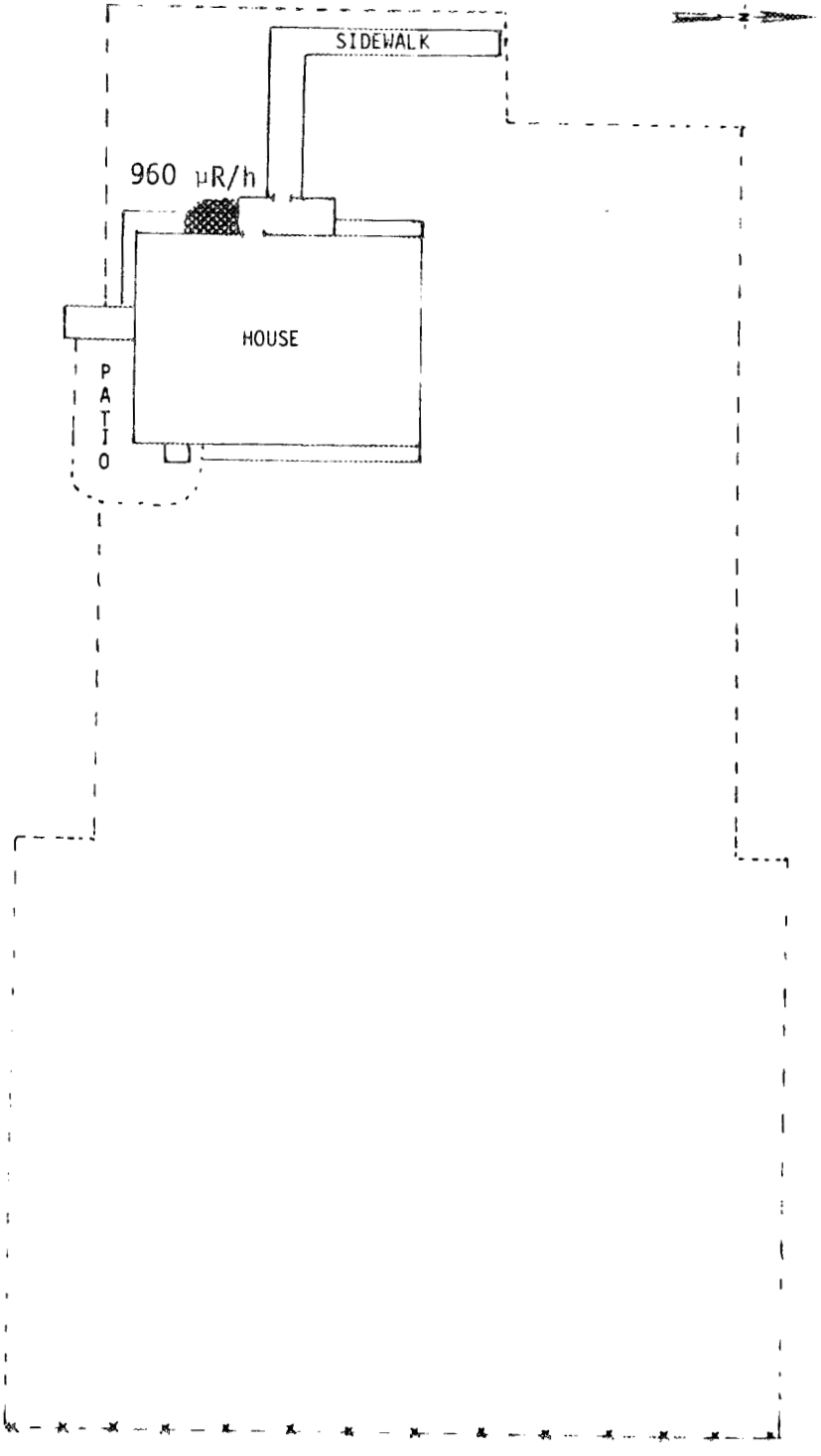


M-106
332 E. Central



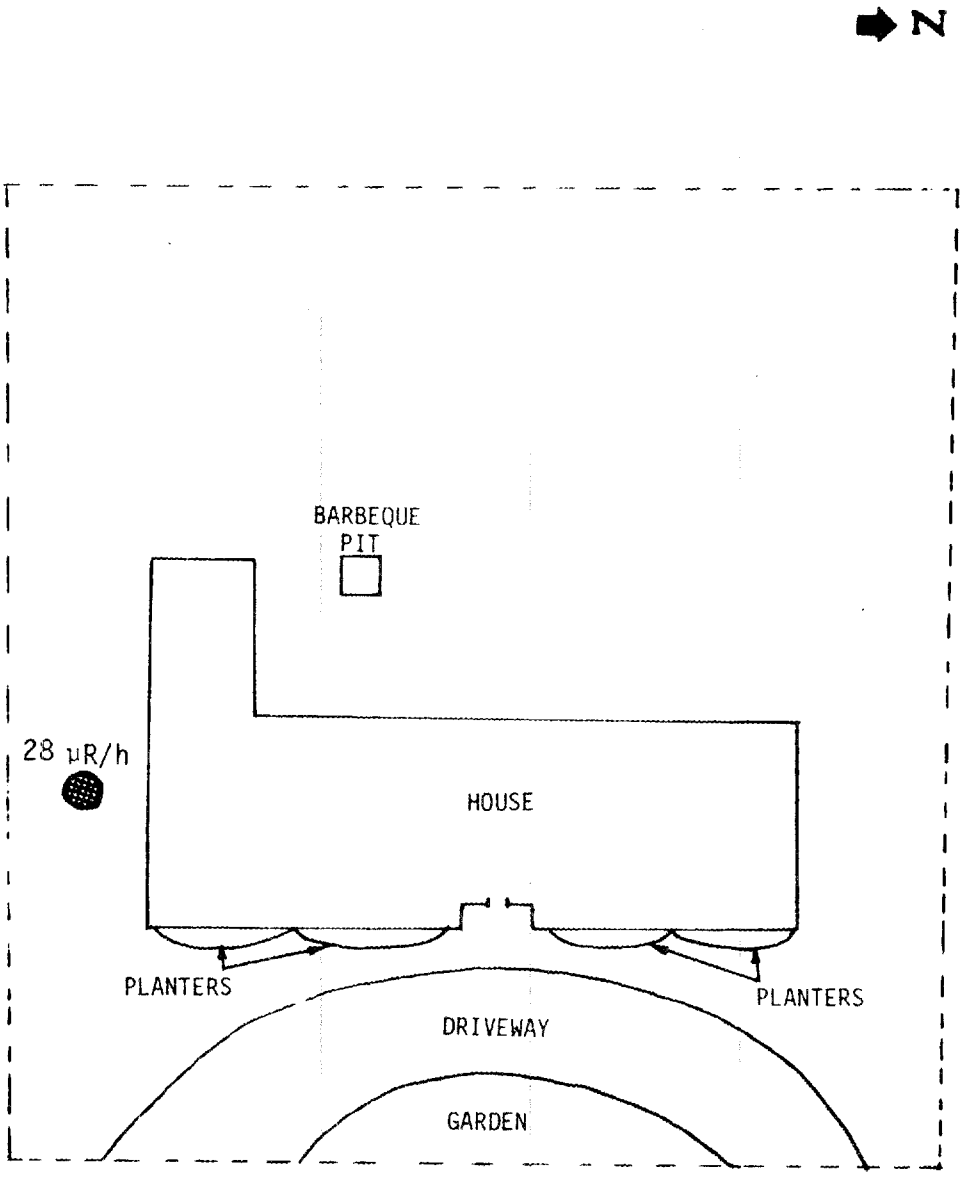
M107
249 S. 3rd E.


N
Range
22-38 µR/h
DIRT
ROAD
PROPANE
PROPANE
CHICKEN
COOP
BLDG
SHED
DIRT
ROAD
PAVED
ROAD
Range
28-38 µR/h
DIRT
ROAD
M-108
395 E. 3rd S.

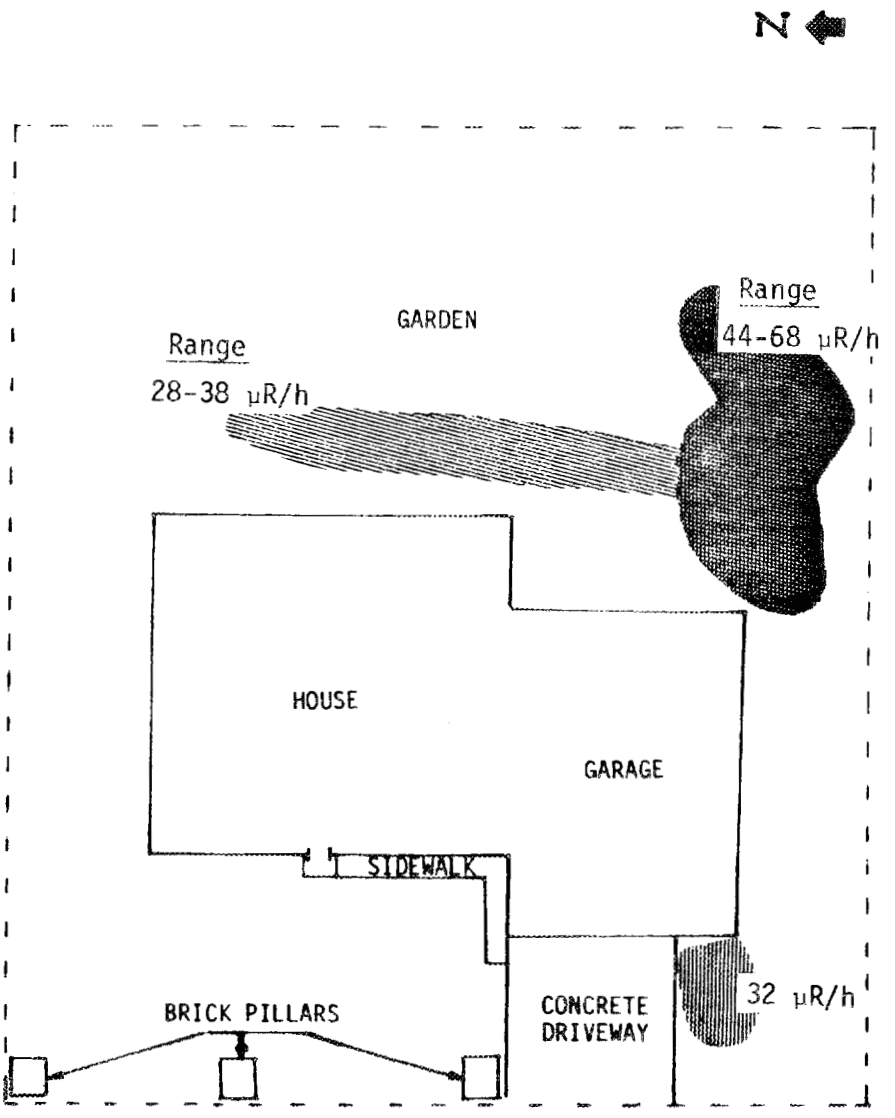


M-114

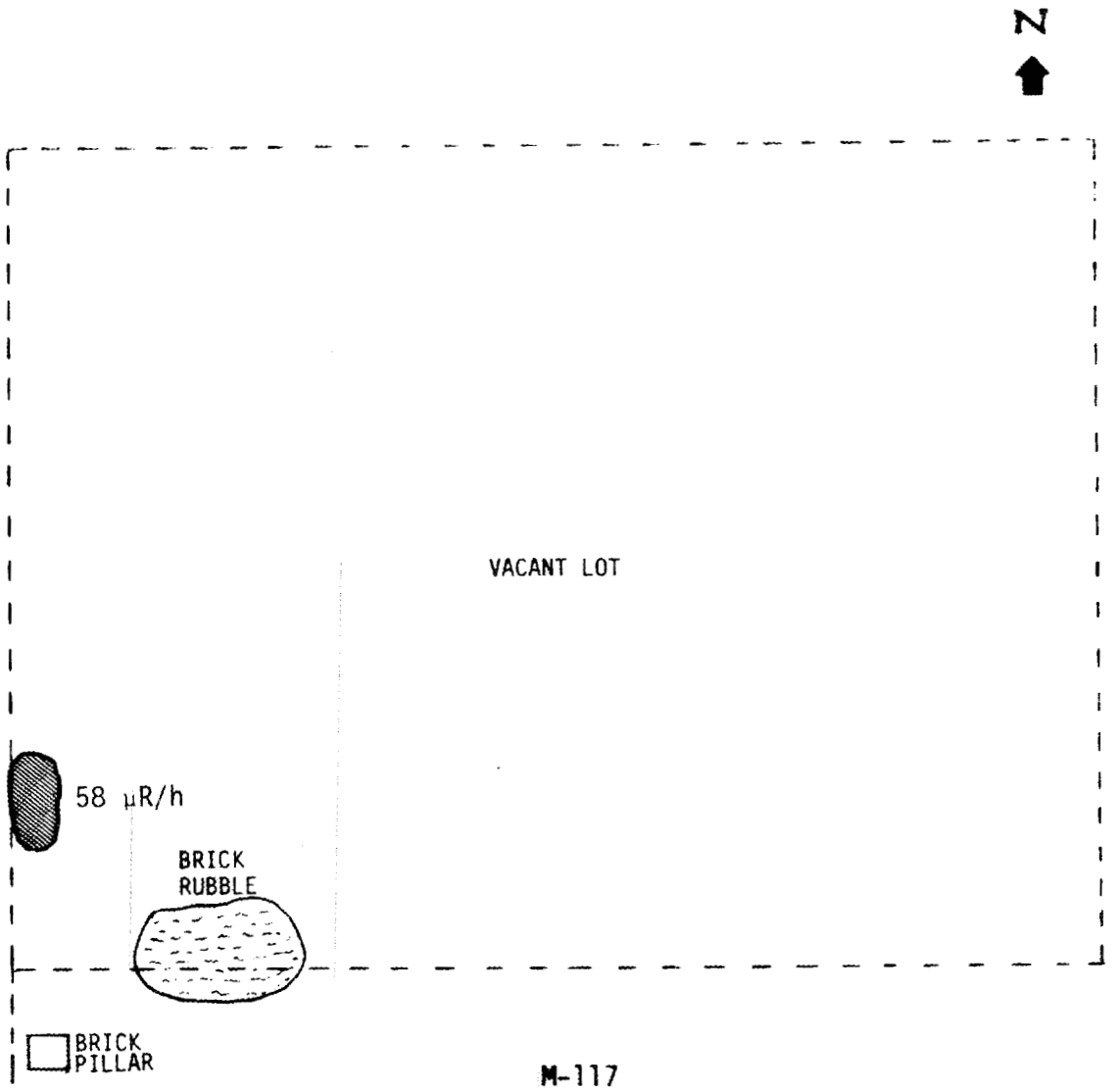
225 S. 2nd E.



M-115
332 N. Creek Ln.

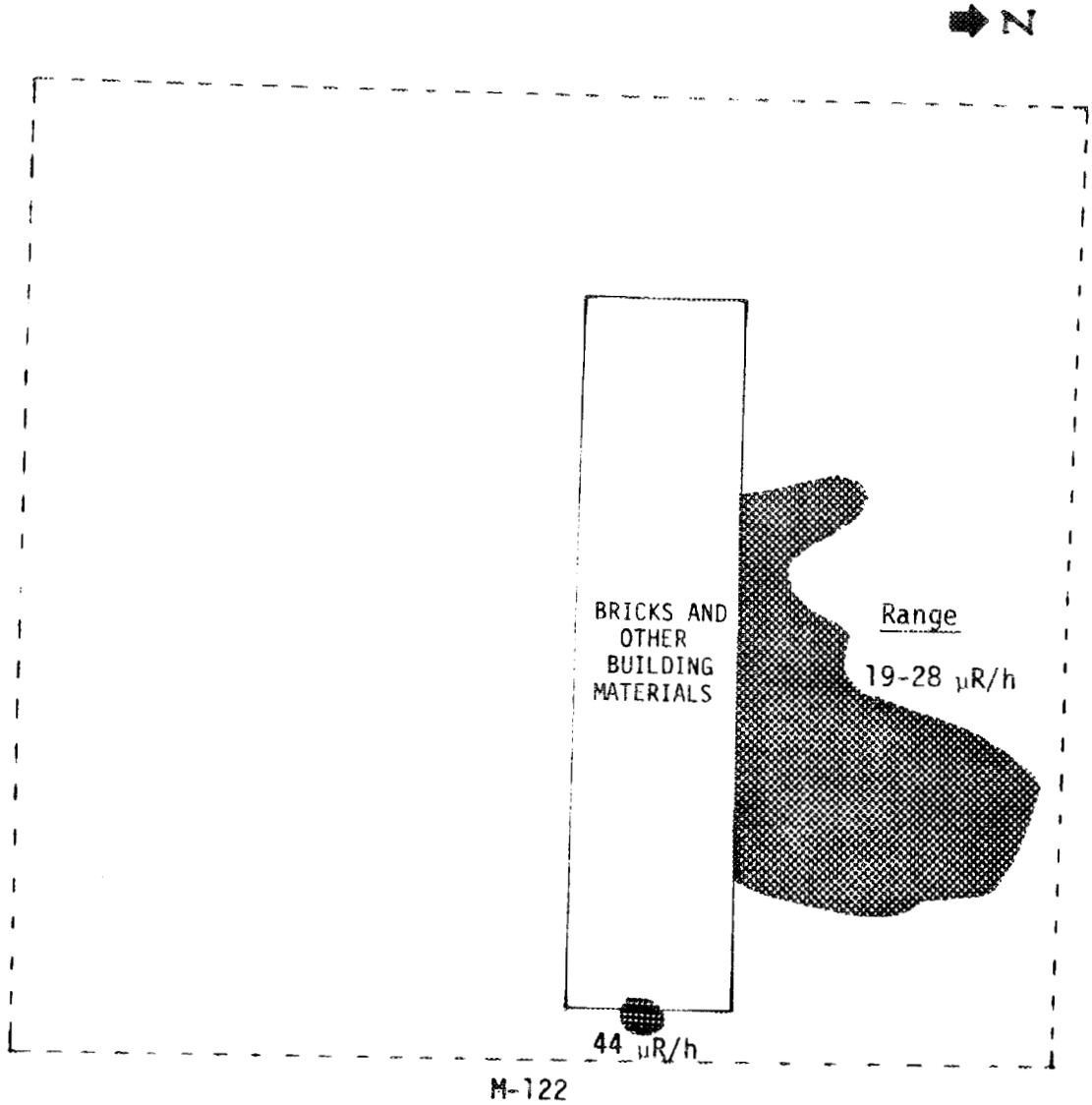


M-116
349 N. Creek Ln.

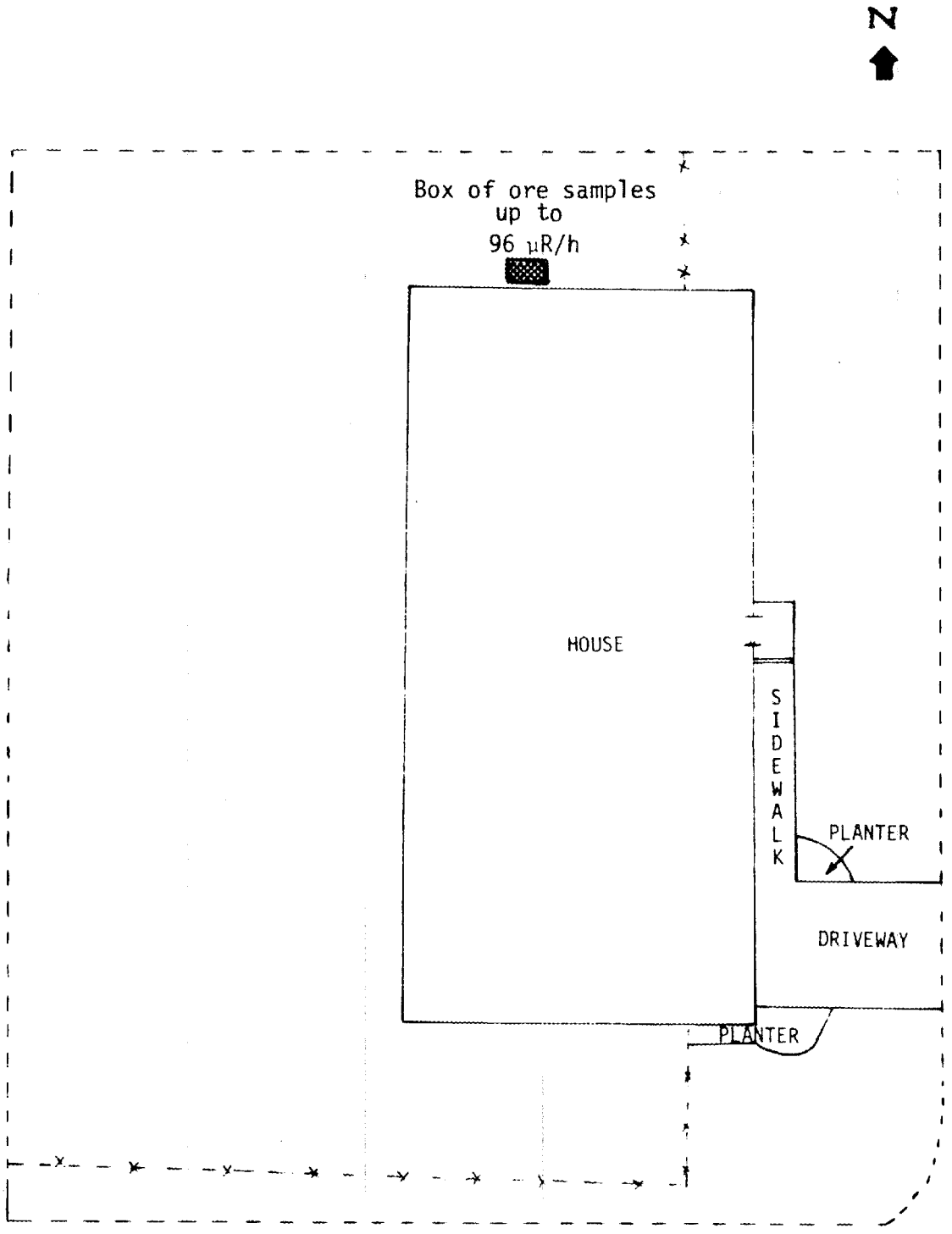


M-117

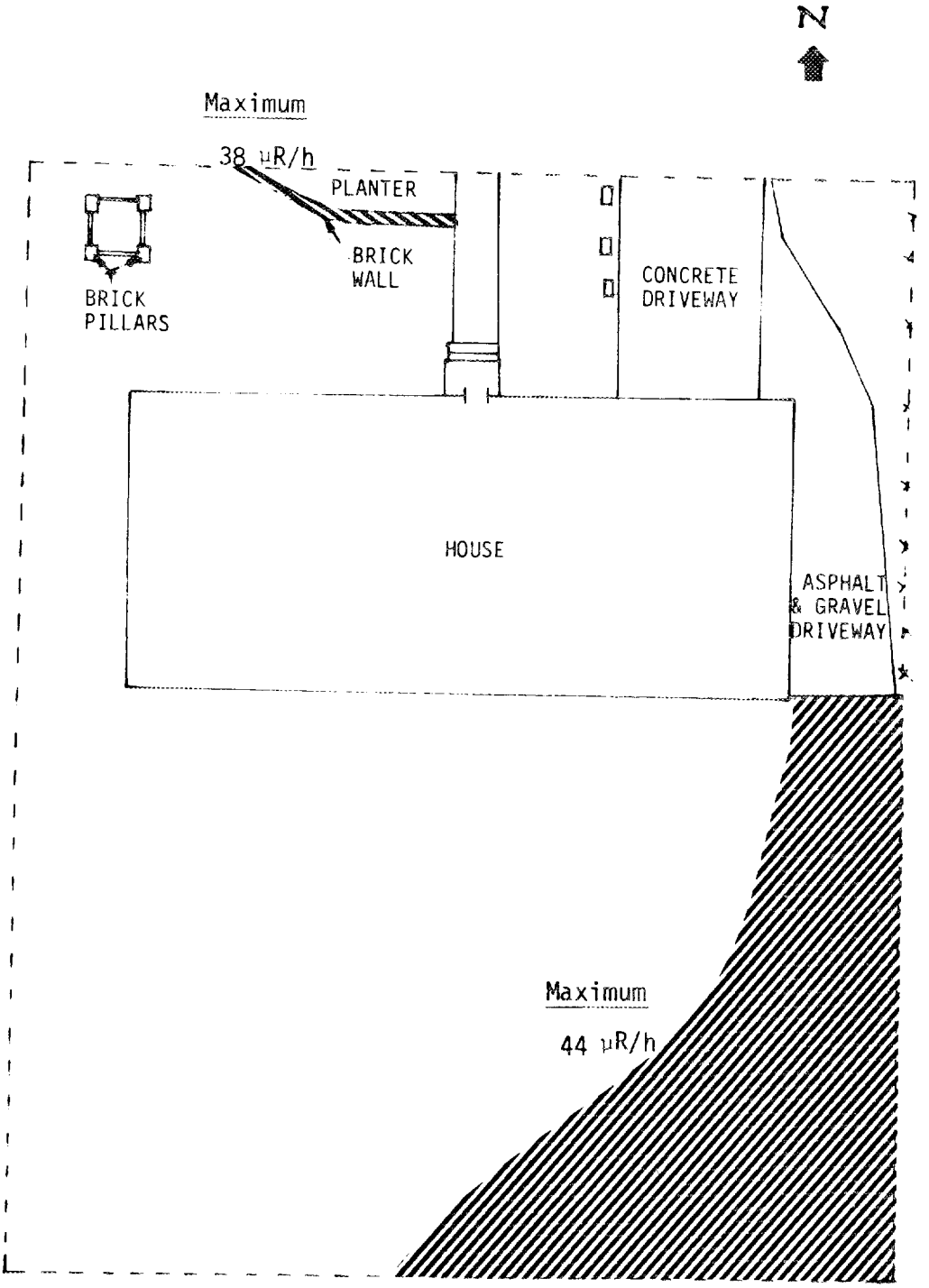
Lot N. of 349 N. Creek Ln.



