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Radiological Survey Activities – Uranium Mill Tailings Remedial Action Project Procedures Manual

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HEALTH AND SAFETY RESEARCH DIVISION

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

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RADIOLOGICAL SURVEY ACTIVITIES -
URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT
PROCEDURES MANUAL

ASSIGNED TO____

Each person to whom a manual is assigned shall maintain it in proper order, inserting new or revised pages upon their receipt. When the assignee transfers or terminates, or when the manual is no longer needed, the manual should be returned to the ORNL/RASA Grand Junction Office.

Immediately upon receipt, the assignee is required to tear off this section of this sheet, sign, and return to C. A. Little, ORNL/RASA Grand Junction Office, U.S. Department of Energy, P. O. Box 2567, Grand Junction, CO 81502.

I acknowledge receipt of the Radiological Survey Activities - Uranium Mill Tailings Remedial Action Project Procedures Manual.

NAME____

DATE:____

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Section 15: Quality Assurance Procedures

ACKNOWLEDGMENTS

This manual is a product of many different staff members from within the RASA/UMTRA project and from other groups in the Dosimetry and Biophysical Transport Section.

The major task of coordinating the overall completion of this manual was accomplished by S. J. Ramos, the RASA/UMTRA Quality Assurance Coordinator.

Reviewers of various sections of the manual included: J. A. Atencio, D. K. Barslund, W. H. Burke, J. R. Davidson, K. S. Dickerson, D. W. Greene, S. C. Hall, R. R. Knott, E. M. Pilz, D. R. Smuin, G. H. Triplett, and M. J. Wilson. The authors thank these reviewers for their attention to detail and their enthusiasm for the task.

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SECTION 1: INTRODUCTION

SUBJECT: INTRODUCTION

1. INTRODUCTION

1.1 INTRODUCTION

From the early 1940's through 1970, uranium ore was processed at mills owned by private companies under contracts with the Manhattan Engineer District and the U.S. Atomic Energy Commission (AEC). As these uranium ore bodies were depleted and the demand for U_3O_8 decreased, many of the mills were deactivated. Large quantities of processed ore residue (called tailings) were left behind. Following conventional metallurgical industry practices, the tailings were deposited either in ponds or in stockpiles and were allowed to dry. Some of these dried deposits were left unprotected, thus allowing the wind to broadcast tailings over the surrounding area. The public was allowed access to some deposits, and, as a result, some tailings were utilized as a sand substitute or as backfill material in construction projects. These properties include residences, schools, hotels, hospitals, open land, and commercial buildings, and are referred to as "vicinity properties."

In 1972, Congress passed Public Law 92-314 to provide funds for cleanup of vicinity properties in Grand Junction, Colorado. Also in 1972, the AEC in cooperation with the U.S. Environmental Protection Agency (EPA) initiated a program to determine the preliminary radiological status and public health effects associated with the inactive uranium mill tailings sites and all associated vicinity properties. In 1978, Congress passed Public Law 95-604, the Uranium Mill Tailings Radiation Control Act (UMTRCA), which required the federal government to perform remedial actions on inactive uranium mill tailings sites that had been used by the federal government, and on each site's associated vicinity properties.

APPROVED: Craig Little DATE: 4/14/86
RASA/UMTRA Project Manager

SUBJECT: INTRODUCTION

The U.S. Department of Energy (DOE) was assigned the responsibility for conducting remedial action at 24 sites, which are located in one eastern and nine western states. The DOE's responsibilities are being met through its Uranium Mill Tailings Remedial Action Project Office (UMTRA-PO) in Albuquerque, New Mexico. The UMTRA-PO is responsible for (1) identifying candidate vicinity properties; (2) determining the extent of contamination of these properties and their eligibility for remedial action; (3) implementing remedial actions; (4) certifying that the properties have been cleaned in conformance with EPA standards (40 CFR Part 19 2); and (5) coordinating its activities with appropriate agencies or representatives of state, tribal, and local governments, of the U.S. Nuclear Regulatory Commission (NRC), and of the DOE Division of Remedial Action Projects. Details of the UMTRA Project policies and guidelines for remedial action activities are given in the Vicinity Properties Management and Implementation Manual.[1]

1.2 PURPOSE

The purpose of this Procedures Manual is to provide a standardized set of procedures that document in an auditable manner the activities performed by the Radiological Survey Activities (RASA) group in the Dosimetry and Biophysical Transport Section (DABTS) of the Health and Safety Research Division (HASRD) at the Oak Ridge National Laboratory (ORNL), in its role as the Inclusion Survey Contractor (ISC). Members of the RASA group assigned to the UMTRA Project are headquartered in the ORNL/RASA office in Grand Junction, Colorado, and report to the ORNL/RASA Project Manager. This portion of the RASA group is hereafter called the RASA/UMTRA group.

1. U.S. Department of Energy, Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601 (June 1984).

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The Procedures Manual ensures that the organizational, administrative, and technical activities of the RASA/UMTRA group conform properly to those of the ISC as described in the VPMIM and the Summary Protocol.[2] This manual also ensures that the techniques and procedures used by the RASA/UMTRA group and contractor personnel meet the requirements of applicable governmental, scientific, and industrial standards.[3,4,5,6,7,8]

1.3 SCOPE

This Procedures Manual is sufficiently comprehensive for use by the RASA/UMTRA group and contractor personnel in the planning, performance, and reporting of radiological surveys. The Procedures Manual provides formal procedures for conducting inclusion radiological surveys and includes program planning, equipment operation, and quality assurance elements. The

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2. U.S. Department of Energy, Summary Protocol - UMTRAP Vicinity Properties: Identification - Characterization - Inclusion (September 1983).
3. U.S. Environmental Protection Agency, "Standards for Remedial Action at Inactive Uranium Mill Processing Sites," Federal Register, Code of Federal Regulations, Sect. 40, Part 192, Wednesday, January 5, 1983, pg. 590-606.
4. U.S. Department of Energy, DOE Order 5700.6 - Quality Assurance, Oak Ridge Operations Office (March 1982).
5. U.S. Department of Energy, UMTRA Project Quality Assurance Plan, DOE/AL-185, Issue B (June 1983).
6. Oak Ridge National Laboratory, Oak Ridge National Laboratory Quality Assurance Manual (April 1974).
7. S. J. Ramos, B. A. Berven, and C. A. Little, Quality Assurance Program Plan for the Radiological Survey Activities (RASA) Program - Uranium Mill Tailings Remedial Action Project (UMTRAP) (May 1985).
8. T. E. Myrick, M. S. Blair, R. W. Doane, and W. A. Goldsmith, A Mobile Gamma-Ray Scanning System for Detecting Radiation Anomalies Associated with Ra-226 Bearing Materials, ORNL/TM-8475 (November 1982).

Procedures Manual as it is described in Sect. 1.6 (Use of the Manual) consists of three parts:

1. Introduction (Sections 1 and 2).
2. Planning Procedures (Sections 3 through 6).
3. Implementation Procedures (Sections 7 through 15).

The first and second sections (Introduction and Integrated Activity Description) provide descriptive and organizational information about the RASA/UMTRA Project and its functions, as well as a description of the use of this manual. The second and third parts (II and III) contain the procedures for planning and implementing the inclusion radiological surveys and evaluations made in support of the DOE's UMTRA Project.

1.4 QUALITY ASSURANCE POLICY STATEMENT

For projects involving activities such as those that are part of the RASA/UMTRA Project, it is the policy of Martin Marietta Energy Systems, Inc. to perform technical services in accordance with accepted quality assurance (QA) practices.

The RASA/UMTRA Project Manager is responsible for establishing QA policies, goals, and objectives for ensuring that the RASA/UMTRA Project is developed adequately and is properly implemented. The RASA/UMTRA QA Coordinator is responsible for conduct and surveillance of the QA program.

The planning and implementing procedures contained in this manual provide QA for documents, activities, materials, and equipment, and also provide for surveillance of the activities related to QA. Individuals using this Procedures Manual should be familiar with its QA provisions and consider that participation in the RASA/UMTRA project is governed by those provisions.

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1.5 TERMINOLOGY

The general information in Sections 1.5.1 (Definitions), 1.5.2 (Abbreviations), and 1.5.3 (Acronyms) is provided to clarify the use of various terms and symbols used in this manual. Where important to the understanding and use of particular procedures, some definitions are repeated in the sections describing specific procedures. Additional definitions, abbreviations, and acronyms pertinent to specific procedures are also provided as part of the description of these procedures, as necessary.

1.5.1 Definitions

AERIAL SURVEY. A search for sources of radiation by means of sensitive instruments mounted in a helicopter or airplane. Generally, the instrumentation records the intensity, location, and spectral analysis of the radiation field.

ALPHA PARTICLE (RADIATION). A helium nucleus consisting of 2 protons and 2 neutrons and having a double positive charge.

ANODE. A positive electrode; an electrode to which electrons or negative ions flow.

ANOMALY. Measured exposure rates which exceed an established background (normal) level.

ARCHIVED SAMPLES. Soil samples stored at RASA/UMTRA for future retrieval or final disposal.

SUBJECT: INTRODUCTION

ARITHMETIC MEAN. Average value; sum of the individual data values divided by the number of observations.

ARITHMETIC STANDARD DEVIATION. An index used to quantify the variation within a set of data according to the formula

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} ,$$

where

s = standard deviation,

x = individual observation,

$\bar{x}$ = arithmetic mean,

n = number of observations.

AUDIT. Investigation into the adequacy of and adherence to established procedures, instructions, specifications, codes, and other applicable contractual and procedural requirements and the effectiveness of implementation.

BACKGROUND RADIATION. Radiation arising from cosmic rays and natural radioactive sources indigenous to the region, area, or location under consideration.

BECQUEREL. The SI unit of the quantity of radioactive material associated with 1 dps (2.7027×10^{-11} Ci).

BETA PARTICLE. An elementary particle emitted from a nucleus during radioactive decay, having a single electrical charge and a mass equal to that of an electron.

BIASED SAMPLE/MEASUREMENT. Samples/measurements taken from a location where radiation levels or other site characteristics are unusual.

CALIBRATION. The activity of measuring, determining, or verifying the accuracy of measurement by a particular instrument or device in relation to a predetermined standard or reference.

CATHODE. A negative electrode; an electrode to which positive ions flow or from which electrons appear to originate.

CERTIFICATE OF COMPLIANCE. A written statement, signed by a qualified party, attesting that the items or services are in accordance with specified requirements and accompanied by additional information to substantiate the statement.

CERTIFICATION. The action of determining, verifying, and attesting in writing to the qualifications or validity of personnel, materials, or measurements.

CERTIFIED TEST REPORT. A written document, approved by a qualified party, that contains sufficient data and information to verify the actual properties of items and the results of all required tests.

CHARCOAL CANISTER. A modified U.S. Army M11 gas canister that uses activated charcoal for absorbing radon gases.

CONTAMINATION. The presence of unwanted radioactive matter.

SUBJECT: INTRODUCTION

CONVERSION FACTOR. A mathematically derived factor empirically determined that converts NaI crystal response to actual radiation exposure values.

NUMBER OF COUNTS (RADIATION MEASUREMENTS). The external indication by a device designed to enumerate ionizing events occurring within a given detector.

DAUGHTER PROGENY. A nuclide formed by the radioactive decay of another nuclide, which in this context is called the parent.

DESIGNATED SITES. Vicinity properties designated by the DOE for investigation by the UMTRA project.

DEVIATION. Written authorization to depart from a particular requirement.

DISINTEGRATION, NUCLEAR. A spontaneous nuclear transformation (radioactivity) characterized by the emission of energy and/or mass from the nucleus of an atom. When large numbers of nuclei are involved, the process is characterized by a definite half-life.

