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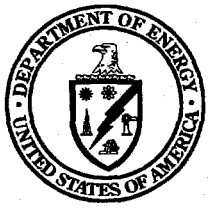
Grand Junction Projects Office
Remedial Action Project

Building 2 Public Dose Evaluation

May 1996



U.S. Department of Energy
Grand Junction Projects Office

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Work Performed Under DOE Contract No. DE–AC04–86ID12584 for the U.S. Department of Energy

Grand Junction Projects Office Remedial Action Project

Building 2 Public Dose Evaluation

Final Report

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May 1996

Prepared for
U.S. Department of Energy
Albuquerque Operations Office
Grand Junction Projects Office

Prepared by
Rust Geotech
Grand Junction, Colorado

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DISCLAIMER

Table of Contents

Tables and Figures within Text

Contents (continued)

Executive Summary

Building 2 on the U.S. Department of Energy (DOE) Grand Junction Projects Office (GJPO) site, is part of the GJPO Remedial Action Program (GJPORAP). This report describes measurements and modeling efforts to evaluate the radiation dose to members of the public who might someday occupy or tear down Building 2. Releasing the building for unrestricted use instead of demolishing it now could save a large amount of money because the site telecommunications system would not be disabled and replaced.

Building 2 was built in 1944 as a Manhattan Project building. The north portion was used as a shower and change facility for uranium workers, the south portion was a warehouse. Many originally exposed surfaces are no longer accessible for contamination surveys because expensive telecommunications equipment has been mounted on panels covering the walls and floors.

Release criteria were proposed in a data quality objectives (DQO) process conducted in cooperation with the Independent Verification Contractor (Oak Ridge National Laboratory). The building may be released for unrestricted use if the predicted dose (excluding radon) to a member of the public occupying the building is less than 15 mrem in a typical year, and less than 30 mrem in the year when demolition occurs. The radon exclusion is consistent with proposed EPA guidance. However, the radon concentration in Building 2 must not exceed 4 pCi/L, which is the action level recommended to the public by the EPA.

In an extensive effort, data were collected to characterize exposure rate, contamination levels, radon concentration, and contaminants in subsurface drain lines. When direct measurements of the dose component were not possible, RESRAD-BUILD, a predictive model sponsored by DOE, was used to assess the dose potential.

Summing all sources, the predicted Total Effective Dose Equivalent (TEDE) from normal occupancy of Building 2 is 2 mrem/year, and radon is insignificant. For demolition the predicted dose is 0.1 mrem and radon is insignificant.

Building 2 is suitable for unrestricted use by the public. Measurement and model predictions show the dose to the public from future use of Building 2 is much less than the legal limit of 100 mrem/year and well below the release criteria proposed in the DQO process. An ALARA analysis should be performed using the predicted dose and potential cost savings. A decision of disposition of the building would follow.

1.0 Introduction

Building 2 on the U.S. Department of Energy (DOE) Grand Junction Projects Office (GJPO) site, which is operated by Rust Geotech, is part of the GJPO Remedial Action Program. This report describes measurements and modeling efforts to evaluate the radiation dose to members of the public who might someday occupy or tear down Building 2. The assessment of future doses to those occupying or demolishing Building 2 is based on assumptions about future uses of the building, measured data when available, and predictive modeling when necessary. Future use of the building is likely to be as an office facility. The DOE sponsored program, RESRAD-BUILD, Version 1.5 (Reference 1) was chosen for the modeling tool.

Releasing the building for unrestricted use instead of demolishing it now could save a substantial amount of money compared with the baseline cost estimate because the site telecommunications system, housed in Building 2, would not be disabled and replaced. The information developed in this analysis may be used as part of an as low as reasonably achievable (ALARA) cost/benefit determination regarding disposition of Building 2.

Building 2 was built in 1944 as a Manhattan Project building. The north portion was used as a shower and change facility for workers involved in uranium milling operations, the south portion was a warehouse. Many originally exposed surfaces, which may be contaminated with uranium and its byproducts, are no longer accessible for contamination surveys because expensive telecommunications equipment has been mounted on panels covering the walls and floors of the north end of the building.

This dose evaluation includes measurements of gamma exposure rate, radon concentration, radioactive contamination in subsurface drain lines, contamination on accessible surfaces, and an evaluation of contamination on originally exposed but now inaccessible surfaces using statistically selected core samples. Data were evaluated using the dose prediction model RESRAD-BUILD (Reference 1). The results are compared with values proposed in a data quality objectives (DQO) process in cooperation with the Independent Verification Contractor (Oak Ridge National Laboratory). The Independent Verification Contractor has responsibility for assuring that the cleanup criteria established for the GJPO Remedial Action Program have been met. The DQO is included as Appendix 3; the executive summary of the DQO follows:

> *This document defines the Data Quality Objectives (DQO) and future use assumptions necessary for predicting the public dose associated with future use of Building 2 as part of the DOE Grand Junction Projects Office Remedial Action Program (GJPORAP). A formal definition of the "affected areas," which is needed for design of the sampling plan, is also included.*
>
> *The DQO states that the building may be released for unrestricted use if the predicted dose (excluding radon) to a member of the public occupying the building is less than 15 mrem in a typical year, and less than 30 mrem in the year when demolition occurs. The required confidence level for sampling is set at 95%. In keeping with proposed EPA guidance (FR Vol. 59, No. 246, p. 66415) the dose criteria do not include the*

contribution from indoor radon, either from naturally occurring radium-bearing soils or fill material situated beneath or near the building. However the radon concentration in Building 2 must not exceed 4 pCi/L, which is the level recommended to the public by the EPA and Centers for Disease Control in "A Citizen's Guide to Radon" (EPA 402-K92-001).

Future use of Building 2 is expected to be the same as its current use: an office facility occupied for eight hours per day, five days per week. Some day the building will be demolished. Exposure to potentially radioactive dust on surfaces that are currently inaccessible may occur, creating larger doses compared with normal occupancy. Demolition is assumed to take 80 hours to complete. No beneficial use of the building debris is expected; all will go to a sanitary landfill.

The "affected area" of Building 2 is the exposed surfaces (including drain lines) that existed during the era of its use as a locker and shower facility for uranium workers. Subsequent construction on the building, which includes interior walls, wood paneling, and floor coverings installed over a leveling slab are designated "unaffected."

2.0 Characterization Data

A sampling plan, included as Appendix 4, was prepared to provide instructions to the personnel collecting characterization information. The sampling plan was derived from the DQO report. Samples and measurements were made following approved procedures from the Rust Geotech Environmental Procedures Catalog (Reference 2) and the Rust Geotech Field Assessments Procedures Manual. (Reference 3). Personnel assigned to do the measurements and collect samples were qualified according to Environmental Procedures Catalog procedure GN-4P, "Standard Procedure for Personnel Qualifications."

2.1 External Gamma Exposure Rate Measurements

A Reuter-Stokes Pressurized Ion Chamber with a NIST-traceable calibration was used to measure the gamma exposure rate. Building 2 was divided into two survey units: North and South. Data were also collected in the log cabin portion of Building 12 as a reference survey unit. Measurement locations are shown in Appendix 1 as Figures A1-1 and A1-2.

Significant comments were considered during the DQO process regarding the selection of Building 12 as a reference area. It is true that materials and construction of Building 12 are different from Building 2, and that Building 12 has a basement. These differences could result in lower or higher radon concentration or exposure rates, and could bias the outcome of the dose assessment. The log cabin portion of Building 12 was chosen as the reference unit because it predates radioactive material use on the site and is likely to conservatively represent the background exposure rate and radon concentration in Building 2. Lacking a clearly unaffected reference structure of similar design and age, Building 12 was chosen because there was little doubt it was unaffected.

Table A1-1 in Appendix 1 shows the exposure rate data measured one meter above the floor for each survey unit. The mean and standard deviation of these data are summarized below in Table 1.

Table 1. Summary of Pressurized Ion Chamber Data

Survey Unit	Mean, μR/hr	Standard Deviation
Building 12 Log Cabin	10.94	0.618
Building 2 North	11.99	0.189
Building 2 South	11.77	0.368
Building 2 North/South Pooled	11.87	0.314

These data were tested for statistical differences using the nonparametric Wilcoxon Rank Sum (WRS) and Quantile tests. The null hypothesis, that there is no difference in the exposure rates between the pooled Building 2 survey units and the reference unit, was rejected in WRS test and accepted in the Quantile test. A parametric 't' test found significant difference between the two means. (See Reference 4 for documentation.)

By considering the exposure rate data for the Building 2 north and south survey units as one (called pooling) and subtracting the background from Building 12, the estimate of the increase in exposure rate above background is 0.926 ± 1.39 μR/hour. The uncertainty term represents the 95% confidence interval around the difference. Pooling the data from the north and south survey units is reasonable since it is likely that future building occupants will have access to both areas.

The data obtained with the pressurized ion chamber is consistent with historical data collected by the Rust Geotech occupational dosimetry area TLD program (Reference 4).

After these measurements were made, evidence of soil contamination below the west foundation of Building 2 was discovered during the excavation of an adjacent structure. Though readily detectable the material does not appear to extend more than ½ meter past the edge of the foundation and is lower in concentration that the site cleanup standard. The material discovered was consistent with uranium contamination from prior site activities. This material did not noticeably affect exposure rate in the structure. However, the present plan is to remove the material during other remedial actions near Building 2.

2.2 Radon Measurements

Landaur Track Etch radon detectors, type DRN, were used to measure radon-222 concentration. Building 2 was divided into two survey units: North and South. One sample was also collected in the log cabin portion of Building 12. Sampling locations are shown in Figures A1-1 and A1-2

in Appendix 1. The samples were collected from January 3 through February 2, 1996. It is generally accepted that in the middle latitudes, where buildings are heated in winter, radon sampling during January will conservatively estimate the annualized average concentration.

Data presented in Appendix 2 show the radon concentration was less than the detection limit, which was 1 pCi/L, for all measurements. This concentration is much less than the 4 pCi/L EPA guideline value.

Data from a 1989-1990 nationwide study of radon in DOE buildings (Reference 5) confirms these measurements. In an exposure from 11/13/89 to 2/13/89 the concentration in Building 2 was 1.4 pCi/L and in Building 12 was 3.0 pCi/L. Since then significant remedial actions have occurred on the GJPO site that have removed nearby radon sources.

2.3 Contamination Measurements

Measurements of total and removable contamination were made in both accessible and inaccessible areas. Although uranium and its byproducts also emit alpha radiation, the proportions of alpha to beta radiation are roughly one to one. Only beta measurements were collected for this characterization because, under field conditions, beta radiation is much more detectable and the contamination guidelines for alpha and beta contamination apply separately. The data are useful to show compliance with traditional contamination guidelines (Reference 6) and to model the dose that would result from future use of the building.

Scanning measurements are made to estimate contamination levels and find elevated areas of contamination called "hot spots." Direct measurements were made to quantitate the contamination levels at hot spots and other randomly selected areas. This should result in a conservatively biased estimate of the average activity per unit area. When scanning was not feasible due to surface coverings on originally exposed surfaces, core samples were taken at random locations selected according to the method in the sampling plan. Core sampling should produce an unbiased estimate of the contamination levels on inaccessible surfaces.

2.3.1 Scanning Measurements

A summary of the scanning measurements made with hand-held contamination survey meters is included in Appendix 1 as Table A1-2. Figure A1-3, also in Appendix 1, shows the locations graphically. NE Electra survey meters with DP6a scintillation probes were operated in the rate meter mode to obtain the data. NIST-traceable chlorine-36 sources were used to calibrate the survey meters. The scanning data were used to identify areas for more detailed evaluation and to decide if small accessible areas exceeded the "hot spot" criteria of three times average guideline value. Locations where elevated count rates were found or suspected were evaluated with direct measurements as discussed below.

Scanning measurements revealed only three areas where contamination greater than the average limit was found. No hot spot greater than three times the average guideline value in any 100-cm^2 area was found.

2.3.2 Direct Contamination Measurements of Accessible Areas

Locations identified in the scanning survey as contaminated or potentially contaminated were quantitatively evaluated for total beta contamination with the same model survey meters used for scanning, operated instead in the scaler mode. Other locations, which were randomly selected according to the sampling plan were also measured. Measurement locations are shown in Figure A1-4 in Appendix 1. To make these measurements, the meter was held at a fixed height (½ inch) over the same location for a fixed time (one minute). At each of these locations a smear test, discussed below, was also taken.

The results of these measurements are shown in Table A1-3 which is in Appendix 1. Only three locations were contaminated more than the average guideline value. None were more than the hot spot criteria. These three areas correlate exactly with the elevated areas identified in the scanning surveys. One location, D90, an old room radiator that is not in service, is contaminated to the level of 10,330 dpm/100 cm^2. Current plans call for this item to be removed during maintenance. Future building occupants are unlikely to encounter this source.

Table 2 on the next page summarizes the average contamination levels found in each sampling unit.

Table 2. Summary of Average Contamination Levels for Each Survey Unit ①

Survey Unit	Accessible or Inaccessible	Total Contamination, dpm/100 cm^2	Standard Deviation, dpm/100 cm^2
New Walls	accessible	-110	167
North - Old Walls ②	accessible	1484	2313
Floor	accessible	413	946
North Floor (cores)③	inaccessible	1023	1129
South Floor (cores) ④	inaccessible	679	743
North - East Wall (cores)	inaccessible	1659	6706
North - North Wall (cores)	inaccessible	4000	8609
North - West Wall (cores)	inaccessible	1897	5254
South - East Wall (cores)	inaccessible	786	5526
South - West Wall (cores)	inaccessible	2499	5962

① No removable contamination greater than guideline values was found in any sampling unit. Using field screening techniques the highest 34 smears were reevaluated with a desktop scaler counter. The mean of these measurements was -4.7 dpm/100 cm^2 with a standard deviation of 43. For dose modeling purposes the one sigma upper limit, 39 dpm/100 cm^2, from this conservatively biased sample of smears will be used as the removable contamination level for each sampling unit when such a value is required.

② When location D90 is removed from consideration (plans call for removal of the contaminated radiator) the mean is 1150 dpm/100 cm^2 and the standard deviation is 1643.

③ Data in the table represent the average over all concrete surfaces, including the new slab. When only the surface of the original slab (side "C" in the location code) is considered, the mean is 2352 dpm/100 cm^2 and the standard deviation is 1198.

④ Data in the table represent the average over all concrete surfaces, including the new slab. When only the surface of the original slab (side "C" in the location code) is considered, the mean is 1460 dpm/100 cm^2 and the standard deviation is 681.

2.3.3 Smear Contamination Measurements of Accessible Areas

At the same location where direct contamination measurements were made, removable contamination smears were taken. The smears were semi-quantitatively evaluated in the field using the hand probe in the scaler mode to decide if a better, more quantitative measurement was required. The results of these field measurements are in Table A1-3 in Appendix 1. The maximum value estimated in this semi-quantitative analysis was 912 dpm/100 cm^2.

No field measurements of smears showed removable contamination greater than the guideline value of 1000 dpm/100 cm2. Thirty-four smears were identified as potentially elevated above background. These smears were quantitatively evaluated using the Ludlum Model 2929 desktop scaler/counter. Table A1-4 in Appendix 1 shows these data. The highest value found in quantitative analysis was 75 dpm/100 cm^2.

To avoid introducing more error than necessary, the field estimates of removable contamination were discarded and replaced with the one sigma upper confidence interval from the quantitative measurements of the thirty-four highest smears. This provides a conservative estimate of the removable contamination. The mean and standard deviation of the potentially elevated smears was -4.7 ± 43 dpm/100 cm^2. The value of the one sigma upper confidence interval was 39 dpm/100 cm^2.

2.3.4 Direct Contamination Measurements of Inaccessible Areas Using Core Samples

Core samples were taken to discover the average contamination level on originally exposed surfaces that are now covered. Core sample locations are shown in Figure A1-5 in Appendix 1. Table A1-5 in Appendix 1 shows the data from direct contamination measurements made in these cores. Figure A1-5 in Appendix 1 shows the locations of core samples.

The following information is useful for decoding the location codes in the table. At each location the top or facing surface of the material was measured after removal and identified as surface "A." The back of the material -- which typically was paneling, sheetrock, plywood, or a concrete slab -- was identified as surface "B." Often multiple layers of material were encountered and then the front of the second material was labeled surface "C." A typical example is Location C21 where sheetrock covered Celotex. The team leader's notes (Reference 4) indicates that facing side of both surfaces were painted.

Table A1-5 includes data taken from both floors (locations C1 through C13) and walls (C14 through C58). Inspection of the wall sample data reveals that the contamination levels do not vary as much with spacial location on the sampling grid as they do by Material Type. Therefore, analysis was done to discover the average contaminant level associated with each material. Table A1-6 in Appendix 1 shows the wall core data sorted by Material Type. Table 3, below, summarizes the mean and standard deviation of the activity per 100 cm^2 for each Material Type.

Table 3. Average Total Contamination for each Survey Unit and Material Type Having Elevated Contamination Levels

Material Type ①	Survey Unit	Mean, dpm/100 cm^2	Standard Deviation
Concrete	North-N	26,676	5,036
" "	North-E	13,114	14,828
Insulation	South-W	19,643	2,825
" "	South-E	9,586	9,618
Wood	North-N	12,146	5,828
" "	North-E	4,050	12,951
" "	North-W	9,075	9,309
" "	South-W	10,641	4,005
" "	South-E	1,735	3,172

① For Material Types with elevated contamination levels only those survey units having data are shown. For Material Types not shown, the average total contamination level in each survey unit was less than 500 dpm/100 cm^2.

The concrete Material Type forms the lower half of the north and east walls of the telecommunications room. The interior face of this concrete appears to be contaminated. Although it is possible that the concrete aggregate is naturally radioactive and is the cause of the elevated readings, it is more likely that this is residual activity from the facility's original use as a shower and change room for uranium workers.

The wood Material Type was found to have elevated contamination in five different survey units. This was often associated with structural wood and was almost uniformly distributed throughout the exterior walls. The contaminant level for wood averaged over all affected survey units is approximately 8000 dpm/100 cm^2 with standard deviation of about 8500.

The insulation Material Type was significantly elevated inside external walls on the south end of the building.

The core samples from the concrete floor slabs revealed relatively uniform contamination levels over the two survey units. The mean value of the pooled data was 1906 dpm/100 cm^2 with a standard deviation of 1039.

2.3.5 Smear Contamination Measurements of Inaccessible Areas Using Core Samples

No removable contamination greater than the guideline value was found in any core sample. The smears exhibiting the largest values were reevaluated using a tabletop smear counter. These reevaluated results are discussed in Section 2.3.3 above. For dose modeling purposes the value of 39 dpm/100 cm^2 will be used.

2.4 Pipe Explorer™ Measurements

Science and Engineering Associates, Inc. (SEA) was contracted to do radiological and video characterization survey of the two identified drain pipes running below Building 2. A report of the SEA operations at the Grand Junction Projects Office (Reference 7) provides information on this and other work performed. SEA used its Pipe Explorer™ system to tow a small video camera and a beta detector through the pipes to collect information. The Pipe Explorer™ process involves inverting (turning inside out) a tubular impermeable membrane under air pressure. The membrane can tow a sensor through pipe constrictions, around 90 degree bends, and vertically up and down. Because the sensor is transported inside the disposable membrane, it is protected from contamination.

Calibration of the beta detector was established using a NIST-traceable strontium-90 source in a geometry matched to the 4-inch iron drain pipe.

Two abandoned drain pipes were to be imaged and measured for beta contamination. Line number 1 drained the bathrooms on the northwest side of Building 2. Line number 2 drained the water from the sinks and showers used by uranium workers in the northeast side of Building 2. The video image and operators log for line number 1 indicates the layout of the pipe and features such as connecting lines. Figure 1, below, is a graph of the data collected in line number 1 and shows that the contamination level in the pipe is significantly below release limits and below the minimum detectable activity for this system of 2,700 dpm/100 cm^2. The Pipe Explorer™ could not be used and was unable to obtain data in line number 2 because it was blocked by sediments The most important effect of the contamination that may be in line number 2 is probably external exposure. This effect was measured as part of the overall exposure rate in the North Survey Unit.

Pipe Explorer Data Summary Graph
Grand Junction Projects Office
Building No. 2, Pipe Run ID, No. 1
4-Inch Iron Pipe
Data taken 2/20/96

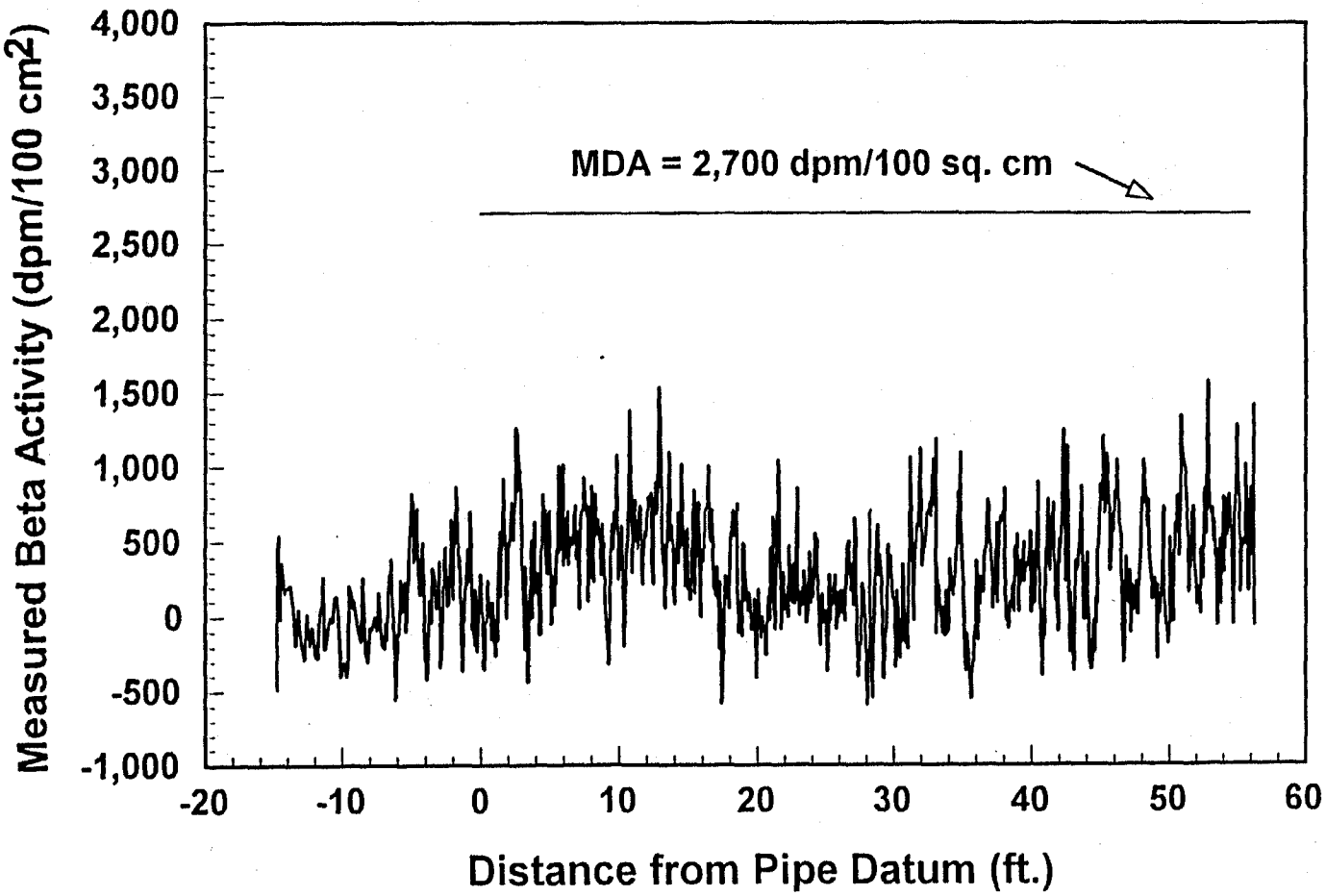


Figure 1

3.0 Dose Assessment

The assessment of future doses to people occupying or demolishing Building 2 is based on measured data, and assumptions about future uses of the building. The assumptions about future use of the building were documented in the DQOs and summarized in Section 1. The process of modeling future dose involves converting assumptions into equations and including the measured data as parameters in those equations. Usually the equations have been published as computer codes and reference documents. The approach taken in this dose assessment is to use the equations and some defaults parameters used in RESRAD-BUILD, Version 1.5 (Reference 1). For external exposure and radon concentration, measured data makes those calculations done by RESRAD-BUILD irrelevant.

RESRAD-BUILD is a new member of a family of programs issued by DOE. These programs have been peer reviewed and gained wide acceptance. Before doing this work the capability of RESRAD-BUILD to assess future doses from Building 2 was evaluated and found adequate (Reference 8).

3.1 Dose During Normal Occupancy

The attributable dose during normal occupancy of the building will be the result of:

external gamma exposure greater than background,

radon concentrations greater than 4 pCi/L,

inhalation of residual airborne contaminants, and

ingestion of residual contaminants.

Measured external exposure rate data were used instead of the modeled exposure rate. Assumptions used in the calculation were that a member of the public occupies the building eight hours each day, five days a week, fifty weeks a year for a total of 2,000 hours each year. In Section 2.1 it was established that the best estimate of exposure rate above background is 0.926 μR per hour. The convention that 1 R equals 1 rem was used. Multiplying the exposure rate, conversion convention, and exposed hour per year results in a dose of 1.85 mrem/year above background. The 95% confidence interval around this estimate is -0.928 to +4.63 mrem/year.

The contribution of radon to the risk of residual radioactivity is best represented by comparison to the national guidelines established by the U. S. EPA for radon in homes. The EPA has set a guideline for action at 4 pCi/L without regard for the source. This was established in the DQO as the decision criteria. The data presented in Section 2.2 show that the concentration of radon is approximately 1 pCi/L or less and therefore radon is not a concern in Building 2.

Contamination in buried pipes is not a concern because the pipe that was measured had contamination levels lower than the release limits. The other pipe is not accessible and any contribution to dose is accounted for in the external exposure measurements.

The input parameters used to run RESRAD-BUILD are detailed in Appendix 5. Data in Section 2.3 of this report was the basis for the input parameters. The report of results is in Appendix 6. The maximum annual inhalation dose predicted by RESRAD-BUILD over the next 30 years is 0.1 mrem. The maximum annual ingestion dose predicted by RESRAD-BUILD over the next 30 years is 0.0005 mrem.

Summing all sources, the predicted Total Effective Dose Equivalent (TEDE) from normal occupancy of Building 2 is 1.95 mrem/year, and the radon concentration is insignificant.

Considering the uncertainty in measurements and assumptions, it is appropriate to state that the dose from normal occupancy is approximately 2 mrem/year TEDE.

3.2 Dose During Demolition

Dose during demolition will be the sum of the same components considered during normal occupancy, but the accessibility of the residual radioactivity and work patterns will be significantly different. The assumptions and input parameters used as input are detailed in Appendix 3. Important differences are in the fraction of the radioactivity that is removable, the dust resuspension rate, the breathing rate and dust ingestion rate of workers, the duration of exposure and outdoor ventilation conditions. The report of the calculated results is in Appendix 4.

Assumptions used in the calculation were that demolition occurs during 10 eight-hour days, for a total of 80 hours. The net effect of shielding configuration changes on the external exposure dose rate should be insignificant, so the same rate is assumed. The predicted external dose during demolition is 0.074 mrem with a 95% confidence interval spanning from -0.037 to +0.185 mrem.

As in the normal occupancy scenario, radon is of no concern.

Any contamination that may be in buried drainage pipes will be largely contained by those pipes during demolition and disposal. This source term is unlikely to significantly alter the calculated inhalation dose.

Inhalation dose due to demolition predicted by RESRAD-BUILD is 0.69 mrem. Ingestion dose predicted by RESRAD-BUILD is 0.002 mrem.

Summing all sources, the predicted Total Effective Dose Equivalent (TEDE) due to demolition of Building 2 is 0.77 mrem, and the radon concentration is insignificant.

Considering the uncertainty in measurements and assumptions, it is appropriate to state that the dose from normal occupancy approximately is 1 mrem TEDE.

3.3 Disposal of Demolition Debris

The demolition debris from Building 2 will be essentially like other debris from the region. No beneficial use of disposal debris is anticipated, and it is likely that all will be incorporated into the

subsurface structure of a sanitary landfill. The process of demolition will cause the radioactive contaminants to be averaged into the mass of debris, resulting in extremely low concentrations. The concentration of radioactivity in the debris is likely to be far below EPA disposal criteria for uranium mill tailings. The disposal criteria, specified in 40 CFR 192, is that activity should not exceed 15 pCi/g in soil structures 15-cm or more below the surface.

4.0 Conclusions

Measurement and model predictions have shown the dose to the public from future use of Building 2 is much less than the legal limit of 100 mrem/year and well below the release criteria proposed in the DQO process. Building 2 is suitable for unrestricted use by the public.

Disposal of demolition debris in a sanitary landfill is acceptable. Disposal will pose no hazard because the radioactivity concentration will be much less than the EPA disposal criteria for uranium mill tailings.

An ALARA analysis should be performed using the predicted dose and potential cost savings. The cost savings estimates should be developed by the GJPORAP. A decision of disposition of the building based on this information would follow.

5.0 References

1. Argonne National Laboratory, *RESRAD-BUILD [Version 1.5]: A Computer Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material*, ANL/EAD/LD-3, 1994.

2. Rust Geotech, *Environmental Procedures Catalog*, Manual 116.

3. Rust Geotech, *Field Assessments Procedures Manual.*

4. Supporting documentation filed in the DOE Grand Junction Projects Office, GJPORAP Building 2 Project Records, April 1996.

5. *Results of the U.S. Department of Energy Indoor Radon Study*, Volume 2. CNG/GJ-TP-1. UNC Geotech, DOE Grand Junction Projects Office, Grand Junction, Colorado, 1990.

6. DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, Figure IV-1, Surface Contamination Guidelines. See the entry for "U-natural."

7. Science & Engineering Associates, Inc., *Results of the Radiological and Video Surveys of Drain Lines at the DOE Grand Junction Projects Office with the Pipe Explorer™ System*, Albuquerque, New Mexico, March 8, 1996.

8. *Evaluation of RESRAD-BUILD for application to Building 2.* February, 1996. Filed in the same volume as Reference 4.

6.0 Appendices

Appendix 1

Data Tables and Figures

Table A1-1. Exposure Rate Measurements Made Using Pressurized Ion Chamber

Building 2					Building 12		
North Survey Unit		South Survey Unit			Reference Survey Unit		
Loc	Exp Rate μR/hr	Loc	Exp Rate μR/hr	Duplicate μR/hr	Loc	Exp Rate μR/hr	Duplicate μR/hr
R11	11.9	R1	10.9		R1	9.9	
R12	12.1	R2	11.6		R2	11.2	
R13	12.3	R3	11.8		R3	11.0	
R14	11.8	R4	11.8		R4	10.9	
R15	12.1	R5	12.0	12.2	R5	13.1	
R16	11.8	R6	11.9		R6	10.8	11.4
R17	11.8	R7	12.3		R7	11.4	
R18	12.1	R8	12.0		R8	10.8	
		R9	11.8		R9	11.3	
		R10	11.6		R10	10.8	
					R11	10.5	
					R12	10.3	
					R13	10.5	
					R14	10.5	
					R15	10.5	
					R16	11.1	
					R17	11.3	
					R18	11.3	
					R19	10.8	
					R20	10.9	
					R21	11.3	
					R22	10.5	
Mean	11.99		11.77			10.94	
Std Dev	0.189		0.368			0.618	

Table A1-2
SCAN MEASUREMENTS
BUILDING 2

			Inst. Reading dpm/100 cm²		Bkg dpm/100 cm²	Net dpm/100 cm²		
Survey Unit	Location ID	Material Type	High	Low		High	Low	Exceeds Limit?
FLOOR	F01-N	Vinyl	2205	1638	1261	944	377	no
FLOOR	F01-S	Carpet	2630	1438	1700	930	-262	no
FLOOR	F02-N	Vinyl	2500	1600	1504	996	96	no
FLOOR	F02-S	Carpet	2548	1438	1700	848	-262	no
FLOOR	F03-N	Vinyl	2403	1875	1261	1142	614	no
FLOOR	F03-S	Carpet	2250	1478	1700	550	-222	no
FLOOR	F04-N	Vinyl	2240	1378	1504	736	-126	no
FLOOR	F04-S	Carpet	3107	2204	1265	1842	939	no
FLOOR	F05-N	Vinyl	2556	1895	1261	1295	634	no
FLOOR	F05-S	Carpet	2540	1632	1700	840	-68	no
FLOOR	F06-S	Carpet	2633	1488	1690	943	-202	no
FLOOR	F07-S	Carpet	2957	1677	1690	1267	-13	no
FLOOR	F08-S	Carpet	2909	1867	1746	1163	121	no
FLOOR	F09-S	Carpet	2510	1867	1265	1245	602	no
FLOOR	F10-S	Carpet	2559	1516	1746	813	-230	no
FLOOR	F11-S	Carpet	2500	1506	1746	754	-240	no
FLOOR	F12-S	Carpet	2459	1597	1746	713	-149	no
FLOOR	F13-S	Carpet	2506	1834	1746	760	88	no
FLOOR	F14-S	Vinyl	2484	1614	1690	794	-76	no
FLOOR	F15-S	Vinyl	2239	1400	1690	549	-290	no
FLOOR	F16-S	Vinyl	2368	1548	1690	678	-142	no
FLOOR	F17-S	Vinyl	2016	1547	1746	270	-199	no
FLOOR	F18-S	Vinyl	2510	1488	1690	820	-202	no
FLOOR	F19-S	Concrete	7680	1963	1333	6347	630	maybe
NEW WALLS	W01-N	Sheetrock	2104	963	1298	806	-335	no
NEW WALLS	W01-S	Paneling	1475	922	1292	183	-370	no
NEW WALLS	W02-N	Paneling	1438	1003	1483	-45	-480	no
NEW WALLS	W02-S	Paneling	1602	933	1216	386	-283	no
NEW WALLS	W03-N	Plywood	1846	960	1298	548	-338	no
NEW WALLS	W03-S	Cork Board	1219	911	1292	-73	-381	no
NEW WALLS	W04-N	plywood	2264	1095	1298	966	-203	no
NEW WALLS	W04-S	Paneling	2000	1125	1292	708	-167	no
NEW WALLS	W05-S	Paneling	1612	1010	1216	396	-206	no
NEW WALLS	W06-S	Paneling	1600	1017	1216	384	-199	no
NEW WALLS	W07-S	Paneling	1719	1109	1292	427	-183	no
NEW WALLS	W08-S	Paneling	1807	1117	1216	591	-99	no
NEW WALLS	W09-S	Paneling	1646	1110	1292	354	-182	no
NEW WALLS	W10-S	Paneling	1929	1124	1216	713	-92	no

Table A1-2
SCAN MEASUREMENTS
BUILDING 2

			Inst. Reading dpm/100 cm²		Bkg dpm/100 cm²	Net dpm/100 cm²		
Survey Unit	Location ID	Material Type	High	Low		High	Low	Exceeds Limit?
NEW WALLS	W11-N	Sheetrock	1641	1125	1325	316	-200	no
NEW WALLS	W11-S	Sheetrock	1536	1080	1229	307	-149	no
NEW WALLS	W12-N	Sheetrock	1715	1103	1325	390	-222	no
NEW WALLS	W12-S	Sheetrock	1531	1016	1229	302	-213	no
NEW WALLS	W13-S	Sheetrock	1856	1094	1088	768	6	no
NEW WALLS	W14-S	Sheetrock	1569	891	1305	264	-414	no
NEW WALLS	W15-S	Sheetrock	1641	1188	1305	336	-117	no
NEW WALLS	W16-S	Sheetrock	1516	1141	1229	287	-88	no
NEW WALLS	W17-S	Sheetrock	1656	1359	1305	351	54	no
NEW WALLS	W18-S	Sheetrock	1609	1109	1305	304	-196	no
NEW WALLS	W19-S	Sheetrock	1651	1151	1471	180	-320	no
NEW WALLS	W20-S	Sheetrock	1672	1156	1471	201	-315	no
NEW WALLS	W21-S	Sheetrock	1719	1331	1305	414	26	no
NEW WALLS	W22-S	Sheetrock	1531	1113	1305	226	-192	no
NEW WALLS	W23-S	Sheetrock	1934	984	1229	705	-245	no
NEW WALLS	W24-S	Sheetrock	1563	938	1229	334	-291	no
NEW WALLS	W25-S	Paneling	1922	1078	1117	805	-39	no
NEW WALLS	W26-S	Sheetrock	1271	949	1117	154	-168	no
NEW WALLS	W27-S	Paneling	1797	1229	1338	459	-109	no
NEW WALLS	W28-S	Paneling	1431	979	1338	93	-359	no
NEW WALLS	W29-S	Sheetrock	1641	1031	1471	170	-440	no
NEW WALLS	W30-S	Paneling	1749	1171	1338	411	-167	no
NEW WALLS	W31-S	Paneling	1542	1041	1117	425	-76	no
OLD WALLS	W05-N	Concrete	3147	1797	1858	1289	-61	no
OLD WALLS	W06-N	Concrete	3610	2109	1858	1752	251	no
OLD WALLS	W07-N	Concrete	4516	1799	1570	2946	229	no
OLD WALLS	W07-N	Radiator	10300	2600	1570	8730	1030	maybe
OLD WALLS	W08-N	Concrete	3046	1605	1570	1476	35	no
OLD WALLS	W09-N	Concrete	2418	1830	1570	848	260	no
OLD WALLS	W10-N	Concrete	4408	1692	1596	2812	96	no
OLD WALLS	W32-S	Concrete	11800	1800	1690	10110	110	maybe
OLD WALLS	W33-S	Concrete	2797	1844	1446	1351	398	no
OLD WALLS	W34-S	Concrete	2942	1990	1746	1196	244	no
OLD WALLS	W35-S	Concrete	2790	1450	1540	1250	-90	no