M-122
Lot N. of 432 Silverstone E.

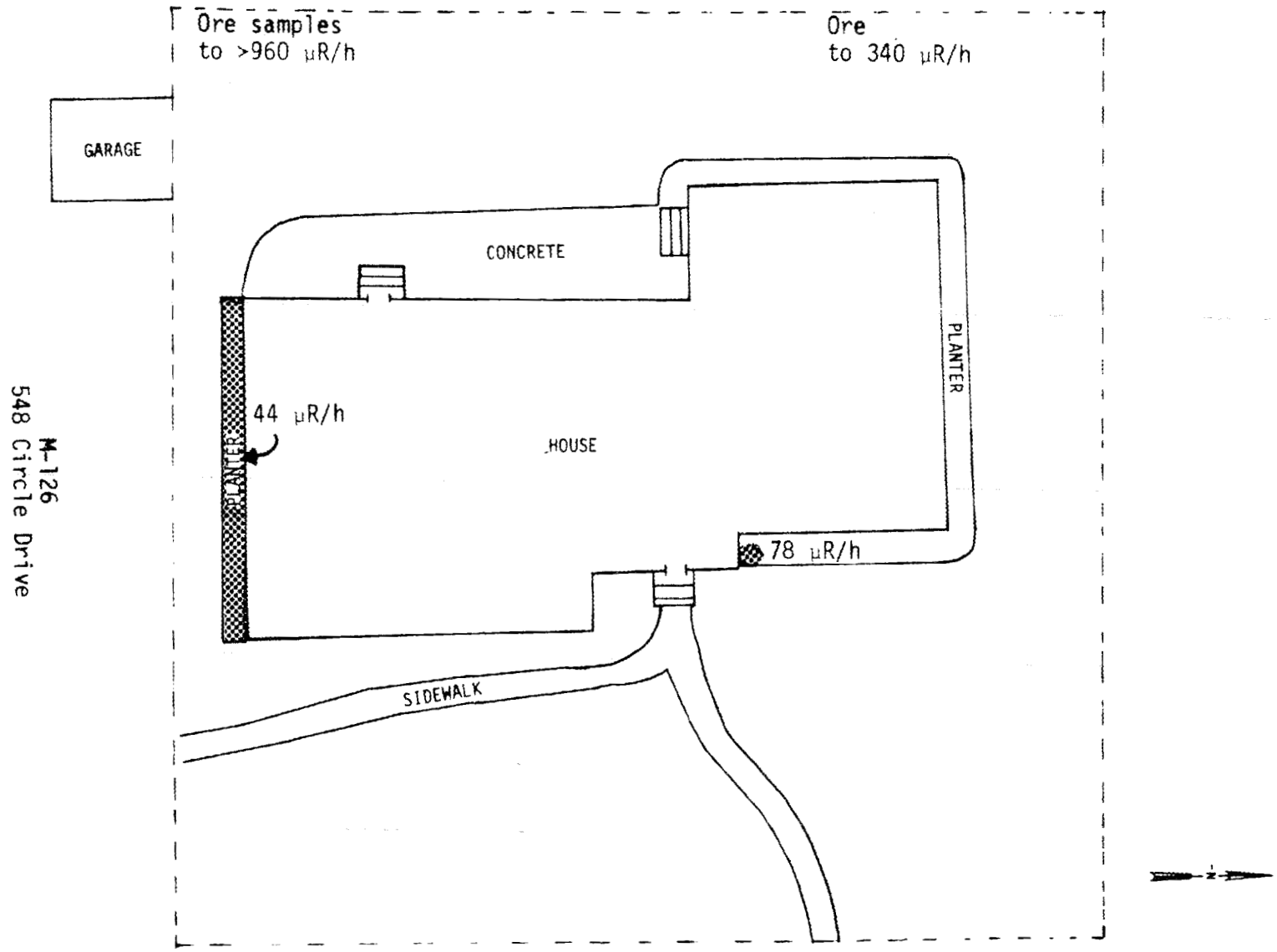


M-123
264 Silverstone W.

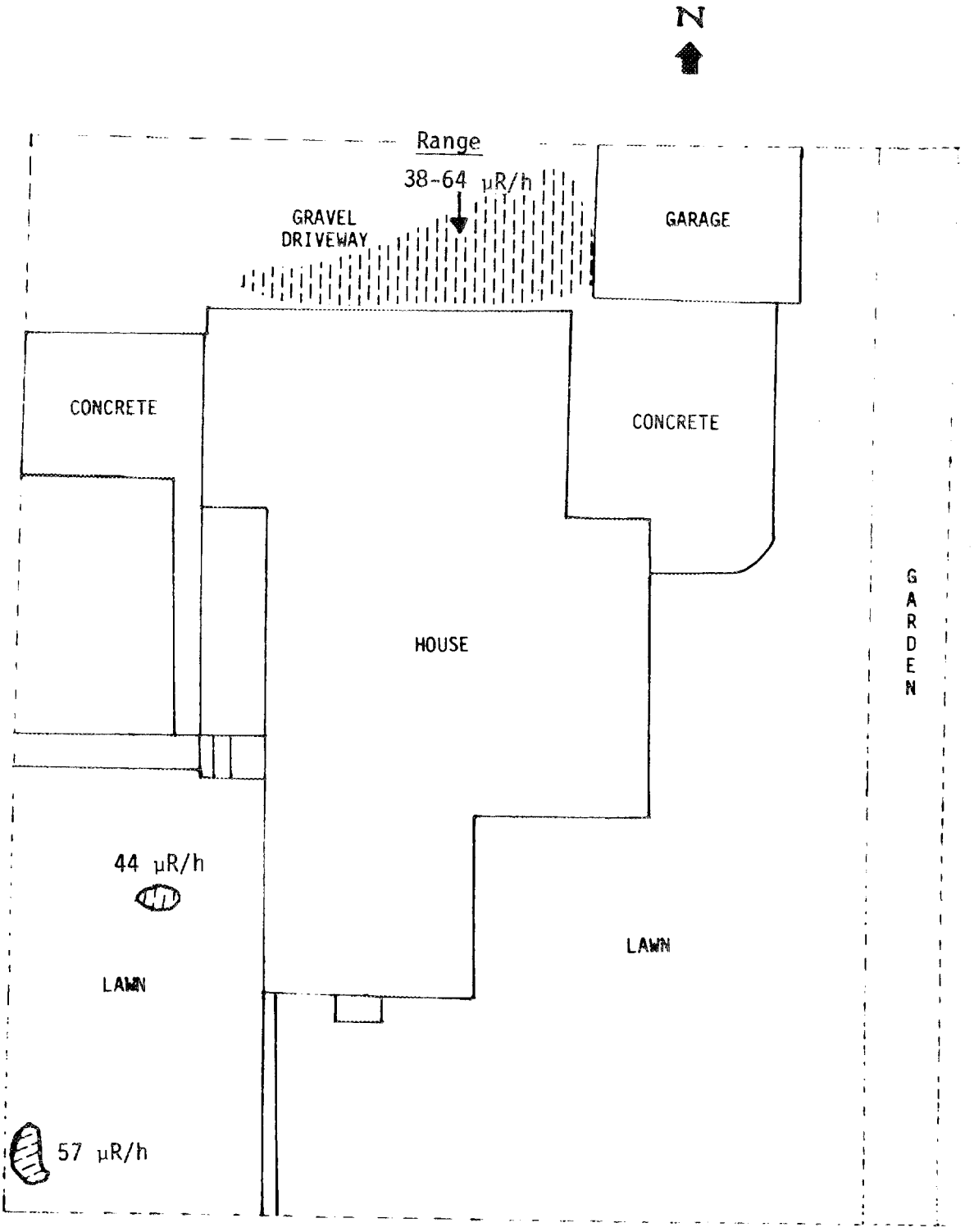


M-124

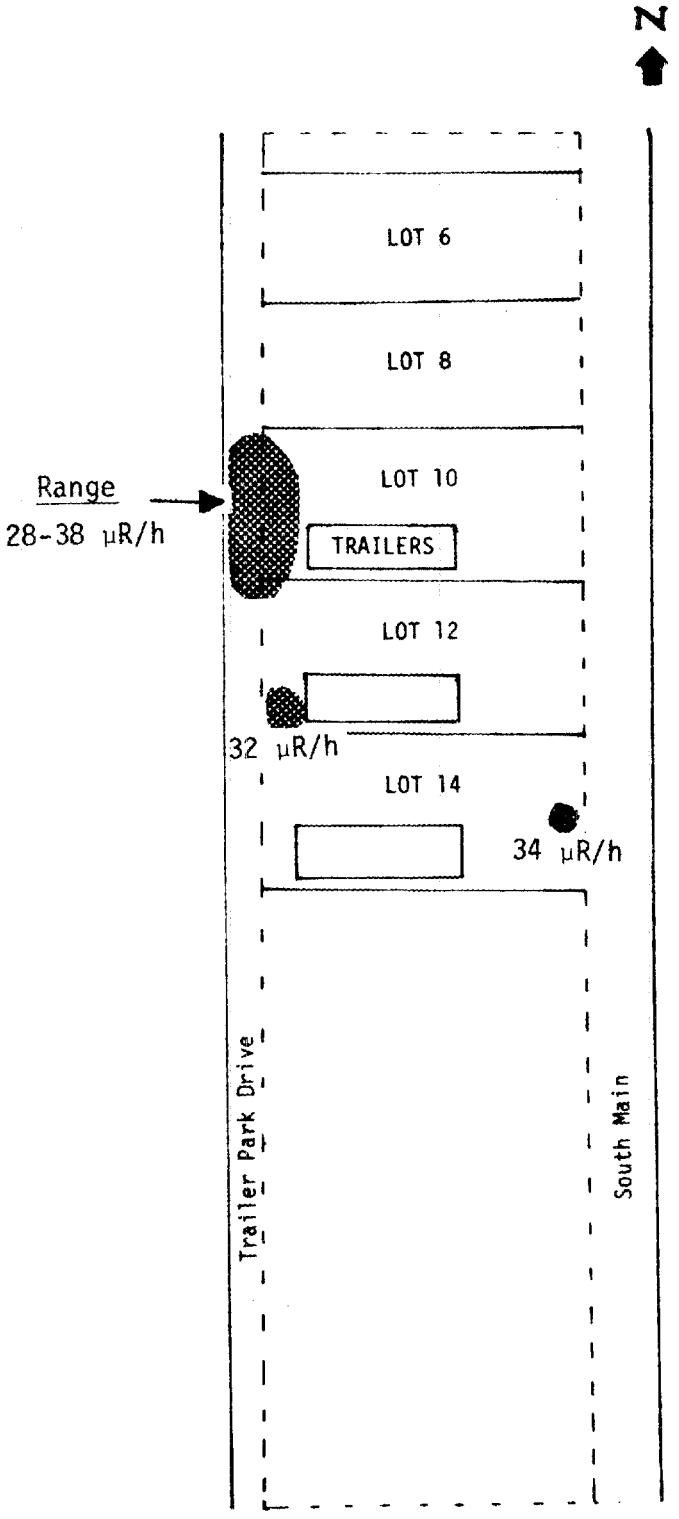
301 Silverstone W.



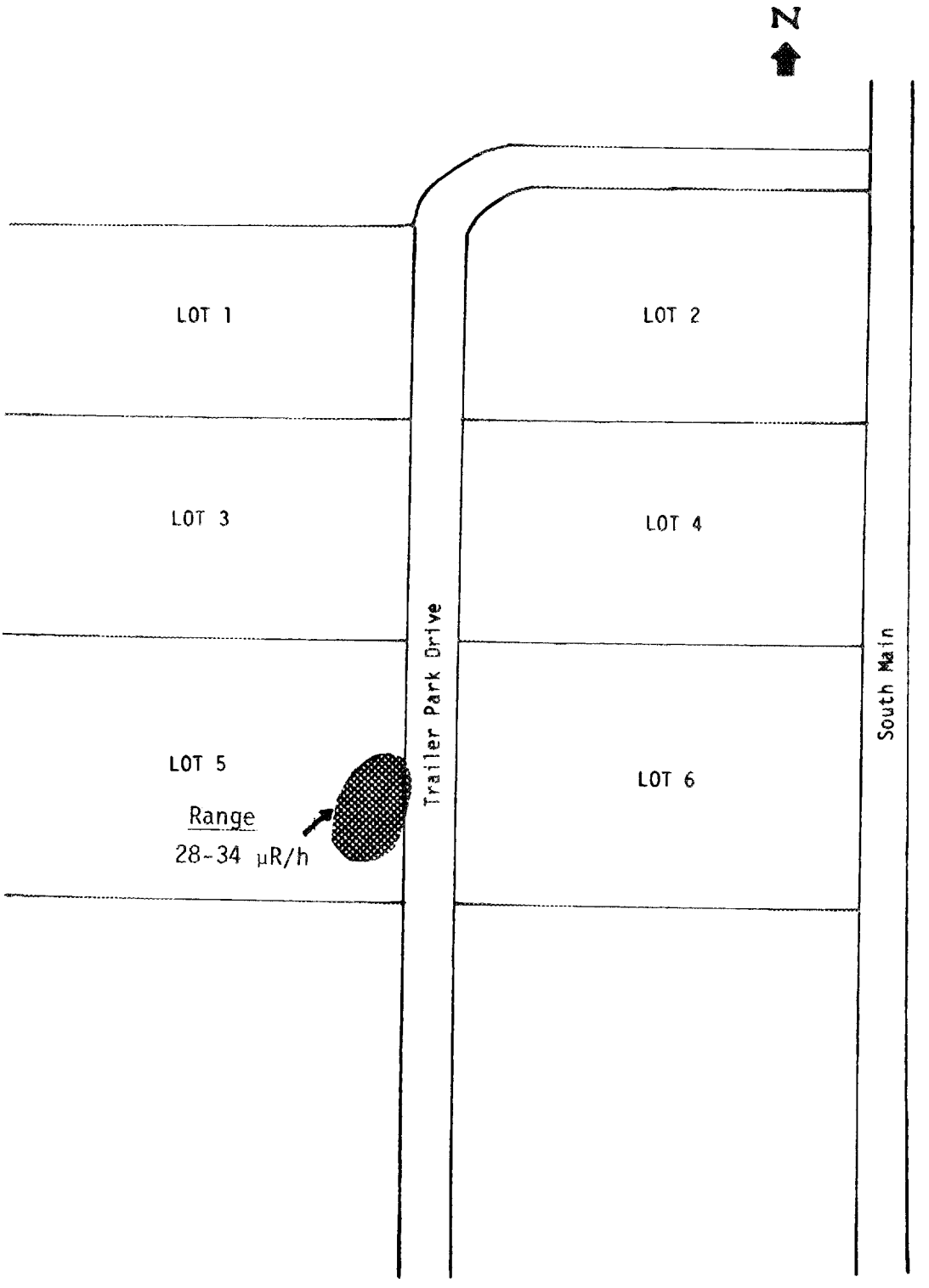
M-126
548 Circle Drive



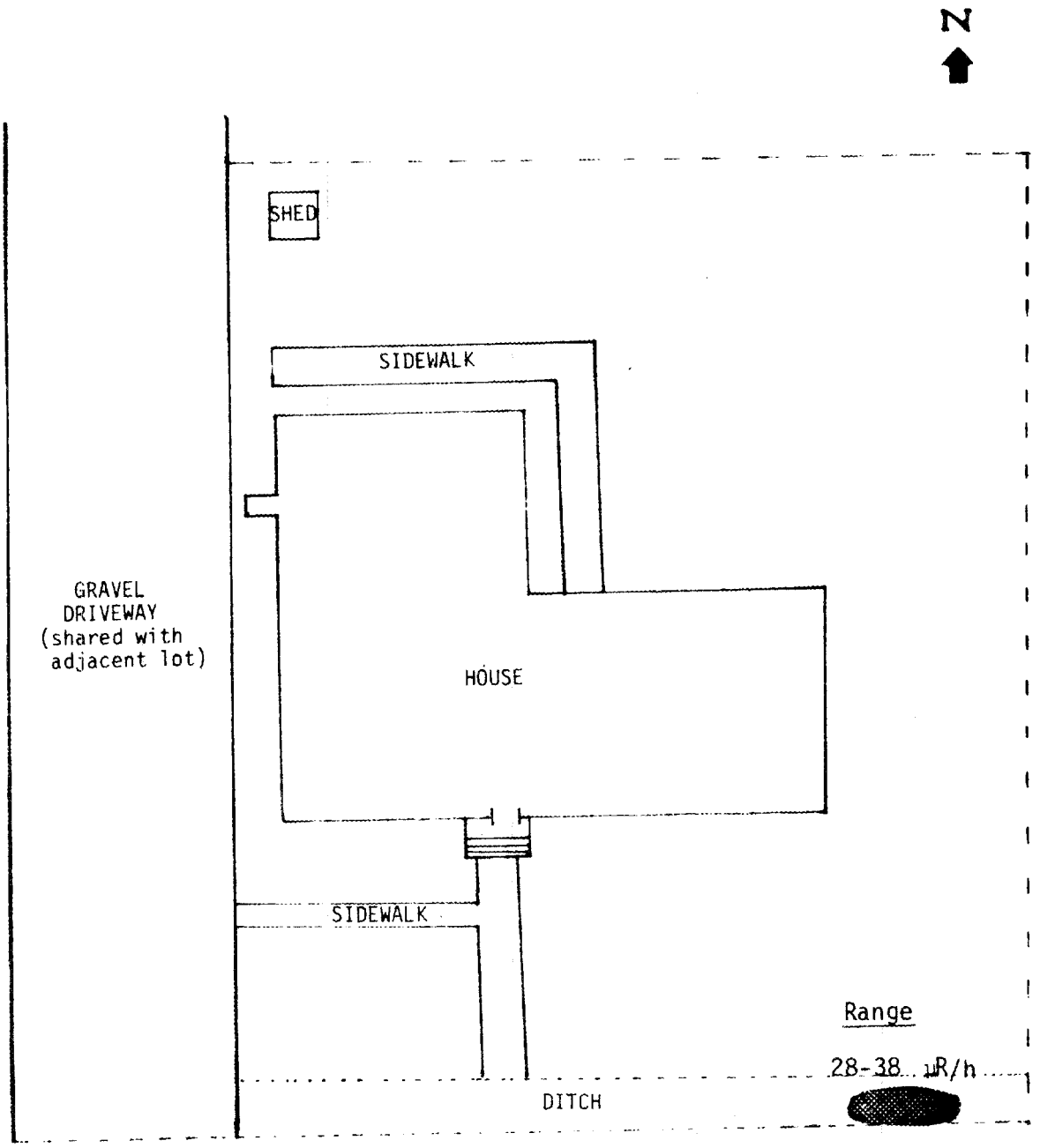
M-127
549 Circle Dr.