DISTANCE TRANSDUCER. An optical device for measuring the distance traveled by the ORNL/RASA UMTRA gamma scanning van.

DOCUMENTATION. Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

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DOVETAIL PROPERTIES. Public or private properties in the vicinity of candidate sites that are active under the Grand Junction Remedial Action Program and that may qualify for remedial action under the UMTRA project.

EFFICIENCY (COUNTERS). A measure of the probability that a nuclear disintegration will be detected when radiation is incident onto a detector.

ELECTRON VOLT. A unit equivalent to the amount of energy gained by an electron in passing through a potential difference of one volt (1.6×10^{-12} erg).

ENERGY DEPENDENCE. The characteristic response of a radiation detector (e.g., efficiency) over a given range of radiation energies.

EXPOSURE. A measure of the ionization produced in air by X or gamma radiation expressed in roentgens (R).

EXPOSURE RATE. Radiation exposure delivered per unit time, normally in roentgens per hour.

FIXED CONTAMINATION. Residual radioactive materials that cannot be easily removed from a surface by wiping the area.

GAMMA RADIATION. High-energy, short-wavelength electromagnetic radiation having a range of wave lengths from 10^{-9} to 10^{-12} cm, originating from an atomic nucleus.

GAMMA SCAN. A measure of the gamma radiation level of surfaces using a portable gamma scintillation survey meter.

GAMMA SCANNING VAN. The modified Dodge 300 van that contains and transports the mobile gamma scanning instrumentation.

GAMMA SCINTILLATOR. A crystal detector that emits visible light in proportion to the intensity of a gamma-ray field. The visible light is converted to an electric current by a photomultiplier tube.

GEIGER-MUELLER COUNTER. Highly sensitive, gas-filled radiation-measuring device that operates at voltages sufficiently high to produce multiple ionizations from each interaction with radiation.

GEOMETRIC MEAN. The exponential of the mean of the natural log of the values.

$$\bar{x}_g = \exp\left[\sum_i \ln \frac{x_i}{n}\right]$$

GEOMETRIC STANDARD DEVIATION. An index used to define the variability of data associated with the geometric mean:

$$s_g = \exp\left[\sqrt{\frac{\sum (\ln x_i)^2 - \frac{(\sum \ln x_i)^2}{n}}{n-1}}\right].$$

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HALF-LIFE, RADIOACTIVE. Time required for one-half of the radioactive atoms present to disintegrate.

HEALTH PHYSICS. That branch of radiological science dealing with the protection of man from harmful effects of ionizing radiation.

HOT SPOT. A surface area exhibiting above-average radiation levels.

INCLUSION SURVEY. A radiological survey conducted on a vicinity property to determine if mill tailings are present and whether the property should be recommended for inclusion for or exclusion from further consideration by the UMTRA Project.

INSPECTION. A phase of quality control by means of examination, observation, or measurement to determine the conformance of materials, supplies, components, parts, appurtenances, systems, processes or structures to predetermined requirements.

IONIZATION CHAMBER. An instrument that detects and measures ionizing radiation by measuring the electrical current that flows when radiation ionizes gas in a chamber, making the gas a conductor of the electricity.

IONIZING RADIATION. Any radiation (e.g., alpha, beta, or gamma) displacing electrons from atoms or molecules, thereby producing ions.

ISOTOPE. One of several nuclides of an element (hence having the same number protons and the same atomic number, that differ from one another in the number of neutrons and, therefore, mass number. Virtually identical chemical properties are exhibited by isotopes of a particular element.

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LETTER REPORT. A document, issued by ORNL/RASA UMTRA, which has a limited DOE and internal distribution. It is distinguished from an ORNL report in that only ORNL/RASA UMTRA Project Manager approval is required prior to submittal to DOE.

LINEAR AMPLIFIER. A pulse amplifier for which the output pulse height is proportional to an input pulse height for a given pulse shape, up to the point at which the amplifier overloads.

LOWER LIMIT OF DETECTION. Lowest level of system response that can be statistically differentiated from background.

LOW-LEVEL RADIATION. Radiation that is of such intensity or concentration that it poses a minimal health hazard.

MAXIMUM PERMISSIBLE CONCENTRATION. Values expressed in microcuries per milliliter that represent concentrations which, if maintained continuously, would result in the maximum permissible doses to the critical organs specified by ICRP.

MINIMUM DETECTABLE ACTIVITY. The lowest level of radioactivity that can be measured precisely using a particular device.

MOBILE GAMMA SCANNING. Gamma radiation monitoring of vicinity properties using the Mobile Gamma Scanning Van.

MULTICHANNEL ANALYZER. An electronic device for sorting successive signal pulses into parallel amplitude channels.

NATURALLY OCCURRING RADIONUCLIDES. Radionuclides and their associated daughter products produced during the formation of the earth or by interactions of matter with cosmic rays.

NOBLE GAS. Any of a group of rare gases, including helium, neon, argon, krypton, xenon, and sometimes radon, that exhibit great chemical stability and extremely low reaction rates. Also known as inert gas.

NUCLIDE. A general term referring to any nuclear species of the chemical elements that exists for a measurable time.

ORNL REPORT - TOPICAL. The ORNL topical report is the treatment of a single subject and is the most widely distributed of the reports produced at Oak Ridge National Laboratory. For ORNL/RASA UMTRA, it is usually a radiological survey report for a vicinity property site.

ORNL-TM REPORT. ORNL-TM documents contain preliminary technical information and are distributed both internally and externally. The information represented and the manner of presentation should be suitable for possible abstracting and indexing.

PARENT. A radionuclide that, upon radioactive decay or disintegration, yields a specific nuclide (the daughter progeny) either directly or as a later member of its radioactive series.

PERSONNEL MONITORING. Determination by either physical or biological measurement of the amount of ionizing radiation to which an individual has been exposed, such as by measuring the darkening of a film badge or performing an analysis on urine for specific radionuclides.

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PHOTOMECHANICAL TRANSFER (PMT). Technical method in which land survey measurements of a vicinity site are put into a functional field or base map utilized by a survey team.

PHOTOPEAK. In an energy spectrum of a NAI(Tl) crystal detector, the pulse-height peak resulting from photoelectric effects from the interaction of the detector with gamma rays.

PRESSURIZED ION CHAMBER. A pressurized ionization chamber, or ion chamber, is a detector that collects ion pairs formed by the interaction of radiation with high-pressure gases within the chamber.

PRIME CONTRACTOR. A contractor having a direct contract for an entire project and who may, in turn, assign portions of the work to subcontractors.

PROCEDURE. A document that specifies or describes how an activity is to be performed. It may include methods to be employed, equipment or materials to be used, and sequence of operations.

PROCESSING SITE. As defined in public Law 95-604, Section 101 (6), (1) any site, including the mill, containing residual radioactive materials, at which all or substantially all of the uranium was produced for sale to any Federal agency prior to January 1, 1971, under a contract with any Federal agency, except in the case of a site at or near Slick Rock, Colorado, unless (a) such site was owned or controlled as of January 1, 1978, or is thereafter owned or controlled by any Federal agency or (b) a license (issued by the Nuclear Regulatory Commission or its predecessor agency under the Atomic Energy Act of 1954 or by a

SUBJECT: INTRODUCTION

State as permitted under Section 274 of such Act) for the production at such site of any uranium or thorium product derived from ores was in effect on January 1, 1978, or was issued or renewed after such date and (2) any other real property or improvement thereon which (a) is in the vicinity of such site and (b) is determined by the Secretary of Energy, in consultation with the Nuclear Regulatory Commission, to be contaminated with residual radioactive materials derived from such site.

PROCUREMENT DOCUMENTS. Contractually binding documents that identify and define the requirements that items or services must meet to be considered acceptable by the purchaser.

PROGENY. Descendants; used to mean the product of radioactive decay of an element; a nuclide remaining after radioactive decay.

PULSE HEIGHT SELECTOR. A circuit designed to select and pass voltage pulses in a certain range of amplitudes.

PURCHASE ORDER. A legal document binding the vendor and purchaser to the specified terms of the agreement, including, but not limited to, quantity, quality, delivery, and price.

PURCHASER. The organization or organizations responsible for issuance and administration of a contract.

QUALIFIED PROCEDURE. A procedure that incorporates all applicable codes and standards, operating parameters, and engineering specifications and has been proven adequate for its intended purpose.

QUALITY ASSURANCE. Those planned and systematic actions necessary to provide adequate confidence that an item or a facility will perform satisfactorily in service, including those actions that provide a means of controlling, calibrating, and measuring the characteristics of an item or process to established requirements.

RADIATION. The emission and propagation of energy through matter or space by means of electromagnetic disturbances that display both wave-like and particle-like behavior; in this context, the "particles" are known as photons. Also, refers to the energy so propagated. The term has been extended to include streams of fast-moving particles (alpha and beta particles, free neutrons, cosmic radiation, etc.). Nuclear radiation is emitted from atomic nuclei in various nuclear reactions, including alpha, beta, and gamma radiation and neutrons.

RADIATION MONITORING. Continuous or periodic determination of the amount of radiation present in a given area.

RADIATION PROTECTION GUIDELINE. The officially determined radiation doses not to be exceeded without careful consideration. These standards are equivalent to what was formerly called the maximum permissible dose or maximum permissible exposure.

RADIATION SOURCE. Usually, a man-made, sealed source of radioactivity used in calibrations, in teletherapy, in radiography, as a power source for batteries, or in various types of industrial gauges. Typical sources are thorium, cesium, potassium, and radium. Machines such as accelerators, and radioisotopic generators, and natural radionuclides may also be considered sources.

RADIATION STANDARDS. Exposure standards, permissible concentrations, rules for safe handling, regulations for transportation, regulations for industrial control of radiation, and control of radiation exposure by legislative means.

RADIOACTIVITY. The property of some elements to spontaneously emit alpha, beta, or gamma rays by the disintegration of the nuclei of atoms.

RADIOISOTOPE. A radioactive isotope; an unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. More than 1300 natural and artificial radioisotopes have been identified.

RADIOLOGICAL SURVEY. The process of measuring the various radiation levels associated with a specified site and the proper documentation and evaluation of the data.

RADIONUCLIDE. Any radioactive species of atom that exists for a measurable length of time. Individual radionuclides are distinguished by their atomic weight and atomic number.

RADIUM. A naturally occurring radionuclide having the atomic number 88.

RADON. The heaviest element of the noble gas group that is produced as a gaseous emanation from the radioactive decay of radium. Its atomic number is 86. All isotopes are radioactive. The isotope Rn-222 has a half-life of 3.82.

RADON FLUX. The number of radon atoms migrating across a unit area within a specified time.

RANDOM SAMPLE/MEASUREMENT. Samples/measurements taken in which no specific consideration is given to the exact sampling/measurement location.

REMEDIAL ACTION. The activity of removing radioactive material or otherwise decontaminating candidate sites or vicinity properties.

REMEDIAL ACTION SITE. As defined in the Residual Radioactive Material Control Act, (1) a site at which remedial action is required and which was used under a contract with any predecessor of the Department of Energy, including the Manhattan Engineer District and Atomic Energy Commission for researching, developing, manufacturing, fabricating, testing, processing, sampling, or storing radioactive material, except a site (a) for which a license (issued by the Nuclear Regulatory Commission or its predecessor agency under the Atomic Energy Act of 1954, or by a State under Section 274 of that Act) for the production or possession at the site of uranium or thorium, their daughter products, including radium, is in effect on the date of enactment of the Residual Radioactive Material Control Act, or is issued or renewed after that date or (b) owned or leased by the Federal Government on or after the date of enactment of the Residual Radioactive Material Control Act and (2) any other location the Secretary of Energy or his designee determines to require remedial action due to contamination with residual radioactive material derived from a site meeting the criteria of part (1) of this definition.

REPORT. A document that gives information for record purposes.