Notes: 1) All measurements collected with NE Electra/DP6a Scintillation Probe calibrated for Cl-36

Table A1-3

DIRECT MEASUREMENTS & SMEARS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 $cm^{\wedge 2}$)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
FLOOR	D001	CARPET	2074	2016	58	no			2094	2016	78	no		
FLOOR	D002	CARPET	2110	2016	94	no			2106	2016	90	no		
FLOOR	D003	VINYL	2267	1804	463	no			2196	1804	392	no		
FLOOR	D004	VINYL	2274	2078	196	no			1918	2078	-160	no		
FLOOR	D005	CARPET	2102	2016	86	no			1820	2016	-196	no		
FLOOR	D006	CARPET	2027	1998	29	no			2008	1998	10	no		
FLOOR	D007	CARPET	2245	2016	229	no			2057	2016	41	no		
FLOOR	D008	CARPET	2204	2016	188	no			1959	2016	-57	no		
FLOOR	D009	VINYL	2309	2016	293	no			1902	2016	-114	no		
FLOOR	D010	CARPET	2163	1998	165	no			1902	1998	-96	no		
FLOOR	D011	CARPET	2126	2016	110	no			1902	2016	-114	no		
FLOOR	D012	VINYL	1928	2078	-150	no			2029	2078	-49	no		
FLOOR	D013	CARPET	2320	2016	304	no			1980	2016	-36	no		
FLOOR	D014	CARPET	2367	1998	369	no			1984	1998	-14	no		
FLOOR	D015	VINYL	1825	1804	21	no			1808	1804	4	no		
FLOOR	D016	CARPET	2180	2016	164	no			1931	2016	-85	no		
FLOOR	D017	VINYL	1788	1804	-16	no			2075	1804	271	no		
FLOOR	D018	CARPET	1963	2016	-53	no			1835	2016	-181	no		
FLOOR	D019	VINYL	1881	1804	77	no			1875	1804	71	no		
FLOOR	D020	CARPET	2138	1788	350	no			1600	1788	-188	no		
FLOOR	D021	VINYL	1776	2078	-302	no			2049	2078	-29	no		
FLOOR	D022	CARPET	1833	1788	45	no			1754	1788	-34	no		
FLOOR	D023	CARPET	1963	2016	-53	no			1861	2016	-155	no		
FLOOR	D024	CARPET	2151	2016	135	no			1967	2016	-49	no		
FLOOR	D025	CARPET	2236	2016	220	no			1608	2016	-408	no		
FLOOR	D026	VINYL	2026	2078	-52	no			1976	2078	-102	no		
FLOOR	D027	CARPET	2129	1788	341	no			1663	1788	-125	no		
FLOOR	D028	CARPET	2042	1788	254	no			1688	1788	-100	no		
FLOOR	D029	CARPET	2123	1998	125	no			1843	1998	-155	no		

Table A1-3

DIRECT MEASUREMENTS & SMEARS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
FLOOR	D030	CARPET	2023	2016	7	no			1918	2016	-98	no		
FLOOR	D097	CONCRETE	6760	1333	5427	yes			1583	1638	-55	no		
FLOOR	D098	CARPET	3315	1265	2050	no			1490	1265	225	no		
FLOOR	D099	CARPET	2416	1910	506	no			2135	1910	225	no		
FLOOR	D100	CARPET	3067	1871	1196	no			1963	1871	92	no		
FLOOR	D101	CARPET	2123	1265	858	no			1596	1265	331	no		
FLOOR	D102	CARPET	2029	1261	768	no			1710	1261	449	no		
FLOOR	D103	CARPET	2057	1261	796	no	413	946	1637	1261	376	no	1	187
NEW WALLS	D031-0	PLYWOOD	1642	1529	113	no			2029	1529	500	no		
NEW WALLS	D031-1	PLYWOOD	1317	1529	-212	no			1918	1529	389	no		
NEW WALLS	D031-2	PLYWOOD	1338	1529	-191	no			1875	1529	346	no		
NEW WALLS	D032-2	SHEET ROCK	1400	1722	-322	no			2176	1722	454	no		
NEW WALLS	D033-0	SHEET ROCK	1747	1722	25	no			1922	1722	200	no		
NEW WALLS	D033-1	SHEET ROCK	1171	1722	-551	no			1633	1722	-89	no		
NEW WALLS	D033-2	SHEET ROCK	1180	1722	-542	no			1641	1722	-81	no		
NEW WALLS	D034-0	PLYWOOD	1592	1533	59	no			1879	1533	346	no		
NEW WALLS	D034-1	PLYWOOD	1524	1533	-9	no			1383	1533	-150	no		
NEW WALLS	D034-2	PLYWOOD	1363	1533	-170	no			1571	1533	38	no		
NEW WALLS	D035-0	PLYWOOD	1646	1530	116	no			1971	1530	441	no		
NEW WALLS	D035-1	PLYWOOD	1325	1530	-205	no			1891	1530	361	no		
NEW WALLS	D035-2	PLYWOOD	1238	1530	-292	no			2038	1530	508	no		
NEW WALLS	D036-0	VINYL	1902	2078	-176	no			2094	2078	16	no		
NEW WALLS	D036-1	PLYWOOD	1518	1347	171	no			2200	1347	853	no		
NEW WALLS	D036-2	PLYWOOD	1441	1347	94	no			2102	1347	755	no		
NEW WALLS	D037-0	VINYL	1743	1882	-139	no			1747	1882	-135	no		
NEW WALLS	D037-1	PLYWOOD	1310	1347	-37	no			1710	1347	363	no		
NEW WALLS	D037-2	PLYWOOD	1130	1347	-217	no			1771	1347	424	no		
NEW WALLS	D038-0	SHEETROCK	1688	1479	209	no			1663	1479	184	no		
NEW WALLS	D038-1	SHEETROCK	1254	1479	-225	no			1725	1479	246	no		

Table A1-3

DIRECT MEASUREMENTS & SMEARS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 $cm^{\wedge 2}$)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NEW WALLS	D038-2	SHEETROCK	1238	1479	-241	no			1700	1479	221	no		
NEW WALLS	D039-0	PANELING	1625	1437	188	no			2135	1437	698	no		
NEW WALLS	D039-1	PANELING	1367	1437	-70	no			2061	1437	624	no		
NEW WALLS	D039-2	PANELING	1278	1437	-159	no			1931	1437	494	no		
NEW WALLS	D040-2	SHEETROCK	1242	1500	-258	no			1692	1500	192	no		
NEW WALLS	D041	SHEETROCK	1335	1384	-49	no			1678	1706	-28	no		
NEW WALLS	D042	PANELING	1171	1450	-279	no			1679	1638	41	no		
NEW WALLS	D043	VINYL	1796	2041	-245	no			1665	1706	-41	no		
NEW WALLS	D044	SHEETROCK	1355	1384	-29	no			1649	1706	-57	no		
NEW WALLS	D045	PANELING	1204	1450	-246	no			1792	1638	154	no		
NEW WALLS	D046	SHEETROCK	1376	1384	-8	no			1596	1706	-110	no		
NEW WALLS	D047	SHEETROCK	1318	1384	-66	no			1780	1706	74	no		
NEW WALLS	D048	SHEETROCK	1171	1384	-213	no			1494	1706	-212	no		
NEW WALLS	D049	SHEETROCK	1347	1384	-37	no			1592	1706	-114	no		
NEW WALLS	D050	SHEETROCK	1392	1384	8	no			1739	1706	33	no		
NEW WALLS	D051	PANELING	1458	1450	8	no			1529	1638	-109	no		
NEW WALLS	D052	SHEETROCK	1343	1384	-41	no			1531	1706	-175	no		
NEW WALLS	D053	PANELING	1129	1450	-321	no			1483	1638	-155	no		
NEW WALLS	D054	SHEETROCK	1404	1384	20	no			1612	1706	-94	no		
NEW WALLS	D055	SHEETROCK	1445	1384	61	no			1665	1706	-41	no		
NEW WALLS	D056	SHEETROCK	1302	1384	-82	no			1637	1706	-69	no		
NEW WALLS	D057	PANELING	1163	1450	-287	no			1546	1638	-92	no		
NEW WALLS	D058	SHEETROCK	1347	1384	-37	no			1680	1706	-26	no		
NEW WALLS	D059	SHEETROCK	1265	1384	-119	no			1563	1706	-143	no		
NEW WALLS	D060	SHEETROCK	1442	1450	-8	no			1567	1638	-71	no		
NEW WALLS	D061	SHEETROCK	1302	1384	-82	no			1559	1706	-147	no		
NEW WALLS	D062	SHEETROCK	1388	1450	-62	no			1688	1638	50	no		
NEW WALLS	D063	PANELING	1388	1450	-62	no			1571	1638	-67	no		
NEW WALLS	D064	SHEETROCK	1279	1450	-171	no			1479	1638	-159	no		

Table A1-3

DIRECT MEASUREMENTS & SMEARS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 $cm^{\wedge 2}$)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NEW WALLS	D065	SHEETROCK	1292	1450	-158	no			1596	1638	-42	no		
NEW WALLS	D066	SHEETROCK	1579	1450	129	no			1583	1638	-55	no		
NEW WALLS	D067	PANELING	1083	1450	-367	no			1563	1638	-75	no		
NEW WALLS	D068	SHEETROCK	1490	1384	106	no			1494	1706	-212	no		
NEW WALLS	D069	SHEETROCK	1215	1450	-235	no			1458	1638	-180	no		
NEW WALLS	D070	PANELING	1171	1450	-279	no	-111	167	1450	1638	-188	no	105	277
OLD WALLS	D032-0	VINYL	2012	2078	-66	no			2400	2078	322	no		
OLD WALLS	D032-1	CONCRETE	2294	1665	629	no			2282	1665	617	no		
OLD WALLS	D040-0	CONCRETE	2054	1500	554	no			1846	1500	346	no		
OLD WALLS	D040-1	CONCRETE	2021	1500	521	no			1667	1500	167	no		
OLD WALLS	D071	CONCRETE	10700	1690	9010	yes			779	806	-27	no		
OLD WALLS	D072	CONCRETE	2583	1446	1137	no			967	806	161	no		
OLD WALLS	D073	CONCRETE	2453	1746	707	no			645	806	-161	no		
OLD WALLS	D074	CONCRETE	2790	1540	1250	no			860	806	54	no		
OLD WALLS	D075	CONCRETE	3467	1963	1504	no			2254	1963	291	no		
OLD WALLS	D076	CONCRETE	2396	1796	600	no			2142	1796	346	no		
OLD WALLS	D077	CONCRETE	2104	1796	308	no			2221	1796	425	no		
OLD WALLS	D078	CONCRETE	1733	1796	-63	no			2271	1796	475	no		
OLD WALLS	D079	CONCRETE	2208	1796	412	no			2367	1796	571	no		
OLD WALLS	D080	CONCRETE	2383	1621	762	no			2400	1621	779	no		
OLD WALLS	D081	CONCRETE	2517	1621	896	no			2325	1621	704	no		
OLD WALLS	D082	CONCRETE	2508	1621	887	no			2533	1621	912	no		
OLD WALLS	D083	CONCRETE	2925	1621	1304	no			2421	1621	800	no		
OLD WALLS	D084	CONCRETE	3647	1788	1859	no			1525	1788	-263	no		
OLD WALLS	D085	CONCRETE	2008	1490	518	no			2338	1490	848	no		
OLD WALLS	D086	CONCRETE	3779	1490	2289	no			2046	1490	556	no		
OLD WALLS	D087	CONCRETE	2750	1490	1260	no			2379	1490	889	no		
OLD WALLS	D088	CONCRETE	2271	1490	781	no			2213	1490	723	no		
OLD WALLS	D089	CONCRETE	5049	1600	3449	no			2310	1600	710	no		

Table A1-3

DIRECT MEASUREMENTS & SMEARS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 $cm^{\wedge 2}$)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exeeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
OLD WALLS	D090	METAL	12400	2070	10330	yes			2210	2070	140	no		
OLD WALLS	D091	CONCRETE	3229	2008	1221	no			2078	2008	70	no		
OLD WALLS	D092	CONCRETE	2054	1692	362	no			2042	1692	350	no		
OLD WALLS	D093	CONCRETE	1975	1692	283	no			2067	1692	375	no		
OLD WALLS	D094	CONCRETE	1796	1692	104	no			1892	1692	200	no		
OLD WALLS	D095	CONCRETE	2538	1692	846	no			2046	1692	354	no		
OLD WALLS	D096	CONCRETE	1979	1692	287	no			2142	1488	654	no		
OLD WALLS	D104	CONCRETE	3629	1580	2049	no	1484	2313	1641	1706	-65	no	398	321

Notes: 1) All readings were collected with NE Electra/DP6A Scintillation probe calibrated for Cl-36. The smears were wiped over an area of approximately 100 cm^2.

Table A1-4

Potentially Elevated Building 2 Smears

Ludlum Model 2929 Scaler

Survey Unit	Sample ID	Instrument Reading, counts	Bkg, counts	Net dpm	Beta Cal Factor	Exceeds Limit?
NORTH-E	C034-B	52	59	-32.7	4.67	no
NORTH-E	D036-1	59	56	13.7	4.57	no
NORTH-E	D036-2	53	56	-13.7	4.57	no
NORTH-E	C037-A	51	59	-37.4	4.67	no
NORTH-E	D039-0	63	56	32.0	4.57	no
NORTH-W	D080	56	56	0.0	4.57	no
NORTH-W	D081	70	56	64.0	4.57	no
NORTH-W	D082	58	56	9.1	4.57	no
NORTH-W	D083	67	56	50.3	4.57	no
NORTH-W	D085	70	56	64.0	4.57	no
NORTH-W	D087	55	56	-4.6	4.57	no
NORTH-W	D088	54	56	-9.1	4.57	no
NORTH-W	C014-B	55	59	-18.7	4.67	no
NORTH-W	C015-B	60	59	4.7	4.67	no
NORTH-W	C016-A	49	59	-46.7	4.67	no
NORTH-W	C016-B	45	59	-65.4	4.67	no
NORTH-N	C023-A	35	59	-112.1	4.67	no
NORTH-N	C025	44	59	-70.1	4.67	no
NORTH-N	C026-B	55	59	-18.7	4.67	no
NORTH-N	C029-E	54	59	-23.4	4.67	no
NORTH-N	C029-F	49	59	-46.7	4.67	no
NORTH-N	C031	50	59	-42.0	4.67	no
SOUTH-E	C052-C	53	59	-28.0	4.67	no
SOUTH-E	C052-D	61	59	9.3	4.67	no
SOUTH-E	C053-B	65	59	28.0	4.67	no
SOUTH-E	C054-B	66	59	32.7	4.67	no
SOUTH-E	C054-D	50	59	-42.0	4.67	no
SOUTH-E	C055-A	71	59	56.0	4.67	no
SOUTH-W	C045-B	75	59	74.7	4.67	no
SOUTH-W	C045-C	65	59	28.0	4.67	no
SOUTH-W	C046-C	52	59	-32.7	4.67	no
SOUTH-W	C046-D	66	59	32.7	4.67	no
SOUTH-W	C049-A	65	59	28.0	4.67	no
SOUTH-F	C010-B	50	59	-42.0	4.67	no
		Mean		-4.67		
		Std Dev		43.29		
		1 sigma UCL		38.628436		

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NORTH-E	C32	CONCRETE	91134	78518	12616	yes					NA	NA		
NORTH-E	C32-A	PLYWOOD	1021	833	188	no			833	806	27	no		
NORTH-E	C32-B	PLYWOOD	698	833	-135	no			914	806	108	no		
NORTH-E	C32-C	SHEETROCK	833	833	0	no			816	806	10	no		
NORTH-E	C32-D	SHEETROCK	779	833	-54	no			591	806	-215	no		
NORTH-E	C33	WOOD	73621	78518	-4897	no					NA	NA		
NORTH-E	C33-A	PLYWOOD	779	833	-54	no			672	806	-134	no		
NORTH-E	C33-B	PLYWOOD	725	833	-108	no			618	806	-188	no		
NORTH-E	C33-C	SHEETROCK	698	833	-135	no			698	806	-108	no		
NORTH-E	C33-D	SHEETROCK	833	833	0	no			403	806	-403	no		
NORTH-E	C34	CONCRETE	111801	78518	33283	yes					NA	NA		
NORTH-E	C34-A	PLYWOOD	1209	833	376	no			672	806	-134	no		
NORTH-E	C34-B	PLYWOOD	860	833	27	no			1048	806	242	no		
NORTH-E	C34-C	SHEETROCK	698	833	-135	no			752	806	-54	no		
NORTH-E	C34-D	SHEETROCK	806	833	-27	no			967	806	161	no		
NORTH-E	C35	WOOD	64491	78518	-14027	no			672	806	-134	no		
NORTH-E	C35-A	PANELING	806	833	-27	no			994	806	188	no		
NORTH-E	C35-B	PANELING	779	833	-54	no			673	806	-133	no		
NORTH-E	C35-C	CELOTEX	1209	833	376	no			698	806	-108	no		
NORTH-E	C35-D	CELOTEX	994	833	161	no			698	806	-108	no		
NORTH-E	C36	CONCRETE	87233	78518	8715	yes			860	806	54	no		
NORTH-E	C36-A	PANELING	725	833	-108	no			569	806	-237	no		
NORTH-E	C36-B	PANELING	725	833	-108	no			994	806	188	no		
NORTH-E	C37	CONCRETE	76360	78518	-2158	no			672	806	-134	no		
NORTH-E	C37-A	PANELING	779	833	-54	no			1021	806	215	no		
NORTH-E	C37-B	PANELING	940	833	107	no			833	806	27	no		
NORTH-E	C38	WOOD	66898	54199	12699	yes					NA	NA		
NORTH-E	C38-A	PANELING	729	833	-104	no			833	806	27	no		
NORTH-E	C38-B	PANELING	806	833	-27	no			457	806	-349	no		
NORTH-E	C38-C	CELOTEX	1048	833	215	no			887	806	81	no		
NORTH-E	C38-D	CELOTEX	967	833	134	no			887	806	81	no		
NORTH-E	C39	WOOD	64242	54199	10043	yes					NA	NA		

Table A1-5
WALL AND FLOOR CORE MEASUREMENTS
BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NORTH-E	C39-A	PANELING	914	833	81	no			376	806	-430	no		
NORTH-E	C39-B	PANELING	564	833	-269	no			779	806	-27	no		
NORTH-E	C39-C	PLYWOOD	1774	833	941	no			833	806	27	no		
NORTH-E	C39-D	PLYWOOD	779	833	-54	no			967	806	161	no		
NORTH-E	C39-E	CELOTEX	1075	833	242	no			967	806	161	no		
NORTH-E	C39-F	CELOTEX	752	833	-81	no			860	806	54	no		
NORTH-E	C40	WOOD	70633	54199	16434	yes			779	806	-27	no		
NORTH-E	C40-A	PANELING	1048	833	215	no			779	806	-27	no		
NORTH-E	C40-B	PANELING	994	833	161	no			645	806	-161	no		
NORTH-E	C40-C	PLYWOOD	1182	833	349	no			779	806	-27	no		
NORTH-E	C40-D	PLYWOOD	1075	833	242	no			994	806	188	no		
NORTH-E	C40-E	CELOTEX	698	833	-135	no			967	806	161	no		
NORTH-E	C40-F	CELOTEX	645	833	-188	no	1659	6706	672	806	-134	no	-25	158
NORTH-F	C01-A	CONCRETE	1370	914	456	no			779	994	-215	no		
NORTH-F	C01-B	CONCRETE	1102	887	215	no			725	994	-269	no		
NORTH-F	C01-C	CONCRETE	1209	887	322	no			1048	994	54	no		
NORTH-F	C02-A	CONCRETE	1612	1102	510	no			725	994	-269	no		
NORTH-F	C03-A	CONCRETE	1561	1319	242	no			591	994	-403	no		
NORTH-F	C03-B	CONCRETE	1317	887	430	no			994	994	0	NA		
NORTH-F	C03-C	CONCRETE	2870	887	1983	no			698	994	-296	no		
NORTH-F	C04-A	CONCRETE	1209	967	242	no			725	994	-269	no		
NORTH-F	C04-B	CONCRETE	1344	887	457	no			914	994	-80	no		
NORTH-F	C04-C	CONCRETE	4380	887	3493	no			806	994	-188	no		
NORTH-F	C05-A	CONCRETE	1397	1021	376	no			618	994	-376	no		
NORTH-F	C05-B	CONCRETE	1397	887	510	no			833	994	-161	no		
NORTH-F	C05-C	CONCRETE	4510	887	3623	no			672	994	-322	no		
NORTH-F	C06-A	CONCRETE	1451	861	590	no			698	994	-296	no		
NORTH-F	C06-B	CONCRETE	1048	887	161	no			860	994	-134	no		
NORTH-F	C06-C	CONCRETE	3190	887	2303	no			994	994	0	NA		
NORTH-F	C13-A	CONCRETE	1397	833	564	no			967	940	27	no		
NORTH-F	C13-B	CONCRETE	1397	833	564	no			1021	940	81	no		
NORTH-F	C13-C	CONCRETE	3220	833	2387	no	1023	1129	1779	940	161	no	172	150

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NORTH-N	C23	CONCRETE	84494	58432	26062	yes			940	806	134	no		
NORTH-N	C23-A	PLYWOOD	833	833	0	no			1048	806	242	no		
NORTH-N	C23-B	PLWOOD	860	833	27	no			672	806	-134	no		
NORTH-N	C23-C	SHEETROCK	779	833	-54	no			994	806	188	no		
NORTH-N	C23-D	SHEETROCK	967	833	134	no			860	806	54	no		
NORTH-N	C24	SHEETROCK	58847	58432	415	no			697	806	-109	no		
NORTH-N	C24-A	PLYWOOD	1075	833	242	no			698	806	-108	no		
NORTH-N	C24-B	PLYWOOD	833	833	0	no			806	806	0	NA		
NORTH-N	C25	CONCRETE	81921	58432	23489	yes			1021	806	215	no		
NORTH-N	C25-A	PLYWOOD	862	833	29	no			645	806	-161	no		
NORTH-N	C25-B	PLYWOOD	806	833	-27	no			698	806	-108	no		
NORTH-N	C25-C	SHEETROCK	672	833	-161	no			672	806	-134	no		
NORTH-N	C25-D	SHEETROCK	833	833	0	no			833	806	27	no		
NORTH-N	C26	CONCRETE	86652	58432	28220	yes			698	806	-108	no		
NORTH-N	C26-A	PLYWOOD	887	833	54	no			645	806	-161	no		
NORTH-N	C26-B	PLYWOOD	833	833	0	no			1075	806	269	no		
NORTH-N	C27	WOOD	77107	58432	18675	yes			698	806	-108	no		
NORTH-N	C27-A	PLYWOOD	833	833	0	no			833	806	27	no		
NORTH-N	C27-B	PLYWOOD	591	833	-242	no			994	806	188	no		
NORTH-N	C28	CONCRETE	92794	58432		no			591	806	-215	no		
NORTH-N	C28-A	PLYWOOD	1075	833	242	no			537	806	-269	no		
NORTH-N	C28-B	PLYWOOD	860	833	27	no			860	806	54	no		
NORTH-N	C29	WOOD	65902	58432	7470	yes					NA	NA		
NORTH-N	C29-A	PLYWOOD	591	833	-242	no			725	806	-81	no		
NORTH-N	C29-B	PLYWOOD	1021	833	188	no			698	806	-108	no		
NORTH-N	C29-C	PLYWOOD	806	833	-27	no			672	806	-134	no		
NORTH-N	C29-D	PLYWOOD	967	833	134	no			725	806	-81	no		
NORTH-N	C29-E	PLYWOOD	1344	1075	269	no			1021	806	215	no		
NORTH-N	C29-F	PLYWOOD	779	1075	-296	no			1048	806	242	no		
NORTH-N	C30	WOOD	68724	58432	10292	yes			860	806	54	no		
NORTH-N	C30-A	PLYWOOD	779	833	-54	no			887	806	81	no		
NORTH-N	C30-B	PLYWOOD	806	833	-27	no			698	806	-108	no		

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NORTH-N	C31	CONCRETE	79680	58432	21248	yes			1129	806	323	no		
NORTH-N	C31-A	PLYWOOD	806	833	-27	no			698	806	-108	no		
NORTH-N	C31-B	PLYWOOD	779	833	-54	no	4000	8609	833	806	27	no	3	156
NORTH-W	C14	WOOD	65072	58847	6225	yes			672	806	-134	no		
NORTH-W	C14-A	PLYWOOD	1586	833	753	no			914	887	27	no		
NORTH-W	C14-B	PLYWOOD	1559	833	726	no			1129	887	242	no		
NORTH-W	C14-C	CELOTEX	887	833	54	no			967	887	80	no		
NORTH-W	C14-D	CELOTEX	887	833	54	no			967	887	80	no		
NORTH-W	C15	WOOD	88893	58847	30046	yes			967	806	161	no		
NORTH-W	C15-A	SHEETROCK	914	833	81	no			887	887	0	NA		
NORTH-W	C15-B	SHEETROCK	1129	833	296	no			1129	887	242	no		
NORTH-W	C15-C	MASONITE	915	833	82	no			914	887	27	no		
NORTH-W	C15-D	MASONITE	1102	833	269	no			1021	887	134	no		
NORTH-W	C15-E	CELOTEX	2150	833	1317	no			779	887	-108	no		
NORTH-W	C15-F	CELOTEX	1451	833	618	no			779	887	-108	no		
NORTH-W	C16	WOOD	64076	58847	5229	yes					NA	NA		
NORTH-W	C16-A	SHEETROCK	1290	833	457	no			1155	887	268	no		
NORTH-W	C16-B	SHEETROCK	1344	833	511	no			1182	887	295	no		
NORTH-W	C16-C	CELOTEX	1102	833	269	no			1021	887	134	no		
NORTH-W	C16-D	CELOTEX	914	833	81	no			725	887	-162	no		
NORTH-W	C17	WOOD	68060	65321	2739	no					NA	NA		
NORTH-W	C17-A	PLYWOOD	860	833	27	no			806	806	0	NA		
NORTH-W	C17-B	PLYWOOD	779	833	-54	no			940	806	134	no		
NORTH-W	C17-C	SHEETROCK	1270	833	437	no			833	806	27	no		
NORTH-W	C17-D	SHEETROCK	1102	833	269	no			725	806	-81	no		
NORTH-W	C17-E	CELOTEX	967	833	134	no			806	806	0	NA		
NORTH-W	C17-F	CELOTEX	779	833	-54	no			860	806	54	no		
NORTH-W	C18	WOOD	83415	65321	18094	yes					NA	NA		
NORTH-W	C18-A	SHEETROCK	698	833	-135	no			752	887	-135	no		
NORTH-W	C18-B	SHEETROCK	914	833	81	no			806	887	-81	no		
NORTH-W	C18-C	CELOTEX	1048	833	215	no			672	887	-215	no		
NORTH-W	C18-D	CELOTEX	806	833	-27	no			887	887	0	NA		

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
NORTH-W	C19	WOOD	74285	65321	8964	yes			940	806	134	no		
NORTH-W	C19-A	SHEETROCK	779	833	-54	no			914	806	108	no		
NORTH-W	C19-B	SHEETROCK	752	833	-81	no			645	806	-161	no		
NORTH-W	C19-C	CELOTEX	940	833	107	no			779	806	-27	no		
NORTH-W	C19-D	CELOTEX	1048	833	215	no			591	806	-215	no		
NORTH-W	C20	WOOD	65902	65321	581	no			645	806	-161	no		
NORTH-W	C20-A	SHEETROCK	812	833	-21	no			483	806	-323	no		
NORTH-W	C20-B	SHEETROCK	940	833	107	no			940	806	134	no		
NORTH-W	C21	WOOD	71214	65321	5893	yes					NA	NA		
NORTH-W	C21-A	SHEETROCK	914	833	81	no			887	806	81	no		
NORTH-W	C21-B	SHEETROCK	725	833	-108	no			940	806	134	no		
NORTH-W	C21-C	CELOTEX	860	833	27	no			645	806	-161	no		
NORTH-W	C21-D	CELOTEX	994	833	161	no			645	806	-161	no		
NORTH-W	C22	WOOD	69222	65321	3901	no			779	806	-27	no		
NORTH-W	C22-A	SHEETROCK	1048	833	215	no			806	806	0	NA		
NORTH-W	C22-B	SHEETROCK	914	833	81	no			698	806	-108	no		
NORTH-W	C22-C	CELOTEX	1048	833	215	no			806	806	0	NA		
NORTH-W	C22-D	CELOTEX	914	833	81	no	1897	5254	806	806	0	NA	3	137
SOUTH-E	C50	INSULATION	82668	55776	26892	yes					NA	NA		
SOUTH-E	C50-A	PANELING	1021	1129	-108	no			779	779	0	NA		
SOUTH-E	C50-B	PANELING	1209	1129	80	no			725	779	-54	no		
SOUTH-E	C50-C	CELOTEX	833	1129	-296	no			725	779	-54	no		
SOUTH-E	C50-D	CELOTEX	1182	1129	53	no			725	779	-54	no		
SOUTH-E	C51	INSULATION	72625	63080	9545	yes					NA	NA		
SOUTH-E	C51-A	PANELING	1129	1129	0	no			752	779	-27	no		
SOUTH-E	C51-B	PANELING	1036	1129	-93	no			940	779	161	no		
SOUTH-E	C51-C	SHEETROCK	1048	1129	-81	no			752	779	-27	no		
SOUTH-E	C51-D	SHEETROCK	1236	1129	107	no			833	779	54	no		
SOUTH-E	C52	INSULATION	71214	63080	8134	yes					NA	NA		
SOUTH-E	C52-A	PANELING	672	1129	-457	no			940	779	161	no		
SOUTH-E	C52-B	PANELING	914	1129	-215	no			860	779	81	no		
SOUTH-E	C52-C	SHEETROCK	1344	1129	215	no			1048	779	269	no		

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
SOUTH-E	C52-D	SHEETROCK	1075	1129	-54	no			1371	779	592	no		
SOUTH-E	C53	INSULATION	62167	63080	-913	no					NA	NA		
SOUTH-E	C53-A	PANELING	1048	1129	-81	no			725	779	-54	no		
SOUTH-E	C53-B	PANELING	940	1129	-189	no			1129	779	350	no		
SOUTH-E	C53-C	SHEETROCK	1048	1129	-81	no			725	779	-54	no		
SOUTH-E	C53-D	SHEETROCK	887	1129	-242	no			806	779	27	no		
SOUTH-E	C54	INSULATION	76194	64989	11205	yes					NA	NA		
SOUTH-E	C54-A	PANELING	1048	1129	-81	no			967	779	188	no		
SOUTH-E	C54-B	PANELING	994	1129	-135	no			1129	779	350	no		
SOUTH-E	C54-C	SHEETROCK	940	1129	-189	no			806	779	27	no		
SOUTH-E	C54-D	SHEETROCK	1075	1129	-54	no			1021	779	242	no		
SOUTH-E	C55	INSULATION	67645	64989	2656	no					NA	NA		
SOUTH-E	C55-A	PANELING	1371	1129	242	no			1102	779	323	no		
SOUTH-E	C55-B	PANELING	1048	1129	-81	no			940	779	161	no		
SOUTH-E	C55-C	SHEETROCK	914	1129	-215	no			887	779	108	no		
SOUTH-E	C55-D	SHEETROCK	1075	1129	-54	no			564	779	-215	no		
SOUTH-E	C56	MASONITE	42662	59096	-16434	no					NA	NA		
SOUTH-E	C56-A	PANELING	860	1129	-269	no			887	779	108	no		
SOUTH-E	C56-B	PANELING	940	1129	-189	no			806	779	27	no		
SOUTH-E	C57	WOOD	64491	59096	5395	yes					NA	NA		
SOUTH-E	C57-A	PANELING	779	1129	-350	no			591	779	-188	no		
SOUTH-E	C57-B	PANELING	914	1129	-215	no			752	779	-27	no		
SOUTH-E	C57-C	SHEETROCK	860	1129	-269	no			833	779	54	no		
SOUTH-E	C57-D	SHEETROCK	1075	1129	-54	no			887	779	108	no		
SOUTH-E	C57-E	WOOD	1155	1129	26	no			833	779	54	no		
SOUTH-E	C57-F	WOOD	914	1129	-215	no			645	779	-134	no		
SOUTH-E	C58	CELOTEX	51543	59096	-7553	no					NA	NA		
SOUTH-E	C58-A	PANELING	967	1129	-162	no			860	779	81	no		
SOUTH-E	C58-B	PANELING	1182	1129	53	no			967	779	188	no		
SOUTH-E	C58-C	CELOTEX	1397	1129	268	no			645	779	-134	no		
SOUTH-E	C58-D	CELOTEX	967	1129	-162	no	786	5526	967	779	188	no	64	153
SOUTH-E	C07-A	CONCRETE	1021	967	54	no			967	1102	-135	no		

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
SOUTH-F	C07-B	CONCRETE	1048	967	81	no			940	1102	-162	no		
SOUTH-F	C07-C	CONCRETE	1720	967	753	no			914	1102	-188	no		
SOUTH-F	C08-A	CONCRETE	1451	1424	27	no			833	940	-107	no		
SOUTH-F	C08-B	CONCRETE	1102	1424	-322	no			967	940	27	no		
SOUTH-F	C08-C	CONCRETE	2520	1424	1096	no			806	940	-134	no		
SOUTH-F	C09-A	CONCRETE	1048	1075	-27	no			994	940	54	no		
SOUTH-F	C09-B	CONCRETE	1155	1075	80	no			833	940	-107	no		
SOUTH-F	C09-C	CONCRETE	2090	1075	1015	no			860	940	-80	no		
SOUTH-F	C10-A	CONCRETE	1639	860	779	no			1048	940	108	no		
SOUTH-F	C10-B	CONCRETE	1182	860	322	no			1424	940	484	no		
SOUTH-F	C10-C	CONCRETE	2410	860	1550	no			940	940	0	NA		
SOUTH-F	C11-A	CONCRETE	1397	1021	376	no			860	940	-80	no		
SOUTH-F	C11-B	CONCRETE	1424	1021	403	no			940	940	0	NA		
SOUTH-F	C11-C	CONCRETE	2710	1021	1689	no			779	940	-161	no		
SOUTH-F	C12-A	CONCRETE	1397	645	752	no			806	940	-134	no		
SOUTH-F	C12-B	CONCRETE	1586	645	941	no			698	940	-242	no		
SOUTH-F	C12-C	CONCRETE	3300	645	2655	no	679	743	591	940	-349	no	-67	176
SOUTH-W	C41	CELOTEX	75198	68973	6225	yes					NA	NA		
SOUTH-W	C41-A	PANELING	725	833	-108	no			779	806	-27	no		
SOUTH-W	C41-B	PANELING	994	833	161	no			887	806	81	no		
SOUTH-W	C41-C	CELOTEX	1290	833	457	no			591	806	-215	no		
SOUTH-W	C41-D	CELOTEX	806	833	-27	no			833	806	27	no		
SOUTH-W	C42	WOOD	74368	68973	5395	yes					NA	NA		
SOUTH-W	C42-A	SHEETROCK	672	833	-161	no			645	806	-161	no		
SOUTH-W	C42-B	SHEETROCK	1048	833	215	no			457	806	-349	no		
SOUTH-W	C43	WOOD	70467	57768	12699	yes					NA	NA		
SOUTH-W	C43-A	PANELING	1102	1129	-27	no			914	779	135	no		
SOUTH-W	C43-B	PANELING	806	1129	-323	no			887	779	108	no		
SOUTH-W	C43-C	PLYWOOD	806	1129	-323	no			672	779	-107	no		
SOUTH-W	C43-D	PLYWOOD	915	1129	-214	no			994	779	215	no		
SOUTH-W	C43-E	CELOTEX	1290	1129	161	no			887	779	108	no		
SOUTH-W	C43-F	CELOTEX	1102	1129	-27	no			645	779	-134	no		

Table A1-5
WALL AND FLOOR CORE MEASUREMENTS
BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit
SOUTH-W	C44	WOOD	73704	63080	10624	yes					NA	NA		
SOUTH-W	C44-A	PANELING	698	1129	-431	no			752	779	-27	no		
SOUTH-W	C44-B	PNAELING	725	1129	-404	no			994	779	215	no		
SOUTH-W	C44-C	SHEETROCK	1075	1129	-54	no			753	779	-26	no		
SOUTH-W	C44-D	SHEETROCK	860	1129	-269	no			591	779	-188	no		
SOUTH-W	C45	WOOD	67645	59096	8549	yes					NA	NA		
SOUTH-W	C45-A	PANELING	618	1129	-511	no			940	779	161	no		
SOUTH-W	C45-B	PANELING	672	1129	-457	no			1021	779	242	no		
SOUTH-W	C45-C	SHEETROCK	1209	1129	80	no			1104	779	325	no		
SOUTH-W	C45-D	SHEETROCK	940	1129	-189	no			752	779	-27	no		
SOUTH-W	C46	INSULATION	78435	55610	22825	yes					NA	NA		
SOUTH-W	C46-A	PANELING	914	1129	-215	no			887	779	108	no		
SOUTH-W	C46-B	PANELING	807	1129	-322	no			940	779	161	no		
SOUTH-W	C46-C	CELOTEX	887	1129	-242	no			1021	779	242	no		
SOUTH-W	C46-D	CELOTEX	887	1129	-242	no			1182	779	403	no		
SOUTH-W	C47	INSULATION	74285	55610	18675	yes					NA	NA		
SOUTH-W	C47-A	PANELING	914	1129	-215	no			914	779	135	no		
SOUTH-W	C47-B	PANELING	779	1129	-350	no			887	779	108	no		
SOUTH-W	C47-C	CELOTEX	752	1129	-377	no			967	779	188	no		
SOUTH-W	C47-D	CELOTEX	672	1129	-457	no			860	779	81	no		
SOUTH-W	C48	INSULATION	72625	55195	17430	yes					NA	NA		
SOUTH-W	C48-A	PLYWOOD	994	1129	-135	no			806	779	27	no		
SOUTH-W	C48-B	PLYWOOD	887	1129	-242	no			860	779	81	no		
SOUTH-W	C48-C	CELOTEX	1075	1129	-54	no			510	779	-269	no		
SOUTH-W	C48-D	CELOTEX	994	1129	-135	no			860	779	81	no		
SOUTH-W	C49	WOOD	71712	55776	15936	yes					NA	NA		
SOUTH-W	C49-A	PANELING	967	1129	-162	no			1182	779	403	no		
SOUTH-W	C49-B	PANELING	1075	1129	-54	no			967	779	188	no		
SOUTH-W	C49-C	SHEETROCK	1155	1129	26	no			967	779	188	no		
SOUTH-W	C49-D	SHEETROCK	860	1129	-269	no	2499	5962	779	779	0	NA	155	159

Table A1-5

WALL AND FLOOR CORE MEASUREMENTS

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Survey Unit	Std Dev for Survey Unit

Notes:

1) Direct readings at locations C14 thru C58 were collected in the core hole with an E-600 with PG-2 low energy gamma detector calibrated for Cl-36. An area correction factor of 8.3 was used to convert the readings from dpm to dpm/100 cm^2 based on the detector area of 12 cm^2. The MDA for this instrument is approximately 8600 dpm/100 cm^2

2) All other readings were collected with an E-600 with SHP-330 detector calibrated to Cl-36. The instrument was configured to read directly in dpm/100 cm^2, using the detector effciency and area correction factor determined during calibration. The MDA for this instrument is approximately 800 dpm/100 cm^2

3) All smears were wiped over an area of approximately 20 to 40 cm^2. The smears were counted with an E-600 with SHP-330. No area correction factor (other than the probe area) was used for these measurements.