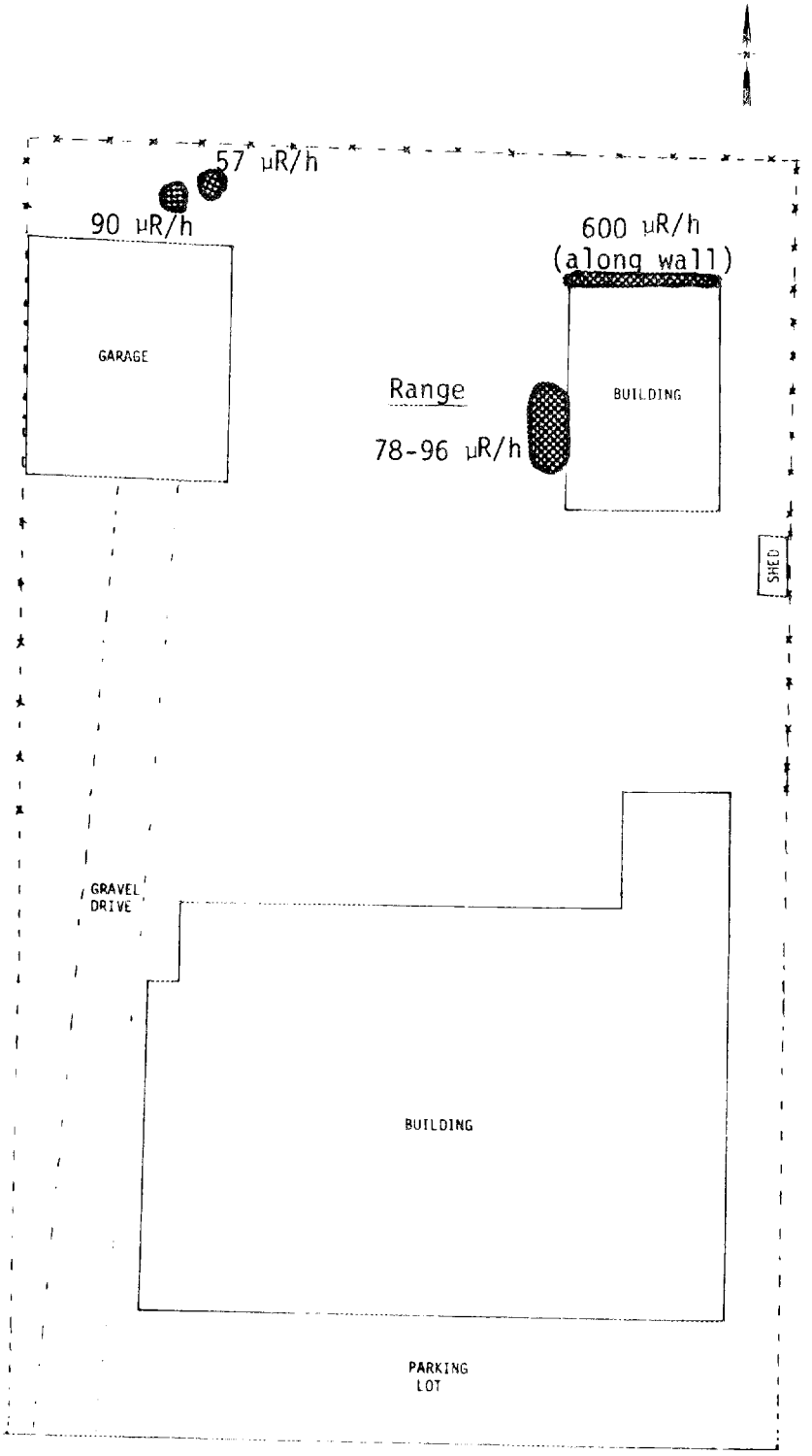
M-128
516 S. Main



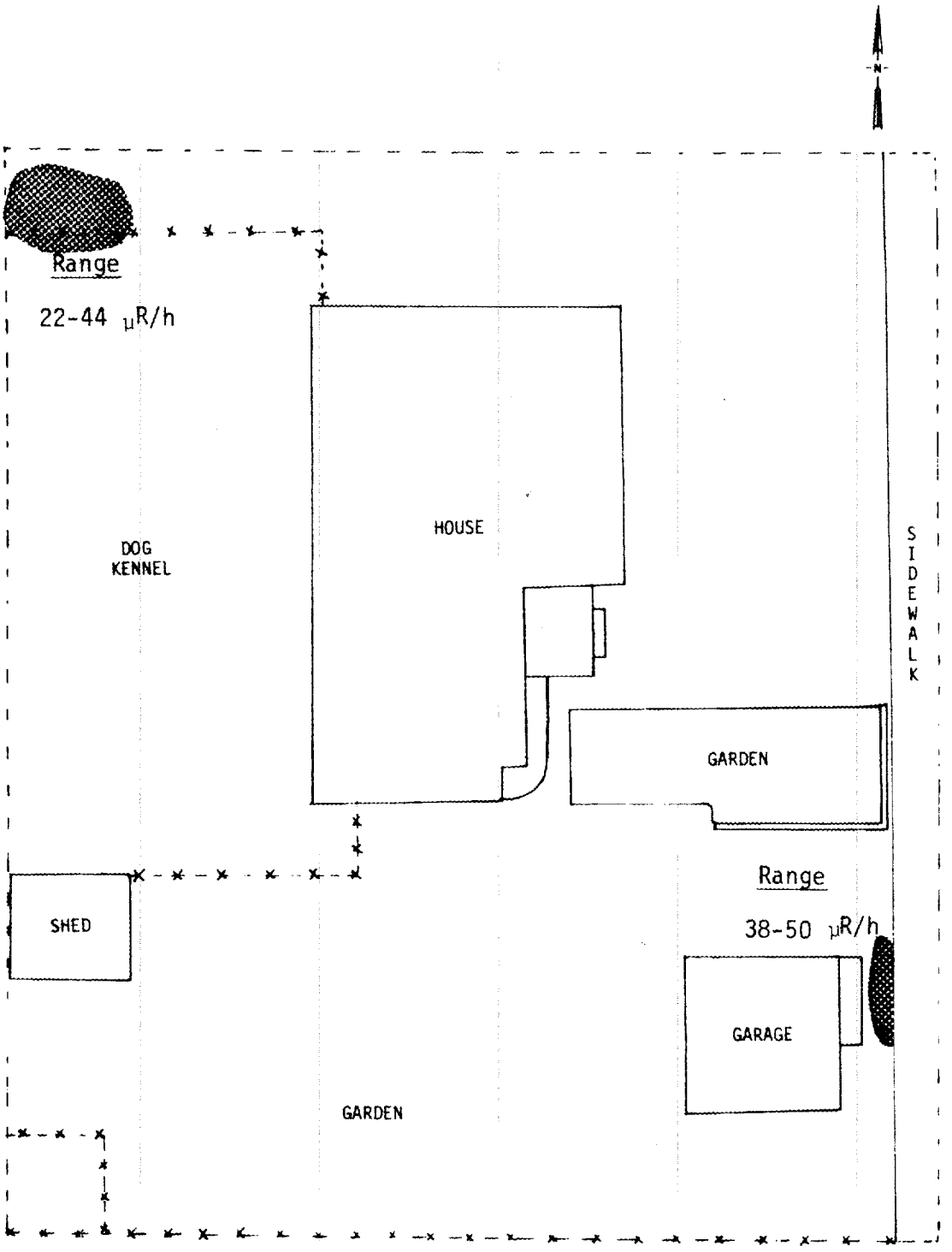
M-128
516 S. Main



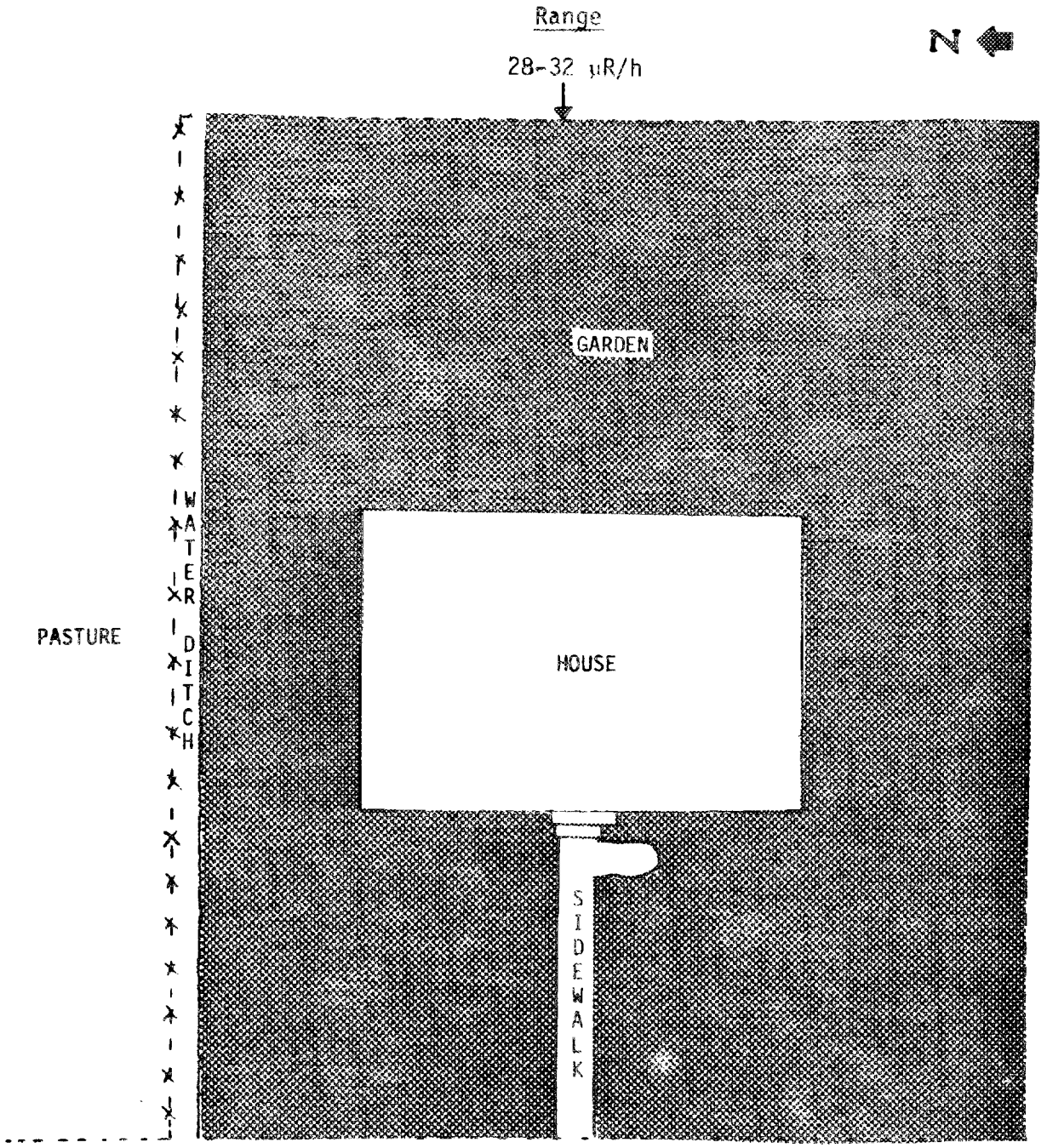
M-129
148 Uranium Dr.



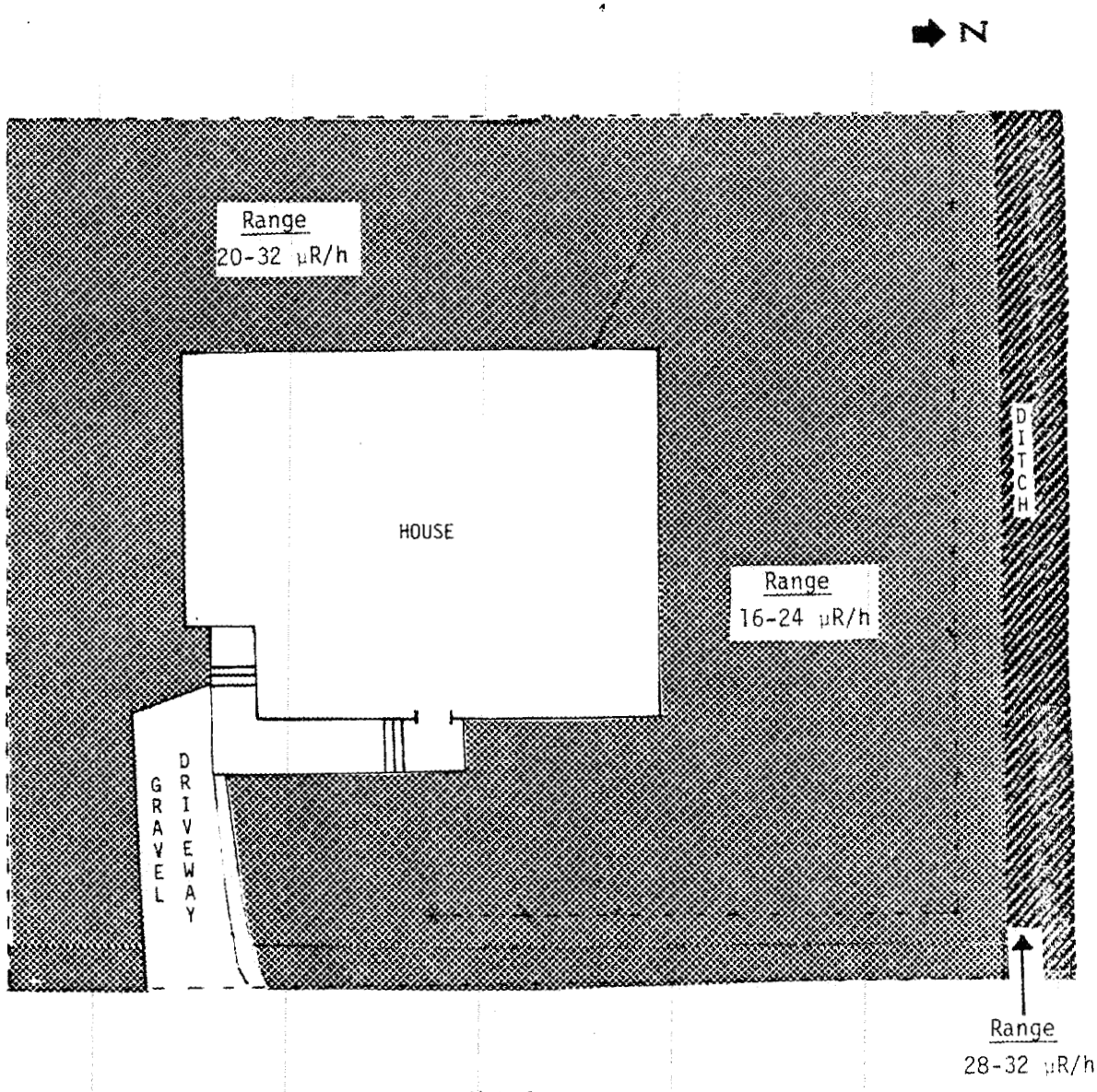
M-130
76 W. 3rd S.



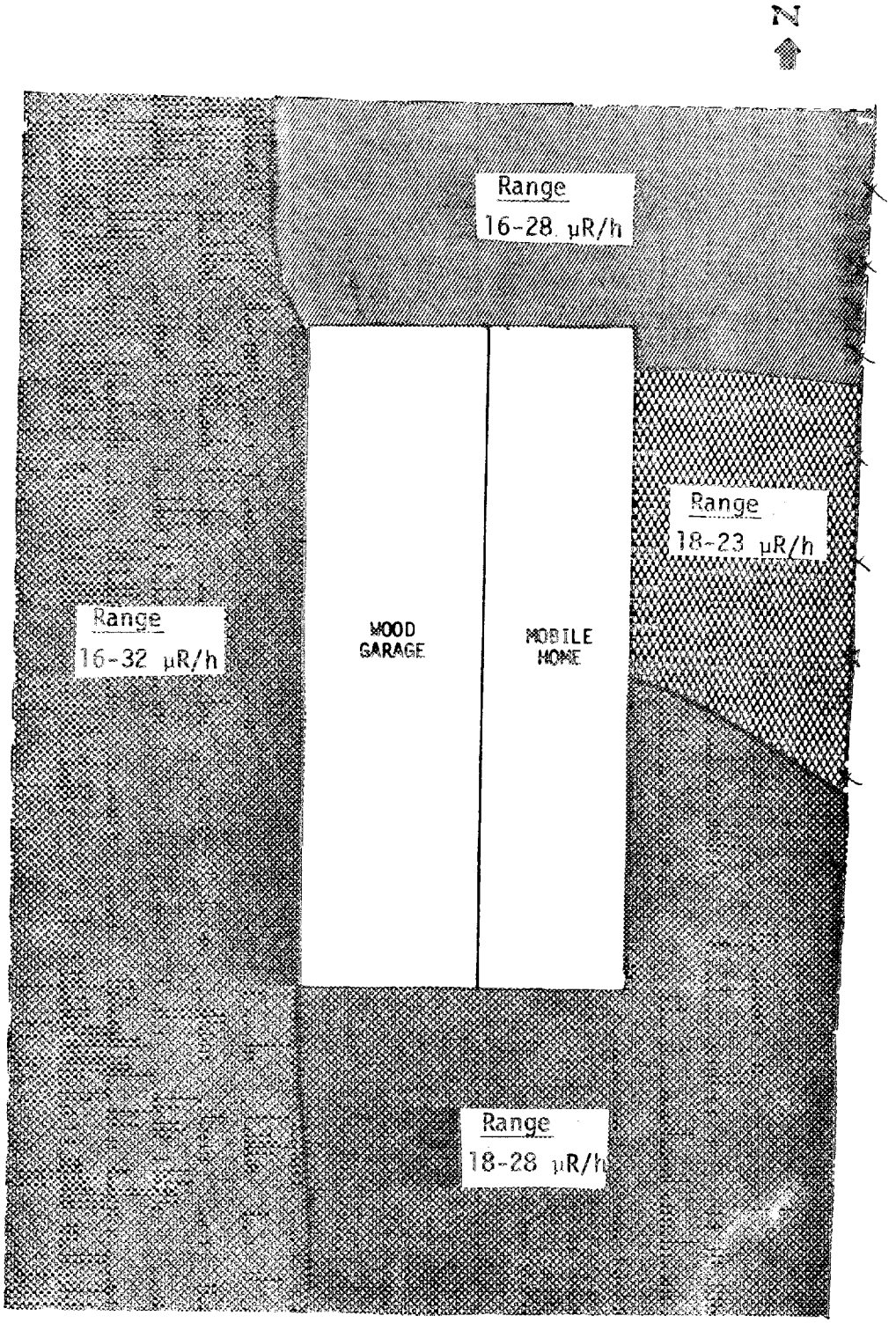
M-132
97 N. 2nd W.



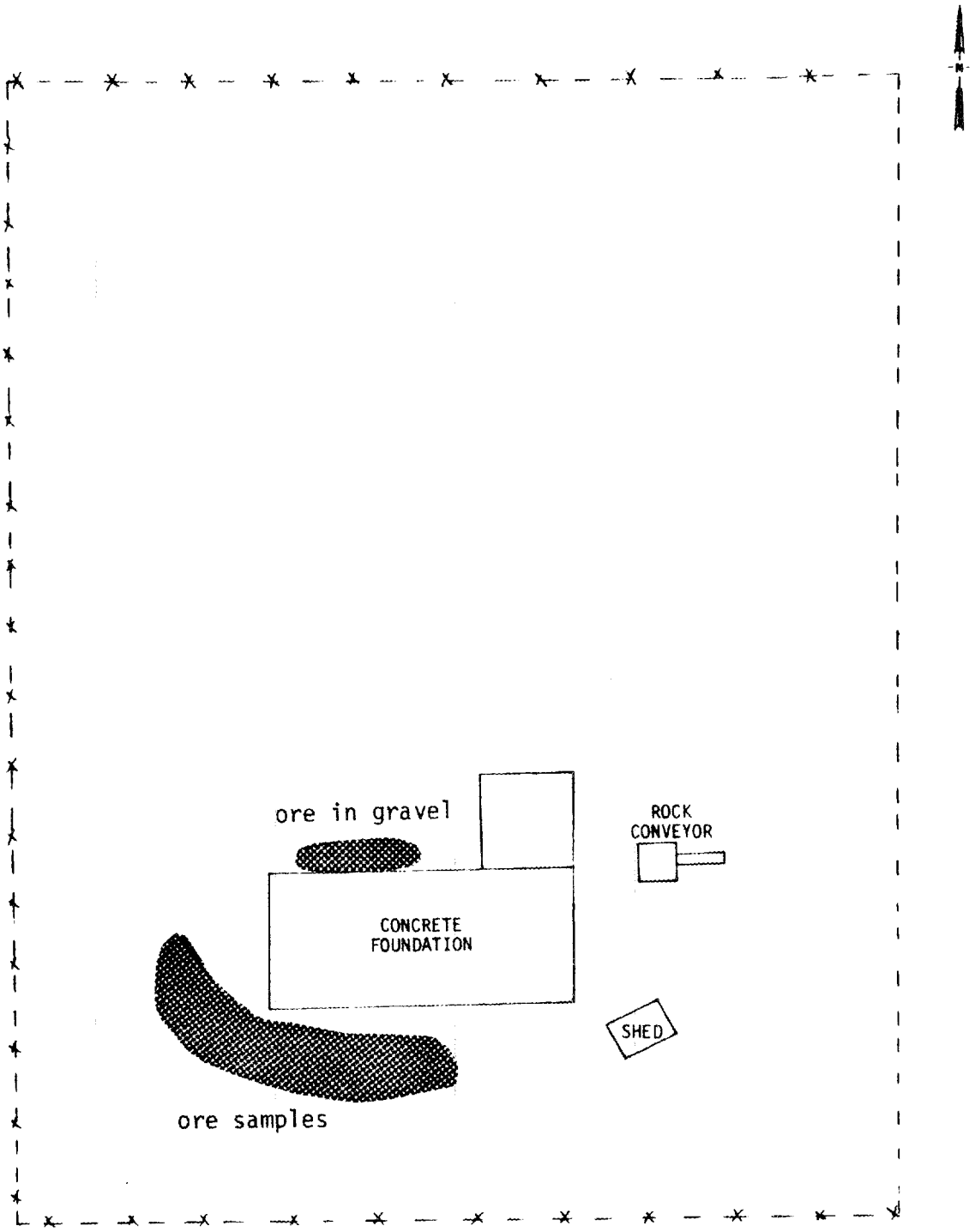
M133
233 S. 3rd E.



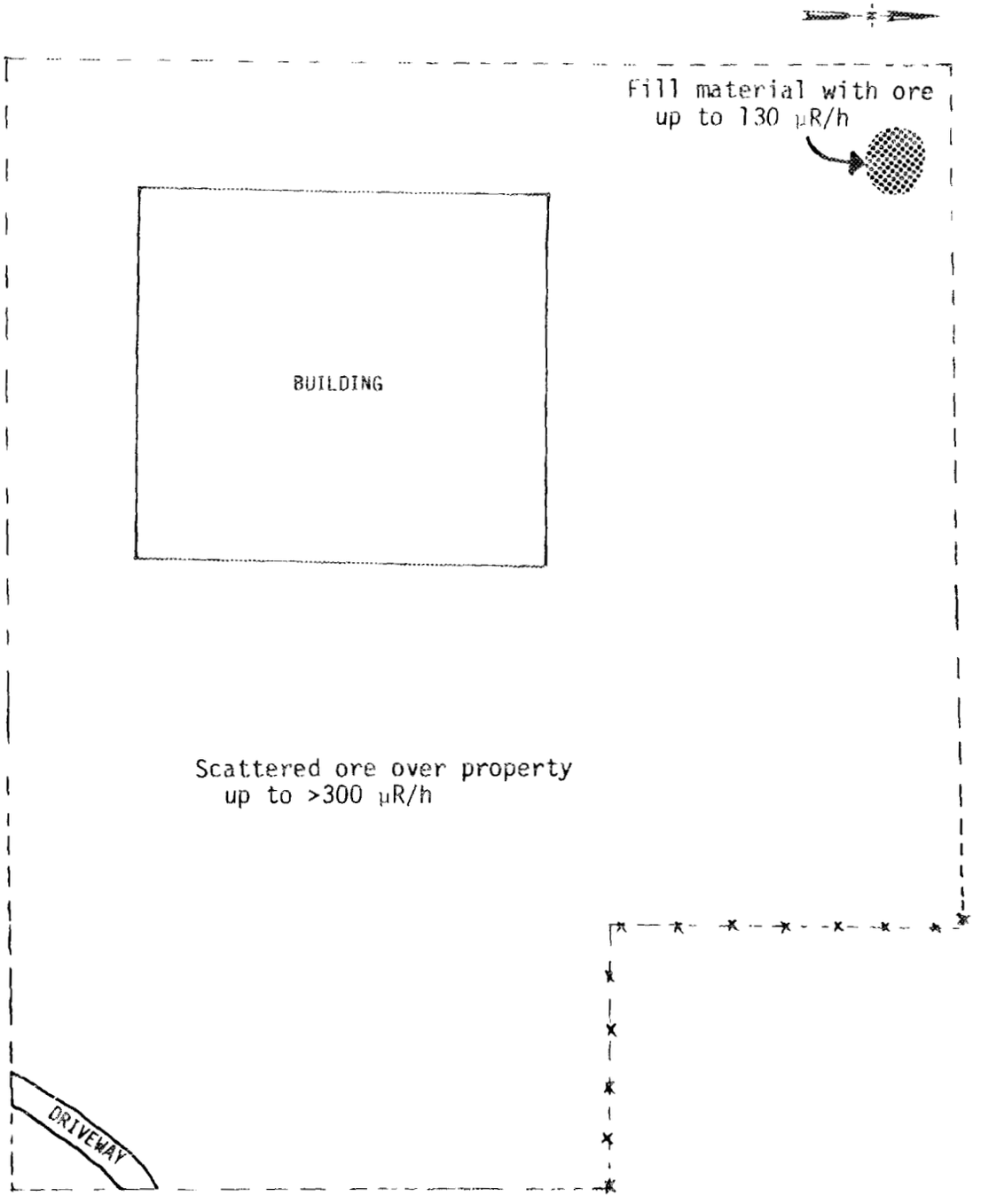
M-134
216 S. 3rd E.



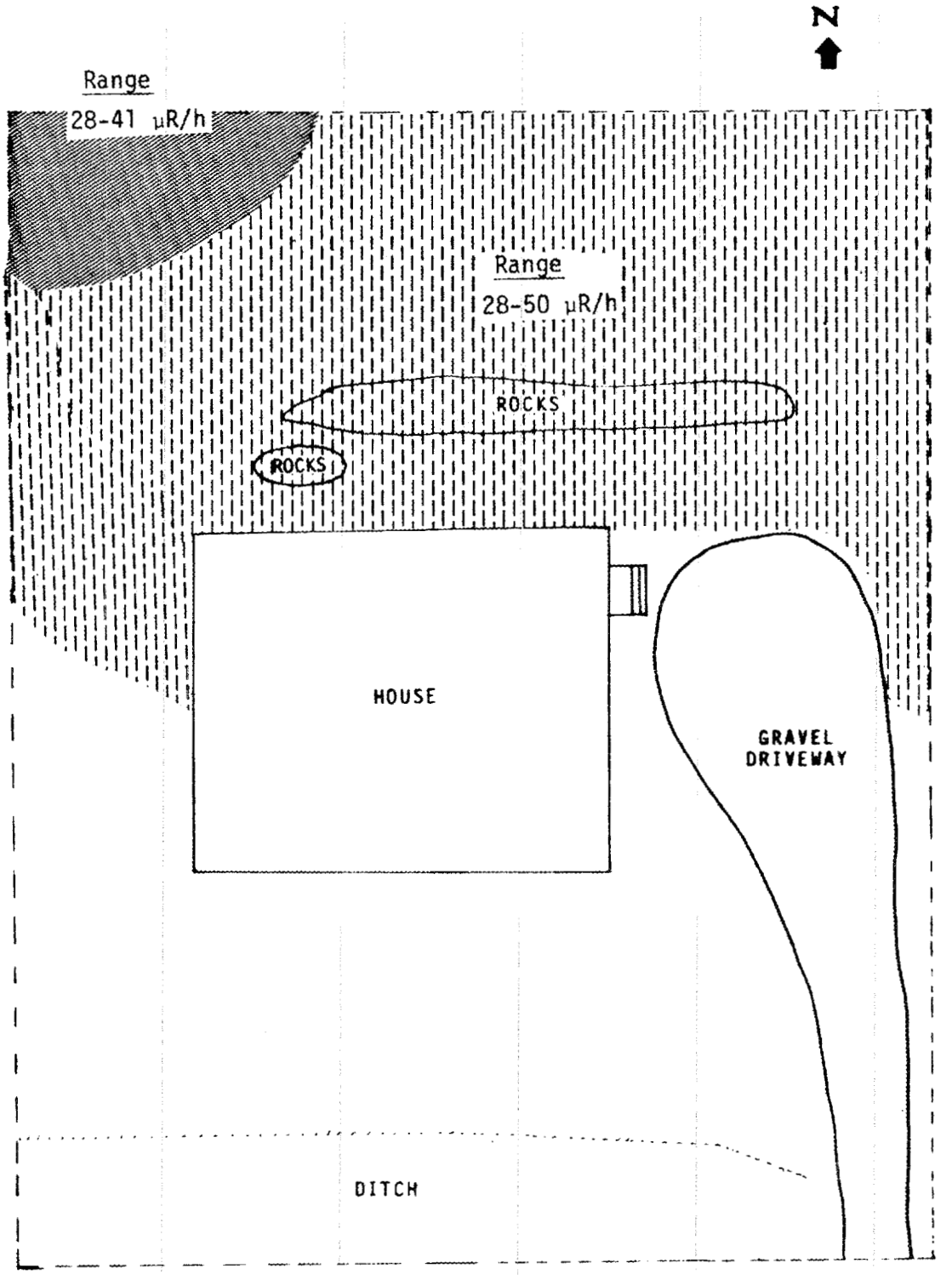
M-135
196 S. 2nd E.