RESIDUAL RADIOACTIVE MATERIAL. Material (including but not limited to waste material, soils, rocks, plants, shrubs, personal property, and building materials) present at a site that results in radiation levels that exceed background levels.

RESIDUE. Material that remains after some fraction is removed.

RESTRICTED USE. A designation following remedial action that requires some control on the activities at a site containing radioactive material.

ROENTGEN. The quantity of X or gamma radiation that will produce (in 2.58×10^{-4} coulomb per kilogram of air at standard temperature and pressure) ions carrying one electrostatic unit of electricity of either sign.

SCATTERED RADIATION. Radiation which, during its passage through a substance, has been modified in direction and, usually, in energy.

SCINTILLATION COUNTER. The combination of phosphors, photomultiplier tube, and associated circuits for counting light emissions produced in the phosphors by incident ionizing radiation (also called a scintillometer).

SHIELDING. A phenomenon in which the gamma radiation is attenuated by a structure such as concrete or asphalt.

SITE LOG BOOK. May be either a field data, radon data, or scanning van log book.

SODIUM IODIDE DETECTOR. A detector that uses a sodium iodide (thallium activated) crystal for detecting gamma rays.

SPECIFIC ACTIVITY. The total radioactivity or that attributable to an identified nuclide per gram of specified material.

SPECIFICATION. A concise set of requirements to be satisfied by a product, material, or process; indicating, whenever appropriate, the procedure by which satisfaction of the requirements may be determined.

SPECTRUM. A visual display, photographic record, or plot of the distribution of the intensity of a given type of radiation as a function of its wavelength, energy, frequency, momentum, mass, or any related quantity.

STANDARD. The result of a particular standardization effort approved by a recognized authority.

SUBCONTRACTOR. A manufacturer or organization that receives a contract from a prime contractor for a portion of the work on a project.

SUBSURFACE SOIL SAMPLE. Soil sample taken from deeper than 15 cm below the soil surface level.

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SURFACE SOIL SAMPLE. Soil sample taken from the first 15 cm of surface soil.

SURVEY METER. Any portable radiation detecting instrument especially adapted for surveying or inspecting an area to establish the existence of radioactive material.

SURVEY PLAN. A radiological survey plan for determining the radiological characteristics of a specific site.

SYSTEMATIC SAMPLE/MEASUREMENT. Samples/measurements taken under a definite method or plan.

TAILINGS. As defined in Public Law 95-604, Section 101(8), the term "tailings" means the remaining portion of a metal-bearing ore after some or all of such metal, such as uranium, has been extracted.

THORIUM. A naturally radioactive element having atomic number 90 and, as found in nature, an atomic weight of approximately 232. The ^{232}Th isotope is abundant and can be transmuted to fissionable ^{232}U by neutron irradiation.

TITLE I ENGINEERING. The phase of engineering associated with planning, evaluating, and scheduling.

TITLE II ENGINEERING. The phase of engineering associated with more detailed activities such as drawings, specifications tests, and calculations.

TRANSFERABLE CONTAMINATION. Radioactive contamination that can be transferred by contact with the contaminated object.

TURKEY BAG. Large plastic bag used to package all individual soil sample bags for one property together for transport to the soil preparation trailer.

UNRESTRICTED USE. Any use without restraint on ownership, occupancy, or land development.

URANIUM. A radioactive element having the atomic number 92 and, as found in natural ores, an average atomic weight of approximately 238. The two principal natural isotopes are ^{235}U (0.7 % of natural uranium) and ^{238}U (99.3 % of natural uranium). Natural uranium also includes a minute amount of ^{234}U. Uranium is the basic raw material of nuclear energy.

URANIUM MILL TAILINGS SITE. A site used in the handling, processing, or storage of uranium ores and their residues.

VERIFICATION. A documented act of confirming, substantiating, and assuring that an activity or condition has been implemented in conformance with the specified requirements.

VICINITY PROPERTIES. Public or private properties in the vicinity of candidate sites in the ORNL/RASA UMTRA program.

WORKING LEVEL. Any combination of short-lived ^{222}Rn progeny in 1 L of air such that the ultimate emission of alpha particle energy is 1.3×10^5 MeV.

X RADIATION. Electromagnetic radiation having wavelengths shorter than those of visible or ultraviolet light and originating from electron energy level transfers outside the nucleus of an atom.

1.5.2 Abbreviations

Standard prefixes may be used with unit abbreviations.

m	milli	10^{-3}	k	kilo	10^{3}
μ	micro	10^{-6}	M	mega	10^{6}
n	nano	10^{-9}	G	giga	10^{9}
p	pico	10^{-12}	T	tera	10^{12}
f	femto	10^{-15}	P	peta	10^{15}
a	atto	10^{-18}	E	exa	10^{18}

Other standard abbreviations are:

alpha	α	gram	g
becquerel	Bq	gray	Gy
beta	B	hectare	ha
centigrade	C	hour	h
counts per minute	cpm	inches	in.
cubic feet	ft^3	liter	L
cubic meters	m^3	meter	m

curie	Ci	metric ton	MT
disintegrations per minute	dpm	minute	min
electron volt	eV	roentgen	R
feet	ft	second	s
gamma	γ	working level	WL

1.5.3 Acronyms

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ALO	DOE Albuquerque Operations Office
ANSI	American National Standards Institute
BFEC	Bendix Field Engineering Corporation
CDH	Colorado Department of Health
DABTS	Dosimetry and Biophysical Transport Section
DOE	Department of Energy
EPA	Environmental Protection Agency
GJRAP	Grand Junction Remedial Action Program
GM	Geiger-Mueller

SUBJECT: INTRODUCTION

HASRD	Health and Safety Research Division
HIG	highest indoor gamma radiation level
HOG	highest outdoor gamma radiation level
ICRP	International Commission on Radiological Protection
ISC	Inclusion Survey Contractor
LLD	lower limit of detection
MDA	minimum detectable activity
MPC	maximum permissible concentration
NaI	sodium iodide
NBL	New Brunswick Laboratory
NBS	National Bureau of Standards
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory

ORO DOE Oak Ridge Operations Office

PIC pressurized ion chamber

PMT photomechanical transfer (field drawing or base map)

QA quality assurance

QAPP RASA/UMTRA Quality Assurance Program Plan

RAC Remedial Action Contractor

RASA Radiological Survey Activities

TAC Technical Assistance Contractor

UMTRAP Uranium Mill Tailings Remedial Action Program

UMTRA/PO Uranium Mill Tailings Remedial Action Project Office

VPMIM Vicinity Properties Management and Implementation Plan

VPDMS Vicinity Property Data Management System

1.6 USE OF MANUAL

This Procedures Manual describes the functions and procedures used by the RASA/UMTRA group in support of the DOE's UMTRA Project. The format and arrangement of the Manual was selected to facilitate its use and the incorporation of revisions as may be required. The Manual is intended for use as a reference for all operations related to the RASA/UMTRA project, and, from time to time, as a training manual.

To ensure the integrity of the Manual, individual procedures or sections should not be removed or used out of context. The Manual is intended for use as a complete entity to assure consistency in the radiological measurements and to enhance their credibility. To this end, copies of the Manual are provided at all appropriate work stations, as well as to individuals having significant responsibilities in the implementation of the RAA/UMTRA project operations.

The RASA/UMTRA Procedures Manual consists of 15 sections, each containing one or more subsections, and an Appendix. Section 1 defines the purpose, scope, and use of the Manual and contains a policy statement on Quality Assurance. For convenience, Section 1 also defines and lists the more common terms, abbreviations, and acronyms used in this Manual. Section 2 provides background information on the administration and functions of the RASA/UMTRA project. Both of these sections should be reviewed in the course of any orientation or training program.

Sections 3 through 6 are planning sections that are intended to provide procedural guidance in the planning and administration of the activities of the RASA/UMTRA project. Normally, the ORNL Project Manager receives word that a property has been designated for an inclusion survey and initiates the procedures described in Section 3 for initiating, conducting, and reporting the results of the survey. (Most of the properties designated for inclusion surveys have already been identified, but new properties are added occasionally.) Preparations for the inclusion survey, Section 7, would then commence. Section 4 provides general guidance for identification and planning of subcontract functions as required, and Section 5 provides the basis for the RASA/UMTRA Quality Assurance Program.

The remaining sections (7 through 15) are intended primarily for use by appropriate staff members in the performance of specific assignments. Each of these sections contains individual procedures that detail the specific activities or measurements performed by the RASA/UMTRA group. Appendix A contains details of the procedures used by the Bendix Field Engineering Corporation to calibrate the pressurized ion chambers and the portable gamma scintillation detectors used by the RASA/UMTRA group.

SECTION 2: INTEGRATED ACTIVITY DESCRIPTION

SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

2. INTEGRATED ACTIVITY DESCRIPTION

2.1 RASA/UMTRA PROJECT ADMINISTRATION

This section describes the organizational structures that have been developed to administer the RASA/UMTRA project.

Primary responsibility for administration of the DOE's UMTRA Project has been assigned to the UMTRA Project Office (UMTRA-PO) of the Albuquerque Operations Office (ALO) by the Division of Remedial Action Programs at DOE headquarters, which reports to the Assistant Secretary for Nuclear Energy. The UMTRA-PO coordinates and controls the activities of the project participants--the Technical Assistance Contractor (TAC), the two Remedial Action Contractors (RACs), and the Inclusion Survey Contractor (ISC). Former administration of the activities of the ISC is coordinated through the Oak Ridge Operations Office (ORO) which interacts directly with the ISC's administrative organization. Exhibit 2.1-1 illustrates the general administrative and reporting structures developed for the DOE's UMTRA Project. Exhibit 2.1-2 illustrates the detailed administrative and reporting structures for the ISC.

The TAC assists the UMTRA-PO in the technical development, planning, and monitoring of the UMTRA Project remedial action activities. With regard to the the activities of the ISC, the TAC is responsible for development and maintenance of the Vicinity Property Data Management System (VPDMS), for assignment of property identification numbers (except for Grand Junction property owners with multiple properties), and for coordination of all vicinity properties public information and participation activities.

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

The duties of the ISC are to determine if designated properties (properties suspected of being contaminated with radioactive material from one or more of the 24 inactive uranium mills covered by the DOE's UMTRA Project) contain sufficient quantities of radioactive material to require remedial action. A formal recommendation is made that the properties either be included in plans for remedial action or be excluded from such plans. The ISC for the DOE's UMTRA Project is the RASA/UMTRA group. This group is part of the RASA group of the Dosimetry and Biophysical Transport Section (DABTS) of the Health and Safety Research Division (HASRD) at the Oak Ridge National Laboratory (ORNL), which is operated for the DOE by Martin Marietta Energy Systems, Inc.

There are two RACs in the UMTRA Project - Morrison-Knudson and Bendix Field Engineering Corporation (BFEC). The RAC receives the Inclusion Survey Reports for properties which the DOE agrees should be included for remedial action. A remedial engineering assessment (REA) is performed to obtain in-depth radiological measurements to be used to develop a bid package or scope of work needed to clean up a property. Properties which are candidates for cleanup are then advertised for bid to private subcontractors, the contracts are awarded, and the work commences. The RAC supervises and inspects the work while under progress, and the Colorado Department of Health then conducts a final inspection to ascertain whether the property should be "certified" as having no level of radiation above EPA standards.

The organizational structure for administrative reporting to the DOE (see Exhibit 2.1-2) includes the RASA/UMTRA Project Manager, the RASA Program Manager, the DABTS Section Head, the HASRD Division Director, the ORNL Associate Director for Biomedical and Environmental Sciences, and the ORNL Laboratory Director. This structure is used to submit formal RASA/UMTRA reports and documents, to procure material items and subcontractor services, and to obtain support services as necessary from other ORNL divisions for conduct of the RASA/UMTRA Project. The legal control point for obtaining subcontractor services, material items, and support from other ORNL divisions is the HASRD Division Director.