4) All reading were for 60 seconds.

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
SOUTH-W	C41	CELOTEX	75198	68973	6225	yes					NA	NA		
SOUTH-W	C41-C	CELOTEX	1290	833	457	no			591	806	-215	no		
SOUTH-W	C41-D	CELOTEX	806	833	-27	no			833	806	27	no		
SOUTH-W	C43-E	CELOTEX	1290	1129	161	no			887	779	108	no		
SOUTH-W	C43-F	CELOTEX	1102	1129	-27	no			645	779	-134	no		
SOUTH-W	C46-C	CELOTEX	887	1129	-242	no			1021	779	242	no		
SOUTH-W	C46-D	CELOTEX	887	1129	-242	no			1182	779	403	no		
SOUTH-W	C47-C	CELOTEX	752	1129	-377	no			967	779	188	no		
SOUTH-W	C47-D	CELOTEX	672	1129	-457	no			860	779	81	no		
SOUTH-W	C48-C	CELOTEX	1075	1129	-54	no			510	779	-269	no		
SOUTH-W	C48-D	CELOTEX	994	1129	-135	no			860	779	81	no		
SOUTH-E	C50-C	CELOTEX	833	1129	-296	no			725	779	-54	no		
SOUTH-E	C50-D	CELOTEX	1182	1129	53	no			725	779	-54	no		
SOUTH-E	C58	CELOTEX	51543	59096	-7553	no					NA	NA		
SOUTH-E	C58-C	CELOTEX	1397	1129	268	no			645	779	-134	no		
SOUTH-E	C58-D	CELOTEX	967	1129	-162	no			967	779	188	no		
NORTH-W	C14-C	CELOTEX	887	833	54	no			967	887	80	no		
NORTH-W	C14-D	CELOTEX	887	833	54	no			967	887	80	no		
NORTH-W	C15-E	CELOTEX	2150	833	1317	no			779	887	-108	no		
NORTH-W	C15-F	CELOTEX	1451	833	618	no			779	887	-108	no		
NORTH-W	C16-C	CELOTEX	1102	833	269	no			1021	887	134	no		
NORTH-W	C16-D	CELOTEX	914	833	81	no			725	887	-162	no		
NORTH-W	C17-E	CELOTEX	967	833	134	no			806	806	0	NA		
NORTH-W	C17-F	CELOTEX	779	833	-54	no			860	806	54	no		
NORTH-W	C18-C	CELOTEX	1048	833	215	no			672	887	-215	no		
NORTH-W	C18-D	CELOTEX	806	833	-27	no			887	887	0	NA		
NORTH-W	C19-C	CELOTEX	940	833	107	no			779	806	-27	no		
NORTH-W	C19-D	CELOTEX	1048	833	215	no			591	806	-215	no		
NORTH-W	C21-C	CELOTEX	860	833	27	no			645	806	-161	no		
NORTH-W	C21-D	CELOTEX	994	833	161	no			645	806	-161	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
NORTH-W	C22-C	CELOTEX	1048	833	215	no			806	806	0	NA		
NORTH-W	C22-D	CELOTEX	914	833	81	no			806	806	0	NA		
NORTH-E	C35-C	CELOTEX	1209	833	376	no			698	806	-108	no		
NORTH-E	C35-D	CELOTEX	994	833	161	no			698	806	-108	no		
NORTH-E	C38-C	CELOTEX	1048	833	215	no			887	806	81	no		
NORTH-E	C38-D	CELOTEX	967	833	134	no			887	806	81	no		
NORTH-E	C39-E	CELOTEX	1075	833	242	no			967	806	161	no		
NORTH-E	C39-F	CELOTEX	752	833	-81	no			860	806	54	no		
NORTH-E	C40-E	CELOTEX	698	833	-135	no			967	806	161	no		
NORTH-E	C40-F	CELOTEX	645	833	-188	no	44.6	1596.4	672	806	-134	no	-4.1	144.5
NORTH-N	C23	CONCRETE	84494	58432	26062	yes			940	806	134	no		
NORTH-N	C25	CONCRETE	81921	58432	23489	yes			1021	806	215	no		
NORTH-N	C26	CONCRETE	86652	58432	28220	yes			698	806	-108	no		
NORTH-N	C28	CONCRETE	92794	58432	34362	yes			591	806	-215	no		
NORTH-N	C31	CONCRETE	79680	58432	21248	yes			1129	806	323	no		
NORTH-E	C32	CONCRETE	91134	78518	12616	yes					NA	NA		
NORTH-E	C34	CONCRETE	111801	78518	33283	yes					NA	NA		
NORTH-E	C36	CONCRETE	87283	78518	8715	yes			860	806	54	no		
NORTH-E	C37	CONCRETE	76360	78518	-2158	no	20648.6	12092.4	672	806	-134	no	29.9	172.9
SOUTH-W	C46	INSULATION	78435	55610	22825	yes					NA	NA		
SOUTH-W	C47	INSULATION	74285	55610	18675	yes					NA	NA		
SOUTH-W	C48	INSULATION	72625	55195	17430	yes					NA	NA		
SOUTH-E	C50	INSULATION	82668	55776	26892	yes					NA	NA		
SOUTH-E	C51	INSULATION	72625	63080	9545	yes					NA	NA		
SOUTH-E	C52	INSULATION	71214	63080	8134	yes					NA	NA		
SOUTH-E	C53	INSULATION	62167	63080	-913	no					NA	NA		
SOUTH-E	C54	INSULATION	76194	64989	11205	yes					NA	NA		
SOUTH-E	C55	INSULATION	67645	64989	2656	no	12938.8	9224.4			NA	NA	0.0	0.0
SOUTH-E	C56	MASONITE	42662	59096	-16434	no					NA	NA		
NORTH-W	C15-C	MASONITE	1915	833	82	no			914	887	27	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
NORTH-W	C15-D	MASONITE	1102	833	269	no	-5361.0	9590.0	1021	887	134	no	53.7	70.9
SOUTH-W	C41-A	PANELING	725	833	-108	no			779	806	-27	no		
SOUTH-W	C41-B	PANELING	994	833	161	no			887	806	81	no		
SOUTH-W	C43-A	PANELING	1102	1129	-27	no			914	779	135	no		
SOUTH-W	C43-B	PANELING	806	1129	-323	no			887	779	108	no		
SOUTH-W	C44-A	PANELING	698	1129	-431	no			752	779	-27	no		
SOUTH-W	C45-A	PANELING	618	1129	-511	no			940	779	161	no		
SOUTH-W	C45-B	PANELING	672	1129	-457	no			1021	779	242	no		
SOUTH-W	C46-A	PANELING	914	1129	-215	no			887	779	108	no		
SOUTH-W	C46-B	PANELING	807	1129	-322	no			940	779	161	no		
SOUTH-W	C47-A	PANELING	914	1129	-215	no			914	779	135	no		
SOUTH-W	C47-B	PANELING	779	1129	-350	no			887	779	108	no		
SOUTH-W	C49-A	PANELING	967	1129	-162	no			1182	779	403	no		
SOUTH-W	C49-B	PANELING	1075	1129	-54	no			967	779	188	no		
SOUTH-E	C50-A	PANELING	1021	1129	-108	no			779	779	0	NA		
SOUTH-E	C50-B	PANELING	1209	1129	80	no			725	779	-54	no		
SOUTH-E	C51-A	PANELING	1129	1129	0	no			752	779	-27	no		
SOUTH-E	C51-B	PANELING	1036	1129	-93	no			940	779	161	no		
SOUTH-E	C52-A	PANELING	672	1129	-457	no			940	779	161	no		
SOUTH-E	C52-B	PANELING	914	1129	-215	no			860	779	81	no		
SOUTH-E	C53-A	PANELING	1048	1129	-81	no			725	779	-54	no		
SOUTH-E	C53-B	PANELING	940	1129	-189	no			1129	779	350	no		
SOUTH-E	C54-A	PANELING	1048	1129	-81	no			967	779	188	no		
SOUTH-E	C54-B	PANELING	994	1129	-135	no			1129	779	350	no		
SOUTH-E	C55-A	PANELING	1371	1129	242	no			1102	779	323	no		
SOUTH-E	C55-B	PANELING	1048	1129	-81	no			940	779	161	no		
SOUTH-E	C56-A	PANELING	860	1129	-269	no			887	779	108	no		
SOUTH-E	C56-B	PANELING	940	1129	-189	no			806	779	27	no		
SOUTH-E	C57-A	PANELING	779	1129	-350	no			591	779	-188	no		
SOUTH-E	C57-B	PANELING	914	1129	-215	no			752	779	-27	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
SOUTH-E	C58-A	PANELING	967	1129	-162	no			860	779	81	no		
SOUTH-E	C58-B	PANELING	1182	1129	53	no			967	779	188	no		
NORTH-E	C35-A	PANELING	806	833	-27	no			994	806	188	no		
NORTH-E	C35-B	PANELING	779	833	-54	no			673	806	-133	no		
NORTH-E	C36-A	PANELING	725	833	-108	no			569	806	-237	no		
NORTH-E	C36-B	PANELING	725	833	-108	no			994	806	188	no		
NORTH-E	C37-A	PANELING	779	833	-54	no			1021	806	215	no		
NORTH-E	C37-B	PANELING	940	833	107	no			833	806	27	no		
NORTH-E	C38-A	PANELING	729	833	-104	no			833	806	27	no		
NORTH-E	C38-B	PANELING	806	833	-27	no			457	806	-349	no		
NORTH-E	C39-A	PANELING	914	833	81	no			376	806	-430	no		
NORTH-E	C39-B	PANELING	564	833	-269	no			779	806	-27	no		
NORTH-E	C40-A	PANELING	1048	833	215	no			779	806	-27	no		
NORTH-E	C40-B	PANELING	994	833	161	no			645	806	-161	no		
SOUTH-W	C44-B	PANELING	725	1129	-404	no	-133.1	183.9	994	779	215	no	70.5	174.4
NORTH-N	C23-B	PLYWOOD	860	833	27	no			672	806	-134	no		
SOUTH-W	C43-C	PLYWOOD	806	1129	-323	no			672	779	-107	no		
SOUTH-W	C43-D	PLYWOOD	915	1129	-214	no			994	779	215	no		
SOUTH-W	C48-A	PLYWOOD	994	1129	-135	no			806	779	27	no		
SOUTH-W	C48-B	PLYWOOD	887	1129	-242	no			860	779	81	no		
NORTH-W	C14-A	PLYWOOD	1586	833	753	no			914	887	27	no		
NORTH-W	C14-B	PLYWOOD	1559	833	726	no			1129	887	242	no		
NORTH-W	C17-A	PLYWOOD	860	833	27	no			806	806	0	NA		
NORTH-W	C17-B	PLYWOOD	779	833	-54	no			940	806	134	no		
NORTH-N	C23-A	PLYWOOD	833	833	0	no			1048	806	242	no		
NORTH-N	C24-A	PLYWOOD	1075	833	242	no			698	806	-108	no		
NORTH-N	C24-B	PLYWOOD	833	833	0	no			806	806	0	NA		
NORTH-N	C25-A	PLYWOOD	862	833	29	no			645	806	-161	no		
NORTH-N	C25-B	PLYWOOD	806	833	-27	no			698	806	-108	no		
NORTH-N	C26-A	PLYWOOD	887	833	54	no			645	806	-161	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
NORTH-N	C26-B	PLYWOOD	833	833	0	no			1075	806	269	no		
NORTH-N	C27-A	PLYWOOD	833	833	0	no			833	806	27	no		
NORTH-N	C27-B	PLYWOOD	591	833	-242	no			994	806	188	no		
NORTH-N	C28-A	PLYWOOD	1075	833	242	no			537	806	-269	no		
NORTH-N	C28-B	PLYWOOD	860	833	27	no			860	806	54	no		
NORTH-N	C29-A	PLYWOOD	591	833	-242	no			725	806	-81	no		
NORTH-N	C29-B	PLYWOOD	1021	833	188	no			698	806	-108	no		
NORTH-N	C29-C	PLYWOOD	806	833	-27	no			672	806	-134	no		
NORTH-N	C29-D	PLYWOOD	967	833	134	no			725	806	-81	no		
NORTH-N	C29-E	PLYWOOD	1344	1075	269	no			1021	806	215	no		
NORTH-N	C29-F	PLYWOOD	779	1075	-296	no			1048	806	242	no		
NORTH-N	C30-A	PLYWOOD	779	833	-54	no			887	806	81	no		
NORTH-N	C30-B	PLYWOOD	806	833	-27	no			698	806	-108	no		
NORTH-N	C31-A	PLYWOOD	806	833	-27	no			698	806	-108	no		
NORTH-N	C31-B	PLYWOOD	779	833	-54	no			833	806	27	no		
NORTH-E	C32-A	PLYWOOD	1021	833	188	no			833	806	27	no		
NORTH-E	C32-B	PLYWOOD	698	833	-135	no			914	806	108	no		
NORTH-E	C33-A	PLYWOOD	779	833	-54	no			672	806	-134	no		
NORTH-E	C33-B	PLYWOOD	725	833	-108	no			618	806	-188	no		
NORTH-E	C34-A	PLYWOOD	1209	833	376	no			672	806	-134	no		
NORTH-E	C34-B	PLYWOOD	860	833	27	no			1048	806	242	no		
NORTH-E	C39-C	PLYWOOD	1774	833	941	no			833	806	27	no		
NORTH-E	C39-D	PLYWOOD	779	833	-54	no			967	806	161	no		
NORTH-E	C40-C	PLYWOOD	1182	833	349	no			779	806	-27	no		
NORTH-E	C40-D	PLYWOOD	1075	833	242	no	63.2	273.0	994	806	188	no	16.8	147.6
SOUTH-W	C42-A	SHEETROCK	672	833	-161	no			645	806	-161	no		
SOUTH-W	C42-B	SHEETROCK	1048	833	215	no			457	806	-349	no		
SOUTH-W	C44-C	SHEETROCK	1075	1129	-54	no			753	779	-26	no		
SOUTH-W	C44-D	SHEETROCK	860	1129	-269	no			591	779	-188	no		
SOUTH-W	C45-C	SHEETROCK	1209	1129	80	no			1104	779	325	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
SOUTH-W	C45-D	SHEETROCK	940	1129	-189	no			752	779	-27	no		
SOUTH-W	C49-C	SHEETROCK	1155	1129	26	no			967	779	188	no		
SOUTH-W	C49-D	SHEETROCK	860	1129	-269	no			779	779	0	NA		
SOUTH-E	C51-C	SHEETROCK	1048	1129	-81	no			752	779	-27	no		
SOUTH-E	C51-D	SHEETROCK	1236	1129	107	no			833	779	54	no		
SOUTH-E	C52-C	SHEETROCK	1344	1129	215	no			1048	779	269	no		
SOUTH-E	C52-D	SHEETROCK	1075	1129	-54	no			1371	779	592	no		
SOUTH-E	C53-C	SHEETROCK	1048	1129	-81	no			725	779	-54	no		
SOUTH-E	C53-D	SHEETROCK	887	1129	-242	no			806	779	27	no		
SOUTH-E	C54-C	SHEETROCK	940	1129	-189	no			806	779	27	no		
SOUTH-E	C54-D	SHEETROCK	1075	1129	-54	no			1021	779	242	no		
SOUTH-E	C55-C	SHEETROCK	914	1129	-215	no			887	779	108	no		
SOUTH-E	C55-D	SHEETROCK	1075	1129	-54	no			564	779	-215	no		
SOUTH-E	C57-C	SHEETROCK	860	1129	-269	no			833	779	54	no		
SOUTH-E	C57-D	SHEETROCK	1075	1129	-54	no			887	779	108	no		
NORTH-W	C15-A	SHEETROCK	914	833	81	no			887	887	0	NA		
NORTH-W	C15-B	SHEETROCK	1129	833	296	no			1129	887	242	no		
NORTH-W	C16-A	SHEETROCK	1290	833	457	no			1155	887	268	no		
NORTH-W	C16-B	SHEETROCK	1344	833	511	no			1182	887	295	no		
NORTH-W	C17-C	SHEETROCK	1270	833	437	no			833	806	27	no		
NORTH-W	C17-D	SHEETROCK	1102	833	269	no			725	806	-81	no		
NORTH-W	C18-A	SHEETROCK	698	833	-135	no			752	887	-135	no		
NORTH-W	C18-B	SHEETROCK	914	833	81	no			806	887	-81	no		
NORTH-W	C19-A	SHEETROCK	779	833	-54	no			914	806	108	no		
NORTH-W	C19-B	SHEETROCK	752	833	-81	no			645	806	-161	no		
NORTH-W	C20-A	SHEETROCK	812	833	-21	no			483	806	-323	no		
NORTH-W	C20-B	SHEETROCK	940	833	107	no			940	806	134	no		
NORTH-W	C21-A	SHEETROCK	914	833	81	no			887	806	81	no		
NORTH-W	C21-B	SHEETROCK	725	833	-108	no			940	806	134	no		
NORTH-W	C22-A	SHEETROCK	1048	833	215	no			806	806	0	NA		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
NORTH-W	C22-B	SHEETROCK	914	833	81	no			698	806	-108	no		
NORTH-N	C23-C	SHEETROCK	779	833	-54	no			994	806	188	no		
NORTH-N	C23-D	SHEETROCK	967	833	134	no			860	806	54	no		
NORTH-N	C24	SHEETROCK	58847	58432	415	no			697	806	-109	no		
NORTH-N	C25-C	SHEETROCK	672	833	-161	no			672	806	-134	no		
NORTH-N	C25-D	SHEETROCK	833	833	0	no			833	806	27	no		
NORTH-E	C32-C	SHEETROCK	833	833	0	no			816	806	10	no		
NORTH-E	C32-D	SHEETROCK	779	833	-54	no			591	806	-215	no		
NORTH-E	C33-C	SHEETROCK	698	833	-135	no			698	806	-108	no		
NORTH-E	C33-D	SHEETROCK	833	833	0	no			403	806	-403	no		
NORTH-E	C34-C	SHEETROCK	698	833	-135	no			752	806	-54	no		
NORTH-E	C34-D	SHEETROCK	806	833	-27	no	12.9	195.3	967	806	161	no	16.3	188.7
SOUTH-W	C42	WOOD	74368	68973	5395	yes					NA	NA		
SOUTH-W	C43	WOOD	70467	57768	12699	yes					NA	NA		
SOUTH-W	C44	WOOD	73704	63080	10624	yes					NA	NA		
SOUTH-W	C45	WOOD	67645	59096	8549	yes					NA	NA		
SOUTH-W	C49	WOOD	71712	55776	15936	yes					NA	NA		
SOUTH-E	C57	WOOD	64491	59096	5395	yes					NA	NA		
SOUTH-E	C57-E	WOOD	1155	1129	26	no			833	779	54	no		
SOUTH-E	C57-F	WOOD	914	1129	-215	no			645	779	-134	no		
NORTH-W	C14	WOOD	65072	58847	6225	yes			672	806	-134	no		
NORTH-W	C15	WOOD	88893	58847	30046	yes			967	806	161	no		
NORTH-W	C16	WOOD	64076	58847	5229	yes					NA	NA		
NORTH-W	C17	WOOD	68060	65321	2739	no					NA	NA		
NORTH-W	C18	WOOD	83415	65321	18094	yes					NA	NA		
NORTH-W	C19	WOOD	74285	65321	8964	yes			940	806	134	no		
NORTH-W	C20	WOOD	65902	65321	581	no			645	806	-161	no		
NORTH-W	C21	WOOD	71214	65321	5893	yes					NA	NA		
NORTH-W	C22	WOOD	69222	65321	3901	no			779	806	-27	no		
NORTH-N	C27	WOOD	77107	58432	18675	yes			698	806	-108	no		

Table A1-6

WALL CORE MEASUREMENTS SORTED BY MATERIAL TYPE

BUILDING 2

			Direct Measurements (dpm/100 cm^2)						Smear Measurements (dpm/100 cm^2)					
Survey Unit	Location ID	Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type	Inst. Reading	Bkg	Net	Exceeds Limit?	Mean for Material Type	Std Dev for Material Type
NORTH-N	C29	WOOD	65902	58432	7470	yes					NA	NA		
NORTH-N	C30	WOOD	68724	58432	10292	yes			860	806	54	no		
NORTH-E	C33	WOOD	73621	78518	-4897	no					NA	NA		
NORTH-E	C35	WOOD	64491	78518	-14027	no			672	806	-134	no		
NORTH-E	C38	WOOD	66898	54199	12699	yes					NA	NA		
NORTH-E	C39	WOOD	64242	54199	10043	yes					NA	NA		
NORTH-E	C40	WOOD	70633	54199	16434	yes	7870.8	8680.7	779	806	-27	no	-12.9	76.0

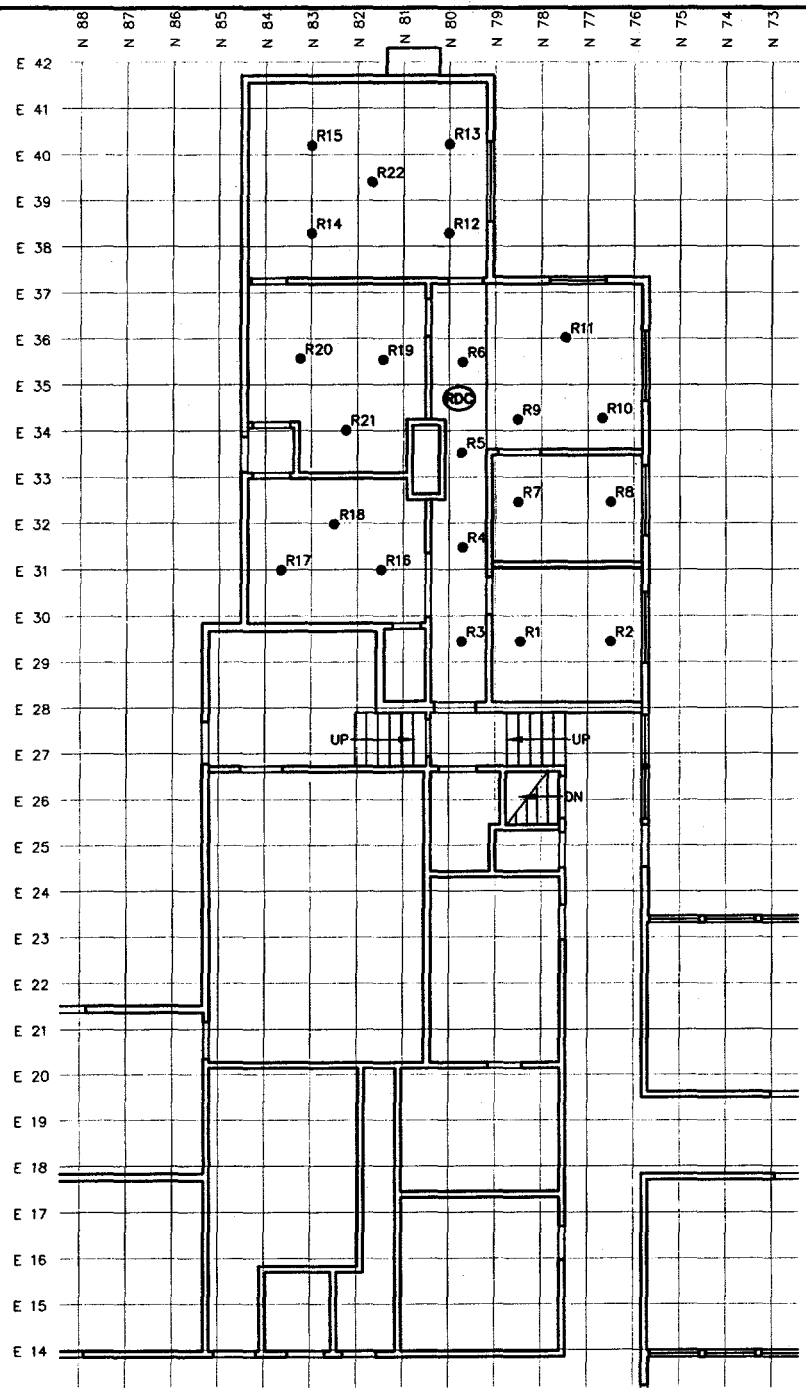
Notes:

1) Direct readings at locations C14 thru C58 were collected in the core hole with an E-600 with PG-2 low energy gamma detector calibrated for Cl-36. An area correction factor of 8.3 was used to convert the readings from dpm to dpm/100 cm^2 based on the detector area of 12 cm^2. The MDA for this instrument is approximately 8600 dpm/100 cm^2

2) All other readings were collected with an E-600 with SHP-330 detector calibrated to Cl-36. The instrument was configured to read directly in dpm/100 cm^2, using the detector effciency and area correction factor determined during calibration. The MDA for this instrument is approximately 800 dpm/100 cm^2

3) All smears were wiped over an area of approximately 20 to 40 cm^2. The smears were counted with an E-600 with SHP-330. No area correction factor (other than the probe area) was used for these measurements.

4) All reading were for 60 seconds.

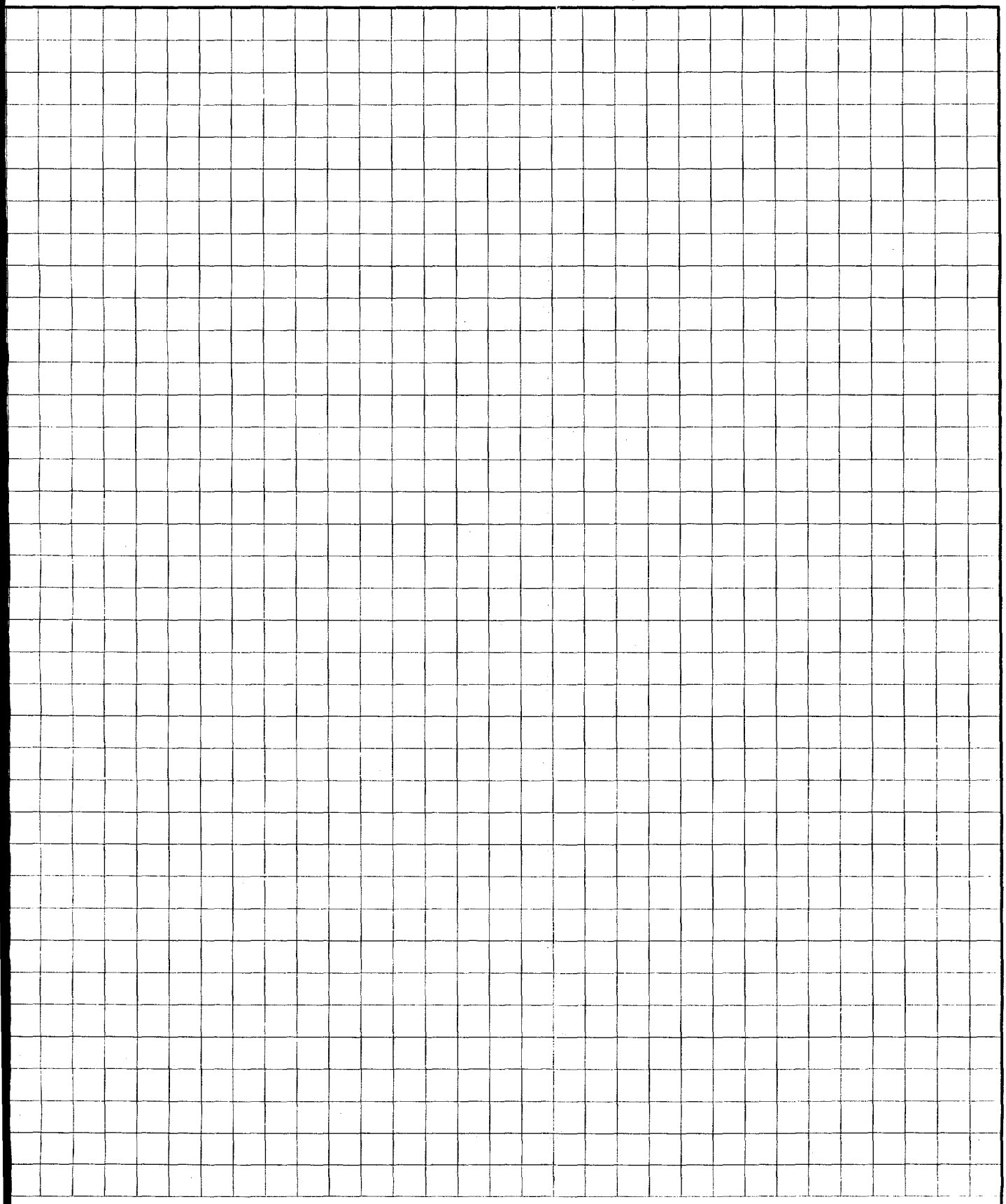


FLOOR PLAN

LEGEND:

R12 PRESSURIZED ION CHAMBER (PIC) MEASUREMENT LOCATION
- MEASUREMENT LOCATION NUMBER
- MEASUREMENT LOCATION

RDC RADON DECAY PRODUCT CONENTRATION (RDC) MEASUREMENT LOCATION



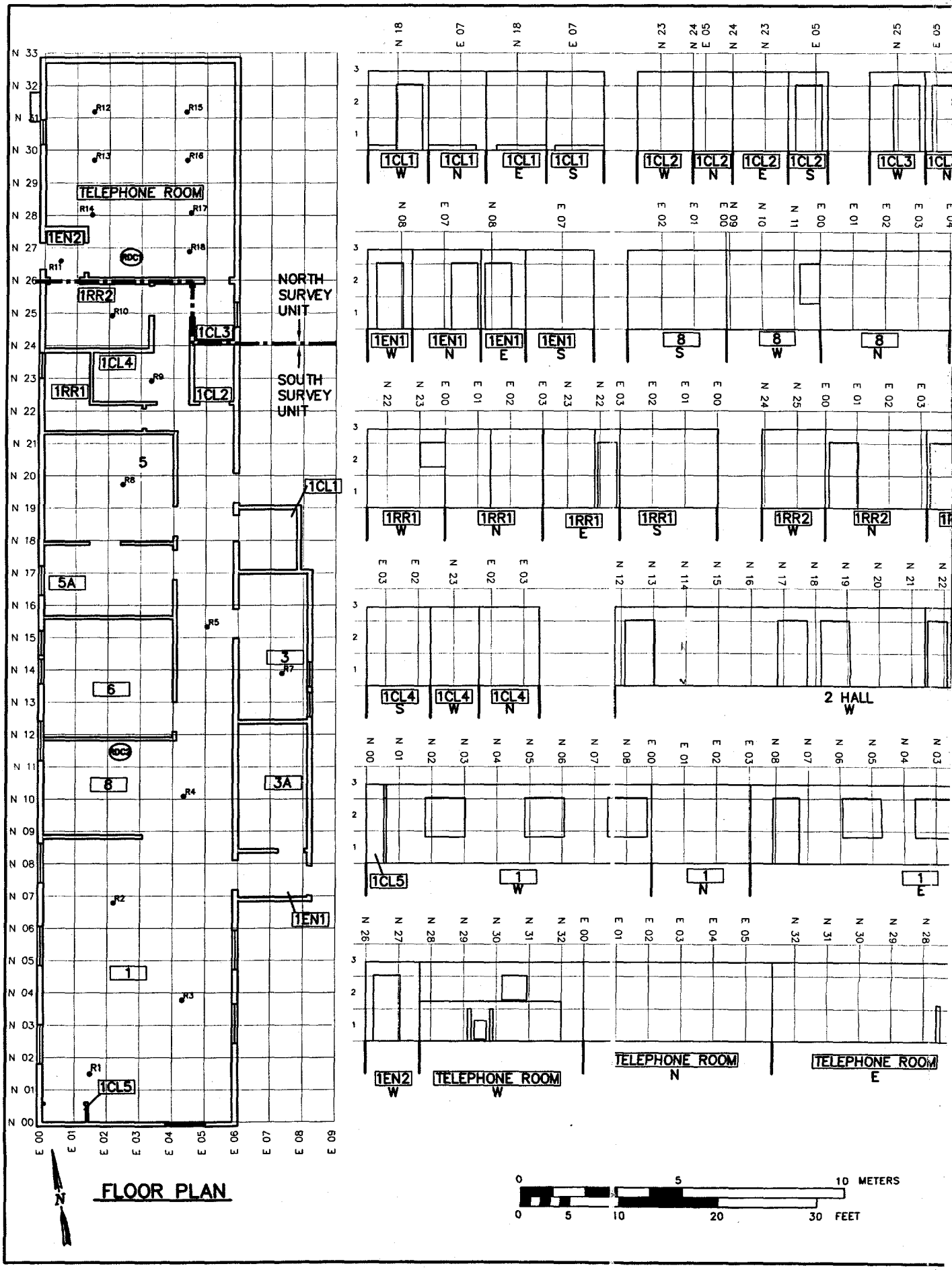
SCALE IN METERS

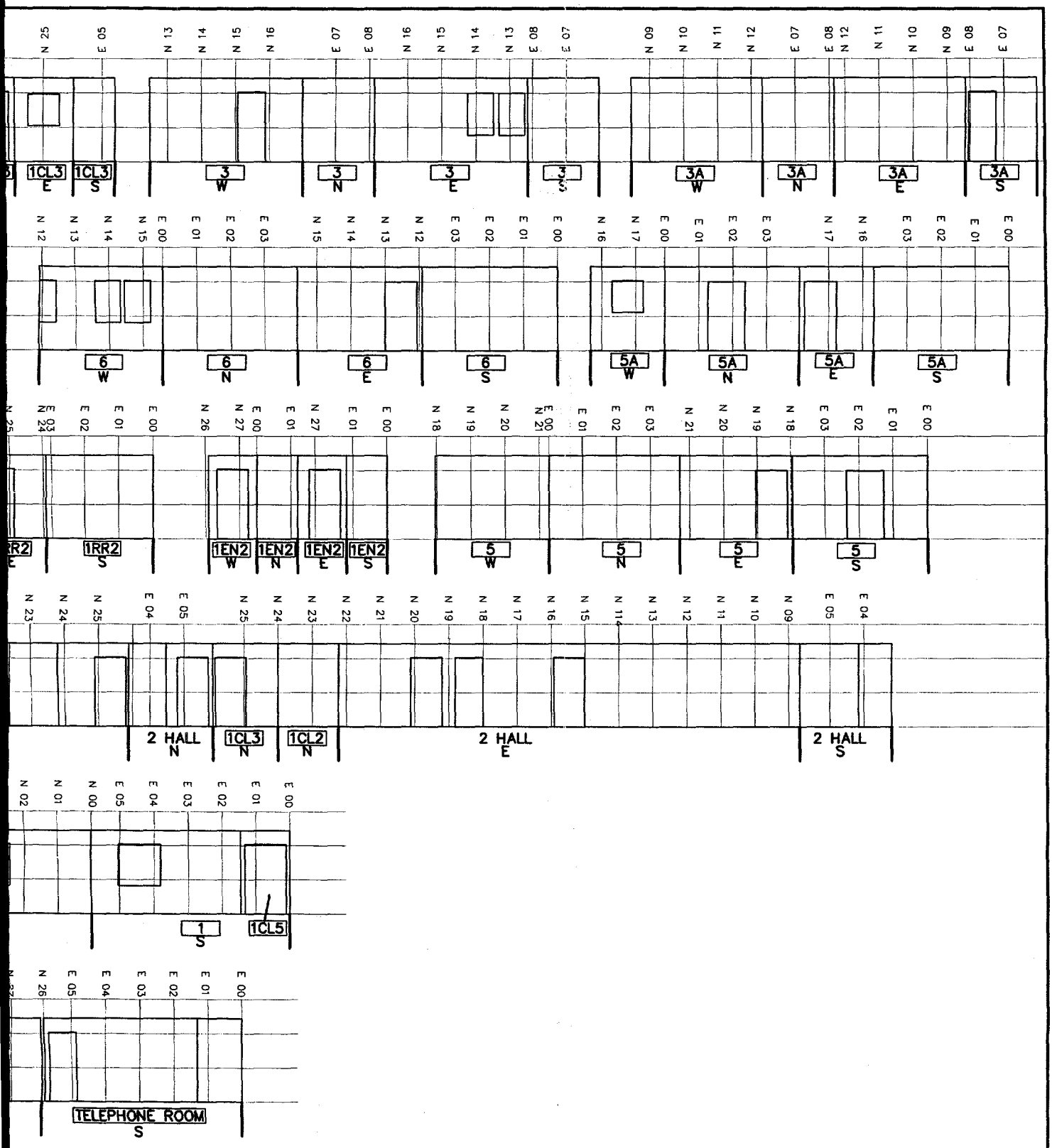
0 5 10

0 5 10 20 30

SCALE IN FEET

PROJECT LOCATION: GRAND JUNCITON PROJECTS OFFICE GRAND JUNCTION, CO	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION PROJECTS OFFICE, COLORADO	
	COMPLETION REPORTS	GJPORAP
	CAD MGR / DATE	BUILDING 12 – FIGURE A1-1 PIC and RDC Measurement Location
	TECHNICAL MANAGER	
RUST First Geotech	PROJECT NO. FAS-031-0002-00-000	SHT. 1 OF 5
	DRAWING NO. 10000700.DWG	


TELEPHONE ROOM
1EN2
1RR2
1CL3
1CL4
1RR1
1CL2
NORTH SURVEY UNIT
SOUTH SURVEY UNIT
5
1CL1
5A
6
3
8
3A
1
1EN1
1CL5
R1
R2
R3
R4
R5
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
RDC
1CL1 W
1CL1 N
1CL1 E
1CL1 S
1CL2 W
1CL2 N
1CL2 E
1CL2 S
1CL3 W
1EN1 W
1EN1 N
1EN1 E
1EN1 S
8 S
8 W
8 N
1RR1 W
1RR1 N
1RR1 E
1RR1 S
1RR2 W
1RR2 N
1CL4 S
1CL4 W
1CL4 N
2 HALL W
1CL5
1 W
1 N
1 E
1EN2 W
TELEPHONE ROOM W
TELEPHONE ROOM N
TELEPHONE ROOM E
FLOOR PLAN
0 5 10 METERS
0 5 10 20 30 FEET



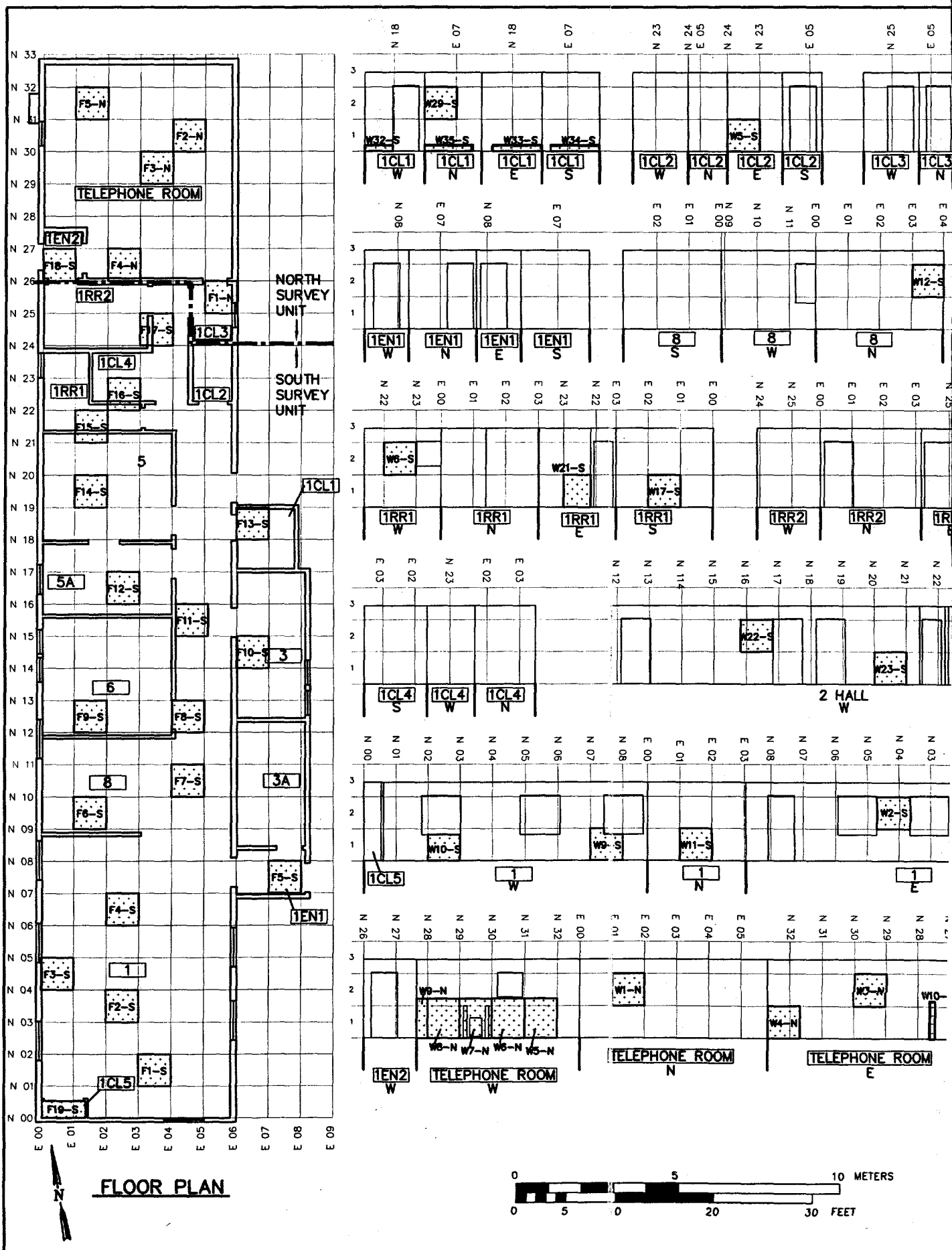
LEGEND:

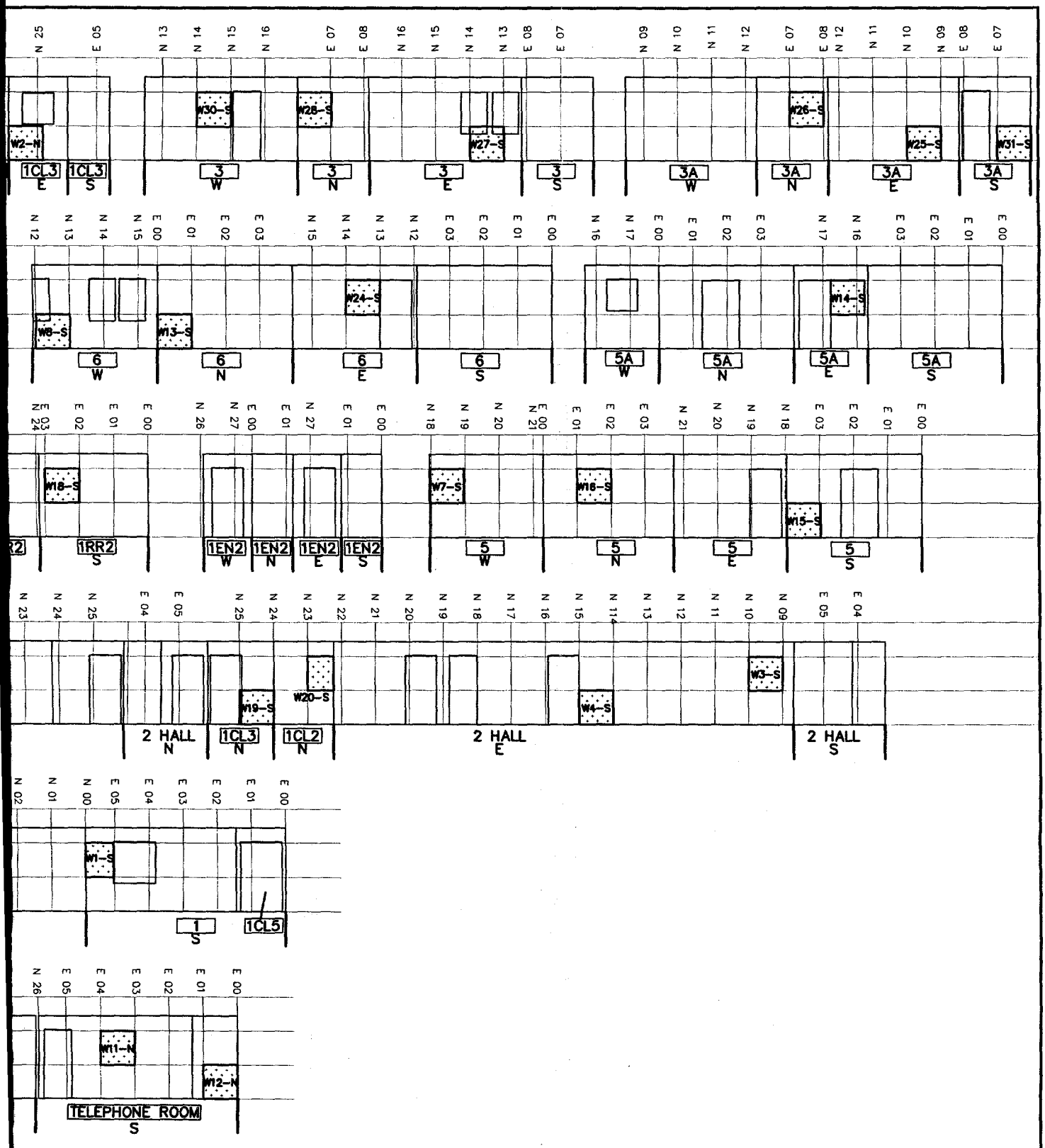
1 / S — ROOM NUMBER AND ELEVATION LABEL

R12 — PRESSURIZED ION CHAMBER (PIC) MEASUREMENT LOCATION
MEASUREMENT LOCATION NUMBER
MEASUREMENT LOCATION

RDC — RADON DECAY PRODUCT CONCENTRATION (RDC) MEASUREMENT LOCATION

PROJECT LOCATION: GRAND JUNCTION PROJECTS OFFICE GRAND JUNCTION, CO	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION PROJECTS OFFICE, COLORADO	
REFERENCE	IDENTIFICATION / VERIFICATION	GJPORAP
	CAD TECH / DATE	
	TEAM LEADER	BUILDING 2 – FIGURE A1-2 PIC and RDC MEASUREMENT LOCATIONS
	UTILITY LOCATION	
	SUBMITTED	
Rust Geotech	PROJECT NO. FAS-031-0002-00-000	SHT. 2 OF 5
	DRAWING NO. 10000600.DWG	


TELEPHONE ROOM
NORTH SURVEY UNIT
SOUTH SURVEY UNIT
5
6
8
5A
3
3A
1
F1-N
F2-N
F3-N
F4-N
F5-N
F18-S
F17-S
F16-S
F15-S
F14-S
F13-S
F12-S
F11-S
F10-S
F9-S
F8-S
F7-S
F6-S
F5-S
F4-S
F3-S
F2-S
F1-S
F19-S
1EN2
1RR2
1CL3
1CL4
1RR1
1CL2
1CL1
1EN1
1CL5
W32-S
W35-S
W33-S
W34-S
W29-S
W5-S
W12-S
W6-S
W21-S
W17-S
W22-S
W23-S
W10-S
W9-S
W11-S
W2-S
W9-N
W8-N
W7-N
W6-N
W5-N
W1-N
W4-N
W3-N
W10-
2 HALL
W
TELEPHONE ROOM
N
TELEPHONE ROOM
E
TELEPHONE ROOM
W
FLOOR PLAN
N
0 5 10 METERS
0 5 0 20 30 FEET

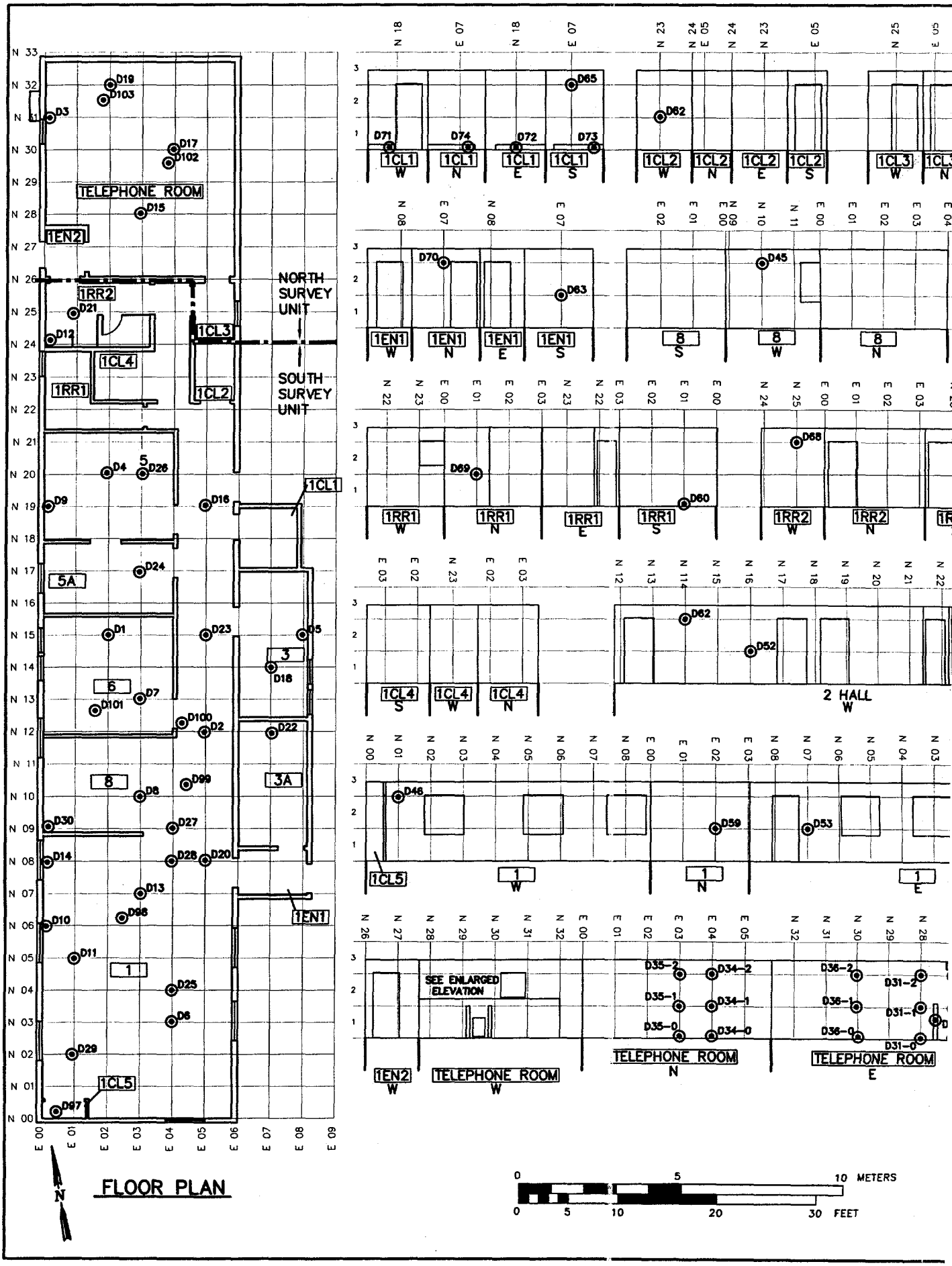


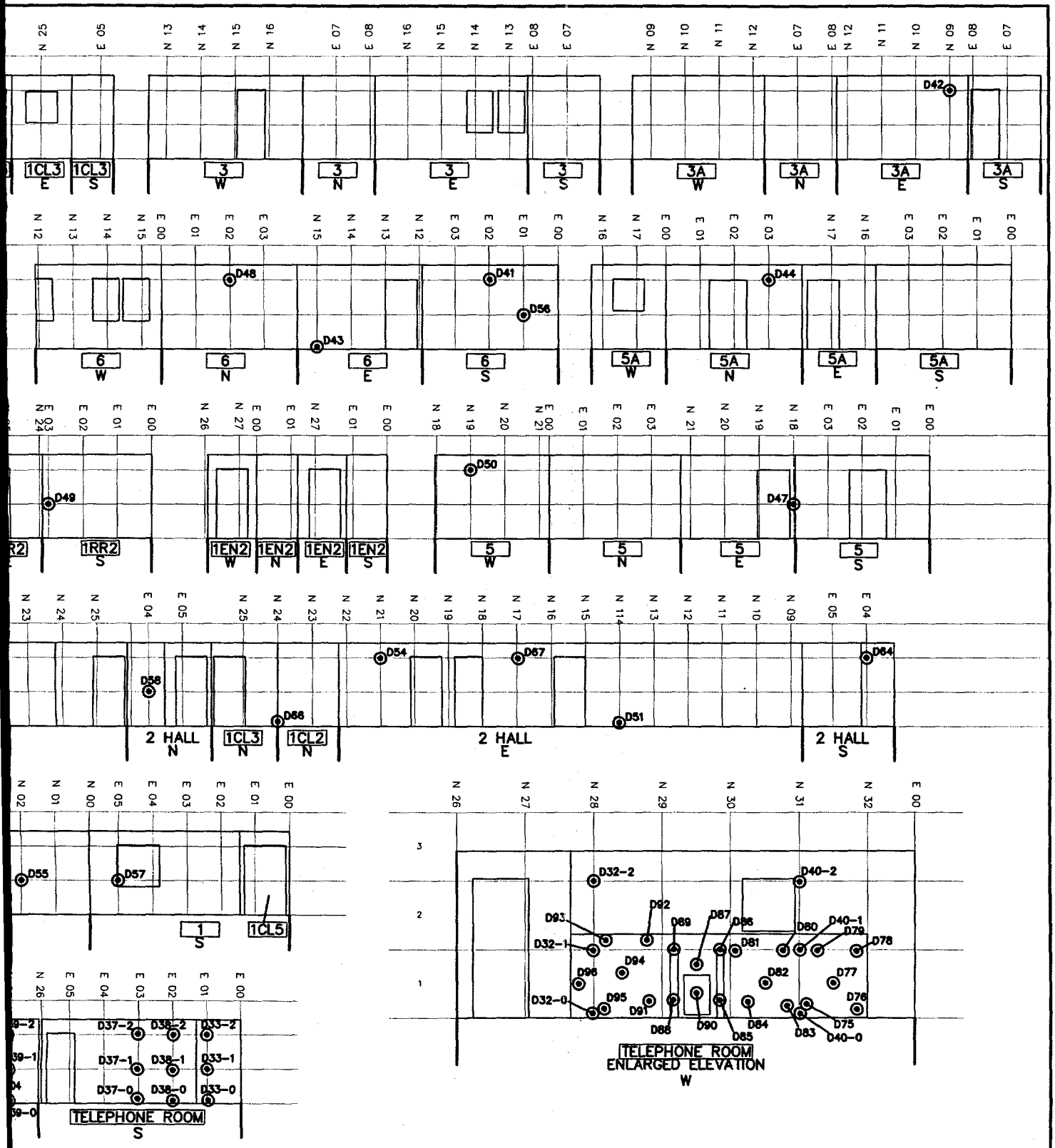
LEGEND:

1 / S — ROOM NUMBER AND ELEVATION LABEL

W11-S — SURVEY AREA
- NORTH OR SOUTH <N S> SURVEY UNIT IDENTIFIER
- 2nd & 3rd CHARACTERS: UNIQUE SURVEY NUMBER
- 1st CHARACTER: WALL OR FLOOR <W F> IDENTIFIER

PROJECT LOCATION: GRAND JUNCTION PROJECTS OFFICE GRAND JUNCTION, CO	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION PROJECTS OFFICE, COLORADO
IDENTIFICATION / VERIFICATION	GJPORAP
BUILDING 2 – FIGURE A1-3 SCAN MEASUREMENT LOCATIONS	
Rust Geotech	PROJECT NO. FAS-031-0002-00-000
	DRAWING NO. 10000600.DWG
	SHT. 3 OF 5


TELEPHONE ROOM
1EN2
1RR2
1CL3
1CL4
1RR1
1CL2
NORTH SURVEY UNIT
SOUTH SURVEY UNIT
5
5A
1CL1
6
8
3
3A
1EN1
1CL5
1
D19
D103
D3
D17
D102
D15
D21
D12
D4
D26
D9
D16
D24
D1
D23
D5
D18
D7
D101
D100
D2
D22
D99
D8
D30
D27
D14
D28
D20
D13
D98
D10
D11
D25
D6
D29
D97
1CL1 W
1CL1 N
1CL1 E
1CL1 S
D65
D71
D74
D72
D73
1CL2 W
1CL2 N
1CL2 E
1CL2 S
D62
1CL3 W
1CL3 N
1EN1 W
1EN1 N
1EN1 E
1EN1 S
D70
D63
8 S
8 W
8 N
D45
1RR1 W
1RR1 N
1RR1 E
1RR1 S
D69
D60
D68
1RR2 W
1RR2 N
1CL4 S
1CL4 W
1CL4 N
D52
2 HALL W
1CL5
1 W
1 N
1 E
D46
D59
D53
SEE ENLARGED ELEVATION
1EN2 W
TELEPHONE ROOM W
TELEPHONE ROOM N
TELEPHONE ROOM E
D35-2
D34-2
D35-1
D34-1
D35-0
D34-0
D36-2
D31-2
D36-1
D31-1
D36-0
D31-0
N
FLOOR PLAN
0 5 10 METERS
0 5 10 20 30 FEET

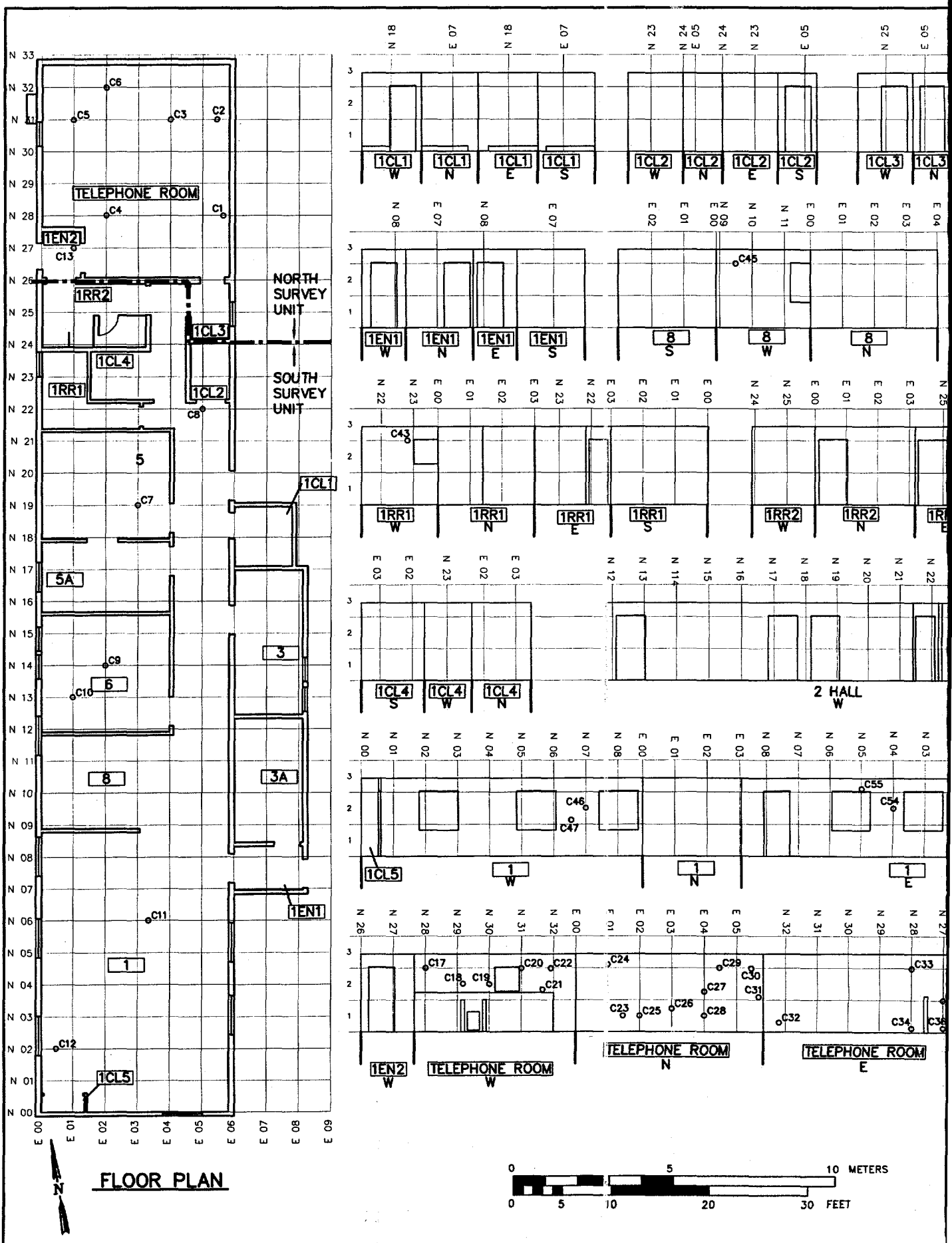


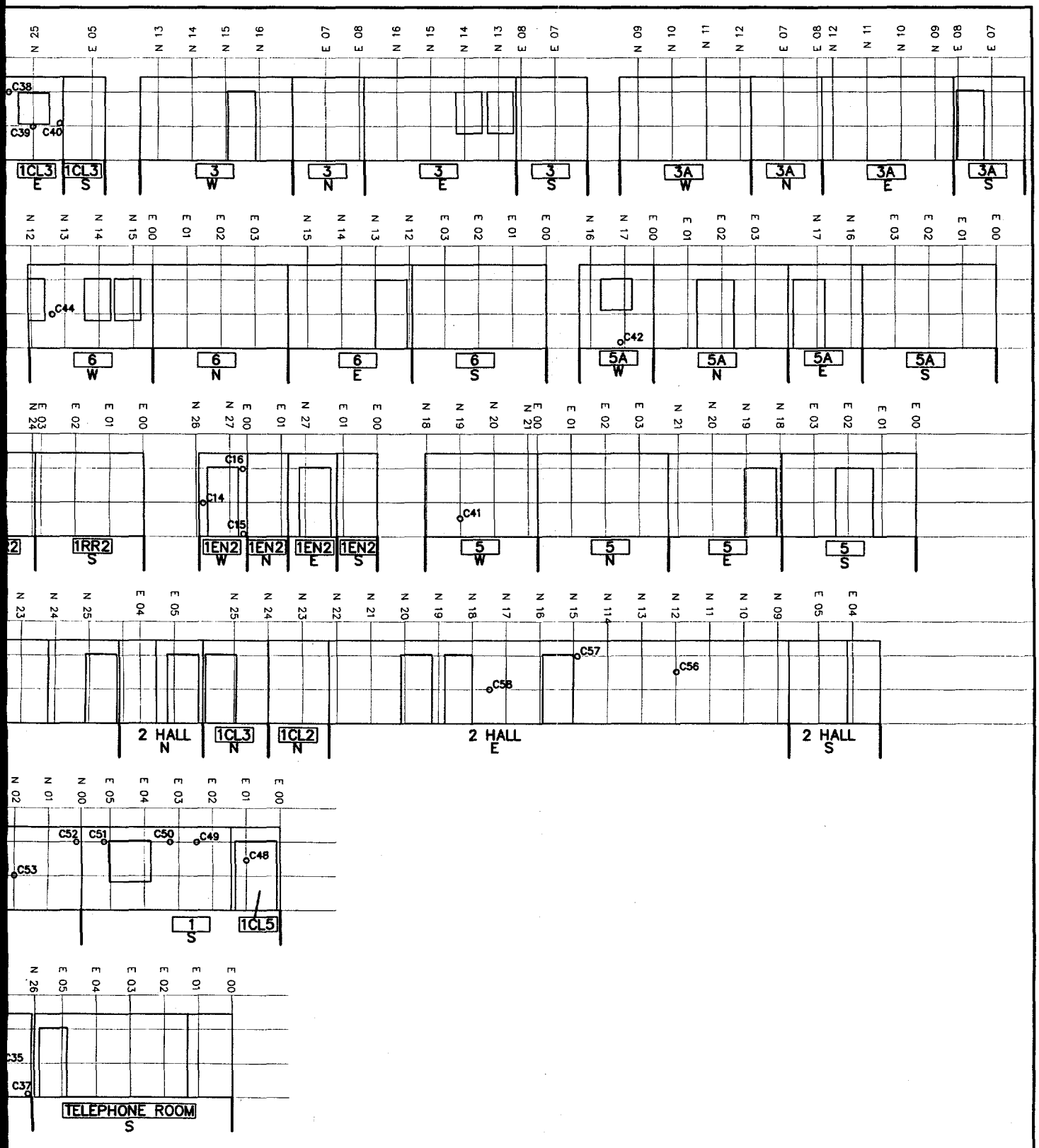
LEGEND:

1 / S — ROOM NUMBER AND ELEVATION LABEL

D43-1 — DIRECT MEASUREMENT / SMEAR LOCATION
- HEIGHT FROM FLOOR (IN METERS)
- MEASUREMENT / SMEAR NUMBER
- INDICATES DIRECT MEASUREMENT / SMEAR

PROJECT LOCATION: GRAND JUNCTION PROJECTS OFFICE GRAND JUNCTION, CO	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION PROJECTS OFFICE, COLORADO	
REFERENCE	IDENTIFICATION / VERIFICATION	GJPORAP
	DRD TECH / DATE	BUILDING 2 – FIGURE A1-4 DIRECT MEASUREMENTS / SMEARS LOCATIONS
	TEAM LEADER	
	UTILITY LOCATOR	
	SUBMITTED	
RUST Rust Geotech		PROJECT NO. FAS-031-0002-00-000 SHT. 4 OF 5
		DRAWING NO. 10000600.DWG


TELEPHONE ROOM
NORTH SURVEY UNIT
SOUTH SURVEY UNIT
1EN2
1RR2
1CL3
1CL4
1RR1
1CL2
1CL1
5
5A
3
6
3A
8
1
1EN1
1CL5
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
1CL1 W
1CL1 N
1CL1 E
1CL1 S
1CL2 W
1CL2 N
1CL2 E
1CL2 S
1CL3 W
1CL3 N
1EN1 W
1EN1 N
1EN1 E
1EN1 S
8 S
8 W
8 N
C45
1RR1 W
1RR1 N
1RR1 E
1RR1 S
1RR2 W
1RR2 N
C43
1CL4 S
1CL4 W
1CL4 N
2 HALL W
1CL5
1 W
1 N
1 E
C46
C47
C54
C55
1EN2 W
TELEPHONE ROOM W
TELEPHONE ROOM N
TELEPHONE ROOM E
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
FLOOR PLAN
0 5 10 METERS
0 5 10 20 30 FEET



LEGEND:

1 / S — ROOM NUMBER AND ELEVATION LABEL

C33 — CORE SAMPLE LOCATION
CORE LOCATION NUMBER
CORE LOCATION

PROJECT LOCATION: GRAND JUNCTION PROJECTS OFFICE GRAND JUNCTION, CO	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION PROJECTS OFFICE, COLORADO	
REFERENCE	IDENTIFICATION / VERIFICATION: CAD TECH / DATE; TEAM LEADER; UTILITY LOCATOR; SUBMITTED	GJPORAP
		BUILDING 2 – FIGURE CORE LOCATIONS FLOORS AND WALLS — AI-5
RUST Rust Geotech		PROJECT NO. FAS-031-0002-00-000; DRAWING NO. 10000600.DWG; SHT. 5 OF 5

Appendix 2

Results of the Landauer Radon Track Etch Measurements

RUST GEOTECH INC.

MEMO TO: R. Morris

FROM: C. Miracle

DATE: February 13, 1996

SUBJECT: RBC results for GJPO Building 46 (copy center)

The Landauer Track-etch cup results for the copy center room and the telecommunications room both measured at less than .0050 Working Levels. The readings are "less than indicated value"due to the low number of tracks on the film. Therefore, the measurements have determined that there is no significant radon within the structure. The third background measurement taken in the "log cabin" portion of building 12 is also less than .0050 Working Levels.

If you have any further questions regarding the measurements taken, please contact me at 6291.