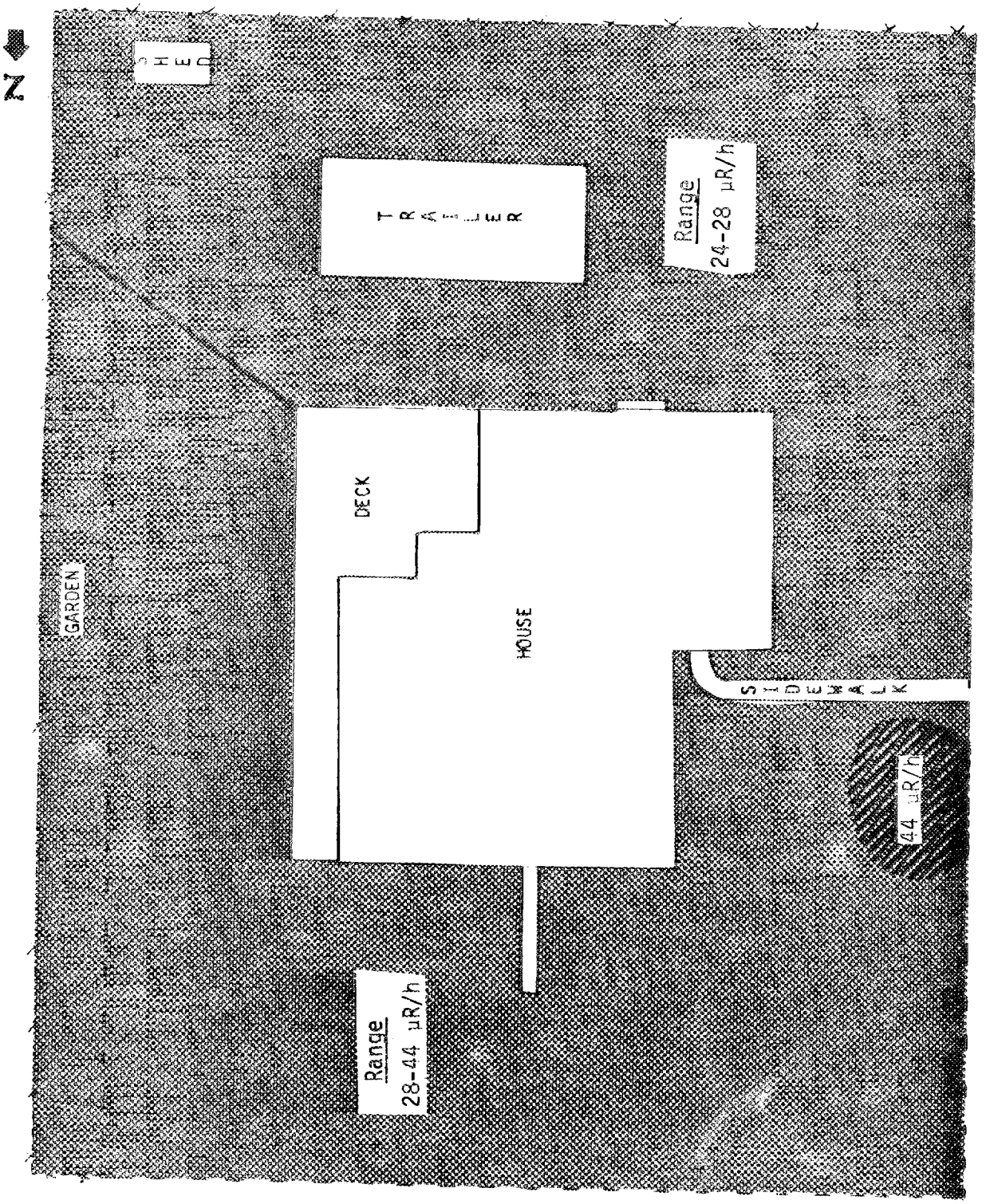
M-136
EG&G Area 6
Lot W. of N. Main



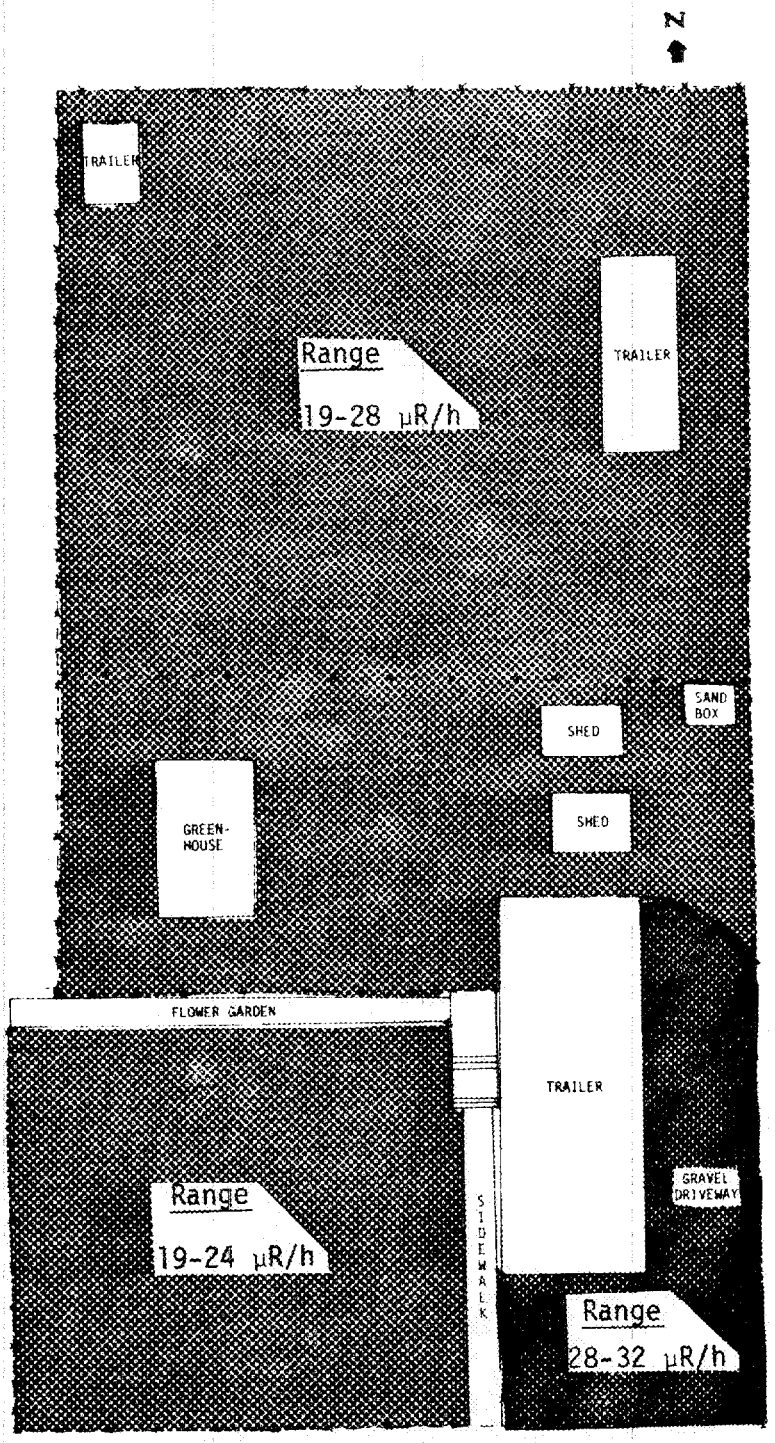
M-137
600 N. Main



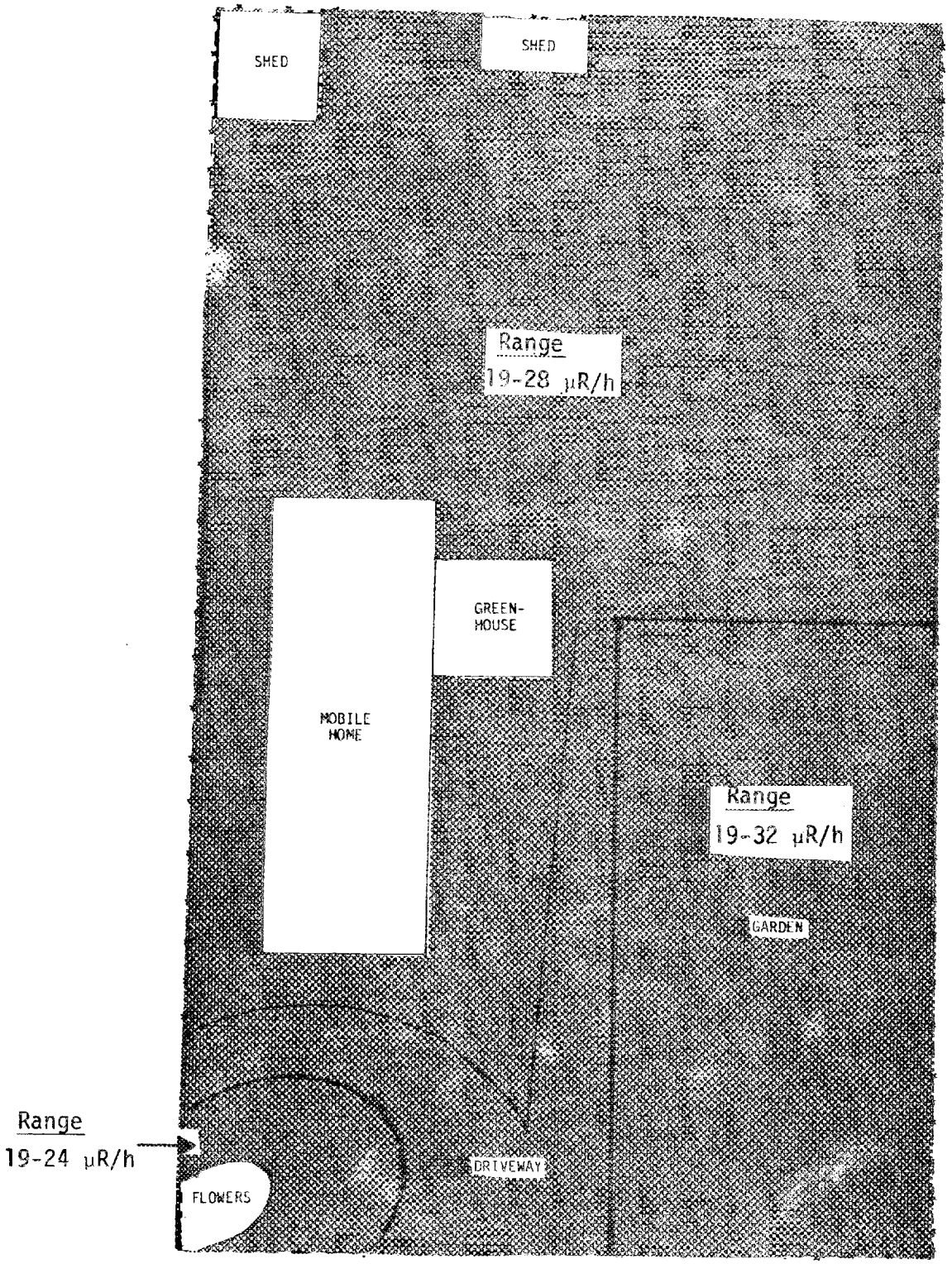
M-138
281 E. 3rd S.



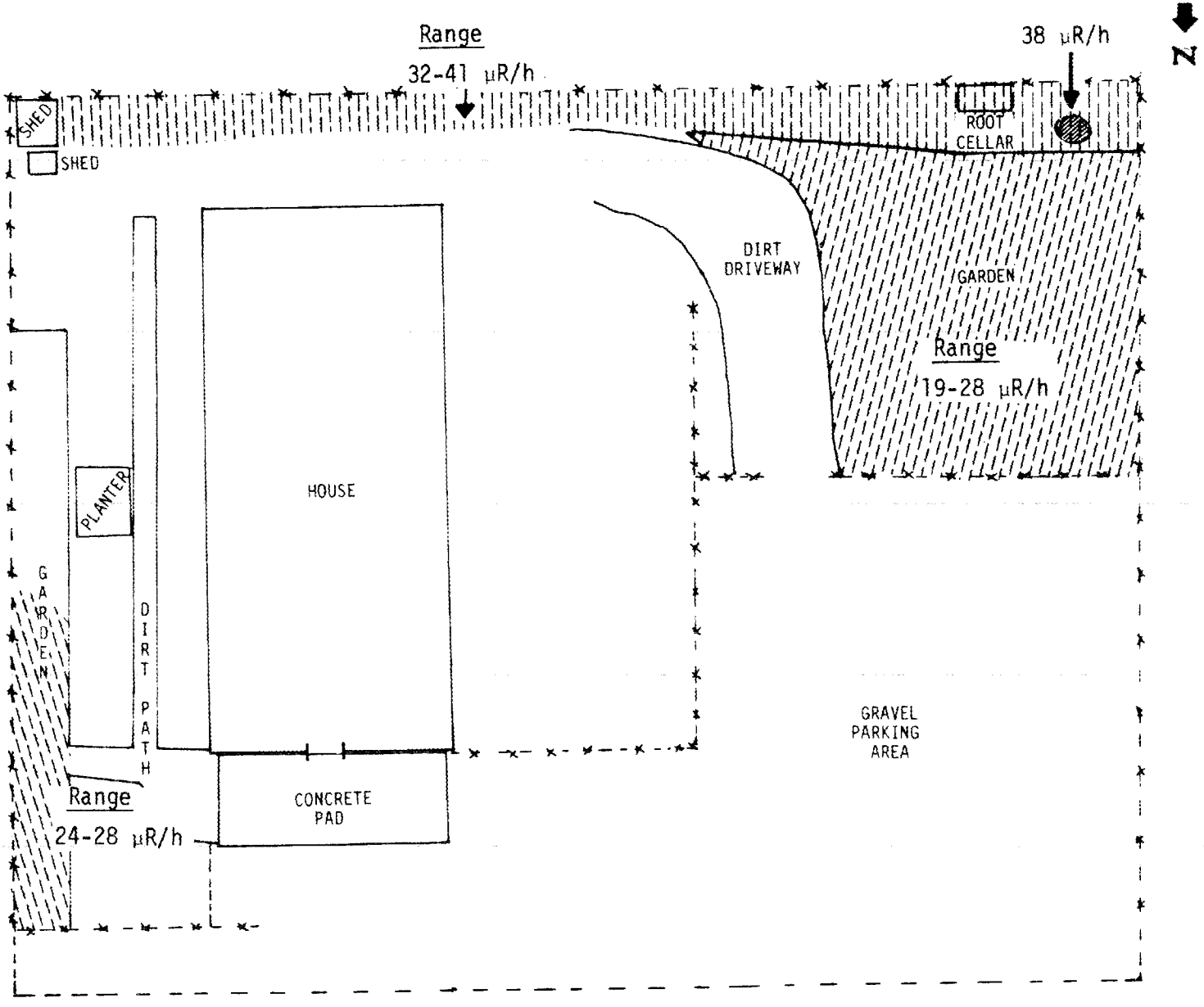
M-139
365 S. 2nd E.



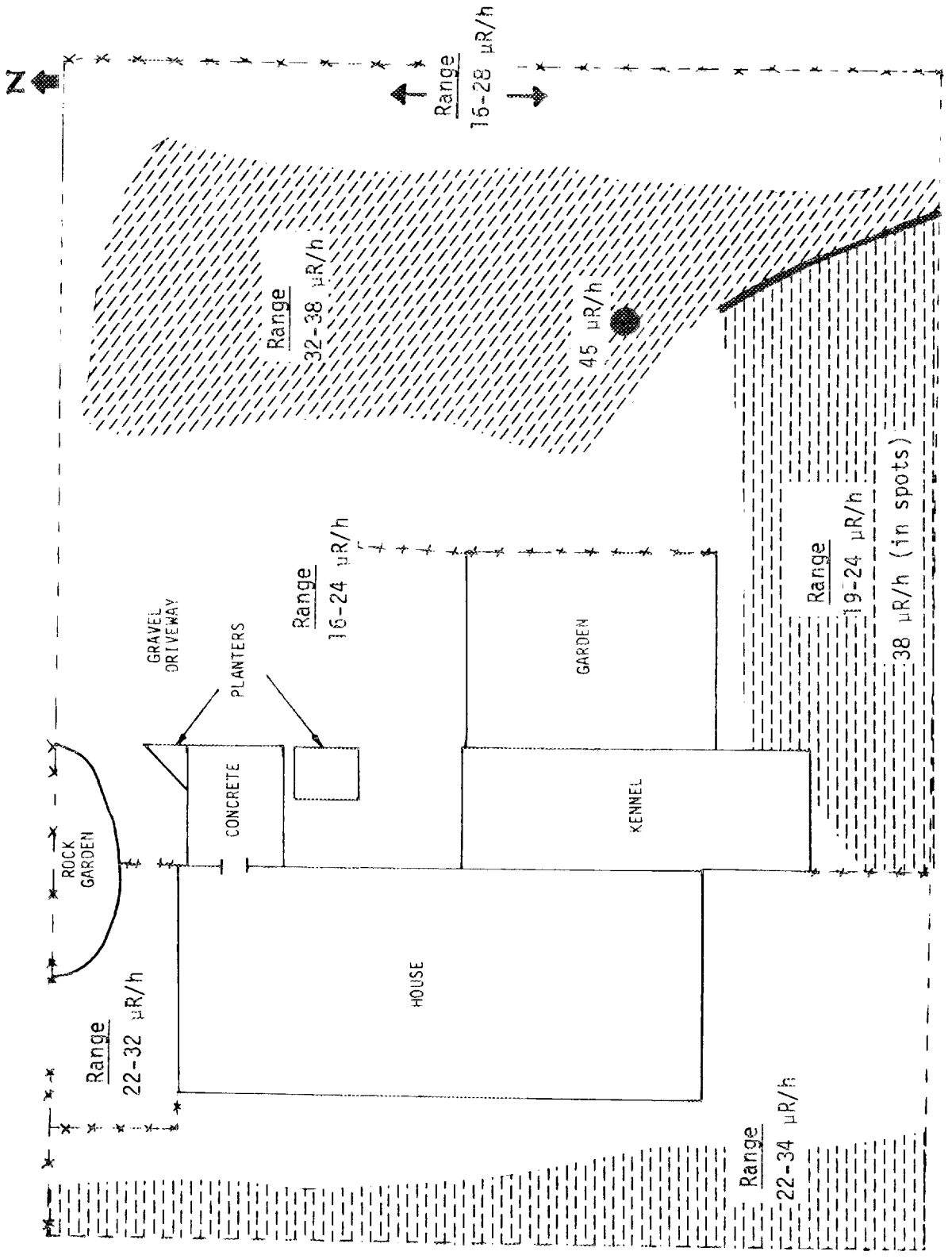
M-140
381 E. 3rd. S.



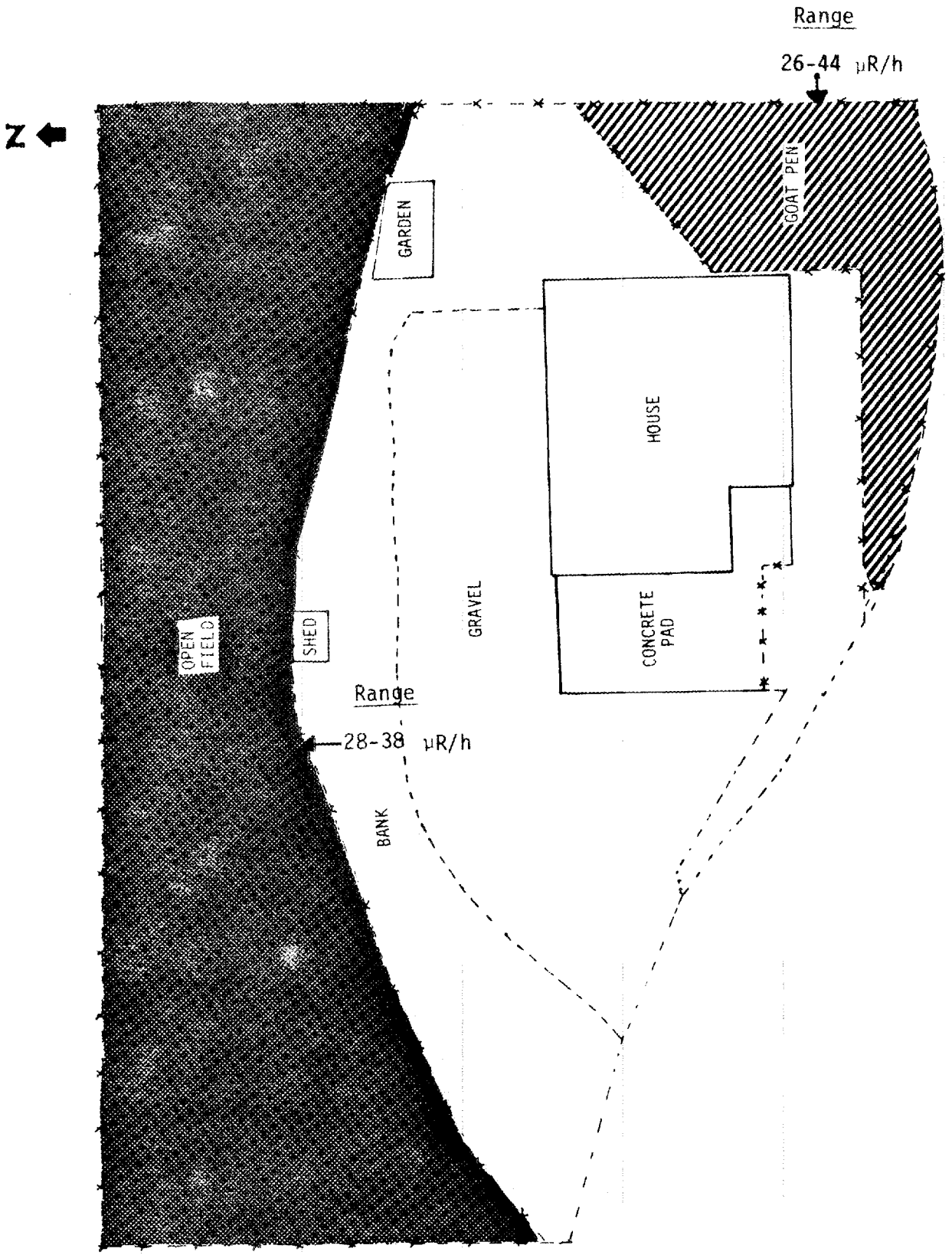
M-141
393 E. 3rd S.



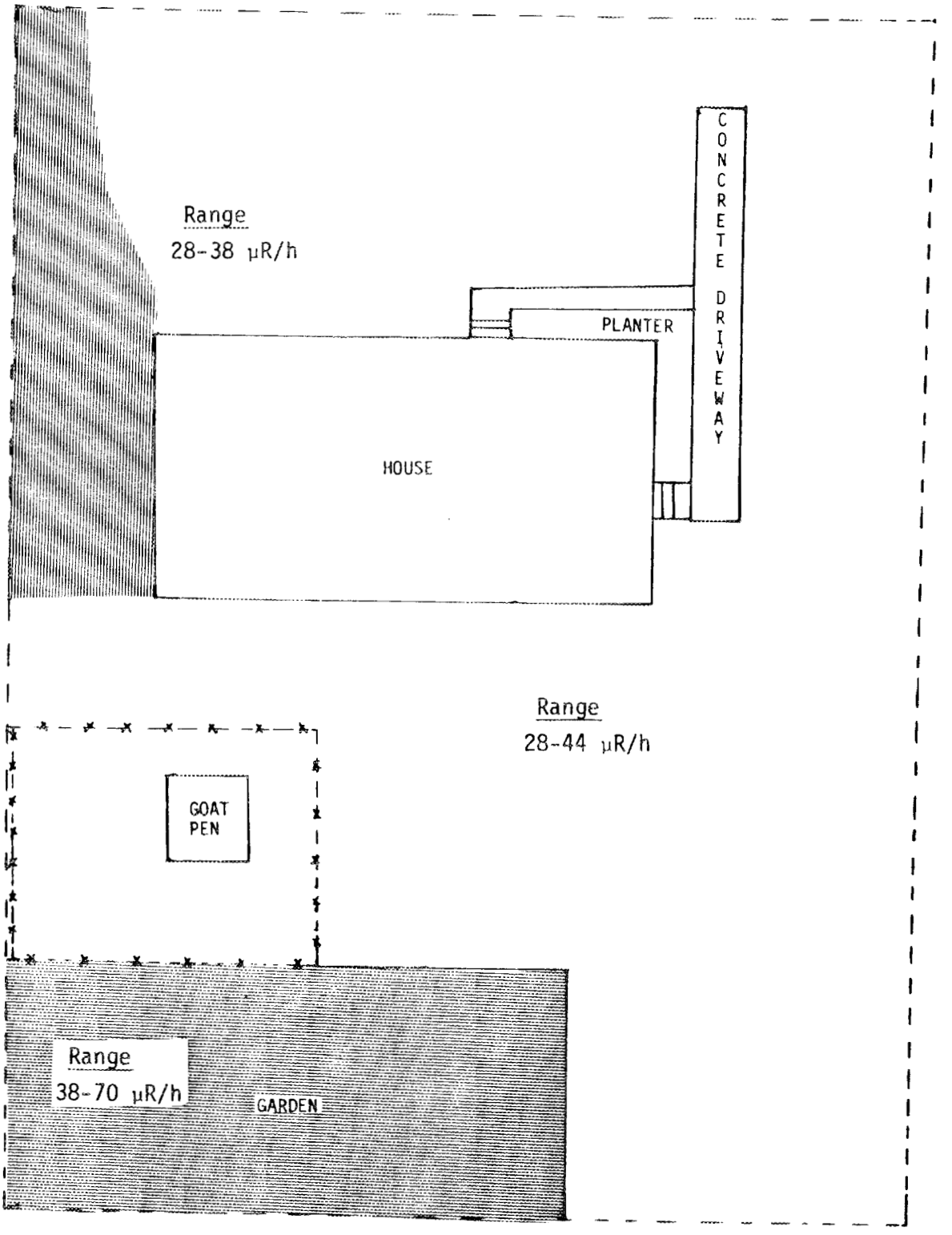
M-143
483 Cemetery Rd.