The organizational structure for financial reporting to the DOE includes the RASA/UMTRA Project Manager, the RASA Program Manager, the DABTS Section Head, the HASRD Division Director, the Nuclear and Chemical Waste Programs Office Manager, Associate Director for Nuclear and Engineering Technologies, and the ORNL Laboratory Director (see Exhibit 2.1-3). This structure is used to report all budgetary information.

The structure for programmatic reporting to DOE is directly from the RASA Program Manager and the RASA/UMTRA Project Manager to the DOE UMTRA-PO. This structure facilitates submittal of inclusion survey reports and recommendations, information RASA/UMTRA reports and documents, and progress reports.

The support/subcontract organizations indicated in Exhibit 2.1-4 provide the services required to support the RASA/UMTRA project activities. Support may be received from various ORNL divisions, the Bendix Field Engineering Corporation in Grand Junction, the Oak Ridge Associated Universities, Colorado State University, two engineering/drafting firms, and a title company. Sections 4 and 14 describe in detail the specific services provided and the procurement and administration of such. Once a service/subcontract is established, the RASA/UMTRA Project Manager coordinates the specific work requirements needed to accomplish project goals.

2.2 RASA/UMTRA PROJECT PROGRAMMATIC ORGANIZATION AND ACTIVITIES

This section describes the project-oriented organization and activities of the RASA/UMTRA group as they are conducted in support of the DOE UMTRA project.

The RASA/UMTRA project involves ten major activities:

1. Reviewing existing data on designated properties;
2. Conducting mobile gamma scanning surveys of vicinity properties, as required;
3. Confirming property loctions, ownership, and tenancy;
4. Obtaining consents-for-access to designated properties;
5. Preparing base maps (property sketches) of accessible properties;
6. Conducting inclusion surveys of accessible designated properties;
7. Analyzing and storing soil samples taken during the inclusion surveys;
8. Preparing and reviewing the inclusion survey report;
9. Reporting inclusion survey findings and inclusion recommendations to the DOE/UMTRA-PO; and
10. Maintaining and transferring, as appropriate, all data on designated and surveyed properties.

The sequence for conducting RASA/UMTRA project activities is illustrated in Exhibit 2.2-1. The DOE UMTRA-PO designates each vicinity property that is to be investigated by the ISC. For a property that has been surveyed by another organization, the UMTRA-PO may request that previously obtained measurements be validated by a mobile gamma scanning survey. If evidence sufficient to make an inclusion or exclusion recommendation cannot be obtained from data existing in the VPDMS or from data obtained during the mobile scanning survey, the activities required to conduct and to report the results of an inclusion survey are initiated.

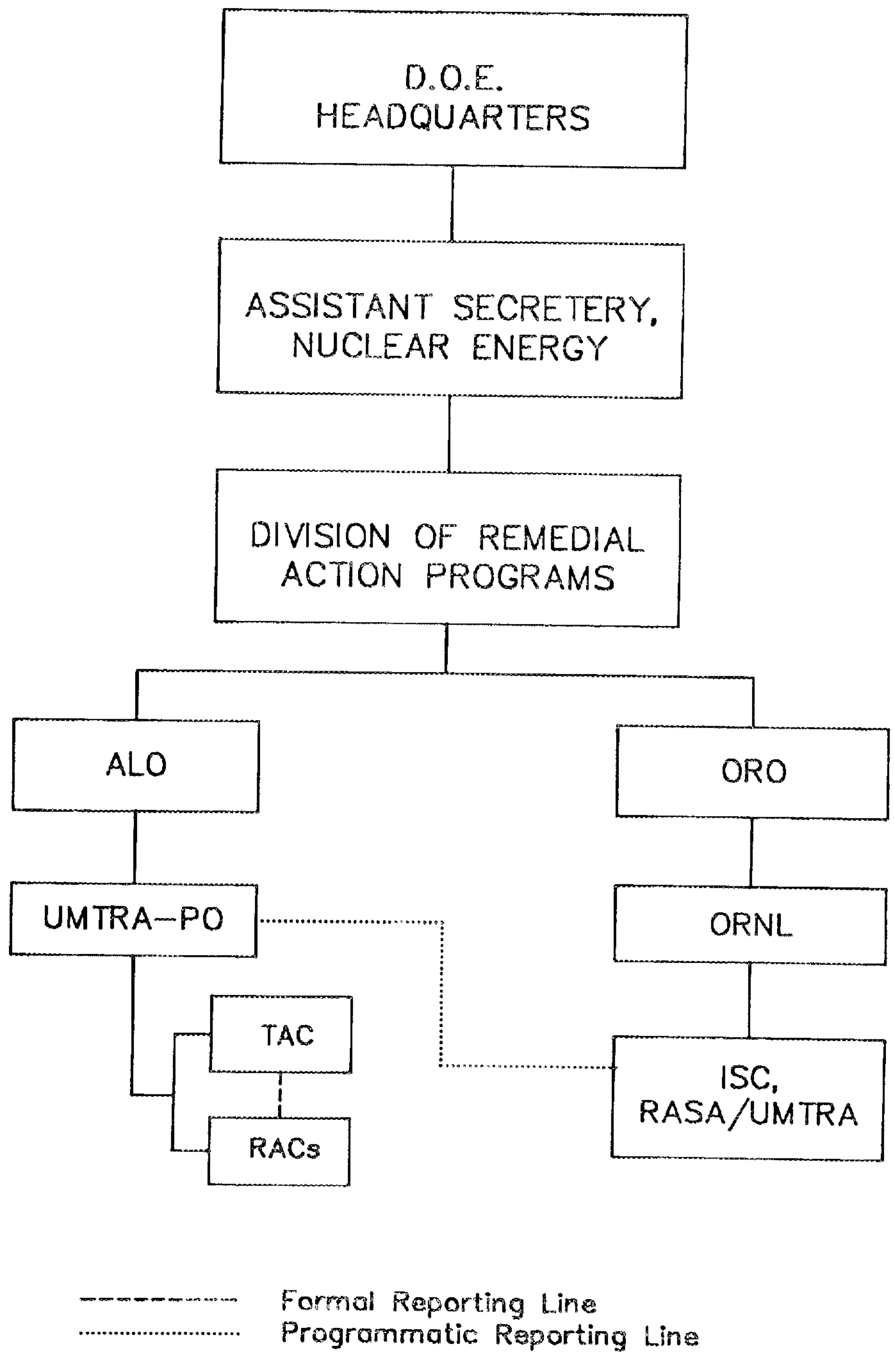
SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Assigned activities are performed by the RASA/UMTRA group with support from other ORNL divisions and from subcontractor personnel. In the programmatic organization, the ORNL/RASA Program Manager is the primary interface between ORNL and DOE management (see Exhibit 2.1-2). The RASA/UMTRA Project Manager, who reports to the RASA Program Manager, organizes the assigned work; coordinates and schedules the survey, analysis, and reporting activities; assigns personnel; and provides for programmatic reporting of the RASA/UMTRA activities to the RASA Program Manager and to the UMTRA-PO. The RASA/UMTRA Project Manager is assisted by an administrative secretry and various support personnel (the Data Management, Quality Assurance, Purchasing, Mobile Survey Coordinators, a Technical Assistant, and an Electronics Technician) and operating personnel (the Public Relations and Graphics Coordinators, and a Survey Manager). The Survey Manager coordinates the activities of the Process and Sample Coordinators and the Field Survey Team Leaders. The Process Coordinator, under direction of the Survey Manager, is responsible for scheduling surveys to be performed by each team, and also serves as a liaison between the functional groups and management. The reporting lines are shown in Exhibit 2.2-2.

The generic RASA/UMTRA project functions that are performed by RASA/UMTRA personnel are listed in Exhibit 2.2-3. RASA/UMTRA personnel are appropriately trained to perform one or more of the specified functions. The staff positions identified as necessary to perform the project management, support, and survey activities are listed in Exhibit 2.2-4. The public relations, graphics, and soil sample analysis staff work on all assigned properties. Field survey teams are assigned specific properties.

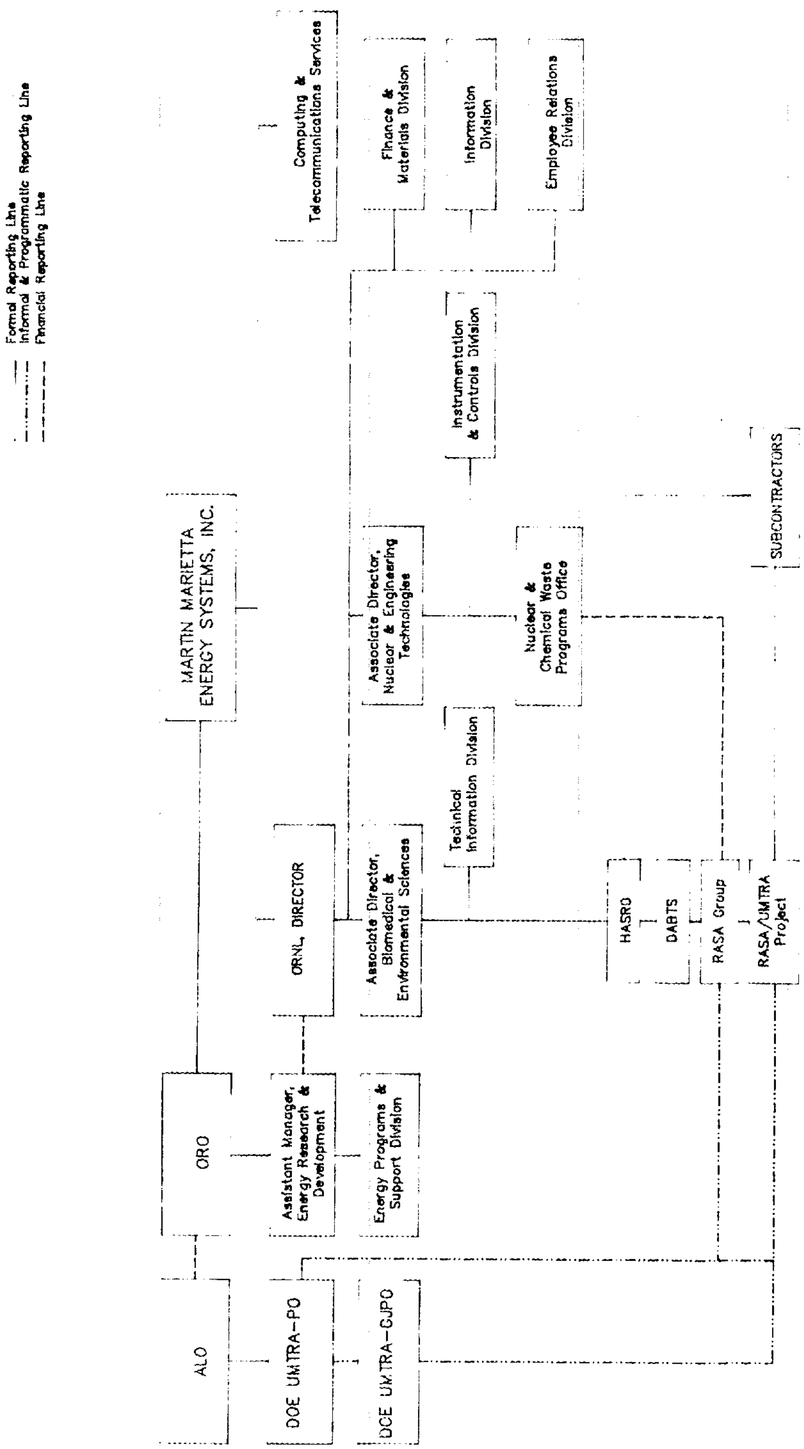
SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.-1. DOE UMTRA project administration