/cm

ALPHA-TRACK MEASUREMENT SUMMARY SHEET

Location Number: 1	Address: GJPO
Other information: Telecommunications Room Location in room	
Start Date: 1/3/96	End Date: 2/2/96
Number of Days:	Batch Number: 40

$$\frac{\text{Exposure (pCi/L/days)}}{\text{Number of Days}} = \text{Radon Concentration (pCi/L)} \qquad \frac{\text{Radon Concentration}}{200} = \text{RDC (Working Level)}$$

Detector Number	Tracks per mm²	Exposure (pCi/L/days)	Radon Concentration (pCi/L)	RDC (working level)
3892176	0.4	30.0	< 1.00	< .0050
3892289	0.0	30.0	< 1.00	< .0050
3892274	0.2	30.0	< 1.00	< .0050
			Average	< .0050

CRITERIA USED FOR PLACEMENT

Placement	Pickup		Placement	Pickup	
N/A		Basement	✓		Detector facing room
N/A		Area of interior removal	✓		At least 18 inches from floor
✓		Lowest habitable level	✓		Serial numbers match pouch
N/A		Highest interior gamma exposure	✓		Detectors away from doors, vents, heat, window or sunlight
✓		Least ventilated area			Detectors are not damaged at pickup
		Other			

Explanation of deviation from placement criteria:

Technician: CM	Verified: CM

ALPHA-TRACK MEASUREMENT SUMMARY SHEET

Location Number: 3	Address: GJPO
Other information: Copy Center Location 2	
Start Date: 11 3 96	End Date: 2/2/96
Number of Days: ~~2/2/96~~	Batch Number: 40

Exposure (pCi/L/days) / Number of Days = Radon Concentration (pCi/L)

Radon Concentration / 200 = RDC (Working Level)

Detector Number	Tracks per mm^2	Exposure (pCi/L/days)	Radon Concentration (pCi/L)	RDC (working level)
3892268	0.6	30.0	<1.00	<.005
3892280	0.0	30.0	<1.00	<.005
3892159	0.1	30.0	<1.00	<.005
			Average	<.005

CRITERIA USED FOR PLACEMENT

Placement	Pickup		Placement	Pickup	
N/A		Basement	✓		Detector facing room
N/A		Area of interior removal	✓		At least 18 inches from floor
✓		Lowest habitable level	✓		Serial numbers match pouch
N/A		Highest interior gamma exposure	✓		Detectors away from doors, vents, heat, window or sunlight
✓		Least ventilated area			Detectors are not damaged at pickup
		Other			

Explanation of deviation from placement criteria:

Technician: CM	Verified: CM

alpha-dat.frm, August 31, 1995

ALPHA-TRACK MEASUREMENT SUMMARY SHEET

Location Number: 2	Address: GJPO
Other information: Log Cabin - Background	
Start Date: 1/3/96	End Date: 2/2/96
Number of Days: ~~2/2/96~~	Batch Number: 40

$$\frac{\textit{Exposure (pCi/L/days)}}{\textit{Number of Days}} = \textit{Radon Concentration (pCi/L)} \qquad \frac{\textit{Radon Concentration}}{200} = \textit{RDC (Working Level)}$$

Detector Number	Tracks per mm^2	Exposure (pCi/L/days)	Radon Concentration (pCi/L)	RDC (working level)
3851473	0.0	30.0	< 1.00	< .0050
3892206	0.0	30.0	< 1.00	< .0050
3892264	0.0	30.0	< 1.00	< .0050
			Average	< .0050

CRITERIA USED FOR PLACEMENT

Placement	Pickup		Placement	Pickup	
N/A		Basement	✓		Detector facing room
N/A		Area of interior removal	✓		At least 18 inches from floor
✓		Lowest habitable level	✓		Serial numbers match pouch
N/A		Highest interior gamma exposure	✓		Detectors away from doors, vents, heat, window or sunlight
✓		Least ventilated area			Detectors are not damaged at pickup
		Other			

Explanation of deviation from placement criteria:

Technician: C.M.	Verified: CM

Radon Monitoring Report

SEND REPORT & 5 1/4" DISKETTE
TO NAME & ADDRESS ON SHIPPING
DOCUMENT.

LANDAUER

Landauer, Inc. 2 Science Road Glenwood, Illinois 60425-1586
Telephone: (708) 755-7911 Facsimile: (708) 755-7016

Acct. No. 0400051

Detector Number	Detector Type	Starting Date	Ending Date	Field Data / Comments	Exposure pCi/l-days	Avg. Radon Conc. pCi/l	GROSS COUNT	NET COUNT	AVG NET TRACKS/ MM SQ.	LOT NO.
3851473	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	36	0	0.0	N1111
3892159	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	41	2	0.1	R1196
3892176	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	46	7	0.4	R1196
3892206	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	27	0	0.0	R1196
3892264	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	35	0	0.0	R1196
3892268	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	49	10	0.6	R1196
3892274	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	42	3	0.2	R1196
3892280	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	38	0	0.0	R1196
3892289	DRN	03-JAN-96	02-FEB-96	* - LESS THAN INDICATED VALUE	* 30.0	* 1.0	38	0	0.0	R1196

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Q.C. Release	Process No.	Report Date	Date Received
WAB	A18147	08-FEB-96	05-FEB-96

Appendix 3

DQOs, Use Scenarios, and Affected Area Designation of GJPORAP Building 2 Characterization

DQOs, Use Scenarios, and Affected Area Designation for GJPORAP Building 2 Characterization

Rev 1.
April 30, 1996

Rust Geotech, Inc.

Prepared by Robert Morris and David Thorne

number the equations

Executive Summary

This document defines the Data Quality Objectives (DQO) and future use assumptions necessary for predicting the public dose associated with future use of Building 2 as part of the DOE Grand Junction Projects Office Remedial Action Program (GJPORAP). A formal definition of the "affected areas," which is needed for design of the sampling plan, is also included.

The DQO states that the building may be released for unrestricted use if the predicted dose (excluding radon) to a member of the public occupying the building is less than 15 mrem in a typical year, and less than 30 mrem in the year when demolition occurs. The required confidence level needed for sampling to establish the future dose is set at the 95% level. In keeping with proposed EPA guidance (FR Vol. 59, No. 246, p. 66415) the dose criteria do not include the contribution from indoor radon, either from naturally occurring radium-bearing soils or fill material situated beneath or near the building. However the radon concentration in Building 2 must not exceed the level recommended to the public by the EPA and Centers for Disease Control in "A Citizen's Guide to Radon" (EPA 402-K92-001), which is 4 pCi/L.

Future use of Building 2 is expected to be the same as its current use: an office facility occupied for eight hours per day, five days per week. Some day the building will be demolished. Exposure to potentially radioactive dust on surfaces that are currently inaccessible may occur, along with larger doses compared with normal occupancy. Demolition is assumed to take 80 hours to complete. No beneficial use of the building debris is expected; all will go to a sanitary landfill.

The "affected area" of Building 2 is the exposed surfaces (including drain lines) that existed during the era of its use as a locker and shower facility for uranium workers. Subsequent construction on the building, which includes interior walls, wood paneling, and floor coverings installed over a leveling slab are unaffected.

DQOs, Use Scenarios, and Affected Area Designation for GJPORAP Building 2 Characterization

This document defines the Data Quality Objectives (DQO) and future use assumptions necessary for predicting the public dose associated with future use of Building 2 as part of the DOE Grand Junction Projects Office Remedial Action Program (GJPORAP). A formal definition of the "affected areas," which is needed for design of the sampling plan, is also included.

Part I. DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQO) process (EPA 1995) includes seven steps to define the data needed for decision-making. In a separate document (Morris 1996) the DQOs for Pipe Explorer operations in Building 2 were specified.

DQO Step 1: State the Problem

Data is needed to define the contaminant level of alpha, and beta/gamma emitting radionuclides, associated with prior operations in Building 2. We assume that "yellowcake" (nominally U_3O_8) is the primary radiological contaminant, although uranium mill tailings may also be involved. The dose rate and radon concentrations also need to be evaluated to find out the dose impact of the existing environment in Building 2.

The contaminant level data will be used in a model to predict the radiation dose likely to occur if the contaminants are left in place. Measurements will include dose rate, radon concentration, and surface contamination on accessible and inaccessible surfaces.

The data and resulting dose model will be incorporated into a report to be issued by the GJPORAP program at the end of February 1996. Therefore, the data report should be submitted to the project health physicist by February 15, 1996.

DQO Step 2: Identify the Decision

Building 2 may be released from radiological control for unrestricted use if the following criteria are met:

Criteria 1: The best estimate of annual Total Effective Dose Equivalent (TEDE) above background (not including dose from naturally-occurring or DOE-enhanced radon and short-lived progeny) to a member of the public under the most likely use scenario for a typical year may not exceed 15 mrem/year above background.

Criteria 2: The best estimate of the annual TEDE above background (not including dose from naturally-occurring or DOE-enhanced radon and short-lived progeny) to a member of the public during a full year that includes building demolition may not exceed 30 mrem/year above background.

Criteria 3: The concentration of radon in the building should be less than the EPA guide value of 4 pCi/L.[1]

Criteria 4: For surface contamination on currently accessible surfaces[2]:

Removable beta contamination should be reduced to levels consistent with those in NRC RegGuide 1.86[3].

Total beta contamination should be reduced to levels that are ALARA. The process used to establish the ALARA level will be documented in the closeout report for the building for those normally

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[1] In keeping with proposed EPA guidance (FR Vol. 59, No. 246, p. 66415) the dose criteria do not include the contribution from indoor radon, either from naturally occurring radium-bearing soils or fill material situated beneath or near the building. However the radon concentration in Building 2 must not exceed the level recommended to the public by the EPA and Centers for Disease Control in "A Citizen's Guide to Radon" (EPA 402-K92-001), which is 4 pCi/L.

[2]Surface contamination will be assessed by measuring high energy beta and gamma ray emissions. It is recognized that the radionuclides found in yellowcake and uranium mill tailings also emit alpha radiation, however in most cases the proportions of alpha emissions to beta emissions is near unity and the alpha and beta limits are to be applied separately. Since beta emissions are more readily detected than alpha emissions, measurement of only the beta signal is assumed to be sufficient to characterize the hazard.

[3]The surface contamination guidelines for uranium in NRC RegGuide 1.86 are the same as those published by DOE in all current regulatory documents.

and currently accessible surfaces exceeding the applicable value in NRC RegGuide 1.86.

In a year of normal occupancy the contaminant levels on inaccessible surfaces and within drainage pipes will not contribute appreciably to dose. In the year of demolition, a short duration exposure to the inaccessible contaminants will occur. The contribution to dose from this pathway will be modeled.

Other areas of Building 2 are of potential interest in future dose scenarios, but we assume that remedial action will be taken to correct these conditions before release. For example, undocumented spot checks of the soil next to the building foundation suggests uranium mill tailings contamination may need to be removed. Prior surveys have shown surface contamination in attic insulation and on wooden structural members. This insulation may need to be removed, and wood may need to be decontaminated. Surveys confirming the adequacy of this cleanup should be performed before release of the building.

DQO Step 3: Identify Inputs

Inputs include the following:

Assumptions for RESRAD-BUILD (ANL/EAD/LD-3), or a similar dosimetry model.

Dose conversion factors and specific activity factors for yellowcake and uranium mill tailings obtained from Rust technical basis documents for internal dosimetry

Future use assumptions for the building. The assumptions for future use of Building 2 are in Part II of this document.

Data from the survey and reference units listed in Table 1.

Laboratory analysis of a high-activity sample to confirm the assumptions regarding radionuclides associated with Building 2.

Background levels of the quantities of concern are normally subtracted from the gross level in the survey. In most cases the background is established by measuring the same phenomenon in a reference area. However, sometimes long-term estimates of the

background may be better, for example area TLD data may provide a better estimate when averaged over a quarter or year. When it is judged that long-term average estimates of background are more reliable, these may be used instead of or in addition to the point measurement of background in the reference area. Since radon levels will be compared with a gross screening level recommended by the EPA, no background subtraction will be used.

Surface contamination background levels are generally assumed to be near zero. However, contamination survey meters are affected by ambient beta and gamma ray background and consequently instrument background will be subtracted.

Besides the external dose rate data set obtained with the PIC measurements, an equivalent data set has been historically measured at GJPO as part of the area TLD program. This data set may be used to supplement or confirm the PIC measurements.

Similarly, a 1989 nationwide survey of radon concentration in DOE buildings may have included Building 2. If so, that information may be used to supplement the data collected in this characterization effort.

Calibration of the beta survey instruments will be done using NIST-traceable Chlorine-36 sources, according to a written procedure. Chlorine-36 is chosen because it has an intermediate beta energy that will conservatively approximate the energy of the beta emissions from the suspected radionuclides.

DQO Step 4: Define the Boundaries

Affected Area Designation

By defining what portions of a facility have been affected by prior operations, the sampling intensity for an area can be established. Here the affected area is influenced both by location and by date of construction. The originally exposed surfaces on the north end of the building are affected. The originally exposed surfaces in the adjacent area to the south are affected by proximity. However, the building has been remodeled several times since that original use. New walls, and wall or floor coverings are not expected to be affected by the original operations, consequently these will be designated as unaffected.

Survey Units

The areas of the building will be divided into survey units. The survey units will be broadly classified as dose rate survey units, radon survey units, and contamination survey units. A summary of the survey units is provided in Table 1.

Dose rate survey units

Building 2 will be divided into two logical dose rate survey units: 1) the telecommunications center to the north and; 2) the copy center and surrounding offices. A reference building will also be used statistically to compare the dose rate survey data. Building 12, "Log Cabin" will be used for this purpose and will be the reference survey unit for dose rate surveys.

Radon survey units

Only two logical survey units exist in Building 2: the telecommunications center and the balance of the building. These are logically separate because they are separately ventilated, and ventilation is strongly associated with radon decay product concentration. Other possible survey units, such as the attic are discounted because they are not routinely occupied and any elevated radon concentration would be more easily shown by elevated surface contamination levels in the attic. Building 12, "Log Cabin" will serve as the reference building for radon measurements since it is considered unaffected and is built on original soils.

Surface contamination survey units

Building 2 will be divided into two areas: 1) the telecommunications center (i.e., historical mill worker change room; and 2) the southern area of the building (i.e., copy center and offices). Each area will contain several survey units for surface activity surveys. In addition, the survey units are different for accessible (i.e., new walls and accessible old walls) and inaccessible surfaces (i.e., old covered walls).

Accessible surfaces - the telecommunications center will consist of two units: 1) all new walls are one survey unit; and 2) the old walls are the other survey unit. The southern portion of Building 2 has two survey units consisting of all new walls as one unit and old walls as the other unit.

Inaccessible surfaces - the telecommunications center will consist of four units: 1) the north wall; 2) the east wall; 3) the west wall; and 4) the floor. The southern portion of Building 2 has three survey units: 1) the floor; 2) the east wall and half of the south wall; and 3) the west wall and half of the south wall.

Table 1. Sampling Units for Building 2 and Reference Area

Measurement Type	Total Sampling Units	Building 12 "Log Cabin"	Building 2 (South End)	Building 2 (North End)
PIC	3	all one unit	all one unit	all one unit
Radon	3	all one unit	all one unit	all one unit
Accessible Surfaces	4	none	old walls one unit	old walls one unit
			new walls one unit	new walls one unit
Inaccessible Surfaces	7	none	floor one unit	floor one unit
			walls two units	walls three units

DQO Step 5: Develop a Decision Rule

The dose rate measurements from the reference building will be compared with the Building 2 data using the Wilcoxon Rank Sum (WRS) test and the Quantile test. Both are nonparametric statistical tests (NUREG-1505).

For the WRS test, the total number of required samples from the reference area and survey units combined is (NUREG -1505):

$$N = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{12c(1-c)(P_r - 0.5)^2} \qquad (1)$$

where:

α	=	specified Type I error rate
β	=	specified Type II error rate
$Z_{1-\alpha/2}$	=	100(1 - α/2) percentile of the standard normal distribution function
$Z_{1-\beta}$	=	100(1 - β) percentile of the standard normal distribution function
c	=	proportion of samples to be collected in the reference area

The proportion, c, of measurements to be taken from the reference area is determined from:

$$c = \frac{v^2 h^{1/2}}{v^2 h^{1/2} + 1} \qquad (2)$$

where:

h	=	number of survey units being compared with the given reference area
v	=	$\sigma_{reference}/\sigma_{survey}$, the ratio of the standard deviation of the measurements in the reference area to the standard deviation of the measurements in the survey units.

The value of v must be estimated from previous samples or expert opinion. Lacking any information to the contrary, assuming that v = 1 is reasonable (NUREG-1505).

Once N is calculated, then m = c*N samples will be taken from the reference area, and n = (1 - c)*N samples will be taken from each survey unit being compared with it.

For the WRS test, the specification of the criteria is based on the amount of the shift, Δ, toward higher values in the survey unit that is important to detect compared with the reference distribution. The criterion for dose rate surveys using pressurized ionization chambers is based on detecting a dose 15 mrem above background. The value of Δ was chosen as 15 mrem above background.

If σ is the standard deviation of the measurements in the reference area, then Δ/σ, expresses this shift as the number of standard deviations toward higher values that would

be considered "large" for the distribution of measurements in the survey unit. The shift Δ is a fixed value depending on the criteria of interest. However, the ease or difficulty of detecting this shift statistically depends on the variability in the data, expressed by σ. Therefore, the statistical hypothesis must depend not solely on the absolute shift Δ, but on the relative shift Δ/σ, which expresses the shift relative to the variability in the measurements at a given site.

Some estimate for σ is needed, based on prior sampling or other information. Radiation control technicians who were interviewed about the dose rate at GJPO generally agree that the exposure rate ranges from 10 to 14 μR/hr. This provides an estimate of $\sigma = 9$ mrem/year. [4]

P_r is the specified probability required to detect that a random measurement from the survey unit be larger than a random measurement from the reference area. P_r is greater than 0.5 whenever $\Delta/\sigma > 0$.

P_r is determined using the specified shift Δ/σ that must be detected with power $1 - \beta$. Values of P_r computed for a normal distribution are determined as follows:

$$P_r = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{\Delta}{\sqrt{2}*\sigma}} e^{-x^2/2} dx = \phi\left(\frac{\Delta}{\sqrt{2}*\sigma} \right) \qquad (3)$$

The normal distribution is used here only to enable the conversion of the values of Δ/σ to values of P_r to calculate the appropriate sample size and error rates. The normal distribution is not used actually to conduct the test.

For an α and β error rate of 0.05 and the comparison of the reference area to two survey units (i.e., north and south ends of Building 2), the required number of samples was determined to be 38. The data is given in Table 2.

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[4] This is an overestimate of sigma that was discovered to be in error after the sampling plan had already been issue. In fact sigma is closer to 1 mrem/yr. Rather than change this value and the associated calculations, we will simply acknowledge the error and note that the result was excess measurement of the gamma exposure rate. No adverse affect on the data set occurred.

Table 2.

Determination of the Number of Pressurized Ionization Chamber Measurements for Building 2 and Reference Area

		1- /2	1-		
0.5	0.5	1.96	1.645		0.59

		D/s			N + 20%
15	15.00	1.0000	0.7600	66	79
15	14.12	1.0625	0.7740	60	72
15	13.33	1.1250	0.7870	54	65
15	12.63	1.1875	0.7990	50	60
15	12.00	1.2500	0.8120	46	55
15	11.43	1.3125	0.8230	43	51
15	10.91	1.3750	0.8350	40	48
15	10.43	1.4375	0.8450	38	45
15	10.00	1.5000	0.8560	35	42
15	9.60	1.5625	0.8650	34	40
15	9.23	1.6250	0.8750	32	38
15	8.89	1.6875	0.8840	30	36
15	8.57	1.7500	0.8920	29	35
15	8.28	1.8125	0.9000	28	34
15	8.00	1.8750	0.9080	27	32
15	7.74	1.9375	0.9150	26	31
15	7.50	2.0000	0.9210	25	30

When applying statistical tests, it should be understood that the use of these hypotheses will occasionally allow some survey unit measurements to be larger than some reference area measurements without rejecting the null hypotheses. The central issue addressed by these statistical tests, is whether the site measurements are sufficiently larger to be considered significantly (statistically) different from reference area measurements. Therefore, to apply these tests, what is meant by "larger" must be defined. This is one purpose of constructing the desired power curve as a function of residual radioactivity as shown in the next section.

The WRS test is able to detect uniform failure of the building of interest from meeting the desired decision error level. It is not able to detect hot-spots of contamination. The Quantile test described NUREG-1505 will also be used to analyze this data set for non-uniform contamation. However, the main objective of this study is to evaluate the potential dose to normal occupants and a future demolition of the building. Therefore the

mean activity and dose is the primary objective of this study, not the detection of hot-spots.

The dose rate data will be used to assess the dose from the external exposure pathway. The external dose will be added to the dose from additional pathways evaluated using the RESRAD-BUILD model.

The radon data will be compared with the reference building and to long-term community averages, but the dose from radon will not be included in the total dose to the building occupants. Instead the radon concentration will be evaluated against the EPA screening guideline value.

Contamination levels on accessible and inaccessible surfaces will be used for input into the RESRAD-BUILD model for the determination of the potential dose to building occupants and demolition crews. In addition, the contamination levels on accessible surfaces will be compared with present DOE standards for release.

The survey procedure for scans, direct measurements, and smears on accessible surfaces was taken from NUREG/CR-5849. A square grid of 1 m by 1 m will be established in Building 2. Scanning of accessible surfaces to identify locations of residual and near-surface activity will be done according to the following schedule:

Affected area surfaces - 100% of floors and walls

Unaffected area surfaces - 10% of floors and walls

Direct measurements of surface activity will be done at systematically and randomly selected locations and at locations of elevated direct radiation, identified by surface scans. At least 30 measurement locations for each survey unit must be selected on the grid points by a random process. If the location contains items that prevent the measurement, then the nearest accessible location should be measured and the location noted on the standard survey forms. An integrated count will be obtained at each randomly selected grid point.

A smear for removable contamination will be obtained at each location of a direct surface activity measurement. These smears should encompass an area of 100 cm^2. Smears will be placed into envelopes or other individual containers, to prevent cross-contamination while awaiting analysis.

Inaccessible surfaces will require the use of core samples to estimate the mean and variance of the total beta contamination level. The number of required samples was determined and subsequently optimized based on the cost of sampling and the importance of the result, using the following equation (ASTM 1982):

$$N = \frac{\sigma^2 z^2}{E^2} \qquad (4)$$

where:

N = number of required samples in a sampling unit.
z = a value corresponding to a confidence level (in this case the 95% CL) for the normal distribution. z = 1.96 in this case.
σ = preliminary estimate of the standard deviation of the contamination level in a sampling unit, in dpm/100 cm^2.
E = the acceptable error in a sampling unit, in dpm/100 cm^2.

The assumed parameters and results are shown in Table 3. The value of sigma was selected after examining survey data from accessible surfaces. E was chosen after estimating an order-of-magnitude effect on the dose due to various contamination levels. The result is a rough estimate of the number of required samples.

Table 3. Parameters used to estimate the required number of samples in each sampling unit.

Sampling units(s)	σ	E	N
North walls	15,000	10,000	9
North floor	15,000	12,000	6
South walls	15,000	10,000	9
South floor	15,000	12,000	6

A total of 24 cores will be taken in the southern end of Building 2. Eighteen cores will be taken on the walls, i.e., 9 cores on each wall sampling unit. Six core samples will be obtained from the floor sampling unit.

A total of 34 cores will be taken in the northern end of Building 2. Twenty-six cores will be taken on the walls, i.e., 9 cores on each wall sampling unit. Six cores will be taken from the floor sampling unit. It may not be possible to randomly select the sampling locations on the walls or floors in the northern end because the telecommunications equipment, which cannot be moved, blocks access. In that case an attempt will be made to obtain representive sampling to extent it is feasible. Any significant departure from representative sampling will be discussed in the final report.

The original wall surface and floor surface will be separated from the cores and direct measurements (i.e., integrated counts) will be taken for gross beta measurements. In addition, a smear for removable contamination will also be obtained for each core.

The main decision rule for the occupants of the building will be based upon a TEDE of 15 mrem above background. The dose to building occupants will be determined from the survey data by using the RESRAD-BUILD model.

The decision rule for demolition crews of the building will be based upon a TEDE of 30 mrem above background. The dose tode demolition crews will be determined from the survey data by using the RESRAD-BUILD model.

DQO Step 6: Specify Limits on Decision Errors

Limits on the decision error rates are developed to establish appropriate goals for limiting uncertainty in the data. This is done by establishing the goals for the Type I error rate and the Type II error rate.

Discomfort curves were developed for each survey and sampling measurement to be taken in Building 2. These curves provide the acceptable error levels and the area of no discomfort for each measurement type and final dose values. Discomfort curves are easy to understand graphical descriptions of the confidence the decision maker needs as a product of the analysis. Each discomfort curve, which is a continuous function, is transformed into a step function curve, called the acceptable decision error curve. This curve matches the discrete confidence levels traditionally used in statistical evaluations.

From this statistical power curve, that can be tested using as a null hypothesis is derived. Power curves are used to define the number of samples needed confidently to estimate a particular quantity, such as dose rate. The discomfort, acceptable decision error, and power curves for the each quantity to be measured are grouped; see Figures 1.a through 4.c. The discomfort curves represent the value judgements of the authors, based on informed consideration of current regulation and practice, and newly proposed regulations.

DQO Step 7: Optimize the Design

Occasionally the predetermined location for a measurement will not be accessible due to obstructions. Then a field variance will be noted and the data will be collected from the nearest accessible point. Variances deemed to be important to the estimate of dose will be discussed in the final report.

Because core sampling is an expensive process, effort was made to optimize the sampling plan for inaccessible areas. The effect of various contamination levels on dose during the demolition scenario was estimated using omphaloskepsis and order-of-magnitude calculations. After the effect on dose was estimated, the value for E, the acceptable error was increased. By maximizing E, the required number of samples is minimized.

Part II. FUTURE USE OF BUILDING 2

Future use of a building is difficult to predict with accuracy. However, we believe that assuming that this 50-year-old World War II-era wooden structure has a useful life of 30 years or less is reasonable. Future use is likely to be continued as an office and telecommunications structure, or perhaps as classroom, but not as a residential structure. This likely use limits occupancy by any individual to 240 days per year, eight hours per day. HVAC is not expected to be substantially different from current practice. Adjacent land use is unlikely to be agricultural because of the soil type and depth near the structure.

Inevitably the building will be demolished at some future date that poses a risk to the constructions workers involved and potentially to workers operating the landfill where debris and rubble will be disposed. Demolition, which will result in elevated airborne dust concentration, is assumed to occur during a two week period. Only new equipment, unaffected by prior operations, is expected to be salvaged. Building materials, such as

copper wiring, drain pipe, wood, and concrete rubble, are assumed to go to a sanitary landfill and not put to any future beneficial use.

References

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NUREG/CR-5849. Manual for Conducting Radiological Surveys in Support of License Termination. Draft Report for Comment. NUREG/CR-5849/ORAU-92/C57. J. D. Berger. U. S. Nuclear Regulatory Commission. 1992.

NUREG 1505. A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys. Draft Report for Comment. U. S. Nuclear Regulatory Commission. August 1995.

ANL/EAD/LD-3. RESRAD-BUILD: A Computer Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material. Environmental Assessment Division, Argonne National Laboratory. November 1994.

Figure 1.a

DECISION MAKER'S "DISCOMFORT CURVE"

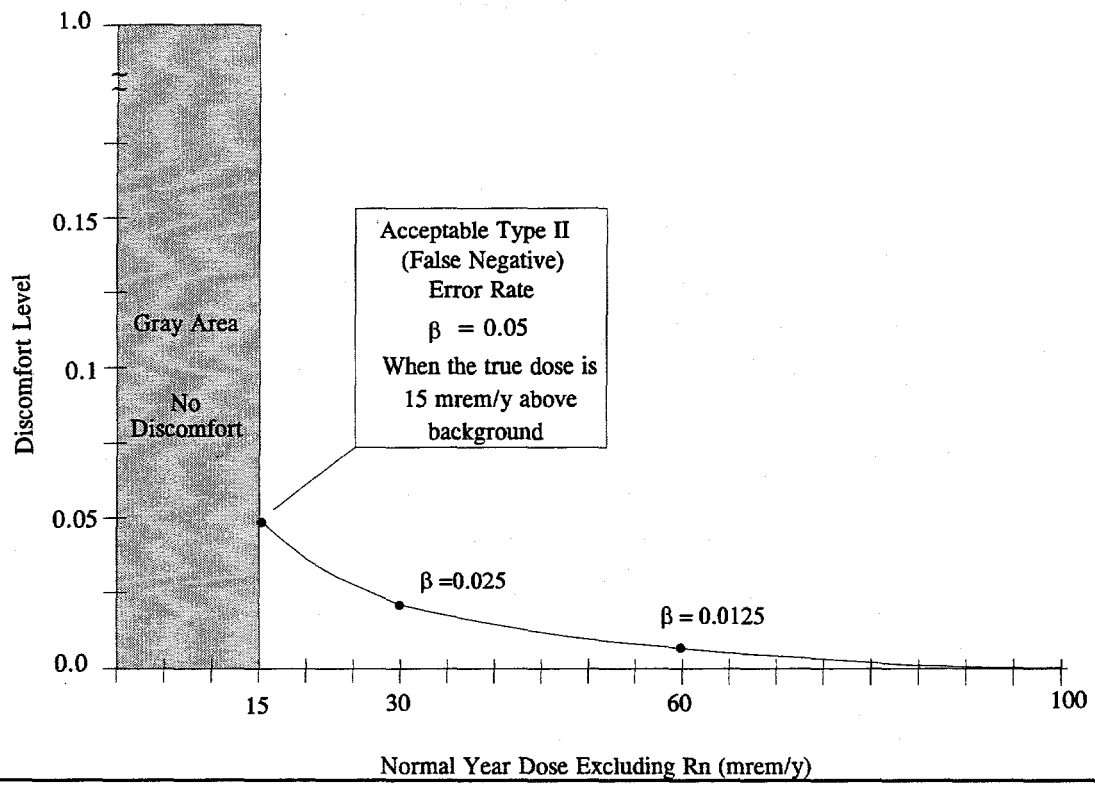


Figure 1.b

ACCEPTABLE DECISION ERRORS

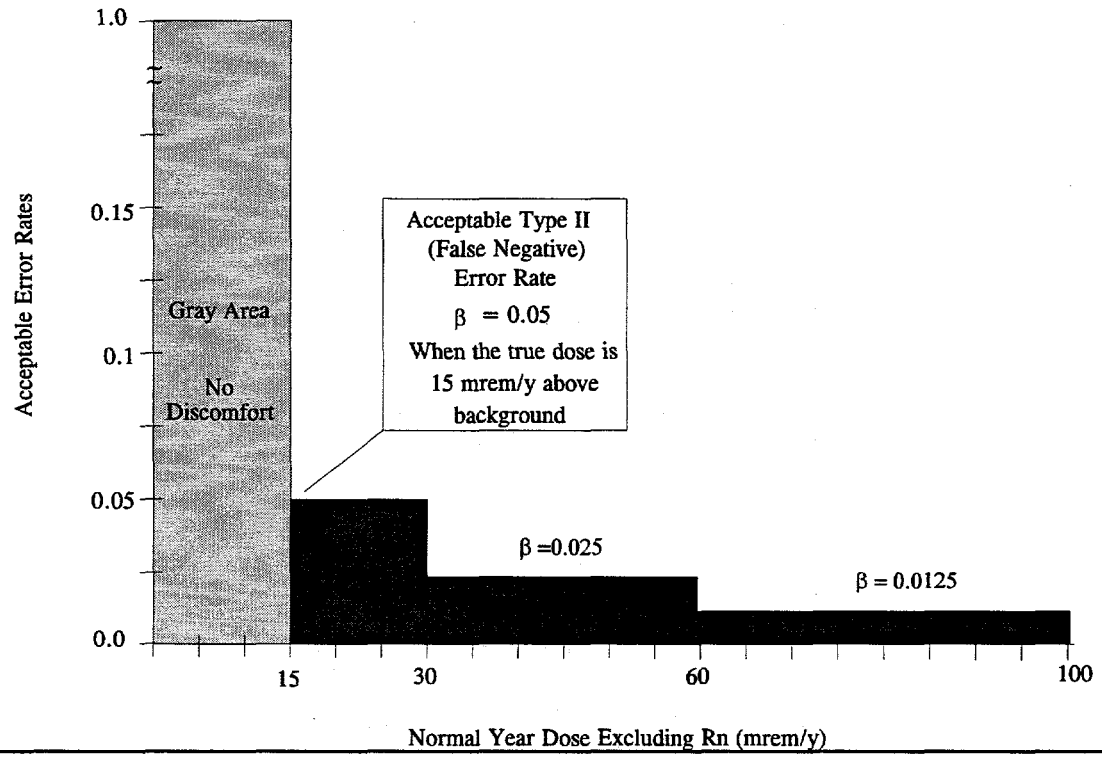


Figure 1.c

CHART OF DESIRED POWER FOR SETTING DECISION ERROR RATE TARGETS

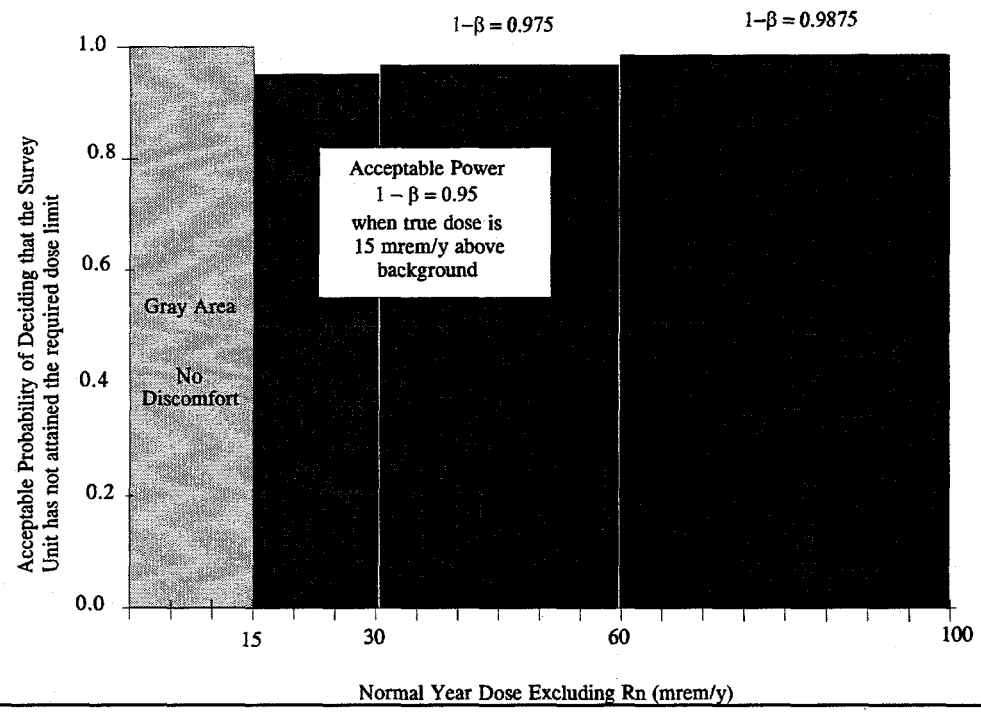


Figure 2.a

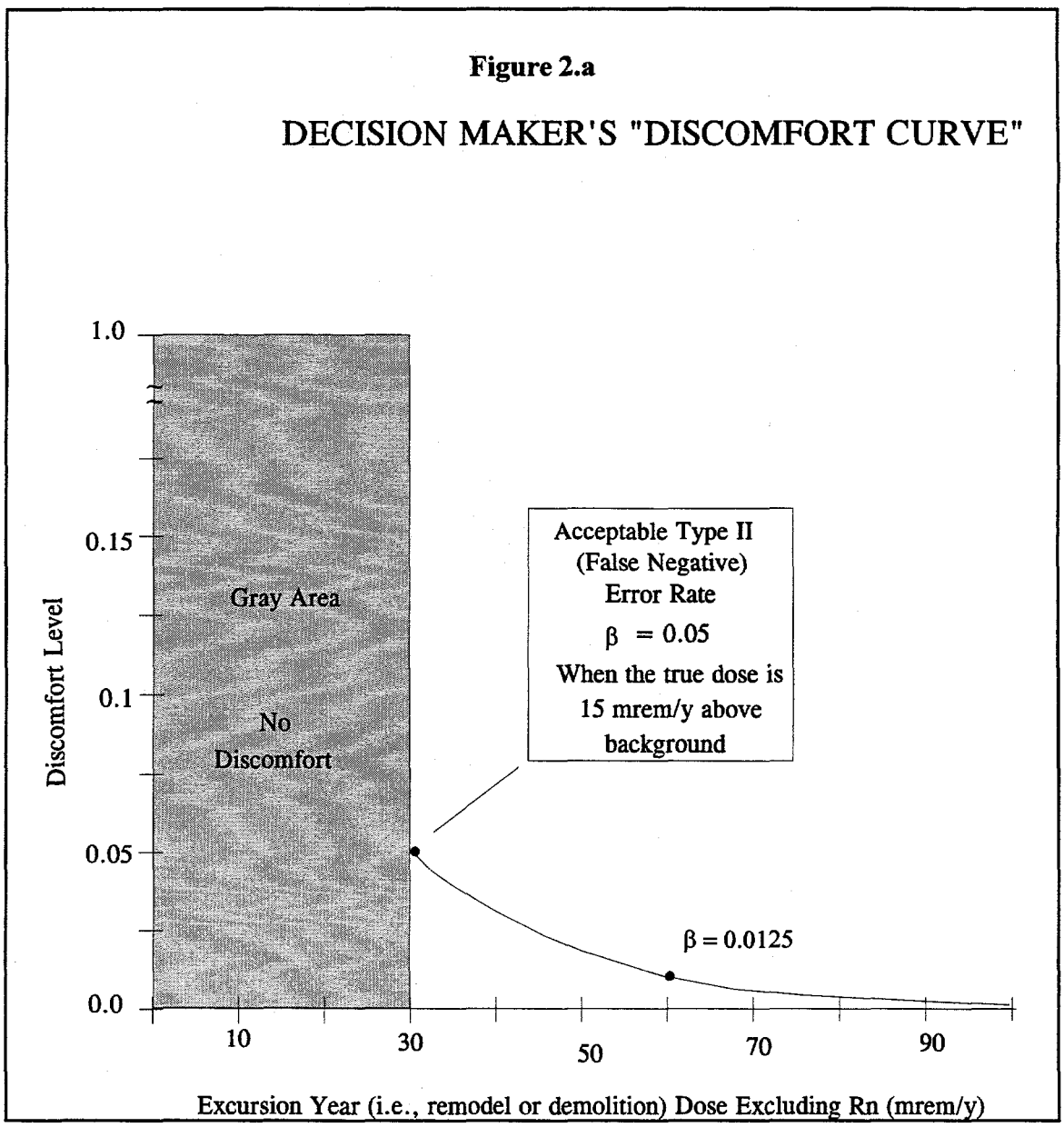

DECISION MAKER'S "DISCOMFORT CURVE"
1.0
0.15
0.1
0.05
0.0
Discomfort Level
Gray Area
No
Discomfort
Acceptable Type II
(False Negative)
Error Rate
β = 0.05
When the true dose is
15 mrem/y above
background
β = 0.0125
10
30
50
70
90
Excursion Year (i.e., remodel or demolition) Dose Excluding Rn (mrem/y)