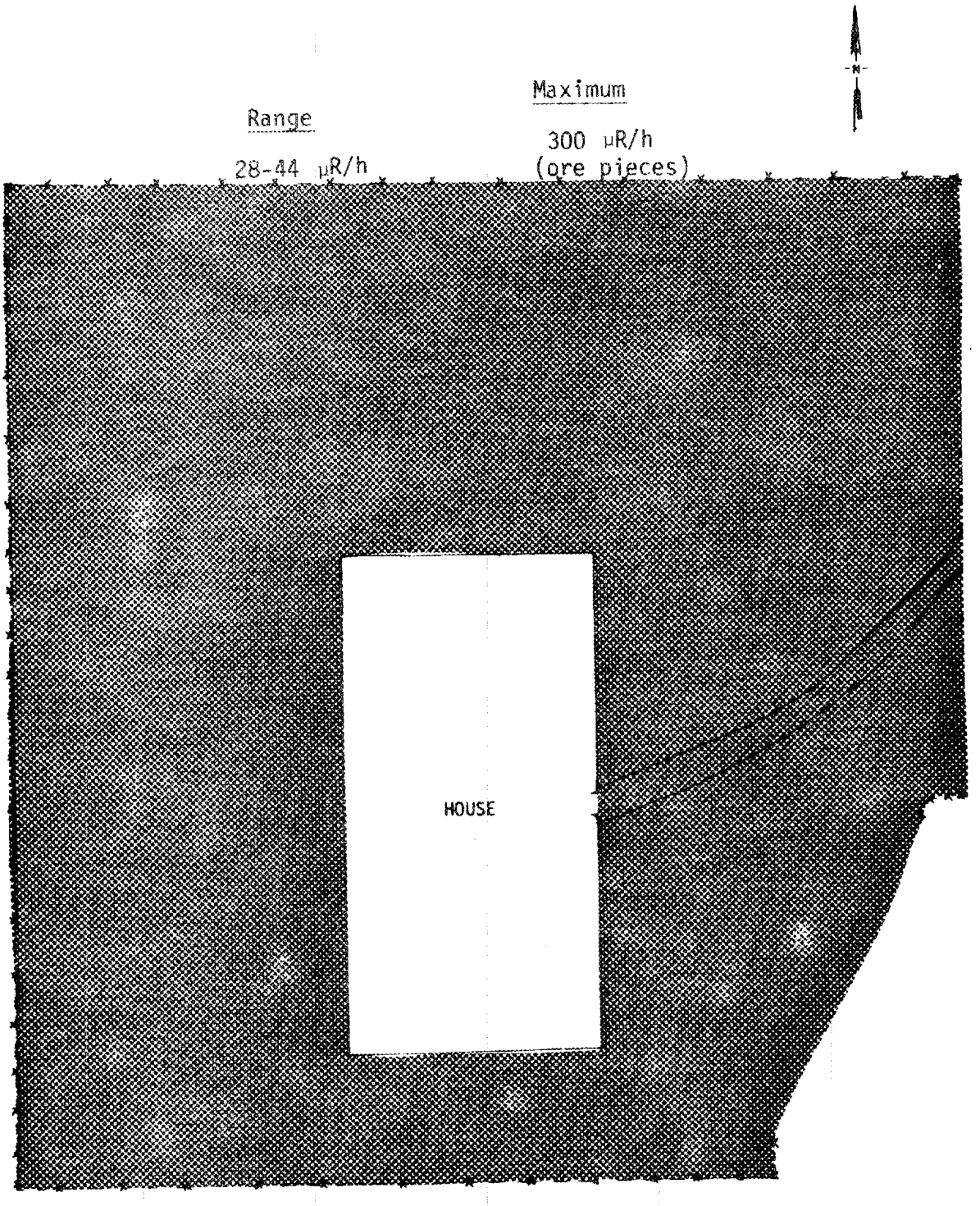
M-144
524 E. Cemetery Rd.



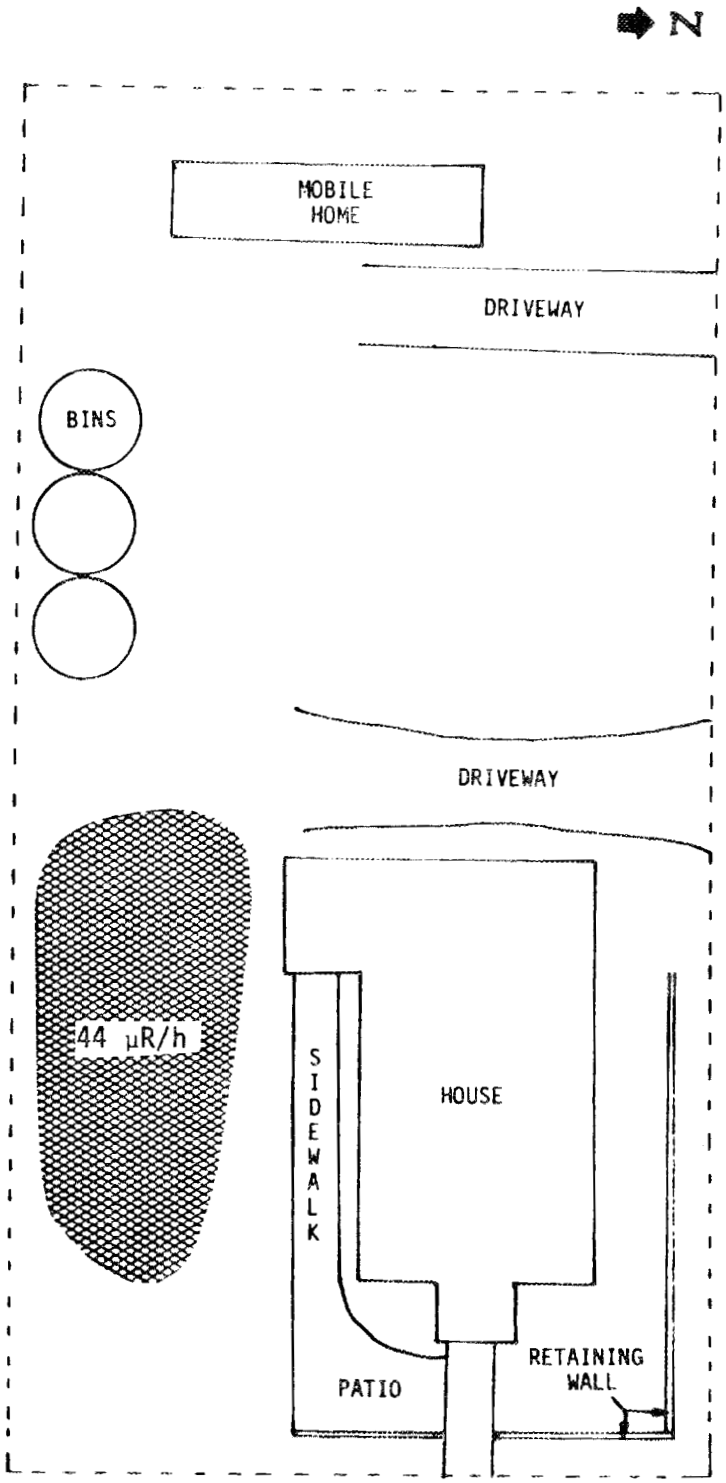
M-145
E. Lower Cemetery Rd.



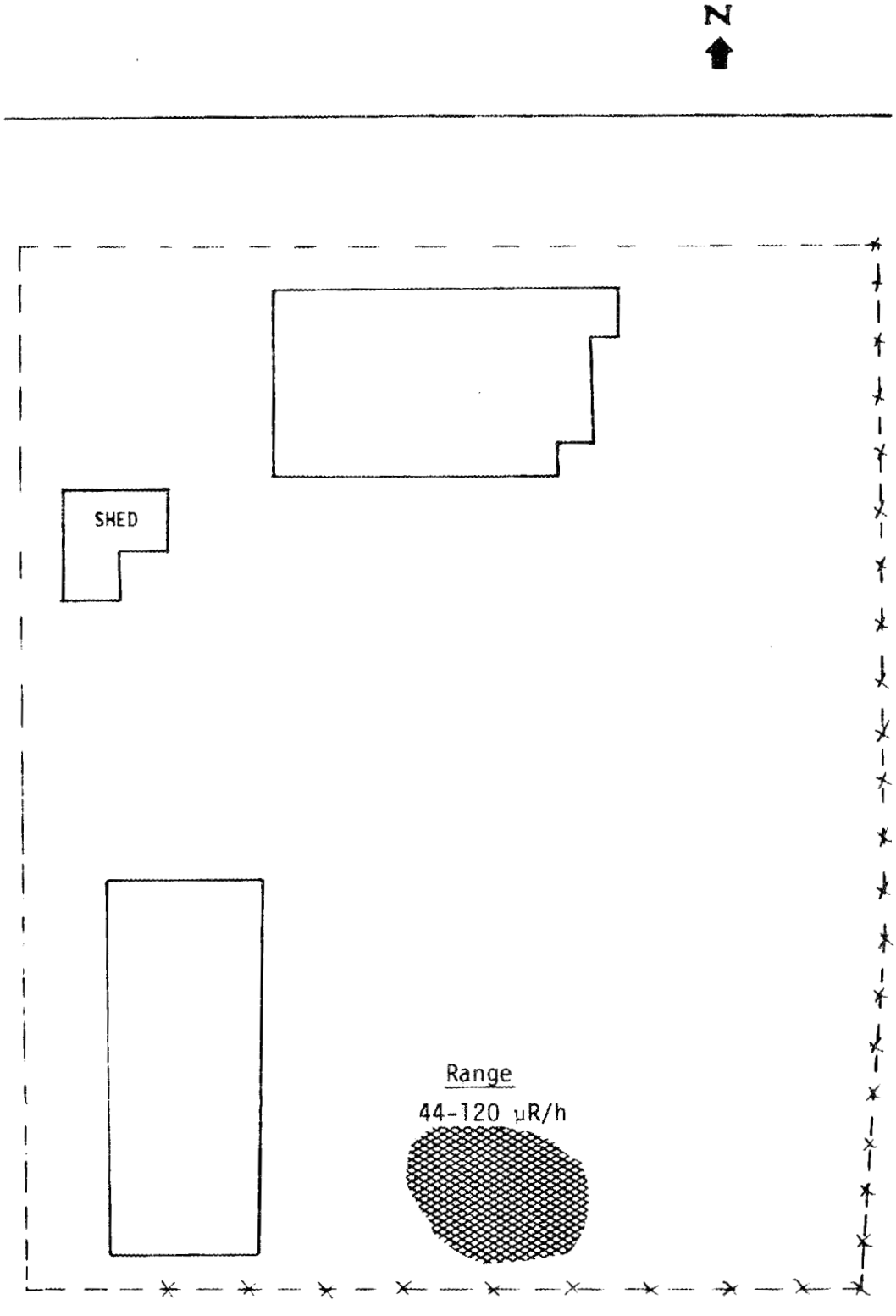
M-147
299 E. 4th S.



M-148
464 S. 2nd E.



M-150
416 S. Main



M-151
296 W. 3rd S.

APPENDIX III

EPA SURVEY OF 21 PROPERTIES WITH POTENTIAL MILL TAILINGS CONTAMINATION IN MONTICELLO

EPA SURVEY OF POSSIBLE MILL TAILINGS CONTAMINATION IN MONTICELLO, UTAH JUNE, 1984.

INTRODUCTION

In June, 1984, a radiation survey of 21 buildings in Monticello, Utah, was completed by the EPA Region VIII Radiation Programs Branch, assisted by personnel from the Office of Radiation Programs - Las Vegas Facility (ORP-LVF), the Region VIII Field Investigation Team, and the Utah Department of Health. The survey locations were suggested by the U.S. Department of Energy (DOE), which had previously conducted extensive gamma radiation surveys in the town. Prior arrangements to survey the properties were made by the Southeastern Utah Health District. Interior radon and radon daughter measurements were made in 19 of the 21 buildings, and interior gamma radiation measurements were made in 10 of them not previously surveyed by DOE. Based on the short-term (grab) sample results, none of the buildings surveyed by EPA exhibited radon daughter concentrations (RDC's) in excess of 0.04 working levels (WL), 10 buildings had measurements on one or more levels exceeding 0.01 WL or 3 picocuries of radon (Rn-222) per liter of air (pCi/l). None of the buildings had overall average exposure rates in excess of 20 microrentgens per hour (uR/h, corrected) above the prevailing local background, and only one building had an individual room with greater than 20 uR/h above background. A summary of the results is shown in Table 1.

BACKGROUND

Monticello has a population of 1200 and is located about 290 miles southeast of Salt Lake City. It is the seat of San Juan County and, in area, the largest county in Utah. It is also rich in mineral deposits, being geologically an extension of the Colorado Plateau. Mining for radium, vanadium, and uranium has been carried out here since the late 19th century. In the early 1940's, the Federal Government built a vanadium mill in Monticello in order to assure a domestic source of this strategic metal. In 1947, the mill was acquired by the Atomic Energy Commission (AEC) and subsequently converted to uranium production -- a relatively simple matter since both materials are found in the same ore. For this reason the mill tailings from both processes were essentially identical, and both contained radium and other radioactive materials as waste products. After the mill itself was closed and dismantled in 1960, the tailings were stabilized on the site in four large piles. In addition to the AEC operation, other mills of various sizes and degrees of success have produced either uranium or vanadium at several locations throughout San Juan County, some still in operation to the present day. One of them produced vanadium in the 1931-39 era, and is located about 25 road miles north of Monticello in Dry Valley. Although this mill was closed over forty years ago, a small quantity of tailings remained on the site in an uncontrolled fashion until 1984, when the owner took steps to consolidate and cover them at the request of the State.

Despite some efforts at control, uranium and vanadium mill tailings were used for construction and fill material at various locations in Monticello. Furthermore, areas near the AEC mill were subjected to windblown tailings from

the piles before they were stabilized and covered. Several investigations by EPA, DOE (successor agency to the AEC), and the State of Utah have identified fairly well those properties with elevated levels of gamma radiation which may have resulted from the presence of tailings. The DOE surveys of 1982-83 identified 147 locations of elevated gamma radiation levels. Subsequent work identified 44 of those properties with gamma radiation levels or radon concentrations in excess of EPA Standards for Remedial Actions at Inactive Uranium Processing Sites (40 CFR 192), two of which have since been cleaned up through an EPA Planned Removal Action. Of the remaining 103 properties, 39 showed evidence only of ore (as opposed to tailings), 24 were judged to be uncontaminated, 15 have not been classified, and 4 sites were not surveyed because of the owners' unavailability or denial of access. The remaining 21 properties were surveyed for interior gamma radiation exposure rates and/or radon/radon daughter concentrations as described below.

Because of the previous ownership of the mill by the AEC, DOE has retained responsibility for the Monticello millsite and the tailings that remain there. DOE also has the authority and responsibility to clean up vicinity properties away from the millsite which have been contaminated by waste products identified as originating from the AEC operation, and it has adopted the EPA standards from 40 CFR 192, with minor modifications, as the cleanup criteria which will be applied to the contaminated Monticello properties. For properties contaminated with material originating from other than the Monticello millsite, however, DOE has stated they have neither the authority nor the responsibility for remedial action. In these cases, cleanup of the contamination may be carried out under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) if certain requirements are met, and the responsibility for the cleanup would be shared by EPA and the State. At the 21 sites where DOE did not have adequate data to determine their eligibility for remedial action, EPA Region VIII and the State of Utah cooperated in surveying these buildings, some of which were suspected of having been contaminated by tailings from the old Dry Valley mill.

SURVEY METHODS

As noted previously, DOE suggested 21 properties for this survey because information from previous surveys was inadequate to determine whether these properties exceeded the standards in 40 CFR 192. It was proposed that grab samples for radon and radon daughters be taken in all of these buildings according to the inclusion procedures given in the Vicinity Properties Management and Implementation Manual (VPMIM, UMTRA-DOE/AL-050601, June, 1984), which basically gives the following standardized conditions for the sampling:

- -- recent outside measurements of Rn-222 have not exceeded 2 pCi/l
- -- wind speeds in the area have not exceeded 10 mph for the preceding 4 hours
- -- doors, windows, and openings in the structure have been closed for the preceding 12 hours
- -- ventilation systems which introduce outside air into the structure have not operated during the preceding 12 hours

In certain cases, all of these conditions could not be met, and those exceptions are noted in Table 1 as well as on the individual data sheets in

Apperdix A. The sampling equipment was provided jointly by EPA Region VIII and the ORP Las Vegas Facility (LVF) and was operated according to LVF Standard Operating Procedure #13, included here as Appendix B. At LVF, radon measurements are calibrated by deemanation of National Bureau of Standards (NBS) Reference Solutions of Ra-226, and are checked by periodic intercomparisons coordinated by the Environmental Measurements Laboratory of the Department of Energy. Radon daughter measurements are calibrated through alpha scintillation counting systems standardized with electroplated disk alpha sources which have been compared to similar sources provided by the NBS. Air volume measurements are compared to a wet test meter which is in turn checked periodically with a laminar flow apparatus whose calibration is traceable to NBS. Radon daughter calibrations have been periodically verified by intercomparisons among several recognized national laboratories.

At 10 of the 21 buildings, only gamma radiation surveys of the exterior and grounds of the property had been conducted previously by DOE, so indoor gamma measurements were made by the EPA survey teams throughout these buildings. Measurements were obtained with Ludlum model 19 scintillometers calibrated by the LVF, and the exposure rates indicated by the scintillometers were corrected to the exposure rate determined by a Reuter-Stokes model RSS-111 pressurized ionization chamber through a linear regression of comparative measurements at several selected exposure rates. The surveys were conducted in accordance with the inclusion procedures specified in the VPMIM, and the data are summarized in Table 1. Data for each individual site are found in Appendix A.

Site visits were made by three survey teams during the period June 19-21, 1984. For those buildings that were occupied residences, every effort was made to schedule the visit in the early morning hours before normal family activities would increase the household ventilation. Homeowners were requested to keep the buildings tightly closed during the preceding night, but some exceptions were noted. Several of the homes were vacant, which simplified the scheduling process. Commercial buildings were usually visited in the morning as well, so measurements could be made prior to the start of the business day. All scheduling arrangements were made by the District Sanitarian for the Southeast Utah Health District, who resides in Monticello, and his efforts greatly increased the efficient utilization of the survey teams. The weather was fair during the period of the survey, with only light to moderate breezes on the mornings of June 19 and 20, and the barometric pressure was stable.

At the request of the State, integrated radon daughter measurements were made at all of the sites where electrical power was available. Radon Progeny Integrating Sampling Units (RPISU's), provided by LVF, were installed in 17 buildings during the site visits and were left to sample for a minimum of one week. The RPISU operating procedure is included in Appendix B. One sampler operated for only 10 hours and a second for 56 hours, but the remaining samplers operated for well over 100 hours. These RPSIU data generally agreed with the grab sample data and the results for both are shown in Appendix A. While a single integrated measurement is insufficient to include or exclude a property from further consideration, its agreement with the grab sample measurements serves to strengthen one's confidence in the validity of the overall results. This expression of confidence is especially important in the summer months, when it may be difficult to obtain valid measurements due to occupant-induced ventilation of the buildings.

RESULTS

Twenty-one buildings in Monticello were suggested for radon and radon daughter measurements by DOE, as the data previously acquired from gamma radiation surveys were inadequate to either include or exclude the buildings from remedial action based on standards in 40 CFR 192. One owner (#119) refused to allow access by the survey teams to his property, and one building(#37) was judged insufficiently closed to allow radon or radon daughter measurements to be meaningful. Measurements were made in the remaining 19 buildings, although 3 of them may have been inadequately closed for the required time before sampling. These were numbers 2, 16, and 118. Measurements were made on the ground level of each building and on any levels below grade. None of the buildings had habitable levels above the ground floor. Duplicate samples for radon daughters were taken at each location, and the results averaged to estimate the RDC on a given level. Usually only one duplicate sample pair was taken on each level unless the building had only a single habitable level. In those cases, samples were usually taken at two locations. Because of equipment limitations, no duplicate radon samples were taken.

None of the 19 buildings surveyed by EPA showed RDC levels greater than 0.04 WL based on the grab samples taken under closed conditions. This is the level used by DOE for inclusion of a property in the remedial action program, as other studies have shown that this level is highly indicative of an annual average RDC of greater than 0.02 WL, the maximum level permitted by 40 CFR 192. Ten of the 19 buildings surveyed had an RDC greater than 0.01 WL based on the grab samples, the level below which DOE will exclude a particular property from further consideration for remedial action. These 10 buildings are listed in Table 2 with the results of both grab sample and integrated measurements. Eight of the remaining 9 buildings had neither gamma exposure rates nor RDC's exceeding the inclusion criteria. The ninth building, a single family residence, did not exceed the criterion for RDC but did have a single room where the average exposure rate exceeded 20 uR/h above background. These locations are listed in Table 3. Also included in Table 3 is location #37, a commercial property in which no radon daughter measurements were made because it could not be adequately closed, and in which the average exposure rate did not exceed the inclusion criterion. As noted previously, only one of the 21 suggested buildings was not surveyed because the property owner denied permission for access to the survey team. In November 1980, a RPISU sample of 91.5 hours, taken in the living area of that house, indicated 0.05 WL. Followup samples in September and October of 1981 indicated 0.03 WL in a closet and 0.4 WL in the crawl space. The latter samples were for periods of 334.7 hours and 240.3 hours, respectively. There is as yet no direct evidence of the presence of uranium mill tailings, so far as EPA is aware.

CONCLUSIONS

Of the 21 buildings suggested for radon daughter measurements by DOE, 10 buildings had one or more floors with the RDC greater than 0.01 WL, as noted in Table 2. According to the protocol in the VPMIM, these buildings should be investigated further to determine the annual average RDC, and the source of the contamination must be defined. Based on visual observation and discussions with the homeowners, it is possible that 8 of these 10 buildings contain tailings from the Dry Valley millsite in the mortar of the exterior or interior masonry.

The 10 buildings listed in Table 3 do not exceed any criteria for radon daughter concentrations, according to the measurements made by EPA, and only one of them had gamma exposure rate greater than 20 uR/h above background. It is recommended that these buildings be dropped from further consideration for any remedial action, and that the property owners be so notified as soon as possible.

One building suggested by DOE was not surveyed by EPA because the owner denied the survey team permission for access. Integrated measurments made in 1980 and 1981, however, strongly suggest that the annual average RDC could exceed 0.02 WL. If the 1983 exterior gamma radiation survey by the DOE contractor provided any evidence of the presence of mill tailings, then some additional consultation with the homeowner is probably indicated. The homeowner was informed of the results by the District Sanitarian following the '80-'81 tests, so unless futher action is contemplated, no further notification would be required.