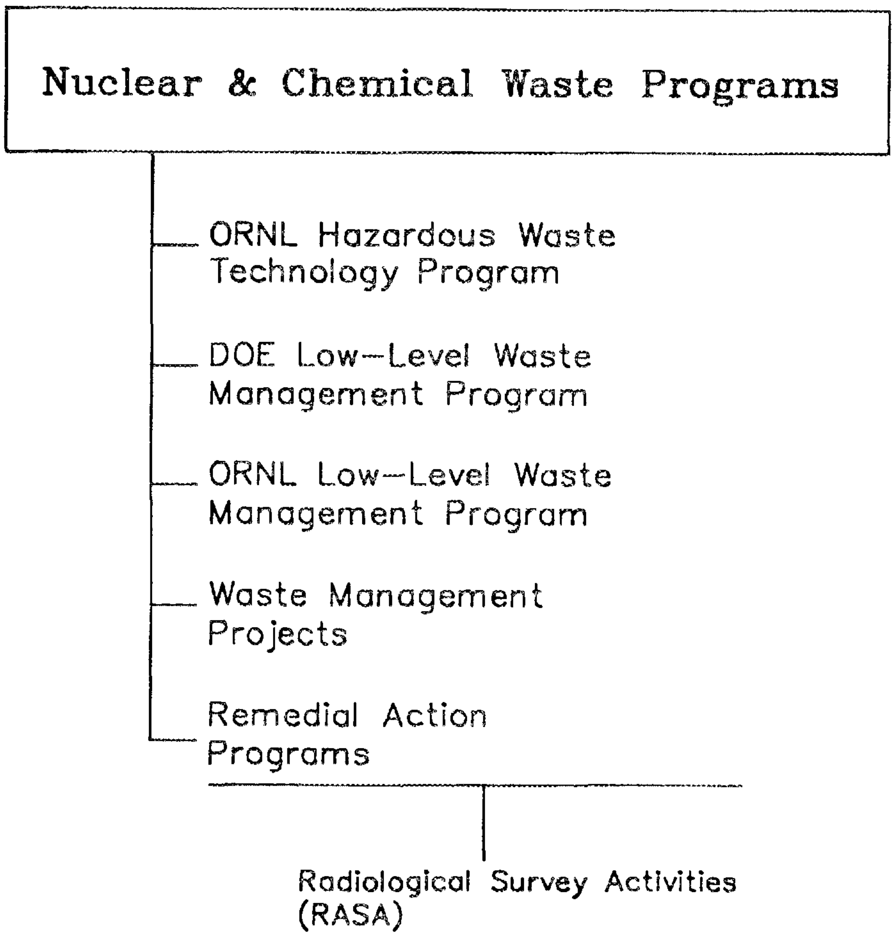
SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 2.1-2. RASA/UMTRA project administration



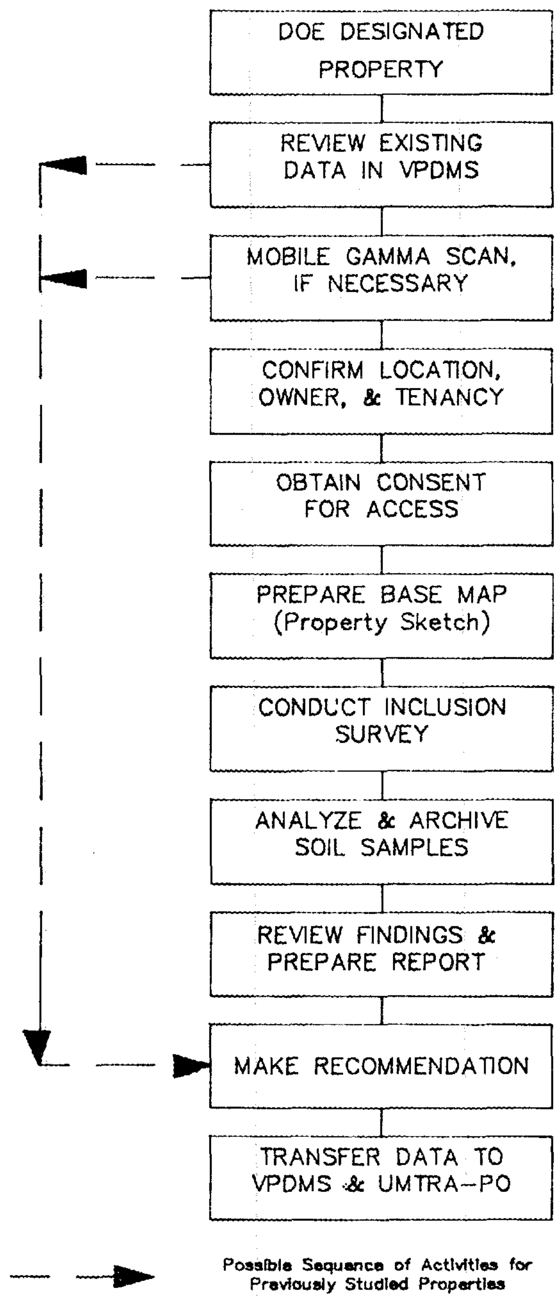
SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.1-3. Financial reporting organizational structure



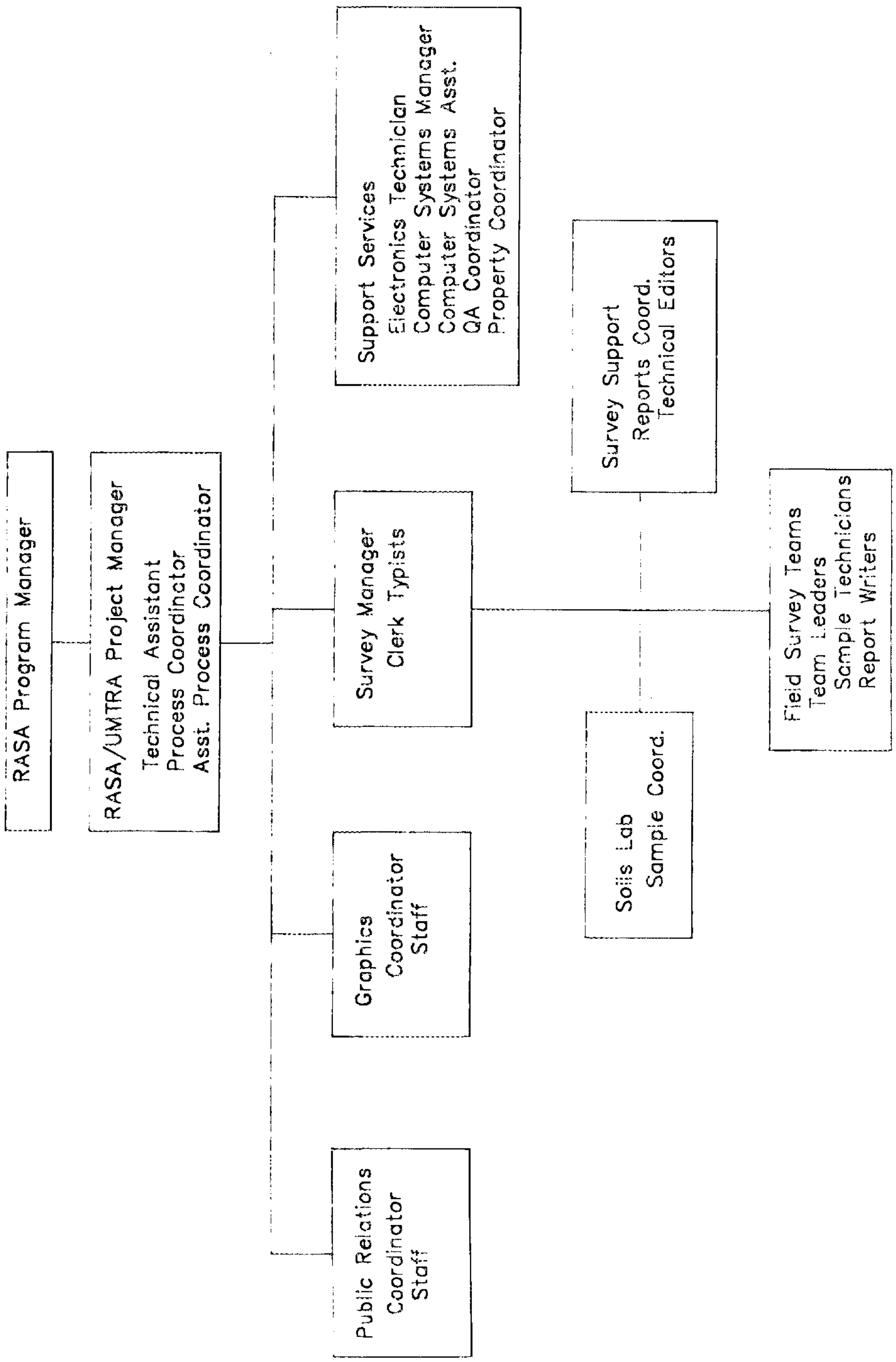
SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.2-1. Sequence of RASA/UMTRA project activities



SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.2-2. RASA/UMTRA project organizational chart



SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.2-3

GENERIC RASA/UMTRA PROJECT PROGRAMMATIC FUNCTIONS

Program Management and Office Operations

RASA/UMTRA Project Management

RASA/UMTRA Office Operations

Subcontract Direction and Management

Records Management

- Environmental Samples
- Survey Records and Archives
- Photographic Files
- Equipment Inventory, Files, and Maintenance
- Administrative Records
- Property Data

Personnel Safety and Training

Project Quality Assurance

Calibration Source Maintenance and Records

Portable Survey Instrument Maintenance

Mobile Scanning Van Maintenance

Field Survey Van Maintenance

Survey Operations

Property Location and Description

Consent For Access Acquisition

Mobile Scanning Van Coordination

Survey Team Leadership

Property Survey Planning

SUBJECT: INTEGRATED ACTIVITY DESCRIPTION

Exhibit 2.2-3 (Continued)

Radiological Measurements Collection and Reporting

Soil Samples Collection, Preparation, Analysis, and Reporting

Radon Daughters Measurement and Reporting

Graphics Preparation and Survey Report Writing

Report Review

Report Transmittal to DOE

Exhibit 2.2-4

RASA/UMTRA PROJECT STAFF POSITIONS*

Project Manager

Technical Assistant

Administrative Secretary

Survey Manager

Clerk/Typist

Secretary

Public Relations Coordinator

Public Relations Staff

Graphics Coordinator

Graphics Staff

Sample Coordinator

Process Coordinator

Assistant Process Coordinator

Technical Editor

Field Survey Team Leader

Sample Technician

Reports Technician

Quality Assurance Coordinator

Computer System Manager

Computer System Staff

Property Coordinator

Electronics Technician

*Some of these positions or facilities may be fulfilled by people in the Oak Ridge, Tennessee, ORNL office.

SECTION 3: PROGRAM ADMINISTRATION

SUBJECT: PROGRAM ADMINISTRATION

3. PROGRAM ADMINISTRATION

3.1 PURPOSE

The purpose of this procedure is to provide information relevant to the management of the RASA/UMTRA Project.

3.2 APPLICABILITY

This procedure applies to all activities of the RASA/UMTRA Project.

3.3 REFERENCES

None.

3.4 DEFINITIONS AND ABBREVIATIONS

See Section 1.5 of this manual, Terminology.

3.5 RESPONSIBILITIES

1. The ORNL/RASA Program Manager is responsible for the implementation of this procedure and for overall management of the RASA/UMTRA Project.
2. The RASA/UMTRA Project Manager is responsible for management of the specific activities performed under the RASA/UMTRA Project. The Project Manager delegates responsibility for conducting specific activities to various support and operating coordinators, and assists the Program Manager in overall project management.