Figure 2.b

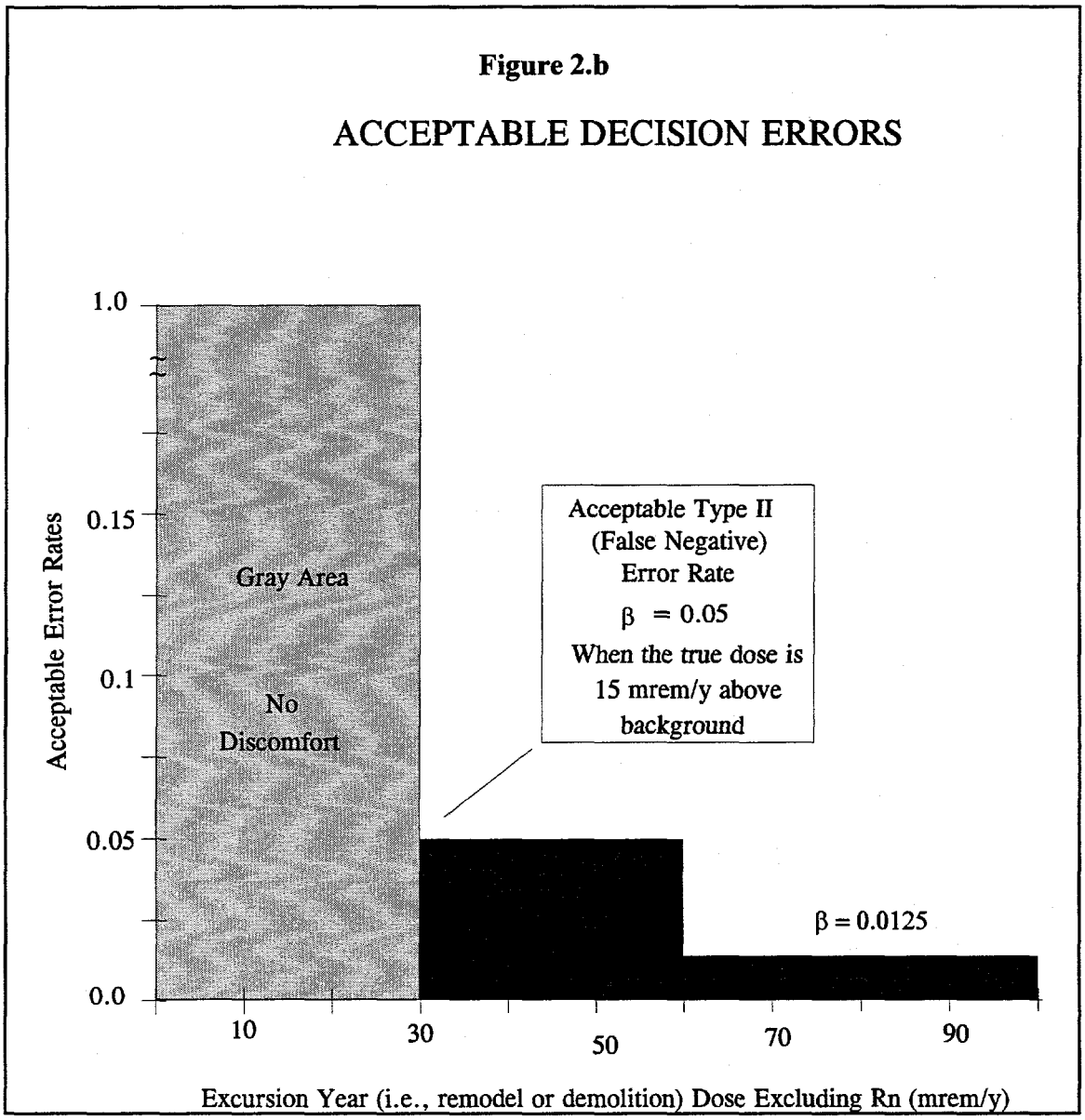

ACCEPTABLE DECISION ERRORS
1.0
0.15
0.1
0.05
0.0
Acceptable Error Rates
Gray Area
No
Discomfort
Acceptable Type II
(False Negative)
Error Rate
β = 0.05
When the true dose is
15 mrem/y above
background
β = 0.0125
10
30
50
70
90
Excursion Year (i.e., remodel or demolition) Dose Excluding Rn (mrem/y)

Figure 2.c

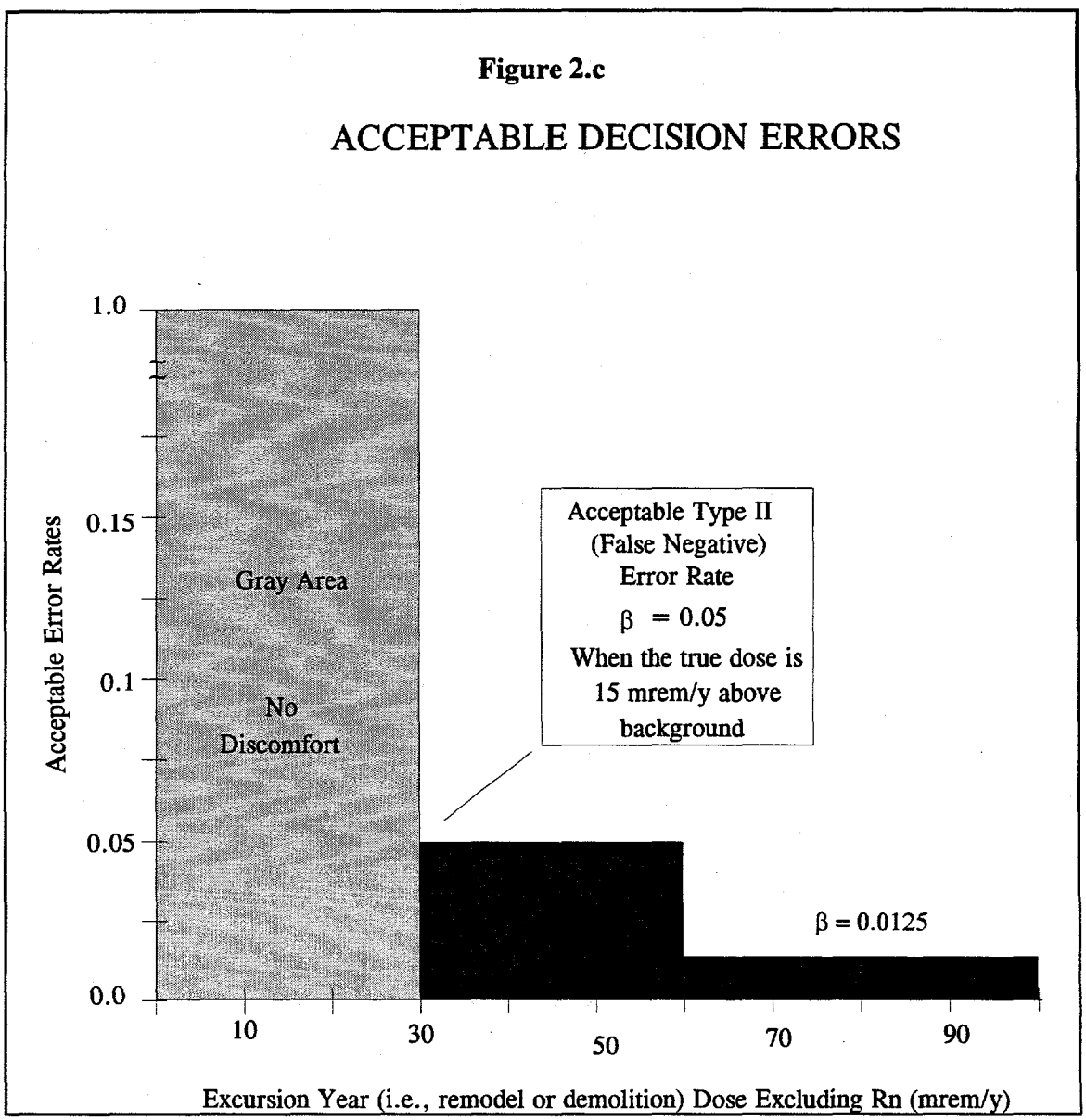

ACCEPTABLE DECISION ERRORS
1.0
0.15
0.1
0.05
0.0
Acceptable Error Rates
Gray Area
No
Discomfort
Acceptable Type II
(False Negative)
Error Rate
β = 0.05
When the true dose is
15 mrem/y above
background
β = 0.0125
10
30
50
70
90
Excursion Year (i.e., remodel or demolition) Dose Excluding Rn (mrem/y)

Figure 3.a

DECISION MAKER'S "DISCOMFORT CURVE"

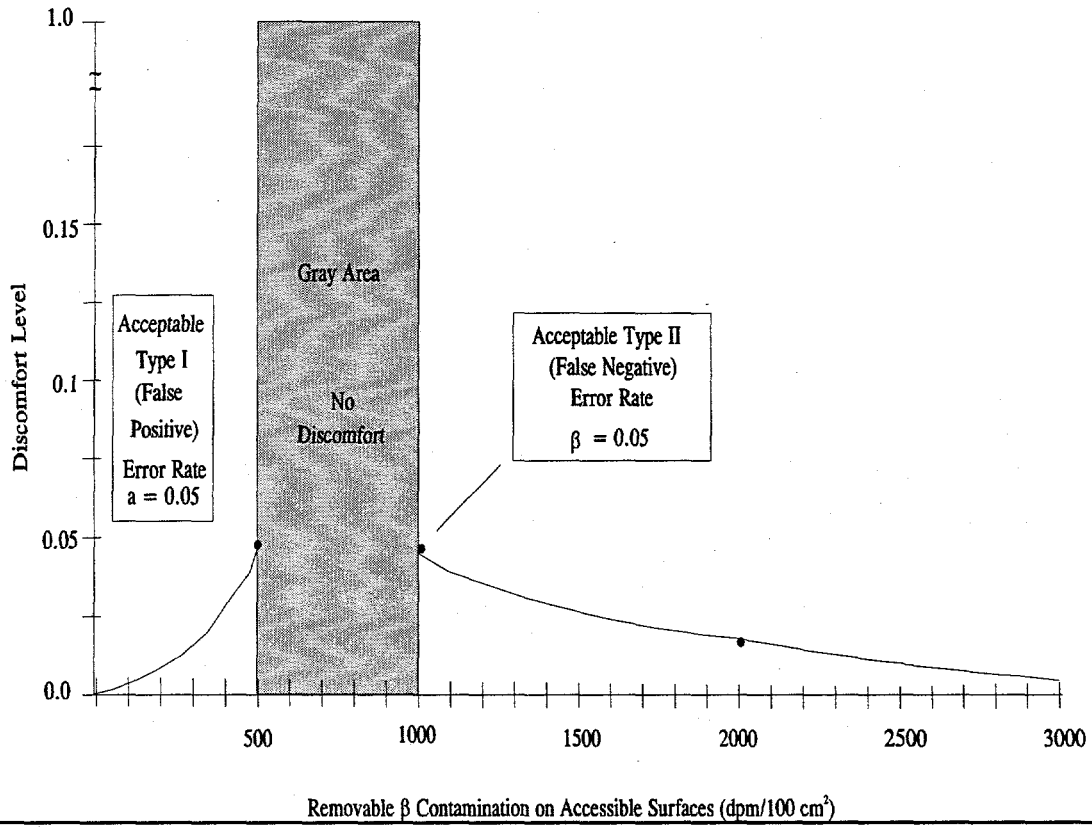


Figure 3.b

ACCEPTABLE DECISION ERRORS

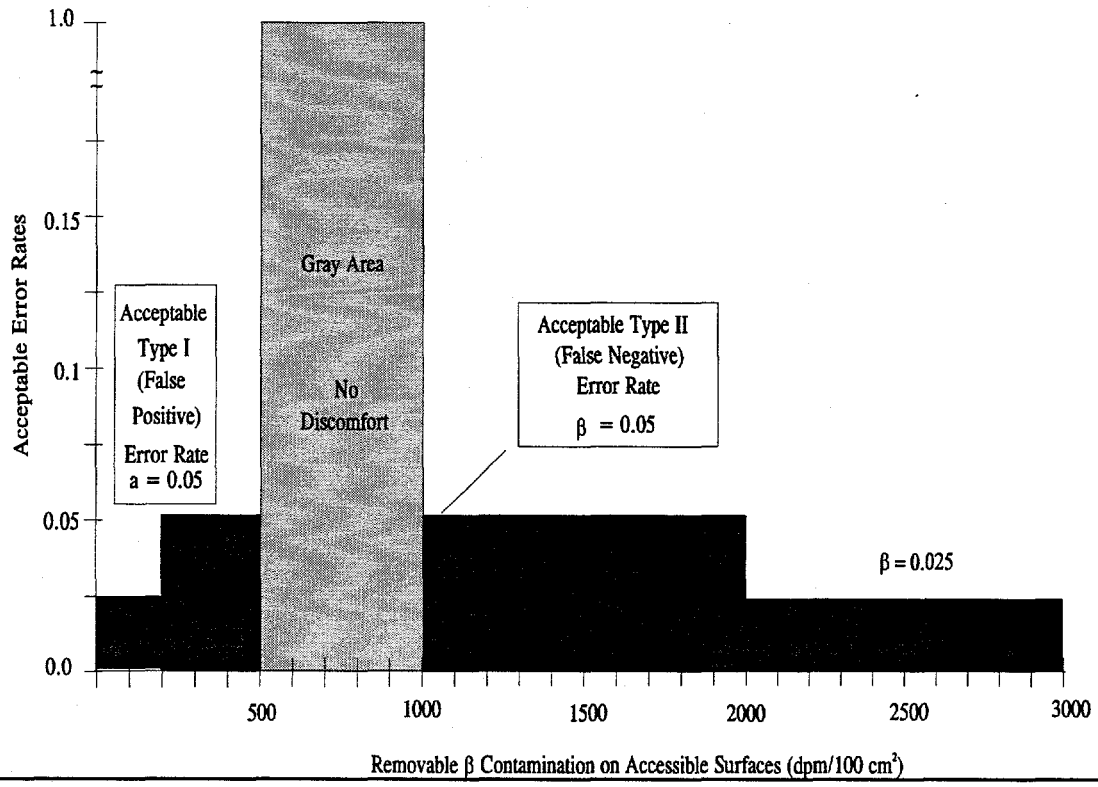


Figure 3.c

CHART OF DESIRED POWER FOR SETTING DECISION ERROR RATE TARGETS

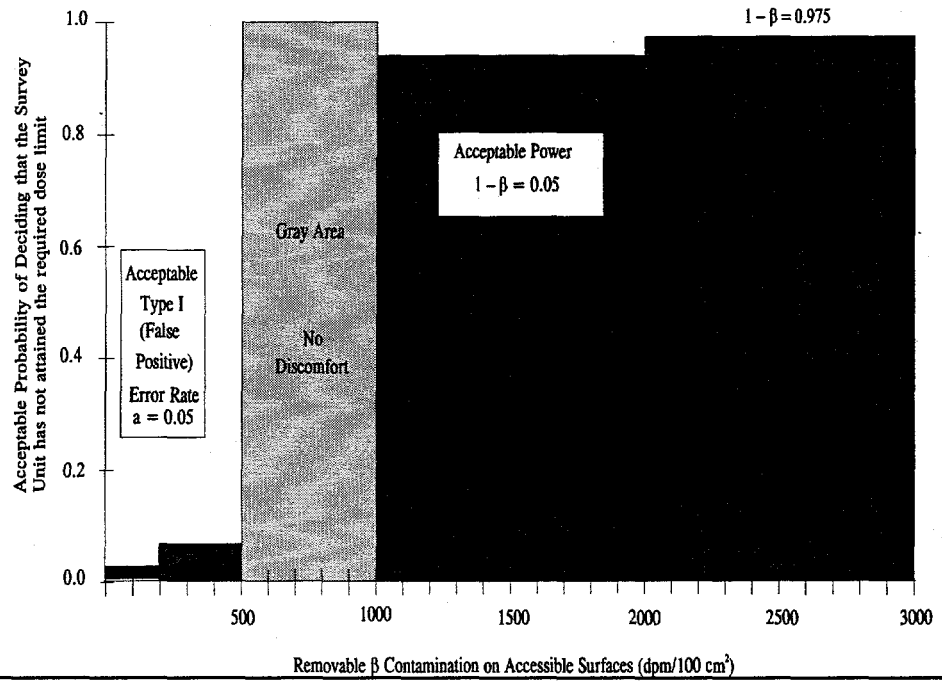


Figure 4.a

DECISION MAKER'S "DISCOMFORT CURVE"

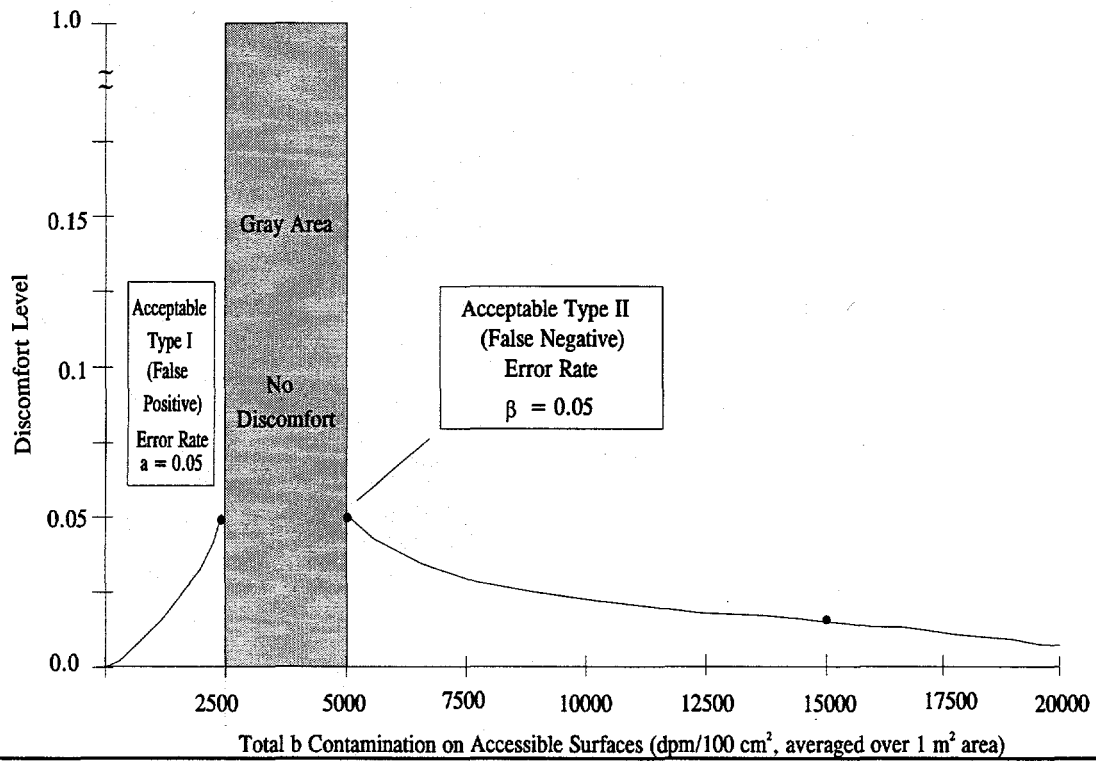


Figure 4.b

ACCEPTABLE DECISION ERRORS

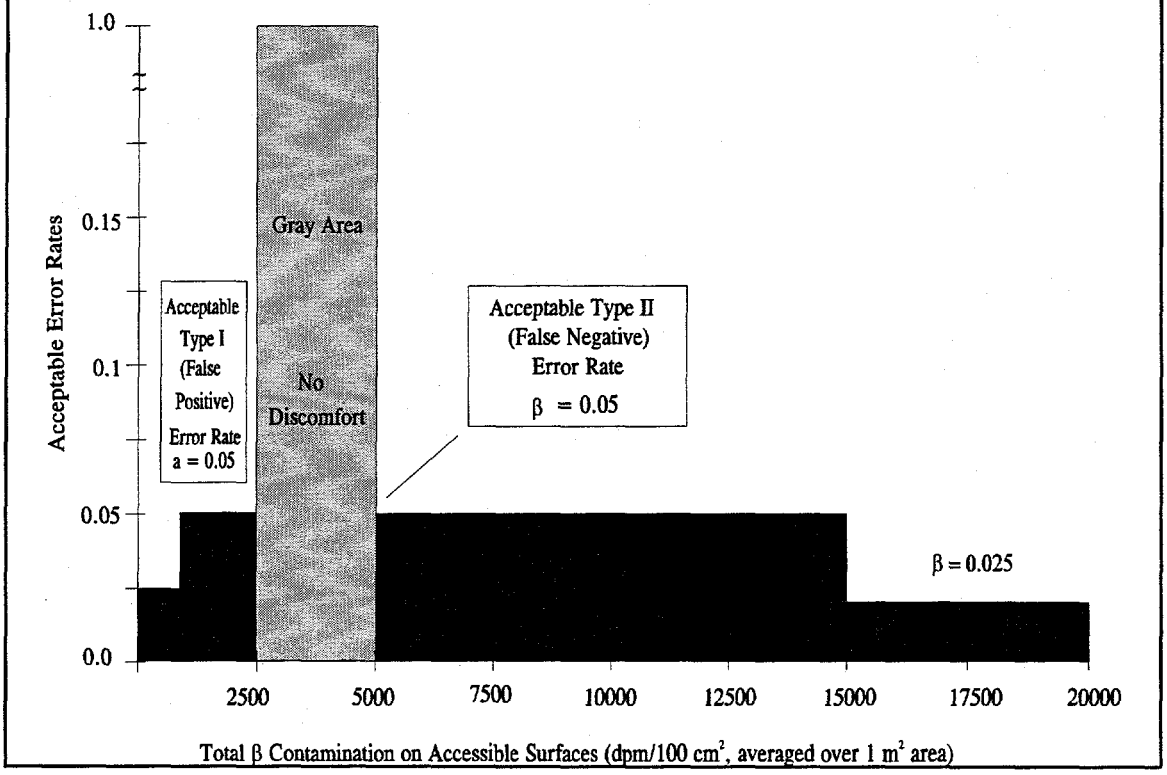


Figure 4.c

CHART OF DESIRED POWER FOR SETTING DECISION ERROR RATE TARGETS

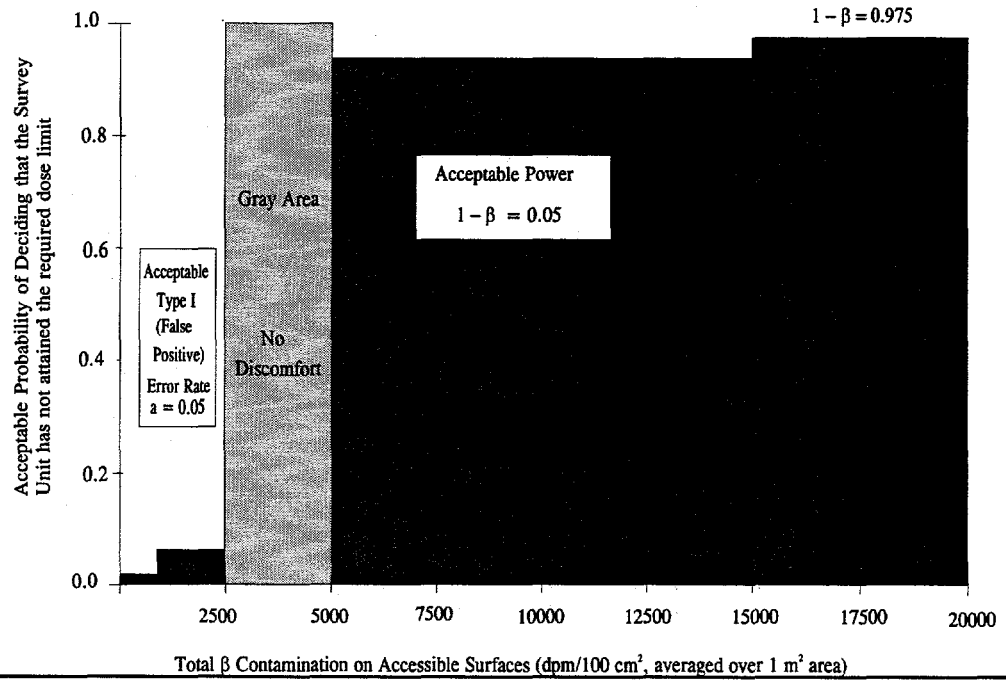


Figure 5.a

DECISION MAKER'S "DISCOMFORT CURVE"

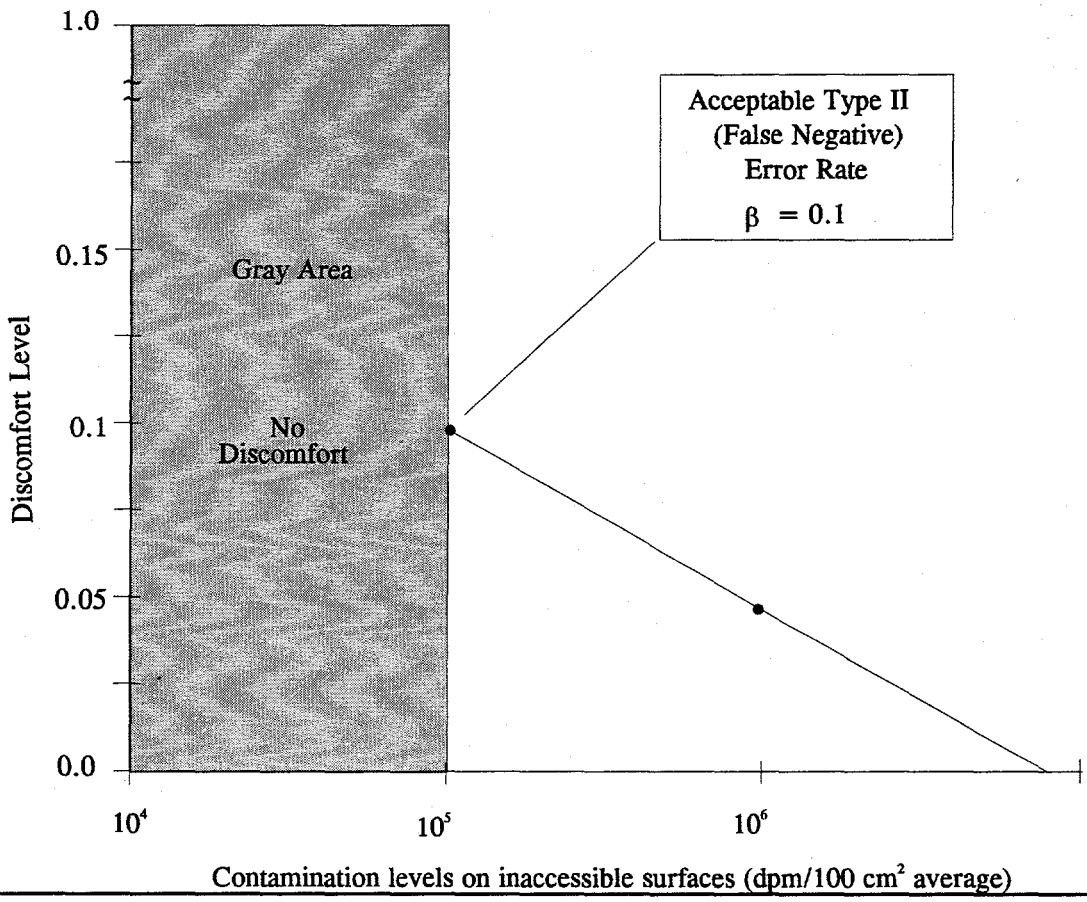


Figure 5.b

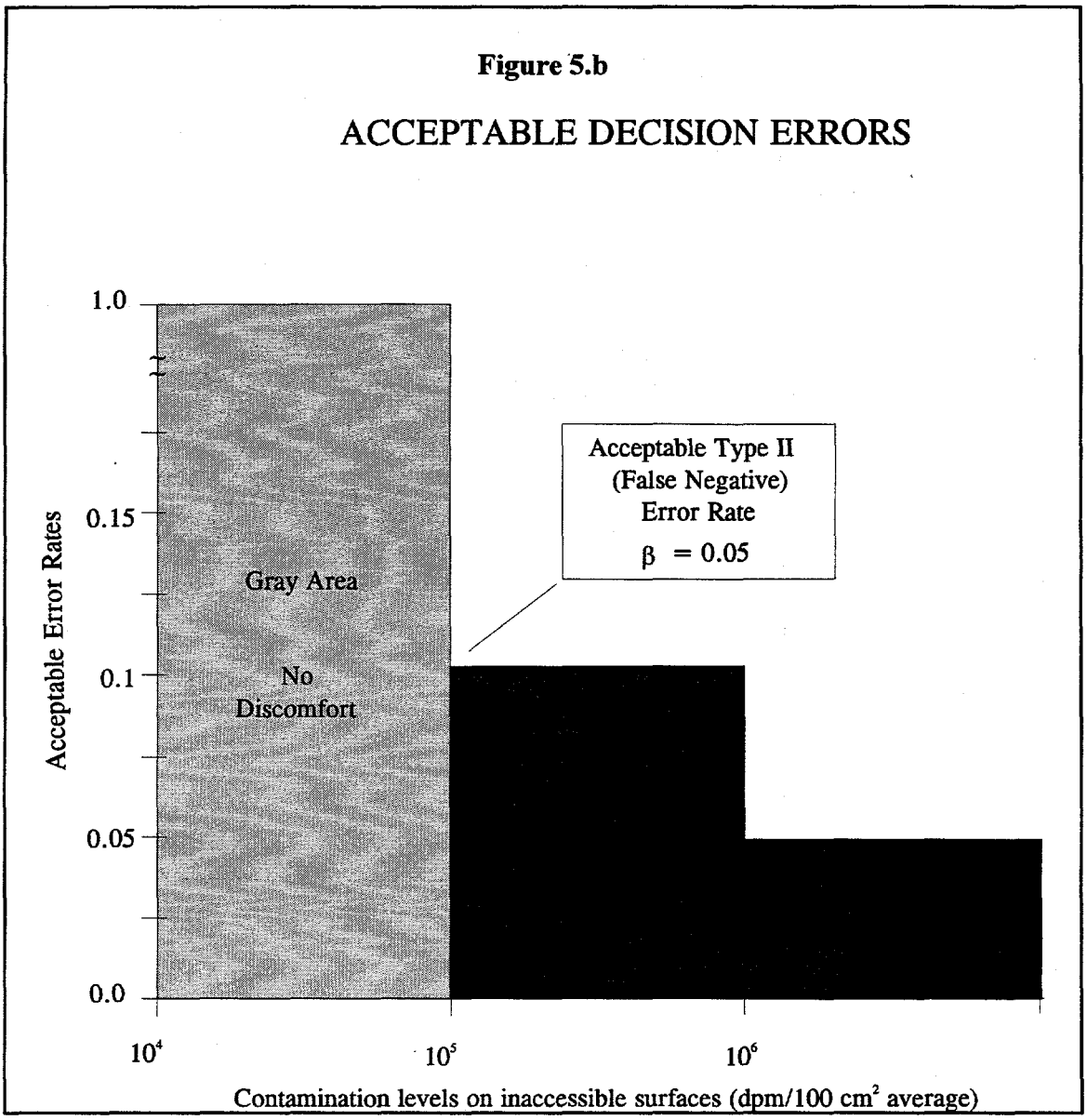
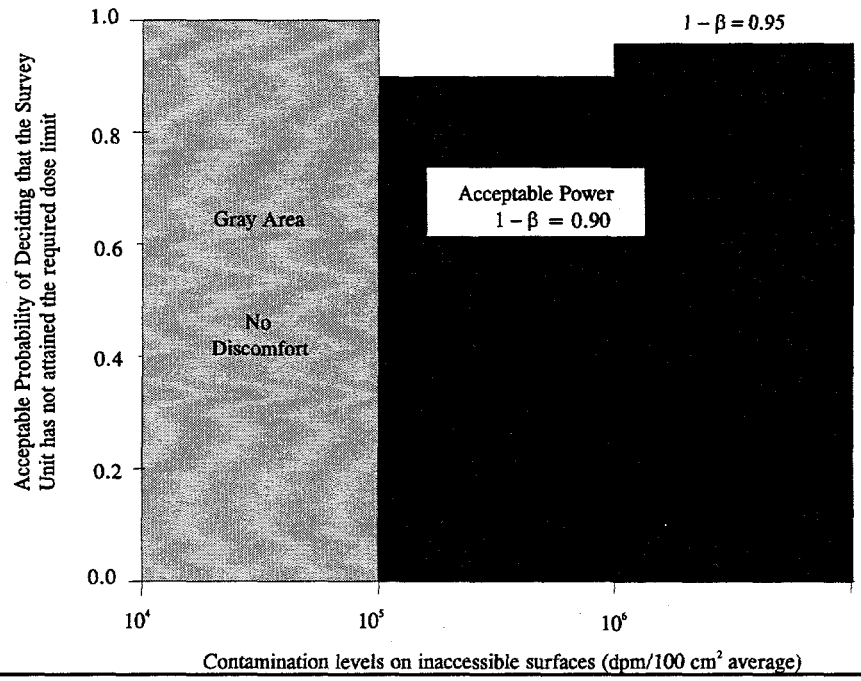

ACCEPTABLE DECISION ERRORS
1.0
0.15
0.1
0.05
0.0
Acceptable Error Rates
Gray Area
No
Discomfort
Acceptable Type II
(False Negative)
Error Rate
β = 0.05
10⁴
10⁵
10⁶
Contamination levels on inaccessible surfaces (dpm/100 cm² average)

Figure 5.c

CHART OF DESIRED POWER FOR SETTING DECISION ERROR RATE TARGETS



Appendix 4

Radiological Survey and Sampling Plan for Building 2 at the DOE Grand Junction Projects Office

Radiological Survey and Sampling Plan for Building 2 at the DOE Grand Junction Projects Office

January 19, 1996

Rust Geotech, Inc.

Prepared by Robert Morris Robert Morris 1/19/96

1.0 Introduction

Building 2 is located at the Department of Energy's (DOE) Grand Junction Projects Office (GJPO) in Grand Junction, Colorado. Currently, Building 2 contains the copy and reproduction equipment in the south end of the building and the telecommunications center at the north end of the building. Historically, the south end of Building 2 was used as a warehouse. The north end of the building was a change room facility containing lockers and showers for uranium-refinery and mill workers. The north end of building 2 is suspected of containing non-uniform contamination related to the change room activities of the mill workers and thus probably contains U-238 and its decay products. The south end of the building is not suspected of being significantly contaminated and most likely contains uniform contamination in small quantities related to surrounding activities at the mill.

Building 2 has been identified for demolition under the Grand Junction Projects Office Remedial Action Program (GJPORAP). However, due to the large cost of such activities related to the telecommunications equipment, a study is being done to predict the radiation dose to the public if the building is released for unrestricted use. The radiation dose will relate to contamination level in the building. This radiological survey and sampling plan were developed to guide the survey and sample collection activities related to Building 2 in support of the development of this variance.

A report (Rust, 1996) describing the data quality objectives for this study has been prepared. It should be consulted for clarification of any questions that may arise in carrying out this sampling plan.

2.0 Sampling Units

Two buildings were chosen for this sampling plan. The "Log Cabin" of Building 12 was chosen as the reference area, which is the unaffected area for comparison with the affected area (i.e., Building 2). Building 2 was divided into two areas, 1) the southern area containing the copy center and 2) the northern area containing the communications equipment. The southern area is considered affected with uniform contamination, while the northern area is considered affected with non-uniform contamination.