ACKNOWLEDGEMENTS

The teams conducted these surveys in a very professional manner, and with extremely short lead time. The members of the teams were as follows:

Mr. Philip Nyberg, EPA Region VIII
Dr. Frederick Au, ORP-LVF
Ms. Edith Boyd, ORP-LVF
Ms. Shirley Duran, ORP-LVF
Mr. John Stevenson, Ecology and Environment, Inc. (EPA/8 F.I.T.)
Mr. Jerry Ripley, Utah Department of Health
Mr. Wayne Ball, Southeastern Utah Health District

TABLE 1. EPA RADON/RADON DAUGHTER SURVEY, MONTICELLO, UTAH, JUNE 19-21, 1984

LOCATION #	DESCRIPTION		AVERAGE EXPOSURE RATE (uncorr., uR/h)	(corr., uR/h)**	RADON DAUGHTER CONCENTRATION	RADON (pCi/l)	WLR (%)
2	Single family, bi-level, masonry (Note 1)	upstairs	11*	13*	0.0017	2.0	8.6
		downstairs	19*	16*	0.015	3.8	39
		overall	15*	15*	0.0084	2.9	29
6	Single family, bi-level, masonry	upstairs	15*	15*	0.010	2.1	50
		downstairs	19*	16*	0.0093	3.0	31
		overall	17*	16*	0.0096	2.6	37
7	Single family, ranch crawl space, masonry	family room (rear)	---		0.0021	1.0	21
		living room (front)	---		0.0028	0.76	37
		overall	18*	16*	0.0024	0.88	27
9	Single family, ranch, basement, partial masonry	basement	14*	14*	0.013	3.3	38
		living room	23*	18*	0.0068	3.9	17
		overall	19*	16*	0.0099	3.6	28
15	Single family, ranch, slab-on-grade, masonry	living room (front)	---	---	0.0054	1.0	53
		family room (rear)	---	---	0.0056	0.94	60
		overall	16*	15*	0.0055	0.97	57
16	Single family, ranch, slab-on-grade, masonry (converted duplex) (Note 2)	bedroom	42*	27*	0.016	3.4	46
		overall	22*	18*	-----	---	--
28	Single family, cottage, crawl space, wood frame	living room	---	---	0.0040	1.2	33
		bedroom	---	---	0.0035	1.1	32
		overall	15*	15*	0.0038	1.2	31
37	Commercial building, used for lumber storage, overhead door fit poorly	overall	16*	15*	No radon/daughter measurments made, as the building is inherently well-ventilated.		
39	Commercial building, adobe construction, basement	basement	14*	14*	0.016	4.3	38
		work area	16*	15*	0.015	3.3	46
		overall	15*	15*	0.015	3.5	44

LOCATION #	DESCRIPTION		AVERAGE EXPOSURE RATE (uncorr., uR/h)	(corr., uR/h)**	RADON DAUGHTER CONCENTRATION	RADON (pCi/l)	WLR (%)
57	Apartment house, 12 units, crawl space, 2-story, wood-frame, brick veneer	apartment #5	19*	16*	0.0033	0.40	83
		apartment #9	19*	16*	0.0051	NV	--
		(both gnd. floor)	---	16*			
118	Single family, ranch, finished basement (Note 3)	upstairs	24	18	0.0034	1.7	19
		downstairs	16	15	0.010	0.83	NV
		overall	20	16	0.0067	1.3	52
119	Single family residence				Owner refused permission for radon survey; RPISU data from 1980-1981 available.		
120	Single family, ranch, finished basement,	upstairs	28	20	0.0069	2.2	43
		downstairs	23	18	0.030	7.1	31
		overall	26	19	0.018	4.6	39
121	Single family, ranch, with partially-finished basement	upstairs	41	25	0.0011	0.20	56
		downstairs	19	16	0.0095	2.7	35
		overall	30	21	0.0053	1.5	36
124	Single family, ranch, unfinished basement, masonry veneer	upstairs	26	19	0.0033	0.56	59
		downstairs	19	16	0.0078	1.1	71
		overall	22	17	0.0056	0.83	67
125	Single family, ranch, finished basement open to grade, masonry veneer	upstairs	25	18	0.012	2.3	54
		downstairs	18	15	0.011	3.4	33
		overall	22	17	0.011	2.8	39
127	Single family, cottage, with basement, wood frame	upstairs	12	13	0.0022	0.85	26
		downstairs	11	12	0.0040	0.42	95
		overall	12	13	0.0031	0.64	48
130	Commercial building, slab-on-grade, sheet metal siding on rear section, finished front showroom (Note 4)	front room	19	16	0.0047	1.4	32

LOCATION #	DESCRIPTION		AVERAGE EXPOSURE RATE (uncorr., uR/h)	(corr., uR/h)**	RADON DAUGHTER CONCENTRATION	RADON (pCi/l)	WLR (%)
132	Single family, ranch, partially-finished basement, 1/2 wood frame, 1/2 masonry	upstairs	13	13	0.0033	1.3	25
		downstairs	13	13	0.025	5.0	49
		overall	13	13	0.014	3.2	44
137	Commercial garage with attached office, slab-on-grade, wood frame/ masonry	office	13	13	0.0034	0.54	63
144	Single family, tri-level, masonry veneer	main floor	14	14	0.0086	3.6	24
		downstairs	13	13	0.011	5.9	19
		overall	14	14	0.0098	4.8	20

** Scintillatometer readings corrected to pressurized ionization chamber measurements by the following relations:

EPA measurements: scint (CORR) = (0.43 scint (UNCORR) + 7.7) uR/h

Bendix F.E.C. measurements: scint (CORR) = (0.44 scint (UNCORR) + 8.1) uR/h

where: scint (CORR) = actual exposure rate, in uR/h
scint (UNCORR) = scintillometer reading, in uR/h

* Measurements made by Bendix Field Engineering Corp. for DOE/GJAO

Note 1. Front door was open when survey team arrived; moderate breeze

Note 2. Rear (south) door was open when survey team arrived; moderate breeze; measurements made in northwest bedroom, farthest from the open door

Note 3. Living room window open when survey team arrived; moderate breeze

Note 4. Sample taken from front showroom, which was relatively tight; rear area very drafty

*****

Table 2.

Monticello Properties with Radon Daughter Concentrations Greater Than 0.01 WL (EPA measurements, June 1984)

LOCATION		RADON DAUGHTER CONCENTRATION (WL)	RADON (pCi/l)	WLR* (%)	INTEGRATED RDC (WL)
2**	upstairs	0.0017	2.0	8.6	------
	downstairs	0.015	3.8	3.9	0.0022
6	upstairs	0.010	2.1	50	------
	downstairs	0.0093	3.0	31	0.0016
9	ground floor	0.0068	3.9	17	------
	basement	0.013	3.3	38	0.010
16**	ground floor	0.016	3.4	46	0.014
39	ground floor	0.015	3.3	46	0.0099
	basement	0.016	4.3	38	------
118**	ground floor	0.0034	1.7	19	------
	basement	0.010	0.83	NV	0.0046
120	ground floor	0.0069	2.2	43	------
	basement	0.030	7.1	31	0.0022
125	ground floor	0.012	2.3	54	------
	basement	0.011	3.4	33	0.0056
132	ground floor	0.0033	1.3	25	0.0018
	basement	0.025	5.0	49	------
144	ground floor	0.0086	3.6	24	------
	downstairs	0.011	5.9	19	0.016

*WLR = working level ratio = $\left(\frac{100\ \text{WL}}{\text{Rn, in pCi/l}}\right)$ 100

**suspect building not adequately closed

Table 3.

Monticello Properties Not Exceeding Inclusion Criteria for Remedial Action

LOCATION	ADDRESS	DESCRIPTION
7	348 Silverstone East	Single family, ranch style
15	65 North 1st West	Single family, ranch style
28	197 S. Uranium Dr.	Single family, cottage
37*	180 South Main St.	Commercial building, warehouse
57	65 East 1st North	12-unit apartment house
121**	(no #) Silverstone East	Single family, ranch style
124	301 Siverstone East	Single family, ranch style
127	569 Circle Dr.	Single family, cottage
130	76 West 3rd South	Commercial building, retail
137	600 North Main St.	Commercial building, garage

* no radon daughter measurements made; building cannot be closed

** one room showed an average exposure rate greater than 20 uR/h above background

EPA SURVEY OF POSSIBLE MILL TAILINGS CONTAMINATION IN MONTICELLO, UTAH
JUNE, 1984

APPENDIX A
Individual Location Data Sheets

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: G.O. Miller

OCCUPANT:

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
x BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	x MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/20 - 29/84	0.0022	--

SURVEY/SITE NO.: DOE #2, EPA 80235

EVENT NO.: 1980: 30 1971: --

ADDRESS: 248 Silverstone West

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 20, 1984

SURVEYORS: Stevenson/Boyd

	corrected	uncorrected
HIG	25*	38*
HOG	27*	42*
LCG	12*	10*

LOCATION OF HIG: Bedroom*

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.015	3.8
GROUND FLOOR	0.0017	2.0
UPPER FLOOR	n/a	n/a

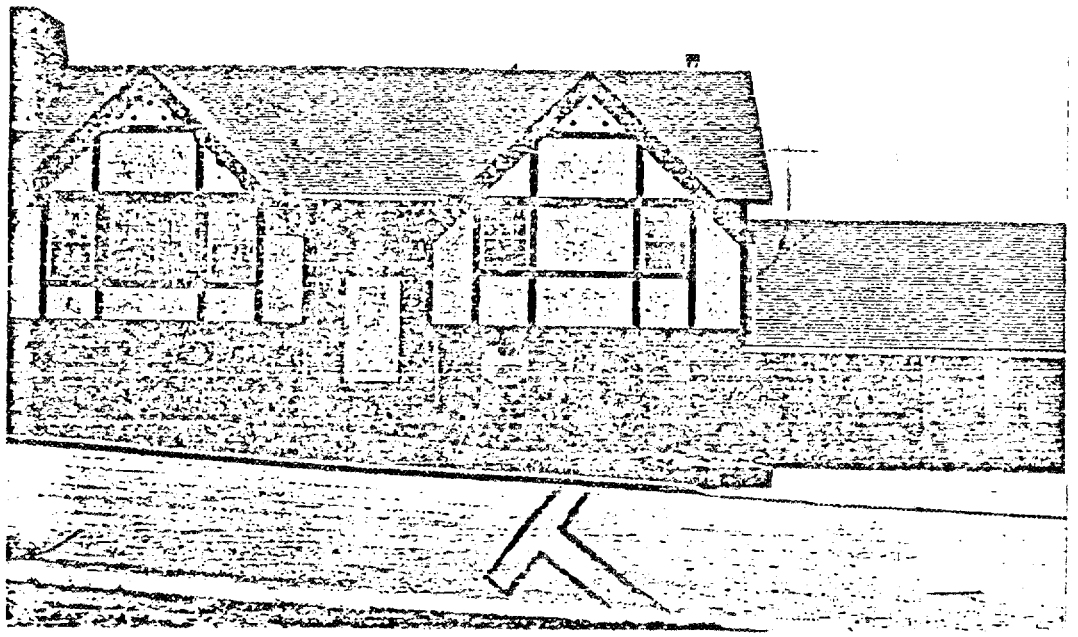
COMMENTS: Radioactivity associated with bricks or mortar in the exterior walls. Front door was open when survey team arrived; moderate breeze.

NUMBER OF PIC READINGS TAKEN

INSIDE 0* OUTSIDE 0*

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.



RADON/GAMMA SURVEY REPORT

OWNER: David Krouscop

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
___	BASEMENT	___	ADOBE
X	SLAB-ON-GRADE	X	MASONRY
___	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	___	NON-MASONRY
NO. OF LEVELS 2		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0016	--

SURVEY/SITE NO.: DOE #6, EPA 80165

EVENT NO.: 1980: 29 1971: --

ADDRESS : 333 Silverstone East

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 19, 1984

SURVEYORS : Stevenson/Boyd

	corrected	uncorrected
HIG	57*	110*
HOG	22*	31*
LOG	13*	12*

LOCATION OF HIG : Den - Family Room*

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0093	3.0
UPPER FLOOR	0.010	2.1

COMMENTS : Original construction date approx. 1978; elevated readings associated with bricks and/or mortar in fireplace*

NUMBER OF PIC READINGS TAKEN

INSIDE 2* OUTSIDE 5*

SOIL SAMPLES TAKEN 1*

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Juan Hansen

OCCUPANT: _____

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
___	BASEMENT	___	ADOBE
___	SLAB-ON-GRADE	_x_	MASONRY
X	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	___	NON-MASONRY
NO. OF LEVELS 1		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.00042	--

SURVEY/SITE NO.: DOE #7, EPA 80190

EVENT NO.: 1980: 27 1971: --

ADDRESS : 348 Silverstone East

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 19, 1984

SURVEYORS : Au/Duran

	corrected	uncorrected
HIG	39*	70*
HOG	46*	85*
LOG	13*	11*

LOCATION OF HIG : Two bedrooms & living rm.

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0024	0.88
UPPER FLOOR	--	--

COMMENTS : Original construction date approx. 1979; radioactivity associated with bricks and/or mortar in the exterior wall

NUMBER OF PIC READINGS TAKEN

INSIDE 1* OUTSIDE 2*

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Robert Day

OCCUPANT: Joe Bistriski

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
x BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	___ MASONRY
___ CRAWL SPACE	x MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
11/20 - 12/1/80	0.074	--
6/21 - 29/84	0.010	--

SURVEY/SITE NO.: DOE #9, EPA 80175

EVENT NO.: 1980: 21 1971: --

ADDRESS: 465 Oakcrest Dr.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 21, 1984

SURVEYORS: Au/Duran

	corrected	uncorrected
HIG	28*	46*
HOG	23*	34*
LOG	11*	7*

LOCATION OF HIG: Kitchen

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.013	3.3
GROUND FLOOR	0.0068	3.9
UPPER FLOOR	--	--

COMMENTS: Radioactivity associated with exterior brick wainscotting (or possibly the mortar) and with fieldstone and/or mortar in living room-fireplace (which covers the E. wall)

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Dale Black

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
___ BASEMENT	___ ADOBE
X SLAB-ON-GRADE	X MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 1	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/21 - 29/84	0.00092	--

SURVEY/SITE NO.: DOE #15, EPA80265

EVENT NO.: 1980: -- 1971: 54

ADDRESS : 65 (81?) North 1st West

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 21, 1984

SURVEYORS : Nyberg/Ball/Ripley

	corrected	uncorrected
HIG	20*	27*
HOG	19*	24*
LOG	13*	12*

LOCATION OF HIG : Family Room *

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0055	0.97
UPPER FLOOR	--	--

COMMENTS : Radioactivity associated with foundation, exterior brick and/or mortar

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Dow Young

OCCUPANT:

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
___ BASEMENT	___ ADOBE
_x_ SLAB-ON-GRADE	_x_ MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 1	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/20 - 29/84	0.014	--

SURVEY/SITE NO.: DOE #16, EPA 80280

EVENT NO.: 1980: 20 1971: --

ADDRESS: 65 South 2nd West

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 20, 1984

SURVEYORS: Nyberg/Ball/Ripley

	corrected	uncorrected
HIG	48*	90*
HOG	92*	190*
LOG	13*	12*

LOCATION OF HIG: (NW) Bedroom *

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.016	3.4
UPPER FLOOR	--	--

COMMENTS: House is a converted duplex, originally built in 1958; radioactivity associated with brick and/or mortar in the exterior walls; tailings also used in child's sandbox in the back yard.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: U.S. Bureau of Land Mgmt.

OCCUPANT: Vacant

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
___	BASEMENT	___	ADOBE
___	SLAB-ON-GRADE	___	MASONRY
X	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	X	NON-MASONRY
NO. OF LEVELS 1		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
none		

SURVEY/SITE NO.: DOE #28, EPA -----

EVENT NO.: 1980: 57 1971: 62

ADDRESS : 197 South Uranium Dr.
(rear house)

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 20, 1984

SURVEYORS : Nyberg/Ball/Ripley

	corrected	uncorrected
HIG	24*	37*
HOG	83*	170*
LOG	13*	11*

LOCATION OF HIG : Kitchen *

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0038	1.2
UPPER FLOOR	--	--

COMMENTS : House was vacant at time of survey, and no electrical service was available. Radioactivity was noted in the yard.

NUMBER OF PIC READINGS TAKEN
INSIDE 0 OUTSIDE 0
SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Grayson Redd

OCCUPANT: Horsehead Lumber Co.

PROPERTY CLASS 1 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
___ BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	X MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	X NON-MASONRY
NO. OF LEVELS 1	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
none		

SURVEY/SITE NO.: DOE #37, EPA -----

EVENT NO.: 1980: 6 1971: --

ADDRESS: 180 South Main St.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 20, 1984

SURVEYORS: Nyberg/Ball/Ripley

	corrected	uncorrected
HIG	52*	100*
HOG	20*	28*
LOG	14*	13*

LOCATION OF HIG: East (front) wall*

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	--	--
UPPER FLOOR	--	--

COMMENTS: Building is a large, open area with sheet metal siding on three sides and a masonry wall on the fourth (east) side. No WL grab samples were taken as the building could not be closed.

NUMBER OF PIC READINGS TAKEN

INSIDE 3* OUTSIDE 0

SOIL SAMPLES TAKEN 1*

* Measurements by Bendix F.I

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Milton Nielson

OCCUPANT: Jim Wight

PROPERTY CLASS 5 GAMMA MAP Bendix

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	X ADOBE
___ SLAB-ON-GRADE	___ MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/21 - 29/84	0.0099	--

SURVEY/SITE NO.: DOE #39, EPA 80305

EVENT NO.: 1980: 7 1971: --

ADDRESS: 248 South Main St.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 21, 1984

SURVEYORS: Au/Duran

	corrected	uncorrected
HIG	39*	70*
HOG	65*	130*
LOG	12*	9*

LOCATION OF HIG: Basement

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.016	4.3
GROUND FLOOR	0.015	3.3
UPPER FLOOR	--	--

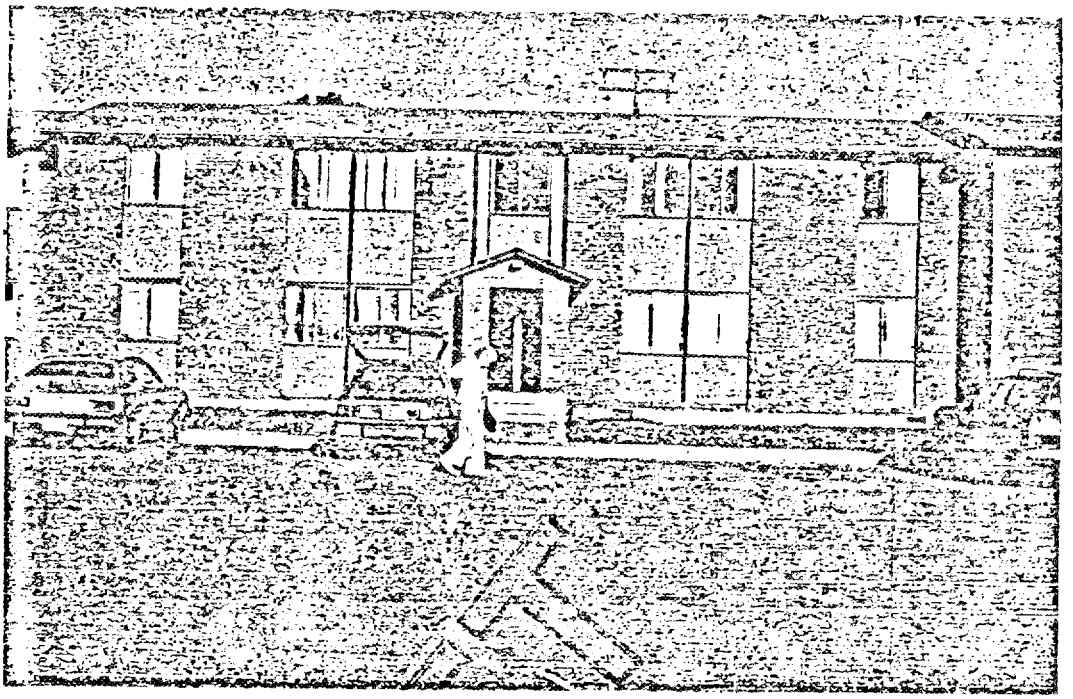
COMMENTS: Building is of adobe but generally not contaminated; radioactivity is associated with adobe blocks used to block off the back door, and with ore samples stored in the basement.

NUMBER OF PIC READINGS TAKEN

INSIDE 1* OUTSIDE 0

SOIL SAMPLES TAKEN 1*

* Measurements by Bendix F.E.C.



RADON/GAMMA SURVEY REPORT

80285

OWNER: Ray Jensen - Buckley Jensen

OCCUPANT: 12-unit apartment house

PROPERTY CLASS 3 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
___ BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	___ MASONRY
x CRAWL SPACE	x MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/21 - 29/84	0.0041	--
6/21 - 29/84	0.0013	--

COMMENTS : Approximate construction date was 1973; radioactivity associated with bricks and/or mortar in front exterior facing.

SURVEY/SITE NO.: DOE #57, EPA 80290

EVENT NO.: 1980: 41 1971: --

ADDRESS : 65 East 1st North (meas.in apts. 5 & 9)

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 21, 1984

SURVEYORS : Stevenson/Boyd

	corrected	uncorrected
HIG	41*	75*
HOG	35*	62*
LOG	12*	8*

LOCATION OF HIG : Along brickwork wall

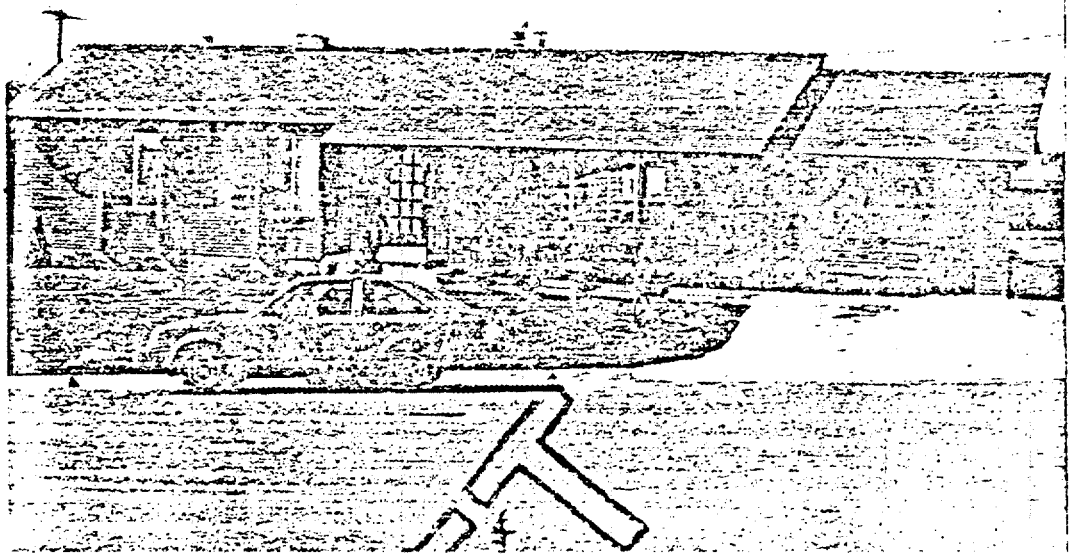
LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
Apt. 5	0.0033	0.40
GROUND FLOOR		
Apt. 9	0.0051	NV

NUMBER OF PIC READINGS TAKEN

INSIDE 13* OUTSIDE 0

SOIL SAMPLES TAKEN 0

* Measurements by Bendix F.E.C.



RADON/GAMMA SURVEY REPORT

OWNER: Jack Young

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	X MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/20 - 29/84	0.0046	--

SURVEY/SITE NO.: DOE #118, EPA 80260

EVENT NO.:

ADDRESS: 587 Oakcrest

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 20, 1984

SURVEYORS: Stevenson/Boyd

	corrected	uncorrected
HIG	42	80
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: Living Room

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.010	0.83
GROUND FLOOR	0.0034	1.7
UPPER FLOOR	--	--

COMMENTS: Single family ranch-style, unfinished basement; living room window open when survey team arrived; moderate breeze

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Ray Jarvis

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 0

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
___ BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	___ MASONRY
X CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS ___	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l	
11/20 - 12/1/80	0.051	--	
9/28 - 10/12/81	0.032	-- (closet)	GROUND FLOOR
9/28 - 10/12/81	0.41	--(crawl space)	UPPER FLOOR

COMMENTS :

Owner refused permission for survey, June 1984. RPISU measurements made in 1980-81, ORNL exterior gamma survey in 1983; nothing found

SURVEY/SITE NO.: DOE #119, EPA 80180

EVENT NO.:

ADDRESS : 496 Blue Mountain Dr.
(496 West Central ?)