APPROVED: Craig Little DATE: 4/14/86
RASA/UMTRA Project Manager

SUBJECT: PROGRAM ADMINISTRATION

3.6 PROCEDURE

3.6.1 RASA Program Manager

The RASA Program Manager is responsible for the overall management of the RASA/UMTRA Project. Management activities include:

1. Assigning the RASA/UMTRA Project Manager,
2. Setting overall priority and milestone schedule for performing the project,
3. Establishing and controlling the project budget,
4. Approving personnel acquisition and levels,
5. Preparing monthly reports to DOE concerning project activities,
6. Reviewing and approving all project-related reports prior to submission to DOE,
7. Setting project priority and time constraints in conjunction with DOE, and
8. Controlling use of ORNL support divisions and subcontractor personnel.

3.6.2 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager has the primary responsibility for project management at the Grand Junction office. Management activities include:

1. Reviewing site-related historical records to assist in estimating the size of the project; the information is used to determine subcontractor requirements, survey team size, and survey planning and scheduling according to the procedures of Sect. 7.1, Identification of Properties to be Surveyed;

2. Defining project requirements including manpower, equipment, subcontractors, and time constraints;
3. Establishing project schedule within time constraints imposed by DOE through the ORNL/RASA Program Manager, including subcontractor scheduling to effect a timely interface between subcontractor and survey team activities according to the procedure of Sect. 6.1, Project Organization and Scheduling;
4. Preparing Mobile Scanning Survey Plan (if applicable) according to the procedure of Sect. 8.1, Preparation of Mobile Gamma Scanning Survey Plan;
5. Identifying support function requirements according to the procedure of Sect. 4.1, Identification and Planning of Support Functions, including activities involving ORAU and preparation of necessary purchase orders and other documents;
6. Identifying quality assurance requirements and preparing quality assurance plans according to the procedure of Sect. 5.1, Quality Assurance Planning;
7. Generating all plans and reports pertinent to the assigned project according to the procedure of Sect. 6.4, Reports and Papers;
8. Planning and coordinating all field activities and task assignments for the project; and
9. Selecting survey team members based on project requirements, specific individual expertise, and the availability of ORNL/RASA and subcontractor personnel.

The chronological order of activities involving project management are illustrated in Exhibit 2.2-1, Sequence of RASA/UMTRA Project Activities.

SUBJECT: PROGRAM ADMINISTRATION

3.7 EXHIBITS

None.

3.8 REVISION HISTORY

Rev. 1	Date: 03/31/86	First Revision

SECTION 4: SUBCONTRACT PLANNING

SUBJECT: SUBCONTRACT PLANNING

4. SUBCONTRACT PLANNING

4.1 PURPOSE

The purpose of this procedure is to provide guidance for planning support functions for the RASA/UMTRA project.

4.2 APPLICABILITY

This procedure applies to all planning for subcontractor support function activities in support of the RASA/UMTRA project.

4.3 REFERENCES

1. Sect. 14, Subcontract Services and Administration

4.4 DEFINITIONS AND ABBREVIATIONS

4.4.1 Definitions

1. Subcontractor. A manufacturer or organization that receives a contract from a prime contractor for a portion of the work on the project. For purposes of this procedure, the prime contractor shall be identified as Martin Marietta Energy Systems.
2. Also see Sect. 1.5 of this manual, Terminology.

4.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

4.5 RESPONSIBILITIES

The RASA Program Manager and the RASA/UMTRA Project Manager are responsible for implementation of this procedure.

4.6 PROCEDURE

4.6.1 RASA Program Manager or RASA/UMTRA Project Manager

The RASA Program Manager or the RASA/UMTRA Project Manager shall prepare and integrate this procedure into the RASA/UMTRA project. To successfully conduct the RASA/UMTRA project, subcontractors are needed to assist RASA/UMTRA in various capacities, and at various times and sites. Either alone or together, the RASA Program Manager and/or the RASA/UMTRA Project Manager will determine when subcontractor services are required. When needed, they shall select from the following services:

1. Industrial cleaners - used for clearing and cleaning building prior to indoor survey
2. Landscape maintenance - used for clearing vegetation and rubble before the outdoor survey
3. Surveyors - establishment of property lines and preparing base maps
4. Construction contractors - used for earth and large debris removal (i.e., backhoe, caterpillar, front-end loader, etc.) for personnel access for surveys
5. Drilling and auger contractors - provide drilling services for subsurface sampling, including augering and continuous core sampling
6. Technical support - used for obtaining technicians and professional radiological health personnel for support in the radiological survey, and to provide property title research as needed
7. Aerial or ground-level photography - used for obtaining photographs of sites or vicinity properties to document sites or site usage

SUBJECT: SUBCONTRACT PLANNING

8. Videotaping support - used for providing training or documentary video tapes for administrative or training purposes
9. Training - used to provide technical training of RASA/UMTRA personnel

4.6.2 Identification of Required Procedures

Based on the needs determined by the RASA Program manager or RASA/UMTRA Project Manager, the RASA Program Manager, or his authorized agent will prepare a subcontract in a manner described under procedure 14.1, Procurement of Services and Equipment; Procedure 14.2, Administration of Subcontracts; and Procedure 14.3, Subcontractor Reporting, for each subcontractor. Whenever possible, at least one month lead time will be allowed between the time the subcontract requirements are submitted to Martin Marietta Energy Systems Purchasing Division and the time frame needed for subcontractor work implementation.

4.6.3 Wage Scale Information

The RASA Program Manager is responsible for submitting a request to Martin Marietta Energy Systems Purchasing Division to annually obtain the wage scales in parts of the country where survey work is expected to be accomplished.

4.7 EXHIBITS

None.

4.8 REVISION HISTORY

Rev. 1	Date: 03/31/86	First Revision

SECTION 5: QUALITY ASSURANCE PLANNING

SUBJECT: QUALITY ASSURANCE PLANNING

5. QUALITY ASSURANCE PLANNING

5.1 PURPOSE

The purpose of this procedure is to describe the integration of QA requirements into the planning and performance of site survey activities.

5.2 APPLICABILITY

This procedure applies to all activities of the RASA/UMTRA Project.

5.3 REFERENCES

1. Sect. 4.1, Identification and Planning of Subcontract Functions
2. Sect. 7. Pre-inclusion Survey Activities
3. Sect. 8.1, Preparation of Mobile Gamma Scanning Survey Plan
4. Sect. 15, QA Procedures
5. Actual implementation procedures in Sections 9-14.

5.4 DEFINITIONS AND ABBREVIATIONS

See Sect. 1.5 of this manual, Terminology.

5.5 RESPONSIBILITIES

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

5.5.1 RASA Program Manager

The RASA Program Manager has overall responsibility for QA planning. He is assisted in fulfilling this responsibility by the RASA/UMTRA QA coordinator.

5.5.2 RASA/UMTRA QA Coordinator

The RASA/UMTRA QA Coordinator is responsible for reviewing and monitoring all plans and activities developed in accordance with procedures identified in Section 3 to ensure that QA aspects have been adequately considered.

5.5.3 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for incorporating the requirements of QA planning and Section 15, QA Procedures, into all planning activities developed in accordance with procedures identified in Section 3 of this procedure.

5.6 PROCEDURE

NOTE: Each of the following subsection titles also identifies the titles of QA procedures as discussed in Section 15, QA Procedures.

5.6.1 Interface Control

During planning activities, the RASA/UMTRA Project Manager should familiarize himself with the requirements of Section 15.1, Interface Control, to ensure that all personnel selected for vicinity property survey teams will be fully informed of their responsibilities and limitations with respect to contacting outside organizations.

SUBJECT: QUALITY ASSURANCE PLANNING

5.6.2 Indoctrination, Training, and Qualification of Personnel

As part of the selection of vicinity property survey team members, the RASA/UMTRA Project Manager should obtain information with respect to qualifications of individuals and identify the requirements for additional training, where applicable. The Survey Manager should schedule survey team indoctrination sessions to ensure that information pertinent to vicinity property survey requirements is fully understood by all survey team members. See Section 15.2 of this manual, "Indoctrination, Training, and Qualification of Personnel," for further guidance.

5.6.3 Project Document Control

Adequate planning for document control (primarily vicinity property files) is to be provided throughout the entire RASA/UMTRA ISC flow of work. Vicinity property file control responsibility prior to the actual survey is shared by the Graphics Coordinator, Consent Form Coordinator, and the Process Coordinator. Document control during and after the survey is the responsibility of the Team Leader, Survey Manager, and the Process Coordinator. The submittal of the inclusion survey report to the DOE and the storage of processed files is the task of the Report Clerk Typist. All specific procedures are provided in Section 15.10, Project Document Control. The Computer System Manager is responsible for providing a networked tracking system in which a specific vicinity property number can be used to query the database, and which monitors the file's progress. As a final control mechanism, documents and correspondence will be reviewed for adequacy and issued by the RASA/UMTRA Project Manager or the Survey Manager.

SUBJECT: QUALITY ASSURANCE PLANNING

5.6.4 Control of Purchased Items and Services

In accordance with the procedure of Sect. 15.4 of this manual, Control of Purchased Items and Services, the RASA/UMTRA Project Manager, assisted by the QA Coordinator, will ensure that requirements for the control of purchased items and services are adequately incorporated in procurement activities associated with vicinity property surveys. An overall review of purchase requests is the responsibility of the HASRD Division Director, and is directly dependent upon established ORNL standard practices and guidelines for procurement. Upon delivery to the RASA/UMTRA office, a visual inspection will be made and any nonconformace reported and documented in accordance with the procedures of Sect. 15.11.

5.6.5 Identification and Control of Material and Equipment

The RASA/UMTRA Project Manager, Survey Manager, Electronics Technician, or Team Leader shall ensure, during the planning stages of the vicinity property survey, that equipment and material to be used during the performance of site survey activities are available, authorized for use, and properly identified in accordance with the procedure of Sect. 15.5, Identification and Control of Material and Equipment.

5.6.6 Control of Processes

Detailed process control requirements for all activities affecting the quality of the vicinity property surveys/reports are described in the applicable implementing procedures as follows: (1) personnel training (15.2); (2) calibration of instruments (7.4, 8.2, 9.1, 9.2, 9.4, 10.3, 11.2); (3) radiation exposure monitoring, control and protection (9.8); (4) project progress tracking (15.6); and (5) the database network system (13.1).

SUBJECT: QUALITY ASSURANCE PLANNING

5.6.7 Inspections

Specific procedures to verify conformance of items, equipment, and material to specified requirements can be found in Sects. 15.4 and 15.5. Procedures to regulate the performance of RASA/UMTRA subcontracts can be found in Section 14. Inspection of field and mobile scan van equipment is explained in Sects. 7.4 and 8.2. To assure the completeness and accuracy of raw survey data before report generation, Team Leaders will have specific pre-report requirements (10.1). As mentioned in Control of Processes, inspection and decontamination of equipment and personnel will also be conducted (9.8).

5.6.8 Test Control and Control of Measuring and Test Equipment

Conformance testing on equipment is conducted on a regular basis. Portable instrumentation is checked each day prior to use to assure correct response (9.1). Calibration of the gamma scintillometer is performed on each property by using a pressurized ion chamber (PIC) or an empirical conversion equation based on historical data (9.4). Gamma scintillometer calibration is also measured semi-annually by either the Bendix Field Engineering Corporation (BFEC), or Instrumentation and Control Division (I&C) by use of their appropriate procedures. The response of the PIC is measured semi-annually. The soil sample analytical system is checked at the beginning of each day of use (10.2) and calibrated as needed by BFEC. Cross-checks of 5% of all samples analyzed are performed and documented (15.7). The mobile gamma scanning van is tested by procedures outlined in Sect. 8.2.