Various sampling units were identified depending on the type of measurement being taken. These sampling units and their descriptions are given in Table 1. Sampling units will be 100 ft^2 for non-uniform contamination and 1000 ft^2 for uniform contamination areas.

3.0 Potential Contaminants

Based on knowledge of site operations and results from GJPO radiological surveys, the principal contaminants associated with GJPO buildings are uranium isotopes and their associated daughter products including Ra-226 and Th-230. These radionuclides are present in uranium mill-tailings and tailings contaminated soil and concrete. Uranium may also be present as yellowcake, primarily as surface contamination.

Table 1. Sampling Units for Building 2 and Reference Area

Measurement Type	Total Sampling Units	Building 12 "Log Cabin"	Building 2 (South End)	Building 2 (North End)
PIC	3	all one unit	all one unit	all one unit
Radon	3	all one unit	all one unit	all one unit
Accessible Surfaces	4	none	old walls one unit	old walls one unit
			new walls one unit	new walls one unit
Inaccessible Surfaces	7	none	floor one unit	floor one unit
			walls two units	walls three units

The sampling units for Inaccessible wall surfaces in the south end of Building 2 consist of the 1) the west and half of the south wall as one unit, and 2) the east and half of the south wall as the other unit. The north end of Building 2 has three wall sampling units for inaccessible surfaces, where each wall, north, east, and west are each individual units.

4.0 Pressurized Ionization Chamber Measurements

A total of thirty-eight Pressurized Ionization Chamber (PIC) measurements will be taken in the Building 938 and in Building 12 (i.e., Log Cabin). Standard RUST survey procedures will be followed for these surveys. Twenty-two PIC measurements will be taken in Building 12 (i.e.,

Log Cabin) to find the average dose in the reference building. Sixteen PIC measurements will be taken in Building 2, eight measurements in the northern portion of the building (i.e., telecommunications center), and eight measurements in the southern portion of the building (i.e., copy center). All PIC measurements will be taken one meter off the floor and one meter from all walls at evenly spaced square grid locations. Occasionally, the grid point may be obscured by office equipment, in these cases the PIC measurement will be taken at the nearest accessible point to the selected grid point. All measurement locations and measurement values will be noted on standard survey forms. PIC measurements will follow applicable procedures contained in the RUST Geotech Field Assessments Procedures Manual, Chapter 11.

5.0 Radon Measurements

One radon measurement will be taken in each sampling unit. One each in Building 12 (i.e., Log Cabin), the southern portion of Building 2 (i.e., copy center), and in the norther portion of Building 2 (i.e., telecommunications center). These measurements will be taken with track etch FA Chip 10 detectors emplaced during winter time for a minimum of one month. Radon measurements will follow applicable procedures contained in the RUST Geotech Field Assessments Procedures Manual, Chapter 10.

6.0 Beta Measurements on Accessible Surfaces

Beta survey measurements for surface activity will consist of a combination of surface scans, direct measurements, and measurements of removable activity. Instrument background, established in a nearby unaffected area, should be subtracted from the measurements. Only Building 2 will be involved in these measurements, no reference measurements in Building 12 are needed. All survey measurements for surface activity will follow applicable procedures contained in the RUST Geotech Field Assessments Procedures Manual, Chapter 22. A square grid will be established at one meter intervals for Building 2.

Scanning of accessible surfaces to identify locations of residual and near-surface activity will be done according to the methods defined in NUREG 5849 (Berger 1992). In summary that method includes the following:

Affected area surfaces - 100% of floor and walls;

Unaffected area surfaces - 10% of floor and walls up to 2 meters above the floor

Scanning speeds will be no greater than one detector width per second. All scanning results will be noted on standard field record forms.

Direct measurements of surface activity will be taken in Building 2. Surface activity measurements will be performed at systematically and randomly selected locations and at locations of elevated direct radiation, identified by surface scans. At least 30 measurement locations for each survey unit must be selected on the grid points by a random process. If the location contains items that prevent the measurement, then the nearest accessible location should be measured and the location noted on the standard survey form. One minute integrated counts will be obtained at each location randomly selected grid point.

A smear for removable contamination will be obtained at each location of a direct surface activity measurement. These smears should encompass an area of 100 cm^2. Smears will be placed into envelopes or other individual containers, to prevent cross-contamination while awaiting analysis.

Survey instruments should be calibrated with NIST-traceable beta sources that approximate the energy of beta emissions associated with uranium and associated radionuclides expected to occur in Building 2. Chlorine-36 beta sources will provide acceptable approximations of the expected energy.

7.0 Sampling of Inaccessible Surfaces

Inaccessible surfaces will the sampled in Building 2 using the applicable procedure in the RUST Geotech Field Assessments Procedures Manual, Chapter 13. Inaccessible surfaces will require the use of coring machines, therefore, a Radiation Work Permit will be required from Health and Safety to ensure worker protection and identification of any potential release of contamination. Using the square grid system established at one meter intervals for Building 2, cores will be taken at accessible grid points chosen, to the extent feasible, to represent the entire sampling unit. The sampling locations will be noted on the standard survey forms.

It may not be feasible to select the sampling locations on the northern sampling units in a truly random manner because access may be blocked by the sensitive telecommunications equipment. Sampling locations should be selected based on the sampler's judgement. Field notes should describe why sampling locations were selected if they deviate significantly from a random pattern or if contiguous areas larger 4 m^2 could not be accessed.

Before sampling in the northern portion of Building 2, the telecommunications equipment should be protected from airborne dust. This may be done by covering equipment with plastic sheeting and using a high efficiency vacuum cleaner to capture the air near the wall coring operations. Any covering or interference with the telecommunication equipment should be verbally approved by the telecommunication supervisor before installation to prevent damaging this sensitive and expensive equipment. Vibrations near the telecommunication equipment should be minimized.

A total of 24 cores will be taken in the southern end of Building 2. Nine cores will be taken on each wall sampling unit in the southern end of Building 2. The sampling units for Inaccessible wall surfaces in the south end of Building 2 consist of the 1) the west and half of the south wall as one unit, and 2) the east and half of the south wall as the other unit. Six core samples will be obtained from the floor sampling unit.

A total of 34 cores will be taken in the northern end of Building 2. Twenty-six cores will be taken on the walls, i.e., 9 cores on each wall sampling unit. The north end of Building 2 has three wall sampling units for inaccessible surfaces, where each wall, north, east, and west are each individual units. Six cores will be taken from the floor sampling unit.

The original wall surface and floor surfaces will be separated from the cores and direct measurement (i.e., integrated one minute counts) will be made. In addition, a smear for removable contamination will also be obtained for each core.

8.0 Data and Records Management

Data and records will be managed according to Rust policies and procedures and the GJPORAP Records Management Plan. Original copies of the base maps and field record forms for Building 2 and 12 (i.e., Log Cabin) will be retained by the organizations that collect the data until all surveys and sampling for the buildings are completed. Within 30 days of completing the surveys, the organizations that collected the data will forward copies of the documents to the project manager. The project manager will then forward the final report along with copies of the base maps and field record forms to the Rust Records Management Section for storage in the appropriate folio. All field and technical data will be archived by RUST or its successors in the GJPO records storage vaults until DOE authorizes disposal.

9.0 References

Berger, J.D. 1992. *Manual for Conducting Radiological Surveys in Support of License Termination*. NUREG/CR-5849, ORAU-92/C57, Draft Report for Comment, Environmental Survey and Site Assessment Program, Energy/Environmental Systems Division, Oak Ridge Associated Universities, Oak Ridge, TN, 37831-0117.

Rust, 1996. "DQOs, Use Scenarios, and Affected Area Designation for GJPORAP Building 2 Characterization." Robert Morris and David Thorne, Rust Geotech, Inc. 1996.

Appendix 5

Input parameters for RESRAD-BUILD

RESRAD-BUILD INPUT DATA

Input parameters for normal occupancy case

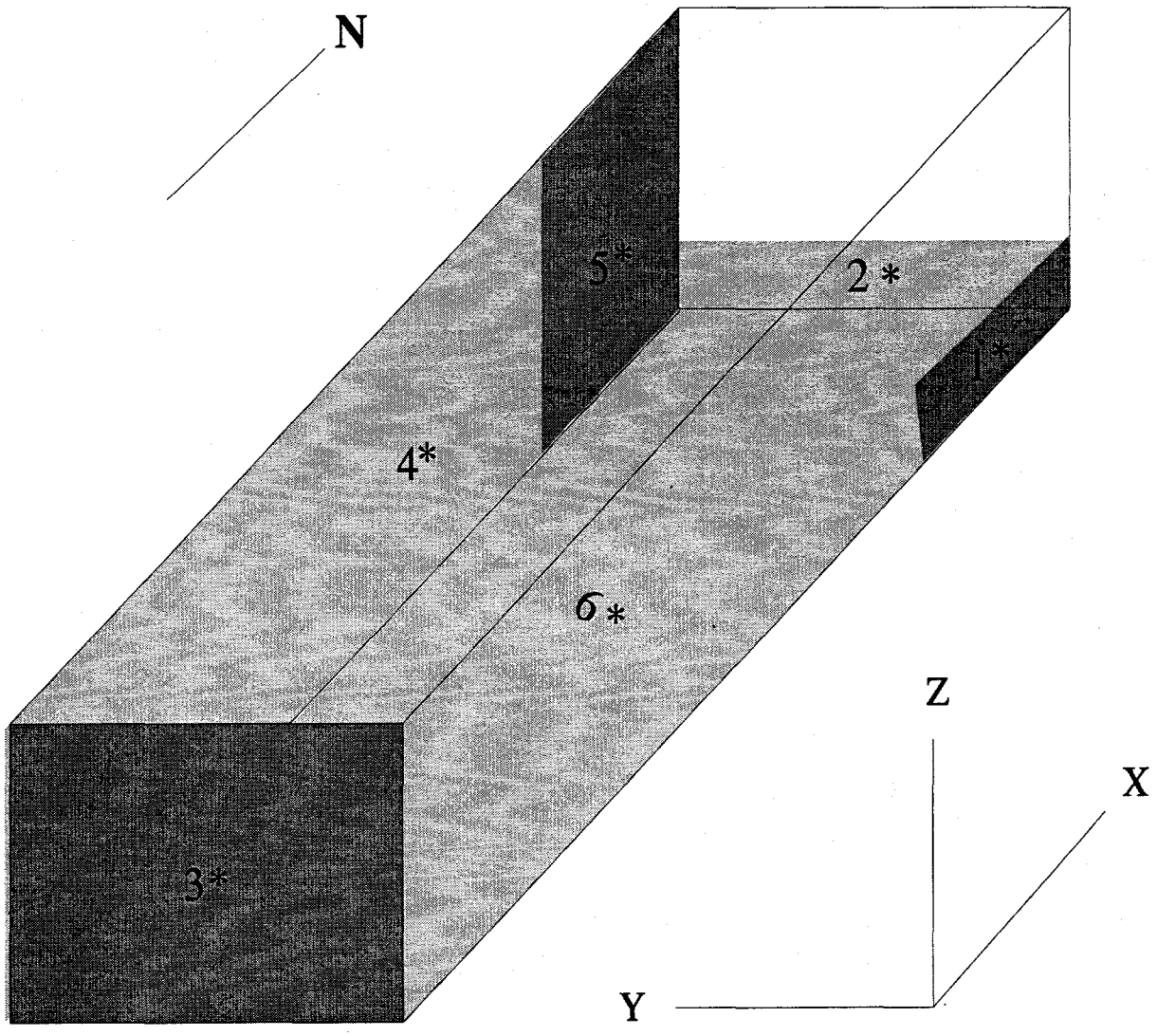
Occupancy characteristics		
Total time spent of site:	240 days	50 weeks/year, 5 days/week, 8 hr/day
Fraction of time in B2:	0.3	where 1 = 24 hours/day
Times set for evaluation:	1,10,20,30	years
Building characteristics		
Number of rooms	2	
Room 1, North End of Building 2		
Height	2.4 m	
Area	50.5 m2	Nominally 5.8 x 8.7 m
Air exchange rate	1/hr	
Outdoor inflow	50 m3/hr	
Room 2, South End of Building 2		
Height	2.4 m	
Area	138 m2	Nominally 5.8 x 23.8 m
Air exchange rate	1/hr	
Outdoor inflow	50 m3/hr	
Total air exchange rate		
N21 (net inflow 1-2)	10/hr	
Deposition velocity	0.01 m/s	default
Resuspension rate	5.00e-7 /s	default
Number of receptors	2	
Receptor 1		
position	3,3,1	approximate room center
room number	1	north end
time fraction	0.27	ratio of size of room 1 to room 2
inhalation rate	18 m3/d	default
ingestion rate	0.0001 m2/d	default
Receptor 2		
position	20,2,1	approximate room center
room no. 2		South end
Time fraction	0.73	ratio of room sizes
Inhalation rate	18 m3/d	default
Ingestion rate	0.0001 m2/d	default
Number of sources	6	

See details regarding sources and shielding below

In all cases the activity is assumed to be refined uranium in naturally occurring activity ratios of 47.33% ^{238}U, 2.2% ^{235}U, and 50.47% ^{234}U. To obtain the input information for each radionuclide,

the total activity listed below in pCi/m2 is multiplied by the factor for each isotope. All sources described here are area sources, coded as type 2. The figure on the next page shows the location of the sources. The source removal time is 30 years (10,950 days).

BULDING 2 - RESRAD-BUILD MODEL SOURCES



1* Indicates source number and grid center

Source 1. Contamination on concrete in the east wall of Room 1 (telecommunications room) is on the original concrete which is now covered by plywood, sheetrock or paneling. The contamination averaged 13,114 dpm/100 cm^2 with a standard deviation of 14,828. This is the same as 596,100 pCi/m^2 with a SD of 674,000. Radioactivity for input to the model is split according to the natural activity ratios described above and results in the following: ^{234}U: 301,000 pCi/m^2, ^{235}U: 13,100 pCi/m^2, ^{238}U: 282,000 pCi/m^2. Concrete was encountered up to about 1 m height along the whole wall. No concrete was found above 1 m. This is consistent with visible structures remaining from the shower and toilet facilities.

To construct a model input the center point and area of the idealized source needs to be defined. Choose the center point as the center of the wall ½ meter above grade. Using the south east corner at floor level as the origin, this point is nominally 28.2/0/0.5. The area is the length of the wall, 8.7 m, times the 1 m concrete height for an area of 8.7 m^2. The source direction is the vector perpendicular to the face of the source and is coincident with x,y, or z vectors with respect to the origin. In this case the source direction is the same as y, which is coded as 2. The source has an area geometry which is coded as 2.

The source is described as an area source covered by sheetrock or paneling. The survey team leader notes indicate two of the points were covered by 2.0 cm of plywood over 1.5 cm of sheetrock. The other two sampled locations were covered by 0.5 cm of paneling which is similar to masonite or plywood. For purposes of this model we assume the source is covered with one layer of wood, 1 cm thick. Since wood is not a choice in the shielding materials, the best match to effective Z among the choices is water which is coded as 2. The density of wood is nominally 0.5 g/cm^3. The air release fraction of the material that is eroded is assumed to be 0.1. The remainder contaminates skin, clothing, and other items and is removed from the site. The removable fraction is assumed to approach zero since it is beneath wall coverings. A value of 0.001 is selected.

Source 2. This is similar to Source 1 except it is in the north wall which is 5.8 m wide with a center point of 32.5/3/0.5. The area of the source is 5.8 m^2. The direction of the source is the same as x, which is coded as 1. The contamination averaged 26,676 dpm/100 cm^2 with a standard deviation of 5,036. This is the same as 1,212,545 pCi/m^2 with a SD of 228,909. Radioactivity for input to the model is split according to the natural activity ratios described above and results in the following: ^{234}U: 612,000 pCi/m^2, ^{235}U: 26,700 pCi/m^2, ^{238}U: 574,000 pCi/m^2.

In two of the five locations the concrete is covered by 2 cm of plywood over 1 cm of sheetrock. In the other locations the covering is 2 cm of plywood. For modeling we assume the system is a volume source of two layers with the top layer being 2 cm of wood. Since wood is not a choice in the shielding materials, the best match to effective Z among the choices is water which is coded as 2. The density of wood is nominally 0.5 g/cm^3. The air release fraction of the material that is eroded is assumed to be 0.1. The remainder contaminates skin, clothing, and other items and is removed from the site. The removable fraction is assumed to approach zero since it is

beneath wall coverings. A value of 0.001 is selected.

Source 3. This source is the insulation present in south wall which extends into the southern ends of the east and west walls. For simplicity the model will show this source only in the south wall and compensate for the other affected areas by doubling the average contamination level for this material type. The south wall is 2.4 m high and 5.8 m long for an area of 13.9 m^2. The source direction is x, which is coded as 1. The center point is 0/3/1. The mean contamination level for the insulation was 12,939 dpm/100 cm^2 with a standard deviation of 9,224. This is the same as 588,100 pCi/m^2 with a SD of 419,000. Doubling the activity to account for the simplification in source geometry, the activity to be used in the model is 1,176,000 pCi/m^2. Radioactivity for input to the model is split according to the natural activity ratios described above and results in the following: ^{234}U: 594,000 pCi/m^2, ^{235}U: 25,900 pCi/m^2, ^{238}U: 557,000 pCi/m^2. For modeling purposes we assume the activity to be in a plane below 0.5 cm of paneling over 1 cm of sheetrock, giving the same effect as 1.5 cm of sheetrock. Since sheetrock is not a choice in the shielding materials, the best match to effective Z among the choices is probably concrete, which is coded as 1. The density of is assumed to be 0.5 g/cm^3. The air release fraction of the material that is eroded is assumed to be 0.1. The remainder contaminates skin, clothing, and other items and is removed from the site. The removable fraction is assumed to approach zero since it is beneath wall coverings. A value of 0.001 is selected.

Source 4. This source is the structural wood found in almost all exterior walls. The average activity on all of the wood found in all of the survey units was 7871 dpm/100 cm2 with a standard deviation of 8681. This is the same as 357,000 pCi/m^2 with a SD of 395,000. Radioactivity for input to the model is split according to the natural activity ratios described above and results in the following: ^{234}U: 180,000 pCi/m^2, ^{235}U: 7,900 pCi/m^2, ^{238}U: 169,000 pCi/m^2. Assume the contaminated wood is studs that occur uniformly through all exterior walls and cover 1 ½ out of every 16 linear inches of wall (in other words, 9.4%). The walls are 2.4 m high and the linear dimension of all the exterior sums to approximately 77 m. Then the affected area for the whole structure is 17 m^2. Since this source is assumed to be symmetrically distributed, and the receptors are assumed to be in the center of each room, the source can be approximated by putting it all in one of the long walls, say the west walls with a center point of 20/5.8/1. The source direction is y or 2. Assume the wood is covered by 2 cm of sheetrock. Since sheetrock is not a choice in the shielding materials, the best match to effective Z among the choices is probably concrete which is coded as 1. The density of is assumed to be 0.5 g/cm^3. The air release fraction of the material that is eroded is assumed to be 0.1. The remainder contaminates skin, clothing, and other items and is removed from the site. The removable fraction is assumed to approach zero since it is beneath wall coverings. A value of 0.001 is selected.

Source 5. This source is the direct contamination measured on the surface of the North - Old Walls Survey Unit, which is the northwest wall of the telecommunications room. The mean contamination level is 1484 dpm/100 cm^2 with a standard deviation of 2313. This is the same as 67,500 pCi/m^2 with a SD of 105,000. Radioactivity for input to the model is split according to

the natural activity ratios described above and results in the following: ^{234}U: 34,000 pCi/m^2, ^{235}U: 1,500 pCi/m^2, ^{238}U: 32,000 pCi/m^2. The center point is 28/5.8/1.2. The affected area is 20.8 m^2. The source direction is y or 2. The air release fraction is assumed to be 0.1 due to particle size and agglomeration. Assume the removable fraction is 0.5. Assume that the material is under a layer of paint with a thickness of 0.01 cm and a density of 2 g/cm^3. The shielding characteristics of paint are assumed to be simulated by concrete of the same thickness.

Source 6. This source is the inaccessible contamination measured between the concrete slabs for the north and south rooms. To simplify the model and because these is not much difference between the means of the survey units, the data from the survey units will be averaged together. The mean contamination level is 1906 dpm/100 cm^2 with a standard deviation of 1039. This is the same as 86,600 pCi/m^2 with a SD of 47,200. Radioactivity for input to the model is split according to the natural activity ratios described above and results in the following: ^{234}U: 44,000 pCi/m^2, ^{235}U: 1,900 pCi/m^2, ^{238}U: 41,000 pCi/m^2. The center point is 16/3/0. The affected area is the whole floor or 189 m^2. The source direction is z or 3. The source is assumed to exist under a 10 cm concrete slab. The air release fraction of the material that is eroded is assumed to be 0.1. The remainder contaminates skin, clothing, and other items and is removed from the site. The removable fraction is assumed to approach zero since it is beneath floor coverings. A value of 0.001 is selected.

The south west wall cores indicate that this might be modeled as a source. However inspection of the data shows that the elevated activity is associated with insulation and wood which have already been modeled as sources 3 and 4.

Levels of surface contamination in all other survey units are less than 1000 dpm/100 cm^2 which is 1/5 of the guideline value and deemed insignificant for this dose assessment.

Input parameters for demolition case

Unless otherwise specified the input parameters are the same as the normal occupancy case

Occupancy characteristics		
Total time spent of site:	10 days	2 weeks, 5 days/wk , 8 hr/day
Fraction of time in B2:	0.3	where 1 = 24 hours/day
Times set for evaluation:	0	years
Building characteristics		
Number of rooms	1	a bubble of air over the downed bldg
Room 1, North End of Building	2	
Height	3 m	
Area	200	Nominally
Total air exchange rate	15 air chgs/hr	Light breeze
Deposition velocity	0.01 m/s	default
Resuspension rate	1.00e-5 /s	lots of airborne debris
Number of receptors	1	

Receptor 1		
position	15,3,1	approximate room center
Number of source	6	

See details regarding sources and shielding below

The source terms remain the same except that the release fractions are modified to account for the destruction actions occurring and the associated aerosol generation rate.

In each case where the air release fraction is 0.1 it is changed to 0.2. The removable fraction is increased to 0.01. The time for source removal is 11 days so that all it is exposed during the demolition.

Appendix 6

RESRAD-BUILD Output

RESRAD-BUILD Table of Contents

T[illegible] : DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT

RESRAD-BUILD Input Parameters

Number of Sources : 6
Number of Receptors: 2
Total Time : 2.400000E+02 days
Fraction Inside : 3.000000E-01

Receptor Information

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	3.000	3.000	1.000	0.270	1.80E+01	1.00E-04
2	2	20.000	3.000	1.000	0.730	1.80E+01	1.00E-04

Receptor-Source Relationship

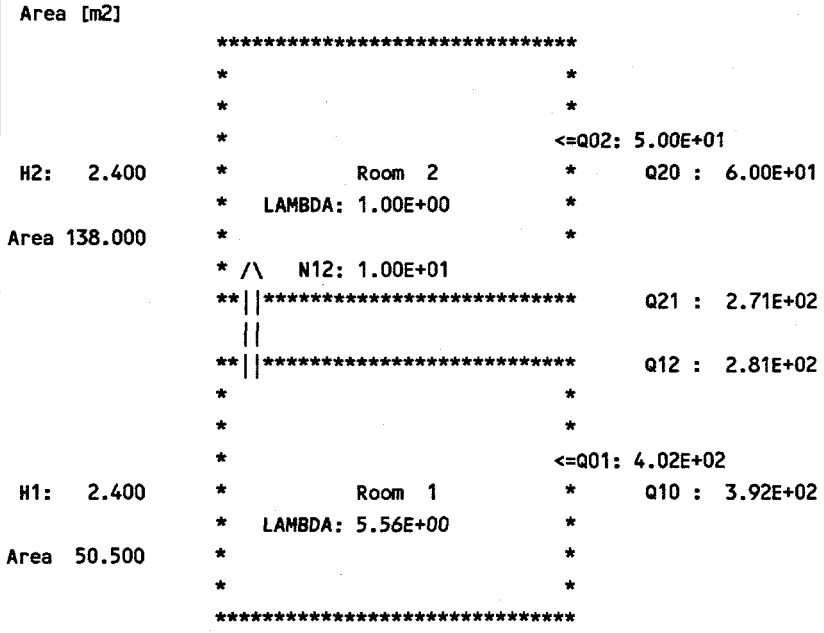
Receptor	Source 1		Source 2		Source 3		Source 4		Source 5	
	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]
1	5.000E-01	1.000E+00	5.000E-01	2.000E+00	5.000E-01	1.500E+00	5.000E-01	2.000E+00	2.000E+00	1.000E-02
2	5.000E-01	1.000E+00	5.000E-01	2.000E+00	5.000E-01	1.500E+00	5.000E-01	2.000E+00	2.000E+00	1.000E-02

Receptor	Source 6	
	Density [g/cm3]	Thickness [cm]
1	2.500E+00	1.000E+01
2	2.500E+00	1.000E+01

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT

ëëëëëëëë Building Information ëëëëëëëë

Building Air Exchange Rate: 1.00E+00 1/hr



Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

T[illegible] : DOE GJPO Bldg 2 Occupancy
[illegible]ile : B2OCC.DAT

ëëëëëëëë Source Information ëëëëëëëë

Source: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50[m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	2.820E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
U-235	1.310E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
U-234	3.010E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05
CO-60	1.000E+00	2.600E-05	1.500E-04	2.750E-04	1.020E-05	1.470E-02

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT

urce: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50[m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	5.740E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	2.670E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	6.120E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

T: : DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT

Source: 3
Location:: Room : 2 x: 0.00 y: 3.00 z: 1.00[m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	5.570E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	2.590E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	5.940E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT

ource: 4
Location:: Room : 2 x: 20.00 y: 5.80 z: 1.00[m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	1.690E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	7.900E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	1.800E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

T[illegible] : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT

Source: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20[m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	3.200E+04	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	1.500E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	3.400E+04	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT

urce: 6
Location:: Room : 2 x: 16.00 y: 3.00 z: 0.00[m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	4.100E+04	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	1.900E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	4.400E+04	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

T : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 1.00000 years

Assessment for Time: 1
Time =1.00E+00 yr

Source Information

Source: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50 [m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	2.820E+05
U-235	1.310E+04
U-234	3.010E+05
PA-231	2.770E-01
TH-230	2.711E+00
AC-227	4.379E-03
RA-226	5.875E-04
PB-210	6.043E-06
CO-60	8.767E-01

: DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 1.00000 years

ource: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50 [m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.740E+05
U-235	2.670E+04
U-234	6.120E+05
PA-231	5.645E-01
TH-230	5.512E+00
AC-227	8.926E-03
RA-226	1.194E-03
PB-210	1.229E-05

:e: 3
Location:: Room : 2 x: 0.00 y: 3.00 z: 1.00 [m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.570E+05
U-235	2.590E+04
U-234	5.940E+05
PA-231	5.476E-01
TH-230	5.350E+00
AC-227	8.658E-03
RA-226	1.159E-03
PB-210	1.193E-05

T' : DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 1.00000 years

Source: 4
Location:: Room : 2 x: 20.00 y: 5.80 z: 1.00 [m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	1.690E+05
	U-235	7.900E+03
	U-234	1.800E+05
	PA-231	1.670E-01
	TH-230	1.621E+00
	AC-227	2.641E-03
	RA-226	3.513E-04
	PB-210	3.614E-06

,e: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20 [m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	3.147E+04
	U-235	1.475E+03
	U-234	3.343E+04
	PA-231	3.119E-02
	TH-230	3.011E-01
	AC-227	4.931E-04
	RA-226	6.525E-05
	PB-210	6.713E-07

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 1.00000 years

Source: 6
Location:: Room : 2 x: 16.00 y: 3.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	4.100E+04
U-235	1.900E+03
U-234	4.400E+04
PA-231	4.017E-02
TH-230	3.963E-01
AC-227	6.352E-04
RA-226	8.588E-05
PB-210	8.834E-07

T : DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 1.00000 years

RESRAD-BUILD Dose Tables

Receptor Point-Source Doses

[mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Total
Receptor 1	2.3E-04	2.9E-04	6.0E-03	2.6E-04	2.7E-02	5.2E-04	3.4E-02
Receptor 2	1.2E-03	1.0E-03	3.7E-03	7.0E-03	6.1E-02	3.8E-03	7.8E-02
Total	1.4E-03	1.3E-03	9.7E-03	7.2E-03	8.8E-02	4.3E-03	1.1E-01

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 1.00000 years

Pathway Detail of Doses
[mrem]

rce: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	3.28E-05	3.60E-09	2.28E-11	1.95E-04	2.23E-20	1.06E-06
2	7.56E-04	1.09E-08	5.23E-11	4.47E-04	1.19E-19	2.43E-06
otal	7.89E-04	1.45E-08	7.51E-11	6.42E-04	1.41E-19	3.49E-06

rce: 2

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.34E-05	4.88E-09	3.09E-11	2.64E-04	3.03E-20	1.44E-06
2	4.15E-04	1.48E-08	7.10E-11	6.06E-04	1.61E-19	3.30E-06
otal	4.38E-04	1.97E-08	1.02E-10	8.71E-04	1.91E-19	4.73E-06

rce: 3

ceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	5.47E-03	9.30E-09	5.89E-11	5.03E-04	1.34E-19	2.74E-06
2	3.53E-04	8.24E-08	3.95E-10	3.38E-03	8.06E-19	1.84E-05
otal	5.82E-03	9.17E-08	4.54E-10	3.88E-03	9.40E-19	2.11E-05

rce: 4

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	7.40E-05	3.45E-09	2.19E-11	1.87E-04	4.96E-20	1.01E-06
2	5.71E-03	3.06E-08	1.47E-10	1.25E-03	2.99E-19	6.81E-06
otal	5.78E-03	3.41E-08	1.69E-10	1.44E-03	3.48E-19	7.83E-06

rce: 5

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	9.61E-06	4.89E-07	3.10E-09	2.64E-02	3.01E-18	1.43E-04
2	2.36E-04	1.48E-06	7.11E-09	6.05E-02	1.61E-17	3.29E-04
otal	2.46E-04	1.97E-06	1.02E-08	8.69E-02	1.91E-17	4.73E-04

rce: 6

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.64E-05	9.30E-09	5.89E-11	5.05E-04	1.35E-19	2.75E-06
2	3.89E-04	8.24E-08	3.95E-10	3.39E-03	8.12E-19	1.84E-05
	4.05E-04	9.17E-08	4.54E-10	3.90E-03	9.47E-19	2.12E-05
				9.76E-02		5.31E-04

RN 4/29/96

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 1.00000 years

Nuclide Detail of Doses
[mrem]

Source: 1

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.14E-04	7.87E-04	9.01E-04
U-234	2.75E-10	6.70E-10	9.45E-10
TH-230	3.03E-15	7.13E-15	1.02E-14
RA-226	2.11E-18	4.83E-17	5.04E-17
PB-210	1.22E-22	5.25E-22	6.47E-22
U-235			
U-235	1.09E-05	1.66E-04	1.77E-04
PA-231	9.96E-10	3.00E-09	3.99E-09
AC-227	8.05E-11	2.86E-10	3.66E-10
U-234			
U-234	1.04E-04	2.53E-04	3.56E-04
TH-230	2.28E-09	5.37E-09	7.66E-09
[illegible]-226	2.70E-12	6.18E-11	6.45E-11
[illegible]0	6.67E-16	2.88E-15	3.55E-15
[illegible]			
CO-60	5.57E-09	1.28E-07	1.34E-07

Source: 2

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.39E-04	6.02E-04	7.41E-04
U-234	3.70E-10	8.59E-10	1.23E-09
TH-230	4.10E-15	9.47E-15	1.36E-14
RA-226	1.81E-18	2.93E-17	3.11E-17
PB-210	1.54E-22	4.55E-22	6.09E-22
U-235			
U-235	1.03E-05	9.88E-05	1.09E-04
PA-231	1.33E-09	3.42E-09	4.75E-09
AC-227	1.06E-10	2.96E-10	4.02E-10
U-234			
U-234	1.39E-04	3.23E-04	4.63E-04
TH-230	3.09E-09	7.14E-09	1.02E-08
RA-226	2.31E-12	3.75E-11	3.98E-11
PB-210	8.45E-16	2.49E-15	3.34E-15

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 1.00000 years

urce: 3

Nuclide	Receptor 1	Receptor 2	Total
238			
U-238	4.51E-03	1.82E-03	6.33E-03
U-234	7.87E-10	4.73E-09	5.52E-09
TH-230	8.61E-15	5.24E-14	6.11E-14
RA-226	3.79E-16	2.63E-17	4.05E-16
PB-210	1.87E-21	1.94E-21	3.81E-21
235			
U-235	1.17E-03	1.45E-04	1.32E-03
PA-231	8.02E-09	1.71E-08	2.51E-08
AC-227	1.10E-09	1.34E-09	2.43E-09
234			
U-234	2.96E-04	1.78E-03	2.08E-03
TH-230	6.49E-09	3.95E-08	4.60E-08
RA-226	4.84E-10	3.36E-11	5.17E-10
PB-210	1.02E-14	1.06E-14	2.09E-14

e: 4

Nuclide	Receptor 1	Receptor 2	Total
238			
U-238	1.43E-04	5.04E-03	5.18E-03
U-234	2.62E-10	1.82E-09	2.09E-09
TH-230	2.91E-15	2.02E-14	2.32E-14
RA-226	5.21E-18	4.01E-16	4.06E-16
PB-210	1.22E-22	2.24E-21	2.37E-21
235			
U-235	1.97E-05	1.24E-03	1.26E-03
PA-231	1.00E-09	1.20E-08	1.30E-08
AC-227	8.30E-11	1.43E-09	1.52E-09
234			
U-234	9.87E-05	6.86E-04	7.85E-04
TH-230	2.19E-09	1.52E-08	1.74E-08
RA-226	6.65E-12	5.12E-10	5.19E-10
PB-210	6.68E-16	1.23E-14	1.29E-14

T` : DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 1.00000 years

Source: 5

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.21E-02	2.79E-02	3.99E-02
U-234	3.70E-08	8.49E-08	1.22E-07
TH-230	4.10E-13	9.40E-13	1.35E-12
RA-226	2.38E-18	1.86E-17	2.09E-17
PB-210	1.48E-20	3.32E-20	4.80E-20
U-235			
U-235	5.67E-04	1.35E-03	1.91E-03
PA-231	1.32E-07	3.03E-07	4.34E-07
AC-227	1.03E-08	2.30E-08	3.33E-08
U-234			
U-234	1.39E-02	3.19E-02	4.57E-02
TH-230	3.07E-07	7.06E-07	1.01E-06
RA-226	3.03E-12	2.36E-11	2.67E-11
PB-210	8.10E-14	1.81E-13	2.62E-13

Source: 6

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	2.45E-04	1.91E-03	2.16E-03
U-234	7.05E-10	4.73E-09	5.44E-09
TH-230	7.81E-15	5.24E-14	6.03E-14
RA-226	2.62E-18	6.16E-17	6.42E-17
PB-210	2.75E-22	1.86E-21	2.13E-21
U-235			
U-235	1.15E-05	9.26E-05	1.04E-04
PA-231	2.49E-09	1.69E-08	1.94E-08
AC-227	1.90E-10	1.31E-09	1.50E-09
U-234			
U-234	2.67E-04	1.79E-03	2.06E-03
TH-230	5.92E-09	3.98E-08	4.57E-08
RA-226	3.37E-12	7.92E-11	8.25E-11
PB-210	1.52E-15	1.02E-14	1.17E-14

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 10.0000 years

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ëëë Assessment for Time: 2 ëëë
ëëë Time =1.00E+01 yr ëëë
ëë
ëë

ëëëëëëëë Source Information ëëëëëëëë

urce: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50 [m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	2.819E+05
	U-235	1.310E+04
	U-234	3.009E+05
	PA-231	2.769E+00
	TH-230	2.710E+01
	AC-227	3.989E-01
	RA-226	5.865E-02
	PB-210	5.637E-03
	CO-60	2.681E-01

T` : DOE GJPO Bldg 2 Occupancy
'ile : B2OCC.DAT Evaluation Time: 10.0000 years

Source: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50 [m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.738E+05
U-235	2.669E+04
U-234	6.118E+05
PA-231	5.643E+00
TH-230	5.510E+01
AC-227	8.129E-01
RA-226	1.193E-01
PB-210	1.146E-02

.e: 3
Location:: Room : 2 x: 0.00 y: 3.00 z: 1.00 [m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.568E+05
U-235	2.589E+04
U-234	5.938E+05
PA-231	5.474E+00
TH-230	5.348E+01
AC-227	7.886E-01
RA-226	1.157E-01
PB-210	1.112E-02