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : None

SURVEYORS :

HIG ___ ___

HOG ___ ___

LOG ___ ___

LOCATION OF HIG :

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT		
GROUND FLOOR		
UPPER FLOOR		

NUMBER OF PIC READINGS TAKEN

INSIDE ____ OUTSIDE ____

SOIL SAMPLES TAKEN ____

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Paul Redd

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
x	BASEMENT	___	ADOBE
___	SLAB-ON-GRADE	X	MASONRY
___	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	___	NON-MASONRY
NO. OF LEVELS 2		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0022	--

SURVEY/SITE NO.: DOE #120, EPA 80240

EVENT NO.:

ADDRESS : 380 Silverstone East

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 19, 1984

SURVEYORS : Au/Duran

	corrected	uncorrected
HIG	27	45
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG : SW Bedroom

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.030	7.1
GROUND FLOOR	0.0069	2.2
UPPER FLOOR	--	--

COMMENTS : Single family, ranch-style home, with finished basement, probably built in late '70's; radioactivity associated with exterior bricks and/or mortar.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Merrill Young

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	X MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0060	--

SURVEY/SITE NO.: DOE #121, EPA 80245

EVENT NO.:

ADDRESS: (no #) Silverstone East

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 19, 1984

SURVEYORS: Au/Duran

	corrected	uncorrected
HIG	40	75
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: SW Bedroom

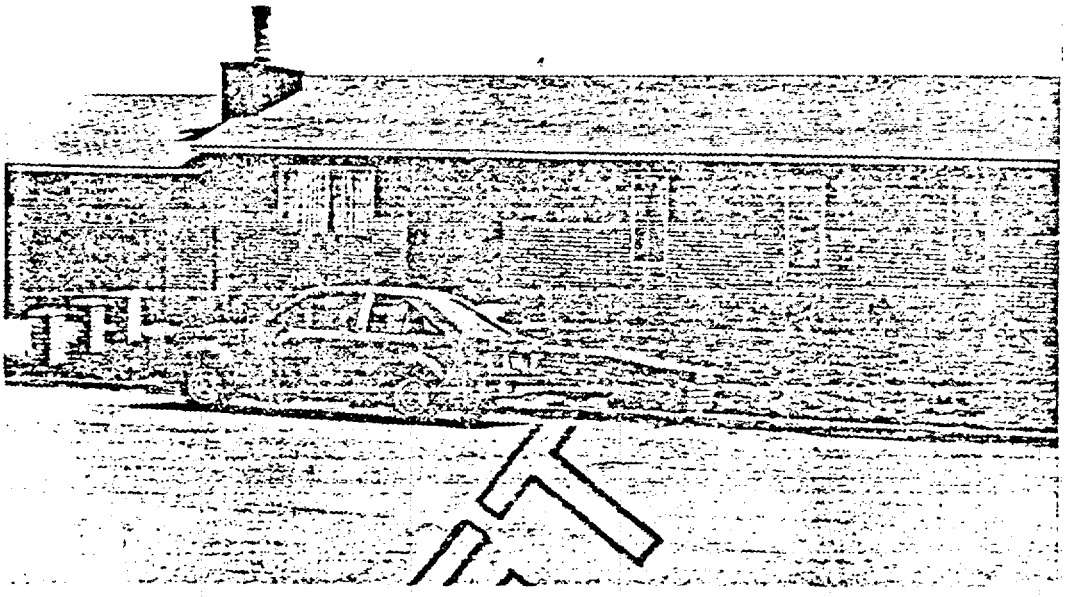
LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.0095	2.7
GROUND FLOOR	0.0011	0.20
UPPER FLOOR	--	--

COMMENTS: Single family, ranch-style home with partially finished basement, probably built in late '70's; radioactivity associated with exterior bricks and/or mortar.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0



RADON/GAMMA SURVEY REPORT

OWNER: Legrand Black

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
X	BASEMENT	___	ADOBE
___	SLAB-ON-GRADE	___	MASONRY
___	CRAWL SPACE	X	MASONRY VENEER
___	UNKNOWN	___	NON-MASONRY
NO. OF LEVELS 2		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
none		

SURVEY/SITE NO.: DOE #124, EPA -----

EVENT NO.:

ADDRESS : 301 Silverstone West

CITY/STATE : Monticello, Utah

COUNTY : San Juan

SURVEY DATE : June 19, 1984

SURVEYORS : Stevenson/Boyd

	corrected	uncorrected
HIG	32	57
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG : Living Room

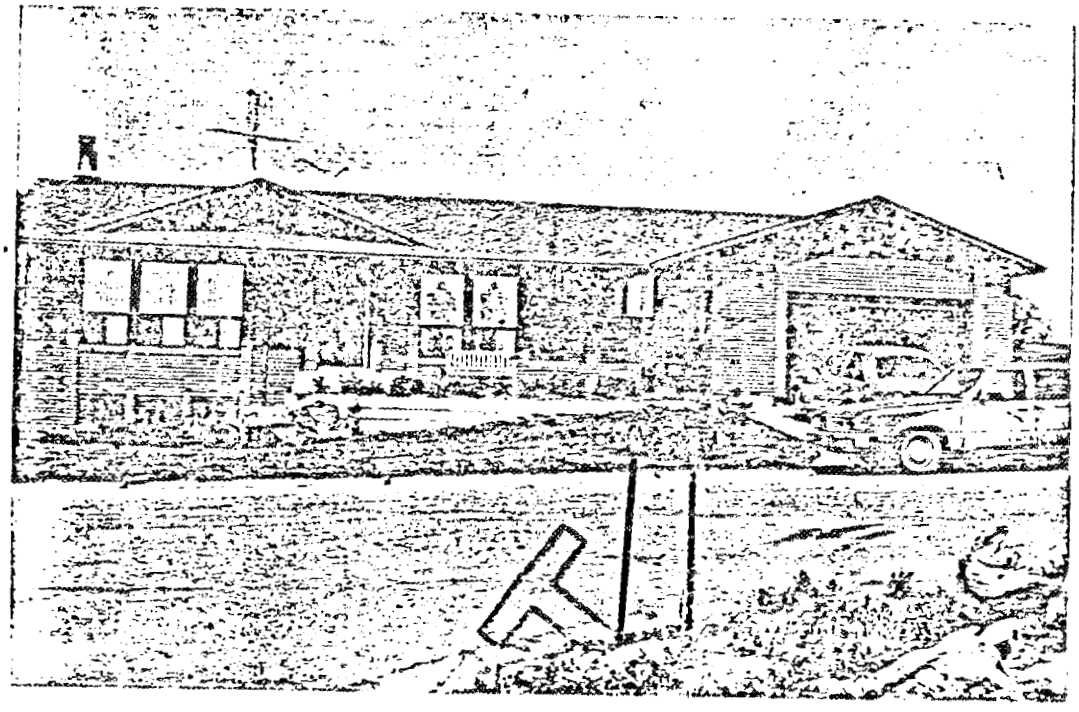
LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.0078	1.1
GROUND FLOOR	0.0033	0.56
UPPER FLOOR	--	--

COMMENTS : Single family, ranch-style home with unfinished basement, probably built in the late '70's; house vacant at time of survey, and there was no power available.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0



RADON/GAMMA SURVEY REPORT

OWNER: Bruce Adams

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	___ MASONRY
___ CRAWL SPACE	X MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0056	--

SURVEY/SITE NO.: DOE #125, EPA 80250

EVENT NO.:

ADDRESS: 401 Silverstone West

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 19, 1984

SURVEYORS: Stevenson/Boyd

	corrected	uncorrected
HIG	31	55
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: Dining Room

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.011	3.4
GROUND FLOOR	0.012	2.3
UPPER FLOOR	--	--

COMMENTS: Single family, ranch-style home, with finished basement, probably built in the late '70's; radioactivity associated with the bricks and/or mortar on the front exterior

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Stephen Nielson

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE'
___ SLAB-ON-GRADE	___ MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	X NON-MASONRY
NO. OF LEVELS 2	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/20 - 29/84	0.0048	--

SURVEY/SITE NO.: DOE #127, EPA 80255

EVENT NO.:

ADDRESS: 549 Circle Dr.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 20, 1984

SURVEYORS: Au/Duran

	corrected	uncorrected
HIG	15	16
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: SW Bedroom

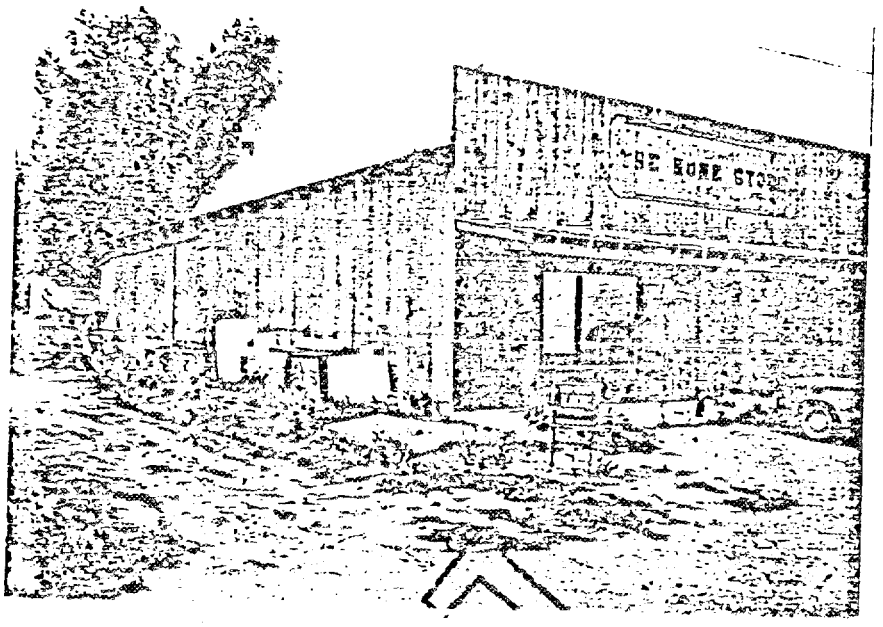
LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.0040	0.42
GROUND FLOOR	0.0022	0.85
UPPER FLOOR	--	--

COMMENTS: Single family cottage, unfinished basement, older home

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0



RADON/GAMMA SURVEY REPORT

OWNER: Milton Nielson

OCCUPANT: Vacant (formerly "The Home Store")

PROPERTY CLASS 5 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
___	BASEMENT	___	ADOBE
X	SLAB-ON-GRADE	X	MASONRY
___	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	X	NON-MASONRY
NO. OF LEVELS 1		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0048	--

SURVEY/SITE NO.: DOE #130, EPA 80300

EVENT NO.:

ADDRESS: 76 West 3rd South

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 19, 1984

SURVEYORS: Nyberg/Ball/Ripley

	corrected	uncorrected
HIG	27	44
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: East wall, front showroom

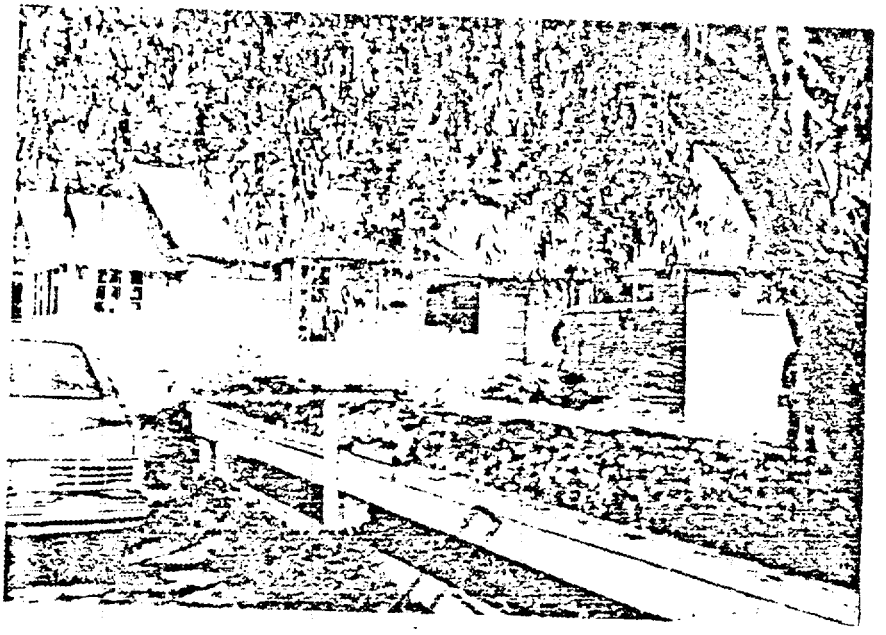
LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0047	1.4
UPPER FLOOR	--	--

COMMENTS: Commercial building, slab-on-grade, sheet metal siding on rear section, front showroom finished w/ drywall; elevated readings from adjacent shed, possibly ore samples.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0



RADON/GAMMA SURVEY REPORT

OWNER: James Douglas

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	X MASONRY
___ CRAWL SPACE	___ MASONRY VENEER
___ UNKNOWN	X NON-MASONRY
NO. OF LEVELS ___	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.0018	--

SURVEY/SITE NO.: DOE #132, EPA 80275

EVENT NO.:

ADDRESS: 97 North 2nd West

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 19, 1984

SURVEYORS: Nyberg/Ball

	corrected	uncorrected
HIG	18	24
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: Living Room

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.025	5.0
GROUND FLOOR	0.0033	1.3
UPPER FLOOR	--	--

COMMENTS: Single family, ranch-style home, with partially finished basement, built in 1941-42 (addition in '59).

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

NO PHOTO AVAILABLE

RADON/GAMMA SURVEY REPORT

OWNER: Keith Redd

OCCUPANT: Goodyear Tire Store

PROPERTY CLASS 5 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE		BUILDING MATERIAL	
___	BASEMENT	___	ADOBE
X	SLAB-ON-GRADE	X	MASONRY
___	CRAWL SPACE	___	MASONRY VENEER
___	UNKNOWN	___	NON-MASONRY
NO. OF LEVELS 1		___	HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/21 - 29/84	0.0024	--

SURVEY/SITE NO.: DOE #137, EPA 80295

EVENT NO.:

ADDRESS: 596 North Main St.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 21, 1984

SURVEYORS: Nyberg/Ball/Ripley

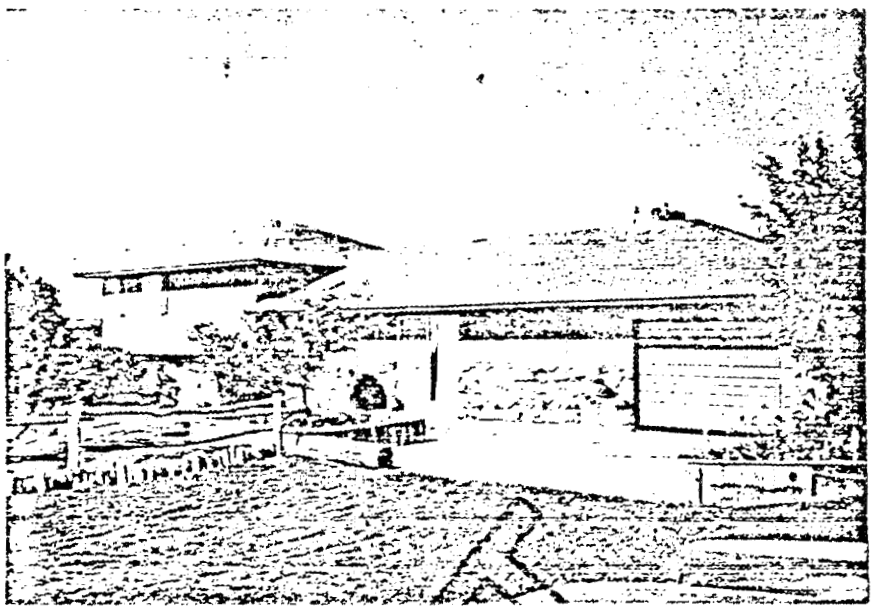
	corrected	uncorrected
HIG	14	15
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: Service/storage area

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	--	--
GROUND FLOOR	0.0034	0.54
UPPER FLOOR	--	--

COMMENTS: Building is a converted service station; overhead doors in the service bay don't seal very well; mostly concrete block construction.

NUMBER OF PIC READINGS TAKEN:
INSIDE 0 OUTSIDE 0
SOIL SAMPLES TAKEN 0



RADON/GAMMA SURVEY REPORT

OWNER: Joe Davis

OCCUPANT: Same

PROPERTY CLASS 1 GAMMA MAP 1

TAILINGS USE

TYPE OF STRUCTURE	BUILDING MATERIAL
X BASEMENT	___ ADOBE
___ SLAB-ON-GRADE	___ MASONRY
___ CRAWL SPACE	X MASONRY VENEER
___ UNKNOWN	___ NON-MASONRY
NO. OF LEVELS ___	___ HOUSE TRAILER

INTEGRATED RADON/DAUGHTER MEASUREMENTS

DATES	WL	Rn, pCi/l
6/19 - 29/84	0.016	--

SURVEY/SITE NO.: DOE #144, EPA 80270

EVENT NO.:

ADDRESS: 524 E. Cemetary Rd.

CITY/STATE: Monticello, Utah

COUNTY: San Juan

SURVEY DATE: June 19, 1984

SURVEYORS: Nyberg/Ball

	corrected	uncorrected
HIG	15	17
HOG	n/a	n/a
LOG	n/a	n/a

LOCATION OF HIG: Living Room

LOCATION	GRAB WL (WL)	GRAB RADON (pCi/l)
BASEMENT	0.011	5.9
GROUND FLOOR	0.0086	3.6
UPPER FLOOR	--	--

COMMENTS: Single family, tri-level home, built in late '70's; elevated gamma reading from rock and/or mortar in fireplace; located on hill east of old millsite.

NUMBER OF PIC READINGS TAKEN

INSIDE 0 OUTSIDE 0

SOIL SAMPLES TAKEN 0

EPA SURVEY OF POSSIBLE MILL TAILINGS CONTAMINATION IN MONTICELLO, UTAH

June, 1984

APPENDIX B

Standard Operating Procedures

Interpretation of Computer Printout for Indoor Radon Progeny Sampling Results

Location Code and Run Number

The first column on the printout contains a five-digit code which indicates the sample location. It is followed by a two-digit number which shows the "run number" or sample number, at that location. Samples at a given location are numbered in chronological order of collection.

Invalid Sample Results

Individual sample results may be invalid for a number of reasons. Such results are designated on the printout by a notation "NV-X" following the "Working Levels" column. The "NV" notation indicates "not valid," and the digit codes, indicating the reason, are as follows:

- NV-1 No measurable "off" flow rate at the end of sampling period due to pump failure, "plugged" filter, etc.
- NV-2 Insufficient exposure to radon progeny; i.e., less than one working level liter was measured for the sampling period.
- NV-3 Invalid average working level due to insufficient time lapse between sample collection.
- NV-4 Error made during TLD readout.
- NV-5 Damaged filter or sampling head.
- NV-6 Miscellaneous.
- NV-7 RPISU samplers run simultaneously in different areas of the same location.
- NV-8 RPISU only run during "working hours."
- NV-9 Special study.
- NV-0 RPISU clock failure.

Invalid sample results appear on the printout in order to maintain a record of the sample, but invalid results are not included in calculating the average working level.

Sample Averaging

The "Average Working Level" appears on the right-hand side of the page at the last sample for each different location. This is a simple arithmetic average of all the individual working level measurements at that location. It is not a time-weighted average. Note that "NV" results are not included in the Average Working Level.

ORP-LVF SOP #1

OPERATING INSTRUCTIONS FOR THE EPA WORKING LEVEL MONITOR (With Top-Mounted Timer)

Purpose and Principle of Operation

This instrument, formally known as the RPISU (Radon Progeny Integrating Sampling Unit), is designed to measure the alpha particle energy from airborne radon progeny, or daughters. This alpha energy is then converted to working level units, a commonly-used measure of the health hazard from the radon progeny. Unlike most working level samplers, the RPISU measures the average, or integrated, working level over a period of days, rather than taking an instantaneous reading.

A small pump pulls air through the detector head, shown in exploded view in Figure 1. The particulate radon daughters are trapped on the filter paper. As the short-lived daughters decay, their alpha energy is deposited in the thermoluminescent dosimeter, or TLD, adjacent to the filter. A second TLD, shielded from the filter by a metal washer, responds to the more penetrating gamma radiation from external background. The reading on the second (gamma) TLD is subtracted from that on the first one (the alpha TLD) to give a net reading due to alpha energy from the filtered radon daughters.

The TLD material has the property of absorbing radiation energy, then emitting a proportional amount of light when it is heated later under controlled conditions. Therefore, the detector heads must be sent back to the EPA laboratory, where they are taken apart, the TLD's removed, and "read out" in a special instrument to measure the amount of light, and consequently the amount of radiation energy absorbed during the sampling period. Knowing the radiation energy absorbed and the volume of air sampled, the average working level during the sampling period can be calculated.

Operating Procedure

To start a sample:

1. Plug the sampler into a 115-volt AC outlet. The sampler has about three feet of cord, which may have been tucked into one of the ventilation holes at the bottom of the sampler. The sampler should start to run immediately. If it does not, see "Troubleshooting" section.

2. Record the location, starting date, and starting reading from the running time meter, on the data envelope which contains a sampling head. (See Figure 2) Also record the RPISU pump number.

3. Place the sampling head in the end of the air inlet tubing. The connection is a twist-lock fitting. (Inlet tubing may be tucked into one of the ventilation holes at the top of the sampler.)

4. Allow the pump to run for a minute or two, then insert the flow meter fitting into the open end of the sampling head. Record the flow rate (in liters per minute) on the envelope. Also record the identification number or letter of the flow meter (this is written on the inside of the white backing, and is read through the lucite body of the meter) and initial the envelope. Disconnect the flow meter (do not collect sample through the flow meter).

To take a sample off:

1. Take a flow rate measurement as at the start of sampling. (See 6 under "Troubleshooting" section if pump is not running).

2. Record the pertinent data in the "End of Sampling" column on the envelope.

3. Replace the sampling head in the envelope, and mail to the EPA laboratory, using the preaddressed padded envelope furnished.

Handy hints and troubleshooting:

1. It is essential that all the information on the data sheet be filled in.

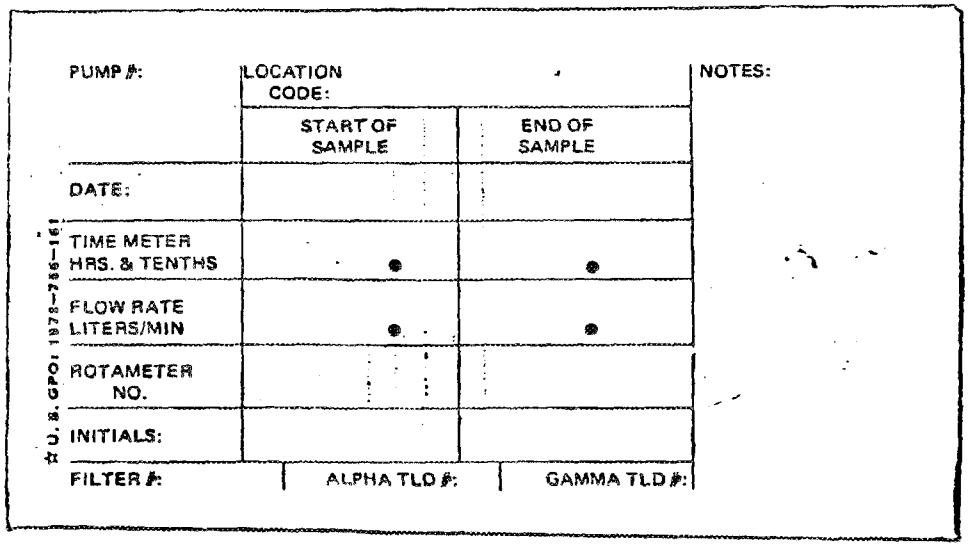
2. The unit is designed for indoor use only.

3. A weekly sampling period is recommended, although a few days longer is okay if dusty conditions are not encountered. A sampling head should not be left on the sampler for more than two weeks.

4. The pump is protected by both pressure drop and thermal overload switches, both of which are bypassed by a reset button. If the filter becomes clogged from dust, smoke, or other particulates in the air, the unit will shut off when the air flow drops below 1.0 lpm. Therefore, it is suggested that a sampling location with relatively clean air be selected, since the unit is quite sensitive in this respect. For example, rooms with a heavy concentration of cigarette smoke have been known to stall the sampler after a relatively short sampling time.

5. If the sampler goes off for any reason, such as a power outage, from being unplugged, from a pressure or thermal overload, etc., it will restart automatically when power is restored. If it is not running, depress the restart button, accessible through one of the top vent holes, and observe the sampler for at least five minutes to be sure it continues to run. If it shuts off within a few minutes the filter is probably overloaded, as discussed above, and the head must be changed.

6. If a head is removed under the above conditions, be sure to take the "off" flow rate reading. This can be done by holding the reset button down long enough to obtain the reading with the flow rate meter. Both "on" and "off" flow rates are essential to calculate the working level. Do not record the "off" flow as zero, unless the pump is completely broken.



3" x 5" manila envelope

Data to be entered at the time the TLD filter holder units are prepared for use:

Filter : number stamped on filter holder

Alpha TLD : number of TLD disc nearest the filter

Gamma TLD : number of TLD disc above steel washer

In addition, the preparation date should be stamped under "NOTES."

Data to be entered by field personnel at time of use:

Pump : number on air pump motor

Location code: number assigned to the sampling location, and location address

Start of sample: enter all data in the column - date, time meter reading (to nearest 0.1 hr), flow rate through the filter, rotameter number used to determine flow rate, and initials of person installing the sampler.

End of sample: enter all data in column - same as Start Column

Notes: any comments on sampler operation, etc.

Figure 2 Individual TLD sampler field record (envelope).