5.6.9 Handling, Storage, and Shipping

Handling, storage, cleaning, packaging, shipping, and preservation of items shall be controlled to prevent damage or loss. Proper field techniques for equipment handling, data collection, and contamination control are provided in Section 9. The proper packaging, storage, and shipping of soil samples are outlined in Sects. 9.6, 10.2, 10.3, and 10.4. The preservation of vicinity property file data, report processing/transmittal, and ultimate data archiving are described in 10.7, 10.8, and 10.9.

5.6.10 Inspection, Test, and Operating Status

The inspection, test, and operating status of all equipment is maintained by the Electronics Technician. Non-conforming equipment records are maintained and the equipment physically relocated to a location inaccessible for usage. Equipment will have stickers in place indicating the inspection schedule. The status of the vicinity property survey activities, as reflected in logs and on the networked database, will be monitored by the Process Coordinator.

5.6.11 Control of Non-conforming Items

Limited to deficiencies related to equipment and instrumentation, the procedures of Sect. 15.11, provide requirements for identification, temporary disposition, methods of repair or modification and reporting of deficiencies. The appropriate forms documenting non-conformance shall be used.

SUBJECT: QUALITY ASSURANCE PLANNING

5.6.12 Corrective Action

Conditions adverse to quality shall be identified promptly and corrected as soon as possible. The identification, cause, and corrective action for significant conditions adverse to quality shall be documented in the appropriate form and reported to appropriate levels of management. Follow-up action by the RASA/UMTRA QA Coordinator shall be taken to ensure corrective action implementation (see Sect. 15.11).

5.6.13 Audits

Planned audits shall be performed internally by the ORNL QA Coordinator for the HASRD and the Nuclear & Chemical Waste Program, and externally by the DOE UMTRA Project Office and the ORNL Quality Assurance & Inspection Department, to verify compliance with all aspects of the quality assurance program and to determine its effectiveness. Auditing of subcontractor performance will also be conducted. The formal surveillance/audit program is described in Sect. 15.12.

9.1.7 Exhibits

None.

9.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SECTION 6: PROJECT MANAGEMENT

6.1 Project Organization and Scheduling

6.2 Project Recordkeeping

6.3 Data Storage

6.4 Reports and Papers

6.5 Public Relations

SUBJECT: PROJECT MANAGEMENT

6. PROJECT MANAGEMENT

6.1 PROJECT ORGANIZATION AND SCHEDULING

6.1.1 Purpose

The purpose of this procedure is to provide guidelines for project organization and scheduling.

6.1.2 Applicability

This procedure applies to all activities conducted by RASA/UMTRA in support of the DOE UMTRA Project.

6.1.3 References

RASA/UMTRA Project Management Plan, in review.

6.1.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

6.1.5 Responsibilities

6.1.5.1 Rasa Program Manager

The RASA Program Manager is responsible for the implementation of this procedure. He will further be responsible for the overall scheduling

APPROVED: Craig Little DATE: 4/14/86
RASA/UMTRA Project Manager

of all RASA/UMTRA Project activities within the guidelines and directives for scheduling provided by DOE.

6.1.5.2 <u>RASA/UMTRA Project Manager</u>

The RASA/UMTRA Project Manager is responsible for the scheduling of all activities of the RASA/UMTRA Project, subject to approval by the RASA Program Manager.

6.1.6 <u>Procedure</u>

6.1.6.1 <u>Project Organization</u>

Elements of the project organization include:

1. RASA Program Manager,
2. RASA/UMTRA Project Manager,
3. Project support staff,
4. Project implementation staff, and
5. Clerical support staff

The project organization is illustrated in Exhibit 2.2-1, RASA/UMTRA Project Organizational Chart, and the project staff positions are listed in Exhibit 2.2-4, RASA/UMTRA Staff Positions.

The ORNL RASA Program Manager assigns the RASA/UMTRA Project Manager.

The RASA/UMTRA Survey Manager assigns specific coordinators and team leaders, in consultaion with the RASA/UMTRA Project Manager.

Scientific or support staff are assigned to a particular property only for the duration of time required to complete their duties connected with that property. Survey team members will be assigned to a specific team leader, but may be assigned to several team leaders during the course of the RASA/UMTRA Project.

SUBJECT: PROJECT MANAGEMENT

Certain support staff members may be responsible for certain laboratory, instrumentation, or data analysis activities of the group. When these personnel are assigned to a particular survey, there may or may not be the implication of the commitment of the hardware resources for which that person is responsible.

Clerical support functions such as report typing and documentation are normally group functions. The support staff may be supporting several property surveys at any given time.

6.1.6.2 Project Scheduling

RASA Program Manager and RASA/UMTRA Project Manager

The UMTRA-PO sets overall project priorities. Within this overall DOE guidance, the RASA Program Manager sets general project priorities. Using the general project priorities as a guide, the RASA/UMTRA Project Manager develops a general schedule for all RASA/UMTRA activities that is consistent with available time, funds, and resources.

RASA/UMTRA Survey Manager

The RASA/UMTRA Survey Manager has the overall responsibility for scheduling the property-specific activities of the RASA/UMTRA Group, within the constraints imposed by the overall schedule of projects developed by the RASA/UMTRA Project Manager.

In preparing the project schedule, the Survey Manager must determine the following factors:

1. Available manpower resources,
2. Available equipment resources,
3. Subcontractor requirements, and
4. Travel time and distance from the Grand Junction Office.

The scheduling of subcontractors is then integrated into the overall schedule, when necessary, to provide timely subcontractor action consistent with the schedule.

6.1.7 Exhibits

None.

6.1.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

6.2 PROJECT RECORDKEEPING

6.2.1 Purpose

The purpose of this procedure is to describe the format and content of records generated by inclusion radiological surveys as conducted by RASA/UMTRA Project personnel.

6.2.2 Applicability

This procedure applies to all RASA/UMTRA Project activities.

6.2.3 References

RASA/UMTRA Project Management Plan, in review.

6.2.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

6.2.5 Responsibilities

SUBJECT: PROJECT MANAGEMENT

6.2.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.

6.2.5.2 All Personnel

All personnel required to enter data into records are responsible for data entry in conformance with this procedure.

6.2.6 Procedure

6.2.6.1 Records Format and Requirements

Records format

The format used for all RASA/UMTRA records shall be free form, generally following the accepted and common practices of ORNL RASA Group for each specific record document.

Records requirements

All data, notes, measurements, and calibrations pertinent to a designated vicinity property must be recorded or entered into the appropriate project record. All entries into records documents will, without exception, conform to the following requirements:

1. All entries will be marked with the date of entry;
2. All entries will be signed or marked with a sign (initials, etc.) traceable, without ambiguity, to the author of the entry;
3. All entries will be written or printed in an easily legible manner; and
4. All entries will be concise and exact, accurately describing the observation, event, or measurement to be documented.

6.2.6.2 Project Record Types

Project records consist of a series of files, log books, and documents, including

1. Field van log book
2. Scanning van calibration log book
3. Scanning van log book
4. Instrument calibration log book
5. Soil sample preparation log book
6. Soil sample data log book
7. Soil sample analysis data file
8. Consent for access data file
9. Main data base file
10. Property portfolio
11. Soil sample archives
12. Published reports
13. Quality assurance logbook

Field van data log book

All instrument check data are recorded in this log book. Content requirements are included in the appropriate procedure for each type of data entry. The log book serves also as a diary of the team leader's activities. Necessary information that should be recorded in the log book includes:

1. Notation or indication of the location of all work,
2. At the end of each day, notations of what occurred that day, and
3. Documentation of all official contacts with property owners, local officials, media representatives, remedial action contractors, etc.

Scanning van calibration log book

All daily calibration data are recorded in this log book. Content requirements for log book entries are included in Procedure 8.2, Mobile Gamma Scanning Van Calibration.

Scanning van log book

All scan survey results are recorded in this log book. Content requirements for scanning van log book entries are included in Procedure 8.3, Mobile Gamma Scanning-Van Operation.

Instrument calibration log book

The Electronics Technician maintains the instrument calibration log book. This log book contains all information pertinent to gamma scintillator, pressurized ion chamber, and mass-scale calibration data, and operational notes. Calibration values received from the appropriate calibration facility are inserted in the individual instrument file. Operational notes include control settings (where applicable), repairs, adjustments or maintenance to the instruments, and observed anomalies in operation. Sample measurement and instrument check data are entered into the field van log book. Content requirements for the instrument calibration log book for each appropriate instrument are included in Section 12 of this manual.

Soil sample preparation log book

The RASA/UMTRA Soils Laboratory contains the soil sample preparation log book. This log book contains all information pertinent to receiving, drying, grinding, and bottling of soil samples. Content requirements for the soil sample preparation log book are included in Procedure 10.2, Soil Sample Preparation.

Soil sample data log book

The RASA/UMTRA Soils Laboratory contains the soil sample data log book. This log book contains a chronological record of all soil sample analysis results and counting system calibrations and checks. Content requirements for the soil sample data log book are included in Procedure 10.3, Soil Radium Content Analysis and Procedure 12.3, Calibration of Laboratory Gamma Spectrometry System.

Consent for access data file

The consent for access data file resides in the RASA/UMTRA database. This file contains information on the current status of the consent-for-access acquisition process for every designated property. The contents of this file are illustrated in Exhibit 7.2-6.

Property portfolio

The property portfolio contains all pertinent information regarding the property, including:

1. Historical data,
2. Consent for access status,
3. Field drawing or base map,
4. Photograph of property,
5. Correspondence,
6. Raw data from inclusion survey,
7. Review comments,
8. Report,
9. Analytical results, and
10. Any required DOE revisions.

Note: Properties to which access was denied will not include items 3-10 listed above.

Sample archives

Following counting and analysis, soil samples are stored in the RASA/UMTRA archives for permanent retention. The samples are stored in bags and placed in steel barrels. An inventory sheet of the contents is kept in each barrel. A copy of the barrel contents is kept in the office files. In addition, the soils analysis log book has an entry for each sample identifying the barrel in which the samples are archived. See Procedure 10.4, Soil Sample Storage.

Published reports

A folder is maintained of the master copy of all formal reports published by RASA/UMTRA, as well as all data utilized in compiling the report.

6.2.7 Exhibits

None.

6.2.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

6.3 DATA STORAGE

6.3.1 Purpose

The purpose of this procedure is to describe the data storage system used in support of the RASA/UMTRA Project.

6.3.2 Applicability

This procedure applies to all data generated directly or indirectly in the RASA/UMTRA Project. Specific data locations are addressed in Procedure 6.2, Project Recordkeeping, and Procedure 11.4, Equipment Calibration Records.

SUBJECT: PROJECT MANAGEMENT

6.3.3 References

None.

6.3.4 Definitions and Abbreviations

6.3.4.1 Definitions

DATA. Information in all forms including written, printed, visual, electronic, or mechanical.

Also see Sect. 1.5 of this manual, Terminology.

6.3.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

6.3.5 Responsibilities

1. The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.
2. The Computer System Manager is responsible for maintaining the RASA/UMTRA database and data archive storage.
3. The Public Relations Coordinator is responsible for maintaining the consent for access data file.
4. Each Team Leader is responsible for all log books in his or her custody and ensures that all site-related data are transferred to the RASA/UMTRA database.
5. The Sample Coordinator is responsible for maintaining the soil laboratory log books and the soil sample archive records.
6. The Electronics Technician is responsible for the instrument inventory and calibration log books.

6.3.6 Procedure

All data generated, either directly or indirectly, and relating to RASA/UMTRA Project activities are retained at the RASA/UMTRA Office, with the following exceptions:

1. Field and scanning van log books are sometimes retained at a survey site until the survey is completed; and
2. Records pertinent to instrument calibration and maintenance and vehicle maintenance, which are established and maintained by organizations external to RASA/UMTRA, are retained by the organization generating the data.