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 10.0000 years

urce: 4
Location:: Room : 2 x: 20.00 y: 5.80 z: 1.00 [m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	1.689E+05
	U-235	7.897E+03
	U-234	1.799E+05
	PA-231	1.670E+00
	TH-230	1.621E+01
	AC-227	2.405E-01
	RA-226	3.507E-02
	PB-210	3.371E-03

ce: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20 [m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	2.666E+04
	U-235	1.250E+03
	U-234	2.833E+04
	PA-231	2.642E-01
	TH-230	2.551E+00
	AC-227	3.807E-02
	RA-226	5.522E-03
	PB-210	5.308E-04

T' : DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 10.0000 years

Source: 6
Location:: Room : 2 x: 16.00 y: 3.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	4.099E+04
U-235	1.899E+03
U-234	4.399E+04
PA-231	4.016E-01
TH-230	3.962E+00
AC-227	5.785E-02
RA-226	8.574E-03
PB-210	8.241E-04

: DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 10.0000 years

RESRAD-BUILD Dose Tables

Receptor Point-Source Doses

[mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Total
ceptor 1	2.3E-04	2.9E-04	6.0E-03	2.6E-04	2.7E-02	5.2E-04	3.4E-02
ceptor 2	1.2E-03	1.0E-03	3.7E-03	7.0E-03	6.1E-02	3.8E-03	7.8E-02
tal	1.4E-03	1.3E-03	9.7E-03	7.2E-03	8.8E-02	4.3E-03	1.1E-01

T[illegible] : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 10.0000 years

Pathway Detail of Doses
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	3.28E-05	3.60E-09	2.28E-11	1.95E-04	2.23E-18	1.06E-06
2	7.56E-04	1.09E-08	5.23E-11	4.47E-04	1.19E-17	2.43E-06
Total	7.89E-04	1.45E-08	7.51E-11	6.42E-04	1.41E-17	3.49E-06

Source: 2

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.34E-05	4.88E-09	3.09E-11	2.64E-04	3.02E-18	1.44E-06
2	4.15E-04	1.48E-08	7.10E-11	6.06E-04	1.61E-17	3.30E-06
Total	4.38E-04	1.97E-08	1.02E-10	8.71E-04	1.91E-17	4.74E-06

Source: 3

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	5.47E-03	9.30E-09	5.89E-11	5.03E-04	1.34E-17	2.74E-06
2	3.52E-04	8.24E-08	3.95E-10	3.38E-03	8.05E-17	1.84E-05
Total	5.82E-03	9.17E-08	4.54E-10	3.88E-03	9.38E-17	2.11E-05

Source: 4

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	7.40E-05	3.45E-09	2.19E-11	1.87E-04	4.95E-18	1.02E-06
2	5.71E-03	3.06E-08	1.47E-10	1.25E-03	2.98E-17	6.82E-06
Total	5.78E-03	3.41E-08	1.69E-10	1.44E-03	3.48E-17	7.83E-06

Source: 5

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	8.15E-06	4.89E-07	3.10E-09	2.64E-02	3.01E-16	1.43E-04
2	2.00E-04	1.48E-06	7.11E-09	6.05E-02	1.60E-15	3.29E-04
Total	2.08E-04	1.97E-06	1.02E-08	8.69E-02	1.90E-15	4.73E-04

Source: 6

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.64E-05	9.30E-09	5.89E-11	5.05E-04	1.34E-17	2.75E-06
2	3.89E-04	8.24E-08	3.95E-10	3.39E-03	8.11E-17	1.85E-05
	4.05E-04	9.17E-08	4.54E-10	3.90E-03	9.45E-17	2.12E-05
				9.76 E-02		5.31 E-02

RM 4/29/96

: DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 10.0000 years

Nuclide Detail of Doses
[mrem]

rce: 1

Nuclide	Receptor 1	Receptor 2	Total
38			
-238	1.14E-04	7.86E-04	9.01E-04
-234	2.75E-09	6.70E-09	9.45E-09
H-230	3.03E-13	7.12E-13	1.02E-12
A-226	2.38E-15	5.46E-14	5.69E-14
B-210	4.18E-18	1.81E-17	2.23E-17
35			
-235	1.09E-05	1.66E-04	1.77E-04
A-231	9.96E-09	3.00E-08	3.99E-08
C-227	7.33E-09	2.60E-08	3.34E-08
34			
-234	1.04E-04	2.53E-04	3.56E-04
H-230	2.28E-08	5.37E-08	7.66E-08
A-226	2.69E-10	6.17E-09	6.44E-09
10	6.22E-13	2.69E-12	3.31E-12
O-60	1.70E-09	3.93E-08	4.10E-08

rce: 2

Nuclide	Receptor 1	Receptor 2	Total
38			
-238	1.39E-04	6.02E-04	7.41E-04
-234	3.70E-09	8.59E-09	1.23E-08
H-230	4.10E-13	9.47E-13	1.36E-12
A-226	2.04E-15	3.31E-14	3.52E-14
B-210	5.31E-18	1.57E-17	2.10E-17
35			
-235	1.03E-05	9.88E-05	1.09E-04
A-231	1.33E-08	3.42E-08	4.75E-08
C-227	9.68E-09	2.69E-08	3.66E-08
34			
-234	1.39E-04	3.23E-04	4.63E-04
H-230	3.09E-08	7.13E-08	1.02E-07
A-226	2.30E-10	3.74E-09	3.97E-09
B-210	7.88E-13	2.33E-12	3.11E-12

T[illegible] : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 10.0000 years

Source: 3

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	4.51E-03	1.82E-03	6.33E-03
U-234	7.87E-09	4.73E-08	5.52E-08
TH-230	8.61E-13	5.24E-12	6.10E-12
RA-226	4.27E-13	2.96E-14	4.57E-13
PB-210	6.43E-17	6.69E-17	1.31E-16
U-235			
U-235	1.17E-03	1.45E-04	1.32E-03
PA-231	8.01E-08	1.71E-07	2.51E-07
AC-227	1.00E-07	1.22E-07	2.22E-07
U-234			
U-234	2.96E-04	1.78E-03	2.08E-03
TH-230	6.49E-08	3.95E-07	4.60E-07
RA-226	4.83E-08	3.35E-09	5.16E-08
PB-210	9.55E-12	9.93E-12	1.95E-11

Source: 4

[illegible]lide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.43E-04	5.04E-03	5.18E-03
U-234	2.62E-09	1.82E-08	2.09E-08
TH-230	2.91E-13	2.02E-12	2.32E-12
RA-226	5.88E-15	4.53E-13	4.59E-13
PB-210	4.20E-18	7.73E-17	8.15E-17
U-235			
U-235	1.97E-05	1.24E-03	1.26E-03
PA-231	1.00E-08	1.20E-07	1.30E-07
AC-227	7.56E-09	1.31E-07	1.38E-07
U-234			
U-234	9.87E-05	6.86E-04	7.85E-04
TH-230	2.19E-08	1.52E-07	1.74E-07
RA-226	6.64E-10	5.11E-08	5.18E-08
PB-210	6.23E-13	1.15E-11	1.21E-11

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 10.0000 years

rce: 5

Nuclide	Receptor 1	Receptor 2	Total
38			
-238	1.21E-02	2.78E-02	3.99E-02
-234	3.70E-07	8.49E-07	1.22E-06
H-230	4.10E-11	9.40E-11	1.35E-10
A-226	2.59E-15	1.85E-14	2.11E-14
B-210	5.11E-16	1.14E-15	1.65E-15
35			
-235	5.67E-04	1.34E-03	1.91E-03
A-231	1.32E-06	3.02E-06	4.34E-06
C-227	9.40E-07	2.10E-06	3.04E-06
34			
-234	1.39E-02	3.19E-02	4.57E-02
H-230	3.07E-06	7.06E-06	1.01E-05
A-226	2.91E-10	2.08E-09	2.37E-09
B-210	7.55E-11	1.69E-10	2.44E-10

rce: 6

lide	Receptor 1	Receptor 2	Total
38			
-238	2.45E-04	1.91E-03	2.16E-03
-234	7.05E-09	4.73E-08	5.44E-08
H-230	7.81E-13	5.24E-12	6.02E-12
A-226	2.96E-15	6.95E-14	7.25E-14
B-210	9.46E-18	6.39E-17	7.33E-17
35			
-235	1.15E-05	9.26E-05	1.04E-04
A-231	2.49E-08	1.69E-07	1.94E-07
C-227	1.73E-08	1.19E-07	1.37E-07
34			
-234	2.67E-04	1.79E-03	2.06E-03
H-230	5.92E-08	3.98E-07	4.57E-07
A-226	3.36E-10	7.90E-09	8.24E-09
B-210	1.41E-12	9.54E-12	1.10E-11

T˙ : DOE GJPO Bldg 2 Occupancy
˙ile : B2OCC.DAT   Evaluation Time: 20.0000   years

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ëë
ëëë   Assessment for Time: 3   ëëë
ëëë   Time =2.00E+01 yr   ëëë
ëë
ëë

ëëëëëëëë Source Information ëëëëëëëë

Source: 1

Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50 [m]

Geometry:: Type: Area   Area:8.70E+00 [m2] Direction: y

Pathway ::

Direct Ingestion Rate: 0.000E+00 [1/hr]

Fraction released to air: 1.000E-01

Removable fraction: 1.000E-03

Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	2.818E+05
	U-235	1.309E+04
	U-234	3.008E+05
	PA-231	5.535E+00
	TH-230	5.418E+01
	AC-227	1.445E+00
	RA-226	2.342E-01
	PB-210	4.188E-02
	CO-60	7.189E-02

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 20.0000 years

urce: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50 [m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.736E+05
U-235	2.668E+04
U-234	6.116E+05
PA-231	1.128E+01
TH-230	1.102E+02
AC-227	2.946E+00
RA-226	4.761E-01
PB-210	8.515E-02

e: 3
Location:: Room : 2 x: 0.00 y: 3.00 z: 1.00 [m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.566E+05
U-235	2.588E+04
U-234	5.936E+05
PA-231	1.094E+01
TH-230	1.069E+02
AC-227	2.858E+00
RA-226	4.621E-01
PB-210	8.265E-02

T` ` : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 20.0000 years

Source: 4
Location:: Room : 2 x: 20.00 y: 5.80 z: 1.00 [m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	1.689E+05
U-235	7.895E+03
U-234	1.799E+05
PA-231	3.338E+00
TH-230	3.240E+01
AC-227	8.717E-01
RA-226	1.400E-01
PB-210	2.505E-02

:e: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20 [m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	2.133E+04
U-235	9.997E+02
U-234	2.266E+04
PA-231	4.227E-01
TH-230	4.081E+00
AC-227	1.104E-01
RA-226	1.764E-02
PB-210	3.155E-03

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 20.0000 years

urce: 6
Location:: Room : 2 x: 16.00 y: 3.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	4.097E+04
U-235	1.899E+03
U-234	4.397E+04
PA-231	8.028E-01
TH-230	7.920E+00
AC-227	2.096E-01
RA-226	3.423E-02
PB-210	6.122E-03

T[illegible] : DOE GJPO Bldg 2 Occupancy
[illegible]ile : B2OCC.DAT Evaluation Time: 20.0000 years

RESRAD-BUILD Dose Tables

Receptor Point-Source Doses

[mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Total
Receptor 1	2.3E-04	2.9E-04	6.0E-03	2.6E-04	2.7E-02	5.2E-04	3.4E-02
Receptor 2	1.2E-03	1.0E-03	3.8E-03	7.0E-03	6.1E-02	3.8E-03	7.8E-02
Total	1.4E-03	1.3E-03	9.7E-03	7.2E-03	8.8E-02	4.3E-03	1.1E-01

Title : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 20.0000 years

Pathway Detail of Doses
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	3.28E-05	3.60E-09	2.28E-11	1.95E-04	8.90E-18	1.06E-06
2	7.56E-04	1.09E-08	5.23E-11	4.47E-04	4.74E-17	2.43E-06
Total	7.88E-04	1.45E-08	7.51E-11	6.42E-04	5.63E-17	3.49E-06

Source: 2

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.34E-05	4.88E-09	3.09E-11	2.64E-04	1.21E-17	1.44E-06
2	4.14E-04	1.48E-08	7.10E-11	6.07E-04	6.43E-17	3.30E-06
Total	4.38E-04	1.97E-08	1.02E-10	8.71E-04	7.63E-17	4.74E-06

Source: 3

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	5.47E-03	9.30E-09	5.89E-11	5.03E-04	5.33E-17	2.74E-06
2	3.52E-04	8.24E-08	3.95E-10	3.38E-03	3.21E-16	1.84E-05
Total	5.82E-03	9.17E-08	4.54E-10	3.88E-03	3.75E-16	2.11E-05

Source: 4

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	7.39E-05	3.45E-09	2.19E-11	1.87E-04	1.98E-17	1.02E-06
2	5.71E-03	3.06E-08	1.47E-10	1.25E-03	1.19E-16	6.82E-06
Total	5.78E-03	3.41E-08	1.69E-10	1.44E-03	1.39E-16	7.84E-06

Source: 5

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	6.52E-06	4.89E-07	3.10E-09	2.64E-02	1.20E-15	1.43E-04
2	1.60E-04	1.48E-06	7.11E-09	6.05E-02	6.40E-15	3.29E-04
Total	1.67E-04	1.97E-06	1.02E-08	8.69E-02	7.61E-15	4.73E-04

Source: 6

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.64E-05	9.30E-09	5.89E-11	5.05E-04	5.37E-17	2.75E-06
2	3.89E-04	8.25E-08	3.96E-10	3.39E-03	3.24E-16	1.85E-05
Total	4.05E-04	9.18E-08	4.54E-10	3.90E-03	3.78E-16	2.12E-05
				9.76 E-02		5.31 E-04

4/29/96

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.14E-04	7.86E-04	9.00E-04
U-234	5.49E-09	1.34E-08	1.89E-08
TH-230	1.21E-12	2.85E-12	4.06E-12
RA-226	1.90E-14	4.36E-13	4.55E-13
PB-210	6.31E-17	2.73E-16	3.36E-16
U-235			
U-235	1.09E-05	1.66E-04	1.77E-04
PA-231	1.99E-08	5.99E-08	7.98E-08
AC-227	2.66E-08	9.43E-08	1.21E-07
U-234			
U-234	1.04E-04	2.53E-04	3.56E-04
TH-230	4.57E-08	1.07E-07	1.53E-07
RA-226	1.08E-09	2.46E-08	2.57E-08
10	4.62E-12	2.00E-11	2.46E-11
CO-60	4.57E-10	1.05E-08	1.10E-08

Source: 2

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.39E-04	6.02E-04	7.41E-04
U-234	7.40E-09	1.72E-08	2.46E-08
TH-230	1.64E-12	3.79E-12	5.43E-12
RA-226	1.63E-14	2.65E-13	2.81E-13
PB-210	8.01E-17	2.36E-16	3.16E-16
U-235			
U-235	1.03E-05	9.87E-05	1.09E-04
PA-231	2.66E-08	6.84E-08	9.50E-08
AC-227	3.51E-08	9.77E-08	1.33E-07
U-234			
U-234	1.39E-04	3.23E-04	4.63E-04
TH-230	6.18E-08	1.43E-07	2.04E-07
RA-226	9.19E-10	1.49E-08	1.59E-08
PB-210	5.86E-12	1.73E-11	2.31E-11

rce: 3

Nuclide	Receptor 1	Receptor 2	Total
38			
-238	4.51E-03	1.82E-03	6.33E-03
-234	1.57E-08	9.47E-08	1.10E-07
H-230	3.44E-12	2.10E-11	2.44E-11
A-226	3.41E-12	2.37E-13	3.65E-12
B-210	9.70E-16	1.01E-15	1.98E-15
35			
-235	1.17E-03	1.45E-04	1.32E-03
A-231	1.60E-07	3.41E-07	5.01E-07
C-227	3.62E-07	4.41E-07	8.04E-07
34			
-234	2.96E-04	1.78E-03	2.08E-03
H-230	1.30E-07	7.90E-07	9.20E-07
A-226	1.93E-07	1.34E-08	2.06E-07
B-210	7.09E-11	7.38E-11	1.45E-10

rce: 4

lide	Receptor 1	Receptor 2	Total
38			
-238	1.43E-04	5.04E-03	5.18E-03
-234	5.25E-09	3.65E-08	4.17E-08
H-230	1.16E-12	8.10E-12	9.26E-12
A-226	4.70E-14	3.62E-12	3.67E-12
B-210	6.34E-17	1.16E-15	1.23E-15
35			
-235	1.97E-05	1.24E-03	1.26E-03
A-231	2.01E-08	2.40E-07	2.60E-07
C-227	2.74E-08	4.73E-07	5.01E-07
34			
-234	9.87E-05	6.86E-04	7.85E-04
H-230	4.37E-08	3.05E-07	3.48E-07
A-226	2.65E-09	2.04E-07	2.07E-07
B-210	4.63E-12	8.51E-11	8.97E-11

T: : DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 20.0000 years

Source: 5

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	1.21E-02	2.78E-02	3.99E-02
U-234	7.40E-07	1.70E-06	2.44E-06
TH-230	1.64E-10	3.76E-10	5.40E-10
RA-226	1.98E-14	1.26E-13	1.45E-13
PB-210	7.70E-15	1.72E-14	2.49E-14
U-235			
U-235	5.67E-04	1.33E-03	1.90E-03
PA-231	2.63E-06	6.05E-06	8.68E-06
AC-227	3.41E-06	7.60E-06	1.10E-05
U-234			
U-234	1.39E-02	3.19E-02	4.57E-02
TH-230	6.15E-06	1.41E-05	2.03E-05
RA-226	1.11E-09	7.07E-09	8.18E-09
PB-210	5.61E-10	1.25E-09	1.82E-09

Source: 6

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	2.45E-04	1.91E-03	2.16E-03
U-234	1.41E-08	9.47E-08	1.09E-07
TH-230	3.12E-12	2.10E-11	2.41E-11
RA-226	2.36E-14	5.55E-13	5.79E-13
PB-210	1.43E-16	9.63E-16	1.11E-15
U-235			
U-235	1.15E-05	9.26E-05	1.04E-04
PA-231	4.98E-08	3.37E-07	3.87E-07
AC-227	6.28E-08	4.33E-07	4.96E-07
U-234			
U-234	2.67E-04	1.79E-03	2.06E-03
TH-230	1.18E-07	7.95E-07	9.14E-07
RA-226	1.34E-09	3.16E-08	3.29E-08
PB-210	1.05E-11	7.09E-11	8.14E-11

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 30.0000 years

Assessment for Time: 4
Time =3.00E+01 yr

Source Information

urce: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50 [m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	2.817E+05
U-235	1.309E+04
U-234	3.007E+05
PA-231	8.299E+00
TH-230	8.124E+01
AC-227	2.962E+00
RA-226	5.260E-01
PB-210	1.317E-01
CO-60	1.927E-02

T[illegible] : DOE GJPO Bldg 2 Occupancy
[illegible]ile : B2OCC.DAT Evaluation Time: 30.0000 years

Source: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50 [m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.734E+05
U-235	2.667E+04
U-234	6.114E+05
PA-231	1.691E+01
TH-230	1.652E+02
AC-227	6.037E+00
RA-226	1.069E+00
PB-210	2.678E-01

[illegible]e: 3
Location:: Room : 2 x: 0.00 y: 3.00 z: 1.00 [m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	5.564E+05
U-235	2.587E+04
U-234	5.934E+05
PA-231	1.641E+01
TH-230	1.603E+02
AC-227	5.856E+00
RA-226	1.038E+00
PB-210	2.599E-01

' - : DOE GJPO Bldg 2 Occupancy
:ile : B2OCC.DAT Evaluation Time: 30.0000 years

urce: 4
Location:: Room : 2 x: 20.00 y: 5.80 z: 1.00 [m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	1.688E+05
	U-235	7.892E+03
	U-234	1.798E+05
	PA-231	5.005E+00
	TH-230	4.858E+01
	AC-227	1.786E+00
	RA-226	3.145E-01
	PB-210	7.875E-02

.e: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20 [m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.095E+04 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	1.600E+04
	U-235	7.500E+02
	U-234	1.700E+04
	PA-231	4.756E-01
	TH-230	4.593E+00
	AC-227	1.697E-01
	RA-226	2.973E-02
	PB-210	7.445E-03

T[illegible] : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 30.0000 years

Source: 6
Location:: Room : 2 x: 16.00 y: 3.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-03
Time to Remove: 1.095E+04 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	4.096E+04
U-235	1.898E+03
U-234	4.396E+04
PA-231	1.204E+00
TH-230	1.188E+01
AC-227	4.296E-01
RA-226	7.688E-02
PB-210	1.925E-02

: DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 30.0000 years

RESRAD-BUILD Dose Tables

Receptor Point-Source Doses

[mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Total
eptor 1	3.3E-05	2.3E-05	5.5E-03	7.4E-05	4.9E-06	1.6E-05	5.6E-03
eptor 2	7.6E-04	4.1E-04	3.5E-04	5.7E-03	1.2E-04	3.9E-04	7.7E-03
tal	7.9E-04	4.4E-04	5.8E-03	5.8E-03	1.2E-04	4.1E-04	1.3E-02

Title : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 30.0000 years

Pathway Detail of Doses

[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	3.28E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	7.55E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	7.88E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 2

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.34E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	4.14E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	4.38E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 3

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	5.47E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	3.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	5.82E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 4

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	7.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	5.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	5.78E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 5

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	4.89E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	1.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	1.25E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 6

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.64E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	3.89E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	4.05E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0 0

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: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 30.0000 years

Nuclide Detail of Doses
[mrem]

ce: 1

uclide	Receptor 1	Receptor 2	Total
8			
238	2.53E-05	5.82E-04	6.07E-04
234	5.77E-11	1.33E-09	1.39E-09
-230	7.57E-15	1.74E-13	1.82E-13
-226	6.37E-14	1.47E-12	1.53E-12
-210	3.03E-17	6.98E-16	7.29E-16
5			
235	6.80E-06	1.57E-04	1.63E-04
-231	1.02E-09	2.36E-08	2.46E-08
-227	3.46E-09	7.97E-08	8.31E-08
4			
234	7.25E-07	1.67E-05	1.74E-05
-230	1.90E-10	4.38E-09	4.57E-09
-226	2.40E-09	5.53E-08	5.77E-08
10	1.46E-12	3.36E-11	3.51E-11
-60	1.23E-10	2.82E-09	2.95E-09

ce: 2

uclide	Receptor 1	Receptor 2	Total
8			
238	1.86E-05	3.25E-04	3.43E-04
234	8.30E-12	2.85E-10	2.93E-10
-230	2.71E-15	5.92E-14	6.19E-14
-226	5.43E-14	8.91E-13	9.45E-13
-210	1.47E-17	3.09E-16	3.23E-16
5			
235	4.69E-06	8.58E-05	9.05E-05
-231	7.01E-10	1.26E-08	1.33E-08
-227	2.60E-09	4.57E-08	4.83E-08
4			
234	1.04E-07	3.58E-06	3.68E-06
-230	6.80E-11	1.49E-09	1.56E-09
-226	2.04E-09	3.35E-08	3.56E-08
-210	7.06E-13	1.48E-11	1.56E-11

Title : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT Evaluation Time: 30.0000 years

Source: 3

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	4.28E-03	2.78E-04	4.55E-03
U-234	2.47E-09	1.15E-10	2.58E-09
TH-230	7.30E-13	4.20E-14	7.72E-13
RA-226	1.15E-11	7.91E-13	1.23E-11
PB-210	3.95E-15	2.21E-16	4.18E-15
U-235			
U-235	1.16E-03	7.28E-05	1.23E-03
PA-231	1.66E-07	1.06E-08	1.76E-07
AC-227	6.15E-07	3.97E-08	6.54E-07
U-234			
U-234	3.10E-05	1.45E-06	3.24E-05
TH-230	1.83E-08	1.05E-09	1.94E-08
RA-226	4.33E-07	2.98E-08	4.63E-07
PB-210	1.90E-10	1.06E-11	2.01E-10

Source: 4

Nuclide	Receptor 1	Receptor 2	Total
U-238			
U-238	5.78E-05	4.46E-03	4.52E-03
U-234	2.68E-11	2.07E-09	2.09E-09
TH-230	9.38E-15	7.24E-13	7.34E-13
RA-226	1.58E-13	1.22E-11	1.23E-11
PB-210	5.00E-17	3.86E-15	3.91E-15
U-235			
U-235	1.57E-05	1.21E-03	1.23E-03
PA-231	2.24E-09	1.73E-07	1.75E-07
AC-227	8.39E-09	6.48E-07	6.56E-07
U-234			
U-234	3.36E-07	2.59E-05	2.62E-05
TH-230	2.35E-10	1.82E-08	1.84E-08
RA-226	5.94E-09	4.58E-07	4.64E-07
PB-210	2.41E-12	1.86E-10	1.88E-10

: DOE GJPO Bldg 2 Occupancy
ile : B2OCC.DAT Evaluation Time: 30.0000 years

ce: 5

uclide	Receptor 1	Receptor 2	Total
8			
238	3.73E-06	9.17E-05	9.54E-05
234	1.13E-11	2.76E-10	2.88E-10
-230	1.37E-15	3.36E-14	3.50E-14
-226	9.09E-15	2.23E-13	2.32E-13
-210	5.01E-18	1.23E-16	1.28E-16
5			
235	1.02E-06	2.50E-05	2.60E-05
-231	1.55E-10	3.82E-09	3.97E-09
-227	5.07E-10	1.25E-08	1.30E-08
4			
234	1.41E-07	3.46E-06	3.60E-06
-230	3.42E-11	8.40E-10	8.75E-10
-226	3.41E-10	8.37E-09	8.71E-09
-210	2.40E-13	5.90E-12	6.14E-12

ce: 6

lide	Receptor 1	Receptor 2	Total
8			
238	1.55E-05	3.67E-04	3.83E-04
234	3.23E-13	7.66E-12	7.98E-12
-230	1.93E-16	4.58E-15	4.77E-15
-226	7.86E-14	1.86E-12	1.94E-12
-210	8.50E-20	2.02E-18	2.10E-18
5			
235	8.86E-07	2.10E-05	2.19E-05
-231	2.53E-10	5.99E-09	6.24E-09
-227	1.05E-09	2.49E-08	2.60E-08
4			
234	4.08E-09	9.67E-08	1.01E-07
-230	4.88E-12	1.16E-10	1.21E-10
-226	2.98E-09	7.06E-08	7.36E-08
-210	4.11E-15	9.76E-14	1.02E-13

T[illegible] : DOE GJPO Bldg 2 Occupancy
File : B2OCC.DAT

RESRAD-BUILD Dose (Time) Tables

Receptor Doses By Time

[mrem]

	Time [yr]			
	1.00E+00	1.00E+01	2.00E+01	3.00E+01
1	3.38E-02	3.38E-02	3.38E-02	5.62E-03
2	7.78E-02	7.78E-02	7.78E-02	7.74E-03

Receptor Doses Per Year

[mrem/yr]

	Time [yr]			
	1.00E+00	1.00E+01	2.00E+01	3.00E+01
1	5.14E-02	5.14E-02	5.14E-02	8.55E-03
2	1.18E-01	1.18E-01	1.18E-01	1.18E-02

See page 15 for maximum inhalation and ingestion doses.

External dose and radon dose are disregarded because they were measured.

RThomas 4/26/96

RESRAD-BUILD Table of Contents

T: : DOE GJPO Bldg 2 Demolition
 ile : B2DEM.DAT

RESRAD-BUILD Input Parameters

Number of Sources : 6
Number of Receptors: 1
Total Time : 1.000000E+01 days
Fraction Inside : 3.000000E-01

Receptor Information

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	15.000	3.000	1.000	1.000	1.80E+01	1.00E-04

Receptor-Source Relationship

Receptor	Source 1		Source 2		Source 3		Source 4		Source 5	
	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]	Density [g/cm3]	Thickness [cm]
1	5.000E-01	1.000E+00	5.000E-01	2.000E+00	5.000E-01	1.500E+00	5.000E-01	2.000E+00	2.000E+00	1.000E-02

Receptor	Source 6	
	Density [g/cm3]	Thickness [cm]
1	2.500E+00	1.000E+01

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT

ëëëëëëëë Building Information ëëëëëëëë

Building Air Exchange Rate: 1.50E+01 1/hr

Height[m] Air Exchanges [m3/hr]
Area [m2]

```
                ********************************
                *                              *
                *                              *
                *                             <=Q01: 9.00E+03
H1:   3.000     *           Room  1            *      Q10 :  9.00E+03
                *   LAMBDA: 1.50E+01           *
rea 200.000     *                              *
                *                              *
                ********************************
```

)eposition velocity: 1.00E-02 [m/s] Resuspension Rate: 1.00E-06 [1/s]

T[illegible] : DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT

ëëëëëëëë Source Information ëëëëëëëë

Source: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50[m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	2.820E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
U-235	1.310E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
U-234	3.010E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05
CO-60	1.000E+00	2.600E-05	1.500E-04	2.750E-04	1.020E-05	1.470E-02

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT

urce: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50[m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

ontamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	5.740E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	2.670E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	6.120E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

Source: 3
Location:: Room : 1 x: 0.00 y: 3.00 z: 1.00[m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	5.570E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	2.590E+04	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	5.940E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT

rce: 4
Location:: Room : 1 x: 20.00 y: 5.80 z: 1.00[m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

ontamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	1.690E+05	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	7.900E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	1.800E+05	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

T' : DOE GJPO Bldg 2 Demolition
 'ile : B2DEM.DAT

Source: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20[m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	3.200E+04	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	1.500E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
,-234	3.400E+04	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT

rce: 6
Location:: Room : 1 x: 16.00 y: 3.00 z: 0.00[m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Radon Release Fraction: 0.000E+00

ontamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	4.100E+04	2.500E-04	1.200E-01	3.530E-06	9.510E-08	1.600E-04
-235	1.900E+03	2.500E-04	1.200E-01	1.950E-05	4.740E-07	9.030E-04
-234	4.400E+04	2.600E-04	1.300E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.100E-02	1.300E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.300E-04	3.200E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.500E-02	6.700E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.100E-03	7.900E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	6.700E-03	2.100E-02	4.140E-07	3.820E-09	1.430E-05

T: : DOE GJPO Bldg 2 Demolition
:ile : B2DEM.DAT Evaluation Time: 0.000000 years

ëë
ëë
ëëë Assessment for Time: 1 ëëë
ëëë Time =0.00E+00 yr ëëë
ëë
ëë

ëëëëëëëë Source Information ëëëëëëëë

Source: 1
Location:: Room : 1 x: 28.20 y: 0.00 z: 0.50 [m]
Geometry:: Type: Area Area:8.70E+00 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	2.820E+05
	U-235	1.310E+04
	U-234	3.010E+05
	PA-231	0.000E+00
	TH-230	0.000E+00
	AC-227	0.000E+00
	RA-226	0.000E+00
	PB-210	0.000E+00
	CO-60	1.000E+00

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT Evaluation Time: 0.000000 years

rce: 2
Location:: Room : 1 x: 32.50 y: 3.00 z: 0.50 [m]
Geometry:: Type: Area Area:5.80E+00 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	5.740E+05
	U-235	2.670E+04
	U-234	6.120E+05
	PA-231	0.000E+00
	TH-230	0.000E+00
	AC-227	0.000E+00
	RA-226	0.000E+00
	PB-210	0.000E+00

ce: 3
Location:: Room : 1 x: 0.00 y: 3.00 z: 1.00 [m]
Geometry:: Type: Area Area:1.39E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	5.570E+05
	U-235	2.590E+04
	U-234	5.940E+05
	PA-231	0.000E+00
	TH-230	0.000E+00
	AC-227	0.000E+00
	RA-226	0.000E+00
	PB-210	0.000E+00

T: : DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT Evaluation Time: 0.000000 years

Source: 4
Location:: Room : 1 x: 20.00 y: 5.80 z: 1.00 [m]
Geometry:: Type: Area Area:1.70E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	1.690E+05
U-235	7.900E+03
U-234	1.800E+05
PA-231	0.000E+00
TH-230	0.000E+00
AC-227	0.000E+00
RA-226	0.000E+00
PB-210	0.000E+00

e: 5
Location:: Room : 1 x: 28.00 y: 5.80 z: 1.20 [m]
Geometry:: Type: Area Area:2.08E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 5.000E-01
Time to Remove: 1.100E+01 [day]

Contamination:: Nuclide Concentration [pCi/m2]

Nuclide	Concentration [pCi/m2]
U-238	3.200E+04
U-235	1.500E+03
U-234	3.400E+04
PA-231	0.000E+00
TH-230	0.000E+00
AC-227	0.000E+00
RA-226	0.000E+00
PB-210	0.000E+00

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT Evaluation Time: 0.000000 years

rce: 6
Location:: Room : 1 x: 16.00 y: 3.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.89E+02 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 2.000E-01
Removable fraction: 1.000E-02
Time to Remove: 1.100E+01 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	4.100E+04
U-235	1.900E+03
U-234	4.400E+04
PA-231	0.000E+00
TH-230	0.000E+00
AC-227	0.000E+00
RA-226	0.000E+00
PB-210	0.000E+00

T[illegible] : DOE GJPO Bldg 2 Demolition
File : B2DEM.DAT Evaluation Time: 0.000000 years

RESRAD-BUILD Dose Tables

Receptor Point-Source Doses

[mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Total
Receptor 1	3.0E-02	4.0E-02	9.3E-02	3.5E-02	4.0E-01	9.4E-02	6.9E-01
Total	3.0E-02	4.0E-02	9.3E-02	3.5E-02	4.0E-01	9.4E-02	6.9E-01

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT Evaluation Time: 0.000000 years

Pathway Detail of Doses
[mrem]

ce: 1

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.79E-05	3.91E-07	3.45E-09	2.95E-02	2.20E-29	8.02E-05
tal	1.79E-05	3.91E-07	3.45E-09	2.95E-02	2.20E-29	8.02E-05

ce: 2

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.15E-05	5.31E-07	4.68E-09	4.00E-02	2.98E-29	1.09E-04
tal	1.15E-05	5.31E-07	4.68E-09	4.00E-02	2.98E-29	1.09E-04

ce: 3

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	3.73E-05	1.23E-06	1.09E-08	9.30E-02	6.93E-29	2.53E-04
tal	3.73E-05	1.23E-06	1.09E-08	9.30E-02	6.93E-29	2.53E-04

ce: 4

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.07E-04	4.58E-07	4.04E-09	3.45E-02	2.57E-29	9.38E-05
tal	1.07E-04	4.58E-07	4.04E-09	3.45E-02	2.57E-29	9.38E-05

ce: 5

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	5.46E-06	5.31E-06	4.69E-08	3.99E-01	2.97E-28	1.09E-03
tal	5.46E-06	5.31E-06	4.69E-08	3.99E-01	2.97E-28	1.09E-03

ce: 6

eceptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.38E-05	1.23E-06	1.09E-08	9.34E-02	6.98E-29	2.54E-04
tal	2.38E-05	1.23E-06	1.09E-08	9.34E-02	6.98E-29	2.54E-04

6.89 E-01 1.88 E-03

RM 4/29/96

T[illegible] : DOE GJPO Bldg 2 Demolition
[illegible]ile : B2DEM.DAT Evaluation Time: 0.000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.34E-02	1.34E-02
U-235		
U-235	6.27E-04	6.27E-04
U-234		
U-234	1.55E-02	1.55E-02
CO-60		
CO-60	3.61E-09	3.61E-09

Source: 2

Nuclide	Receptor 1	Total
U-238		
U-238	1.82E-02	1.82E-02
U-235		
U-235	8.50E-04	8.50E-04
U-234		
U-234	2.10E-02	2.10E-02

Source: 3

Nuclide	Receptor 1	Total
U-238		
U-238	4.24E-02	4.24E-02
U-235		
U-235	1.98E-03	1.98E-03
U-234		
U-234	4.89E-02	4.89E-02

: DOE GJPO Bldg 2 Demolition
ile : B2DEM.DAT Evaluation Time: 0.000000 years

ce: 4

uclide	Receptor 1	Total
8		
238	1.58E-02	1.58E-02
5		
235	7.57E-04	7.57E-04
4		
234	1.81E-02	1.81E-02

ce: 5

uclide	Receptor 1	Total
8		
238	1.82E-01	1.82E-01
5		
235	8.53E-03	8.53E-03
4		
234	2.10E-01	2.10E-01

ce: 6

uclide	Receptor 1	Total
8		
238	4.24E-02	4.24E-02
5		
235	1.97E-03	1.97E-03
4		
234	4.93E-02	4.93E-02

T: : DOE GJPO Bldg 2 Demolition
:ile : B2DEM.DAT

RESRAD-BUILD Dose (Time) Tables

Receptor Doses By Time

[mrem]

	Time [yr]
	0.00E+00
1	6.91E-01

Receptor Doses Per Year

[mrem/yr]

	Time [yr]
	0.00E+00
1	2.53E+01

This summary includes external dose which has been measured, not modeled. Disregard this quantity and see page 15 for inhalation and ingestion doses.

R Morris
4/23/96