BY PCN/SAW-RP DATE 6-28-84 SUBJECT Radon/Radon Daughter Sampling Train Layout SHEET NO. 1 OF 1
CHKD BY DATE JOB NO

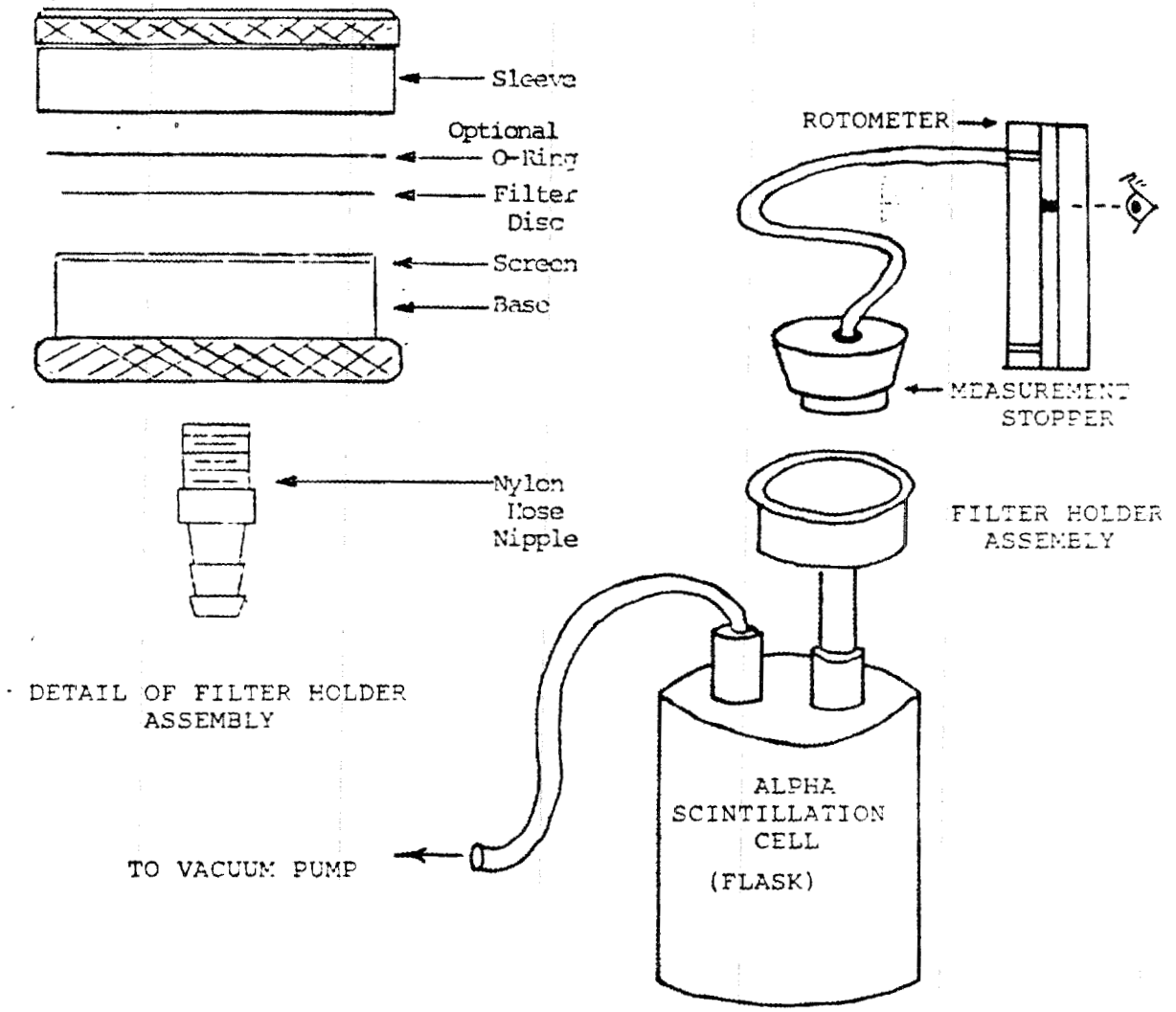


Figure 2 Sampling Configuration for Radon and Radon Daughters

into the front of the filter holder. The rotometer should be held vertically at eye level, and the reading should be made at the center of the ball. If the flow rate exceeds the maximum value of the rotometer, the flow may be reduced by use of a needle valve at the pump. When making this measurement, the stopper should be inserted in the filter before the pump is turned on, and the pump should be run only long enough to obtain the rotometer reading, in order to minimize the particulate accumulation on the filter surface prior to the actual sampling period. Record the rotometer reading on the data form. Once that has been done, the stopper should be removed and the system is now ready for sampling.

5. Remove the stopwatch from the monitoring kit, turn it on, and reset it to zero. Also note the exact time of day that the sampling began, using a watch or other convenient means. When everything is ready, start the stopwatch and the pump simultaneously.

   Note: It has been found very useful to start the sample on some even minute according to the monitor's wristwatch. In this way, the sampling/counting sequence can be maintained, even if the stopwatch should malfunction. The time of day is also necessary for the computation of the delay between the sample time and the cell count time.

6. At exactly 5 minutes elapsed time, turn the pump off. Reconnect the stopper and rotometer to the front of the filter holder assembly as in step 4 and turn the pump on only long enough to obtain a final rotometer reading. Record the final rotometer reading on the data form. Disconnect the fittings from the cell, and set the cell aside for later evaluation. Carefully open the filter holder assembly and remove the filter, using the tweezers provided in the kit. Place the filter, with the collection side down, into one of scintillator trays in preparation for counting.

Evaluation of the Radon Daughter Sample

1. Assure that the counting system (EDA Instruments, Inc. model RDA-200) has been checked and found operational, and that a 5-minute filtered grab sample has been properly acquired.

2. Turn the counting system "OFF," open the counting chamber, and remove any scintillator trays or cells from the chamber. Place the scintillator tray, containing the filter to be evaluated, into the counting chamber after removing the protective plastic cap from the tray (if necessary). Reclose the counting chamber with the flat chamber cap. Set the "TIME (MIN)" selector to "10" (for a 10-minute count) and turn the "POWER" switch to "INT." Wait at least two minutes for any residual light activation to die away.

3. At any time between 40 and 90 minutes after the start of sampling, press the "START" button to initiate the count. Enter the actual count start time on the data form (or record the delay time from the

stopwatch). If necessary, calculate the delay from the start of sampling to the start of counting, in minutes, and record it on the data form. Note that it is most convenient to begin the count on an even minute after sampling.

4. When the count is complete, record the total sample counts and the count time (10 minutes) on the data form. The "POWER" switch should be turned to "OFF" and the scintillator tray and sample removed from the counting chamber. The system is now ready to receive the next sample.

5. Calculate the actual flowrate, in liters per minute, from the relation:

$$\text{Flowrate} = (\text{Roto Rdg}) \times (\text{CF}) \times \sqrt{29.92/\text{Bar. Press.}}$$

where: Roto Rdg is the rotometer reading
CF is the correction factor for the rotometer, noted on the calibration sticker on the side of the rotometer.
Bar. Press. is the uncorrected local barometric pressure, obtained from the altimeter/barometer in the kit

Record the actual flowrate on the data form.

6. Calculate the counting efficiency of the counting system from the relation:

$$\text{Eff.} = \frac{\text{cpm of check source}}{\text{dpm of check source}}$$

where: cpm is the count rate of the standardized, electroplated alpha source measured during system checkout
dpm is the true disintegration rate of the alpha source, noted on its storage container

Record the efficiency on the data form.

7. Calculate the radon daughter concentration, in units of working level, from the relation:

$$\text{WL} = \frac{\text{sample cpm} - \text{bkg cpm}}{\text{K} \times \text{Eff.} \times \text{Sample length (min.)} \times \text{Flowrate}}$$

where: sample cpm is the count rate of the sample
bkg cpm is the background count rate, obtained during checkout
K is the Kusnetz factor from Table 1, based on the delay period, in minutes, from the end of sampling to the mid-point of the count period
Eff. is the system counting efficiency (calculated above)
Sample length is 5 minutes
Flowrate is as calculated above

Record the WL on the data form.

(KUSNETZ METHOD)

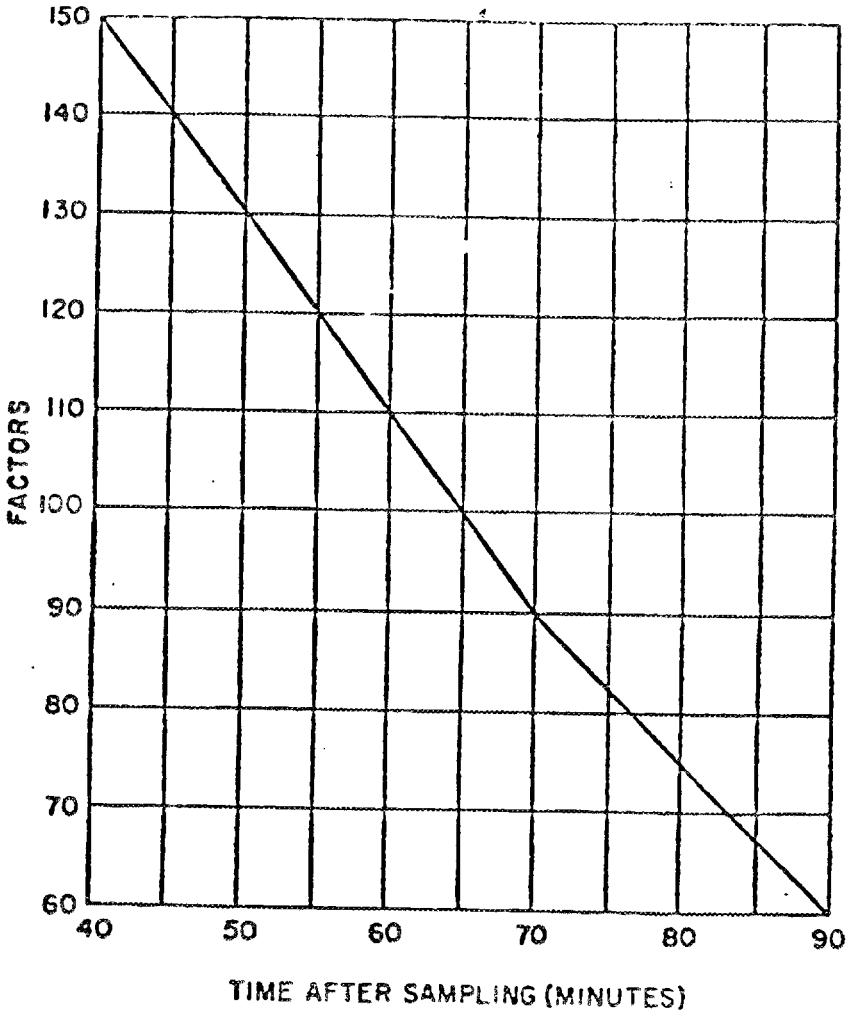


TABLE 1

Factors for Determining Multiple of Working Level of Radon Daughter Products in the Atmosphere

Min.	Factor	Min.	Factor	Min.	Factor	Min.	Factor	Min.	Factor
40	150	50	130	60	110	70	90	80	75
41	148	51	128	61	108	71	89	81	74
42	146	52	126	62	106	72	87	82	73
43	144	53	124	63	104	73	85	83	71
44	142	54	122	64	102	74	84	84	69
45	140	55	120	65	100	75	83	85	68
46	138	56	118	66	98	76	82	86	66
47	136	57	116	67	96	77	81	87	65
48	134	58	114	68	94	78	78	88	63
49	132	59	112	69	92	79	76	89	61
								90	60

Evaluation of the Radon Sample

1. Assure that the counting system (EDA Instruments, Inc. model RDA-200) has been checked and found operational, and that at least 4 hours have elapsed since the alpha scintillation cell was filled.

2. Turn the counting system "OFF," open the counting chamber, and remove any scintillator trays or cells from the chamber. Place the cell to be evaluated into the chamber, window side down, after removing the protective plastic cap. Reclose the counting chamber with the extended chamber cap. Set the "TIME (MIN)" selector to 10 minutes (for a 10-minute count) and turn the "POWER" switch to "INT." Wait at least 2 minutes for any residual light activation to die away.

3. Press the "START" button to initiate the count, and note the date and time of the count on the data form.

4. When the count is complete, record the count on the data form and repeat steps 3 and 4 until three 10-minute counts have been recorded. Alternatively, one or more 30-minute counts may suffice for this.

5. Turn the counting system "OFF" and remove the cell from the counting chamber. The system is now ready to receive the next sample.

6. Calculate the number of hours of decay of the sample, from sample collection time to the mid-point of the counting period, and record it on the data form. Calculate the average of three sample counts and record it also.

7. Calculate the radon concentration, in units of picocuries per liter, from the relation:

$$\text{Radon pCi/l} = \frac{\text{sample cpm} - \text{bkg cpm}}{\text{CF} \times \text{Flask Volume (l)} \times \text{decay factor}}$$

where: sample cpm is the average count rate of the sample
bkg cpm is the cell background count rate
CF is the average cell/system counting efficiency, in units of cpm/pCi, obtained from the most recent calibration (typically 3-4)
Flask Volume is 0.16 liter (average for model RDX-013 cells)
decay factor is based on the time between sample collection and the mid-point of the counting period, taken from the table on the data form, or calculated by $e^{-0.00756t}$, where t is the decay time in hours

Record the radon concentration on the data form.

8. Calculate the working level ratio, often called the "percent equilibrium," as follows:

$$\% \text{ Equil} = \frac{(\text{WL}) \times 10{,}000}{\text{Radon pCi/l}}$$

where: WL and Radon pCi/l are as calculated previously

Record the equilibrium on the data form.

REFERENCES

ANSI73 American National Standard for Radiation Protection in Uranium Mines, ANSI N13.8 - 1973 et seq.

Lu57 Lucas, H.F., Jr., "Improved Low Level Alpha Scintillation Counter for Radon," Rev. Sci. Instrum. 28, 680-683 (1957)

Ro72 Rolle, R., Health Physics 22, 233 (March, 1972)

Th70 Thomas, J.W., Health Physics 19, 691 (1970)

Th71 Thomas, J.W., Personal Communication (July 1971)

APPENDIX A
****

RADON/RADON PROGENY FIELD MONITORING KIT

__- ZERO Centurian Carrying Case, lock no. _____

__-Scintillation Counter, EDA Instruments model RDA-200, s/n_____ (EPA#_____)

with __-Alpha Scintillation Cells
__-Scintillat
_1-Power Supply, 115 Vac
__-Swagelok Quick- Connect Tube Fittings
_1-Standard Scintillation Cell, s/n_____
_1-PM Tube Housing Cover (used when counting cells)
_1-PM Tube Housing Cover (used when counting filters)
__-Alpha Check Source (isotope _____, s/n_____)
_1-Instruction Manual

__-Air Pump, Staplex model , s/n_____ (EPA#_____)

__-Air Pump,

__-Flow Measurement Stoppers, for 25-mm filters, with Luer-Lok fittings

__-Filter Holders, 25mm, open face, with Luer-Lok fittings

__-Filter Holders, 25mm, open face, with 1/4" barb fittings

__-Filter Holders, 25mm, in-line, with 1/4" barb fittings

__-Rotometer, Dwyer model VFA-22 ( ), ORP-LVF #_____

__-Rotometer, Dwyer model VFA-23 (0.6 - 5 lpm), ORP-LVF #_____

__-Rotometer, Dwyer model VFB-68 (3-30 lpm), ORP-LVF #_____

__-Boxes, Millipore filters, 100 ea., 25mm, micron (type)

__-Spare Luer-Lok/barb fitting, male

__-Spare Luer-Lok/barb fitting, female

__-Digital Electronic Stopwatch, with case, ORP-LVF #_____

__-Altimeter/Barometer, with case

__-Kitchen Timer, spring wound, 60 minute

__-Hand Vacuum Pump, Nalgene "Mityvac"

_8-Spare "C" Batteries (for EDA)

_3-Spare "AA" Batteries (for stopwatch)

_1-3-Prong to 2-Prong a/c Adapter Plug

_1-Extension Cord, 8'

_1- Tweezers

ORP-LVF SOP # 13

PROCEDURE FOR ACQUISITION AND EVALUATION OF SHORT-TERM RADON AND RADON DAUGHTER SAMPLES

Purpose and Principles of Operation

Short-term or "grab" samples are used to determine the concentrations of radon (Rn-222) gas and radon daughter products in ambient air at a single point in time. By appropriately controlling the environment in which the samples are taken, these instantaneous results are often used to estimate long-term averages, though that is beyond the scope of this procedure. The following describes the acquisition and evaluation of grab samples of radon and/or radon daughters in ambient air using the monitoring kit assembled by ORP-LVF. The contents of the kit are listed in Appendix 1.

Grab sampling for radon and/or radon daughters basically involves the acquisition of a measured volume of air. While the two quantities are measured separately, both types of samples may be acquired simultaneously for convenience. For the radon daughter sample, a measured volume of air is drawn through a membrane filter (Millipore type HA, 0.45-micron pore size, or equivalent). An air pump capable of drawing from 1 to 10 liters per minute is used for the sampling. The filter is subsequently evaluated by alpha scintillation counting the radioactive decay of the particulate radon daughters. In this procedure the Kusnetz Technique (ANSI73) is preferred, but other techniques such as those developed by Tsvoglou (Th70, 71), or Rolle (Ro72) can also be used. In the Kusnetz technique, the filter is counted at any time during a period from 40 to 90 minutes after sampling. The radon daughter concentration, expressed in units of working level (WL), can be calculated from the count rate, the system counting efficiency, the air sampling rate and duration of sampling, and a correction factor for the delay time between the end of the sampling period and the mid-point of the counting period.

The concentration of radon gas is determined using an alpha scintillation cell, similar to the design of Lucas (Lu57), into which a known volume of filtered air is drawn. After a waiting period of at least 4 hours, during which the radon daughters grow into secular equilibrium with the radon, the cell is evaluated by counting the alpha scintillation events. The radon concentration is calculated from the count rate, the predetermined system counting efficiency, the cell volume, and the correction factor for radioactive decay between the times of sampling and counting.

There are four distinct, sequential tasks used to obtain simultaneous "grab" samples of radon gas and its particulate daughters. First, the counting system is standardized by making background counts, followed by counts of the standard alpha scintillation cell (provided with each counting system) and an electroplated disk source of known alpha emission activity. Second, the sample is acquired by connecting the filter holder, scintillation

cell, and air pump in series. Third, the filter is evaluated to determine the radon daughter concentration by the Kusnetz technique. Finally, the alpha scintillation cell is evaluated to determine the radon concentration.

Counting System Checkout Procedures

1. Remove the counting system (EDA Instruments, Inc., model RDA-200) from the carrying case, set it upright on a convenient surface, and turn the main power switch to "INT" (internal battery power). The "LIGHT" warning flag will show red when the instrument is first turned on, but should disappear when sampling is initiated. If it does not disappear, check for light leaks in the counting chamber. Set the "TIME (MIN)" selector to "10" (for a 10-minute count) and depress the "SAMPLE" push-button while observing the "BATT" (battery) warning flag. If the flag shows red, even momentarily, replace the batteries according to instructions in the RDA-200 Operation Manual. Check to see that the "RA-AM" switch is always in the "RA" position.

2. Turn the "POWER" switch to "OFF," open the counting chamber, and remove the standard test cell (normally stored in the chamber when the instrument is not in use). Record the serial number of the cell and the standard count rate in the "Comments" section of the data form (see example, Figure 1). Place the cell into the counting chamber with the window side inward and reclose the counting chamber with the flat chamber cap and threaded ring. Wait at least 2 minutes for any residual light activation to die away, turn the "POWER" switch to "INT," press the "SAMPLE" button, and record the accumulated counts after 10 minutes in the "Comments" section of the data form. Repeat the count, and record. (Note: The red indicator light located beneath the "START" button will blink continuously during the counting period, but will go out when the count is complete. The numeric, 5-digit display will appear when "SAMPLE" is depressed, but the 4 most significant digits will disappear after a few seconds in order to conserve battery life; to read the full display at any time, merely press the "DISPLAY" button).

3. Turn the "POWER" switch to "OFF," open the counting chamber and remove the test cell, and select a scintillator tray from the kit. Remove the black plastic cap from the scintillator tray (if present), carefully place a clean filter paper into the tray (using tweezers to handle the filter), and insert the scintillator tray into the counting chamber. Replace the flat chamber cap and threaded retaining ring, wait at least 2 minutes, and push "START" for a 10-minute background count (this count will be used as the background count for subsequent filter counts for radon daughter measurements). Record the background count in the appropriate block on the data form. Repeat the count, and record.

OWNER : SURVEY DATE:

STREET:

CITY : COUNTY: STATE:

SURVEYORS:

RADON SURVEY DATA

LOCATION	SAMPLE DA/TI	ROTO RDG BEG	ROTO RDG END	FLOW RATE		BKGD COUNTS	BKGD COUNT PRD.	COUNT DATE, TIME	DELAY	COUNTS	COUNT PRD.	RESULTS	% EQU.
					FILTER/TRAY				min			WL:	
					FLASK No.:				hrs 1			pCi/l:	
									hrs 2				
									hrs 3				
					FILTER/TRAY				min			WL:	
					FLASK No.:				hrs 1			pCi/l:	
									hrs 2				
									hrs 3				
					FILTER/TRAY				min			WL:	
					FLASK No.:				hrs 1			pCi/l:	
									hrs 2				
									hrs 3				
					FILTER/TRAY				min			WL:	
					FLASK No.:				hrs 1			pCi/l:	
									hrs 2				
									hrs 3				

COMMENTS:

FIGURE 1. SAMPLE DATA FORM

EUSMETZ FACTOR (E)

min (E)	min (E)
40 - 150	66 - 98
42 - 146	68 - 94
44 - 142	70 - 90
46 - 138	72 - 87
48 - 134	74 - 84
50 - 130	76 - 82
52 - 126	78 - 78
54 - 122	80 - 75
56 - 118	82 - 73
58 - 114	84 - 69
60 - 110	86 - 66
62 - 106	88 - 63
64 - 102	90 - 60

RADON DECAY FACTOR

Hours	Factor
4	0.9702
5	0.9639
6	0.9557
7	0.9485
8	0.9413
9	0.9342
10	0.9272
11	0.9202
12	0.9133
13	0.9066
14	0.8996
15	0.8928
16	0.8861

$$\text{FLOW RATE} = (\text{ROTO RDG.}) \times (\text{CF}) \times \sqrt{29.93/(\text{B.P.})}$$

$$\text{EFF} = \frac{\text{CPM (CHECK SOURCE)} - \text{BKGD CPM}}{\text{DPM (CHECK SOURCE)}}$$

$$\text{WL} = \frac{\text{SAMPLE CPM} - \text{BKGD CPM}}{\text{K} \times \text{EFF} \times \text{SAMPLE LENGTH} \times \text{FLOW RATE}}$$

$$\text{Rn pCi/l} = \frac{\text{SAMPLE CPM} - \text{BKGD CPM}}{\text{CF} \times \text{FLASK VOLUME} \times \text{DECAY FACTOR}}$$

$$\text{\% EQUILIBRIUM} = \frac{\text{WL} \times 10{,}000}{\text{Rn pCi/l}}$$

COUNTER No. :

COUNTER EFF. :

SAMPLE LENGTH :

BARO. PRESS. :

ROTOMETER No. :

CF (SLOPE) :

Y-INTERCEPT:

4. Repeat step 3, using the standardized electroplated disk alpha source in place of the filter paper, to obtain two 10-minute counts for use in calculating the counting system efficiency.

5. Repeat step 3 for each alpha scintillation cell which will be used to make field measurements, in order to obtain the background count rate for each cell. Note that the extender cap for the counting chamber is required for counting cells, in place of the flat cap, and that 30-minute counts for cell background are preferable to 10-minute counts whenever possible. Record the cell (or flask) background counts and count times in the appropriate block on the data form.

Note on alpha scintillation cell preparation: each alpha scintillation cell should be evacuated (using the hand vacuum pump in the monitoring kit or some other appropriate vacuum source to remove the current radon sample) at least 4 hours before commencing the next background count, to allow any residual radon daughter activity to decay away. For measurements of radon in the range commonly found in residences (about 1-10 pCi/l), the background for any cell should not exceed 1 cpm, although higher background count rates may be tolerable for higher expected radon concentrations. If the background is excessive, the cell should be re-evacuated or purged with aged air (or dry nitrogen) and allowed to stand 2-4 hours before re-evaluating the background count rate.

Sample Acquisition

1. Enter the owner's name of the location to be sampled, the address, survey date, and your name (as surveyor) in the appropriate spaces at the top of the data form. Use one form for each structure surveyed, and additional forms as required. Also enter the uncorrected barometric pressure, obtained from the altimeter/barometer in the kit, in the appropriate space on the data form.

2. The pump (Staplex model BN rechargeable type or equal) should be fully charged for proper operation. Do not operate the pump while it is connected to 115V ac power, as damage may result. Four to eight hours of charging is usually sufficient for normal operation.

3. Connect the pump, alpha scintillation cell, and the filter holder assembly (containing an unused membrane filter, Millipore type HA, 0.45-micron pore size, 25-mm diameter) as shown in Figure 2. Connections to the cell are made with male Swagelok quick-disconnect fittings which must be pressed firmly into the female connector until a distinct "click" is heard. All other fittings should be checked to assure they are gas-tight. Record the sample location, pump number, flask or cell number, rotometer number, and counter serial number on the data form.

4. Using the rotometer and the specially modified rubber stopper provided in the monitoring kit, measure the initial air flow rate through the sampling train by pressing the rubber stopper firmly

ORNL/TM-9738

INTERNAL DISTRIBUTION

1–5. B. A. Berven
6. T. E. Carter
7. R. O. Chester
8 C. Clark
9. W. D. Cottrell
10. M. L. Espegren
11. A. R. Hawthorne
12. S. V. Kaye
13–17. C. A. Little
18. J. L. Marley
19. F. R. O'Donnell
20. T. H. Row
21. F. A. Santos
22. P. J. Walsh
23. J. P. Witherspoon
24. D. A. Witt
25. M. G. Yalcintas
26–27. Central Research Library
28. Document Reference Section
29. Laboratory Records
30. Laboratory Records – RC
31. ORNL Patent Office

EXTERNAL DISTRIBUTION

32. Office of Assistant Manager, Energy Research and Development, Oak Ridge Operations Office, Oak Ridge, TN 37831

33–59. Technical Information Center, DOE, Oak Ridge, TN 37831

60–69. Arthur J. Whitman, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874