6.3.6.1 Written and Printed Data Storage

Field van log books

All field van log books are retained in the custody of the Team Leader or his designee. Following completion of a property survey, the Team Leader transfers any survey data to the RASA/UMTRA database and also archives a copy in his files.

Scanning van log books

All log books normally associated with the van are maintained in the van until the log books are filled. When filled, the log books are kept in the Mobile Scan Team Leader's files. Data pertinent to a specific van scan are transferred to the RASA/UMTRA Project manager.

Other log books

All other log books generated by RASA/UMTRA are maintained in the custody of the coordinator primarily responsible for the activity covered by the log book.

SUBJECT: PROJECT MANAGEMENT

6.3.6.2 Visual Data Storage

Visual data, consisting of maps, photographs, and drawings concerning a specific property, are retained in the property portfolio and copies are also retained by the coordinator responsible for producing the data.

6.3.6.3 Electronic Data Storage

1. Property photographs are stored in a photography folder along with negatives placed in appropriate negative protectors. Each Team Leader maintains a photography folder.
2. Maps are stored in folders, and property drawings are stored on floppy disks by the Graphics Coordinator.

Electronic data consists of all property data, which are retained in the RASA/UMTRA database, and on floppy disks which make up the data archive storage system.

6.3.7 Exhibits

None.

6.3.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

6.4 REPORTS AND PAPERS

6.4.1 Purpose

The purpose of this procedure is to provide guidance for publishing survey-related documents and reports of RASA/UMTRA.

6.4.2 Applicability

Primary documents (e.g., reports) written by RASA/UMTRA will follow this procedure and its references.

6.4.3 References

1. HASRD Procedures for Publications and Oral Presentations, October 1980
2. ORNL Style Guide, May 1974
3. Procedures Manual for the ORNL Remedial Action Survey and Certification Activities (RASCA) Program, September 1982.

6.4.4 Definitions and Abbreviations

LETTER REPORT. A document issued by RASA/UMTRA that has a limited DOE and internal distribution.

Also see Sect. 1.5 of this manual, Terminology.

6.4.5 Responsibilities

The ORNL/RASA Project Manager is responsible for implementation of this procedure and for ensuring the adequacy of all documents and correspondence issued by RASA/UMTRA.

All RASA/UMTRA personnel responsible for authoring any of the documents covered by this procedure will comply with this procedure.

6.4.6 Procedure

6.4.6.1 Types of Reports

The primary reports and documents produced by RASA/UMTRA are letter reports containing the results of mobile-scanning and inclusion surveys and recommendations to the DOE-PO on whether to include or exclude surveyed properties from remedial action activities. Procedures for publication of other types of reports are given in the Procedures Manual for the ORNL Remedial Action Survey and Certification Activities (RASCA) Program. The procedures detailed in that manual will be followed if other types of reports are issued by RASA/UMTRA personnel.

Prior to its issuance, a letter report must be reviewed by at least two appropriate persons.

An example of the content of an inclusion survey report is shown in Exhibit 6.4.6-1. An example of a recommendation letter is shown in Exhibit 6.4.6-2.

6.4.7 Exhibits

1. Exhibit 6.4.6-1, Example of An Inclusion Survey Report
2. Exhibit 6.4.6-2, Example of A Recommendation Letter

6.4.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

6.5 PUBLIC RELATIONS

6.5.1 Purpose

The purpose of this procedure is to establish the responsibilities and rules for public release of information concerning work activities of the RASA/UMTRA Project.

6.5.2 Applicability

This procedure applies to all RASA/UMTRA project related activities and particularly those related to remote survey sites.

SUBJECT: PROJECT MANAGEMENT

6.5.3 References

D-5-8, Standard Practice Procedures, Martin Marietta Energy Systems, Inc., News Release to Media.

6.5.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

6.5.5 Responsibilities

6.5.5.1 ORNL/RASA Program Manager

The ORNL/RASA Program Manager is responsible for survey activity information releases to the public in Oak Ridge.

6.5.5.2 RASA/UMTRA Project Manager

The Project Manager is responsible for survey activity information release to the public at survey site locations.

6.5.6 Procedure

1. At ORNL, the RASA Program Manager is the only representative who may communicate with the media and public. He will release information only of a general nature concerning group activities and refer only to technical data approved by DOE for public release.
2. At survey sites, the Project Manager and his approved representatives may communicate with the media and the public in reference to official business. As such, the Team Leader is not authorized to discuss with the media the results of any survey activities but may discuss the following:

   a. group identification,
   b. group affiliation (ORNL),

c. estimated time of survey activities,

d. identification of survey individuals,

e. identification of work authorization (DOE), and

f. description of survey team activities.

The Project Manager and his representative may refer other technical questions to the RASA Program Manager or to the DOE and may inform the media or the public of the issues he/she is authorized to discuss.

6.5.7 Exhibits

None.

6.5.8 Revision History

Rev. 0	Date: 03/31/86	First Revision

Exhibit 6.4-1

EXAMPLE OF AN INCLUSION SURVEY REPORT

Location Number: (GJ01974)

HEALTH AND SAFETY RESEARCH DIVISION

REPORT OF INCLUSION SURVEY AT LOCATION GJ01974
1036 ROOD AVENUE
GRAND JUNCTION, COLORADO 81501

Investigation Team

B. A. Berven - RASA Program Manager
C. A. Little - RASA/UMTRA Project Director
P. F. Tiner - Survey Team Leader

M. J. Wilson

September 1985

WORK PERFORMED AS PART OF THE
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Grand Junction Office
Grand Junction, Colorado 81502
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC-5-840R21400

EXHIBIT 6.4-1 (Continued)

Location Number: GJ01974

INTRODUCTION

An inclusion radiological survey of location GJ01974 was conducted on July 25, 1985 by Oak Ridge National Laboratory. This property, located at 1036 Rood Avenue, consists of a single family residence. This survey was conducted using methods as defined in the Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601 (June 1984) and the RASA UMTRA Procedures Manual (June, 1985). General location information is provided in Table 1, radiological survey results are given in Table 2 and 3, and supporting graphics are provided in Figure 1. A view of the property is provided in Figure 2. All measurements are gross readings; background has not been subtracted.

The conversion formula used is y = mx + b, where 'y' equals the exposure rate in μR/h, 'x' equals scintillometer measurement in kcpm, and 'm' and 'b' are predetermined constants. On this property, 'm' equals 1.69 and 'b' equals 3.45.

SIGNIFICANCE OF FINDINGS

Property location GJ01974 contains two regions of outdoor contamination, A and B, shaded on Figure 1. Region A encompasses ~4 m^2, and revealed gamma exposure rates of 15-27 μR/h. Soil sample S1A and concrete sample S1Z, collected from Region A, disclosed ^{226}Ra-in-soil concentrations of 3.7 and 17 pCi/g, respectively. These values do not meet inclusion criterion of >5 pCi/g above background when averaged over 100 m^2. Region B encompasses an area of ~4 m^2, and revealed gamma exposure rates of 14-17 μR/h. These readings do not exceed background plus one standard deviation averaged over 100 m^2.

There were no gamma exposure rates detected above the background range of 10-15 μR/h on the indoor property. Based upon these findings, it is recommended that location GJ01974 be excluded from further consideration by the UMTRA Project.

EXHIBIT 6.4-1 (Continued)

RECOMMENDATION

RECOMMENDED FOR: Exclusion

RECOMMENDATION BASIS: Outdoor gamma is <background plus 1 standard deviation or 30% averaged over 100 m^2

^{226}Ra is <5 pCi/g above background in surface 15 cm soil layer averaged over 100 m^2

Indoor gamma is <1 standard deviation or 30% above background in all rooms

EXHIBIT 6.4-1 (Continued)

Table 1. Location Information

Property Information

LOCATION:	1036 Rood Avenue Grand Junction, CO 81501
OCCUPANT/TENANT:	Unknown
TELEPHONE:	Unknown

Owner Information

OWNER:	Columbia Savings & Loan, attn: G. H. Mott
ADDRESS:	P. O. Box 250 Grand Junction, CO 81502
TELEPHONE:	(303) 242-6642
PROPERTY CLASSIFICATION:	Single family, residential
TOTAL AREA OF PROPERTY:	580 m^2
STRUCTURES ON PROPERTY:	1 Two story frame apartment building with partial basement

SUBJECT: PROJECT MANAGEMENT

EXHIBIT 6.4-1 (Continued)

Location Number: GJ01974

Table 2. Radiological Screening Survey Results

Outdoor Screening Data

BACKGROUND EXPOSURE RATE:	13 μR/h
BACKGROUND + 1 STANDARD DEVIATION:	17 μR/h
BACKGROUND EXPOSURE RATE RANGE:	11-14 μR/h
EXPOSURE RATE RANGE IN CONTAMINATED REGIONS:	A: 15-27 μR/h B: 14-17 μR/h
HIGHEST OUTDOOR GAMMA (HOG) IN CONTAMINATED REGION:	27 μR/h
LOCATION OF HOG:	Region A
POINT SOURCE*:	None
ESTIMATED AREA OF OUTDOOR CONTAMINATION BY REGION:	A: 4 m2 B: 4 m2
NET ESTIMATED AREA-WEIGHTED AVERAGE BY REGION**:	A: .28 μR/h B: .08 μR/h

**Formula used: $GAW = \frac{\sum_{i=1}^{n} G_i A_i}{100}$

where:

GAW = the area-weighted exposure rate in [μR/h]
G_i = net average exposure rate in [μR/h]
(G_i = GGross − GBackground)
A_i = area of region involved in [m^2] and,
100 = threshold area in [m^2]

EXHIBIT 6.4-1 (Continued)

Location Number: GJ01974

Table 2. Radiological Screening Survey Results (Continued)

Indoor Screening Data

STRUCTURE DESCRIPTION OR NUMBER:	House
BACKGROUND EXPOSURE RATE:	13 μR/h
BACKGROUND + ONE STANDARD DEVIATION:	17 μR/h
BACKGROUND EXPOSURE RATE RANGE:	10-15 μR/h
HIGHEST INDOOR GAMMA (HIG)	15 μR/h
LOCATION OF HIG:	General
POINT SOURCE*:	None
NET ESTIMATED AREA-WEIGHTED AVERAGE BY REGION/ROOM**:	0 μR/h

**Formula used: $x = \frac{\sum_{i=1}^{n} G_i A_i}{9.3}$

where:

x = area-weighted gamma exposure rate in [μR/h]
G_i = net gamma exposure rate in [μR/h]
A_i = area of deposit in [m^2]
9.3 = threshold area in [m^2]

EXHIBIT 6.4-1 (Continued)

Location Number: GJ01974

Table 3. Extended Survey Results

Outdoor Extended Data

Soil Sample Summary

Soil Sample Number	Region Sampled	Sample Depth (cm)	^{226}Ra Concentration (pCi/g) (Canalysis)	Representative (Biased) Sampling Area m^2	Net Estimated Area-Weighted Average* (pCi/g, CAW)
S1A	A	0-15	3.7	4	.09
S1Z	A	0-15	17	4	.62
S2	Rep	0-15	3.7	>100	2.3

*Formula used: $C_{AW} = \dfrac{\sum_{i=1}^{n} C_i A_i D_i}{(100)(.15)}$

where=

C_{AW} = area-weighted ^{226}Ra concentration in [pCi/g]

C_i = net ^{226}Ra concentration in [pCi/g] and

(C_i = Canalysis - Cbackground)

A_i = area of region that sample represents in [m^2]

D_i = thickness of sample in [m]

100 = threshold area in [m^2], and

.15 = threshold thickness in [m]

SUBJECT: PROJECT MANAGEMENT

EXHIBIT 6.4-1 (Continued)

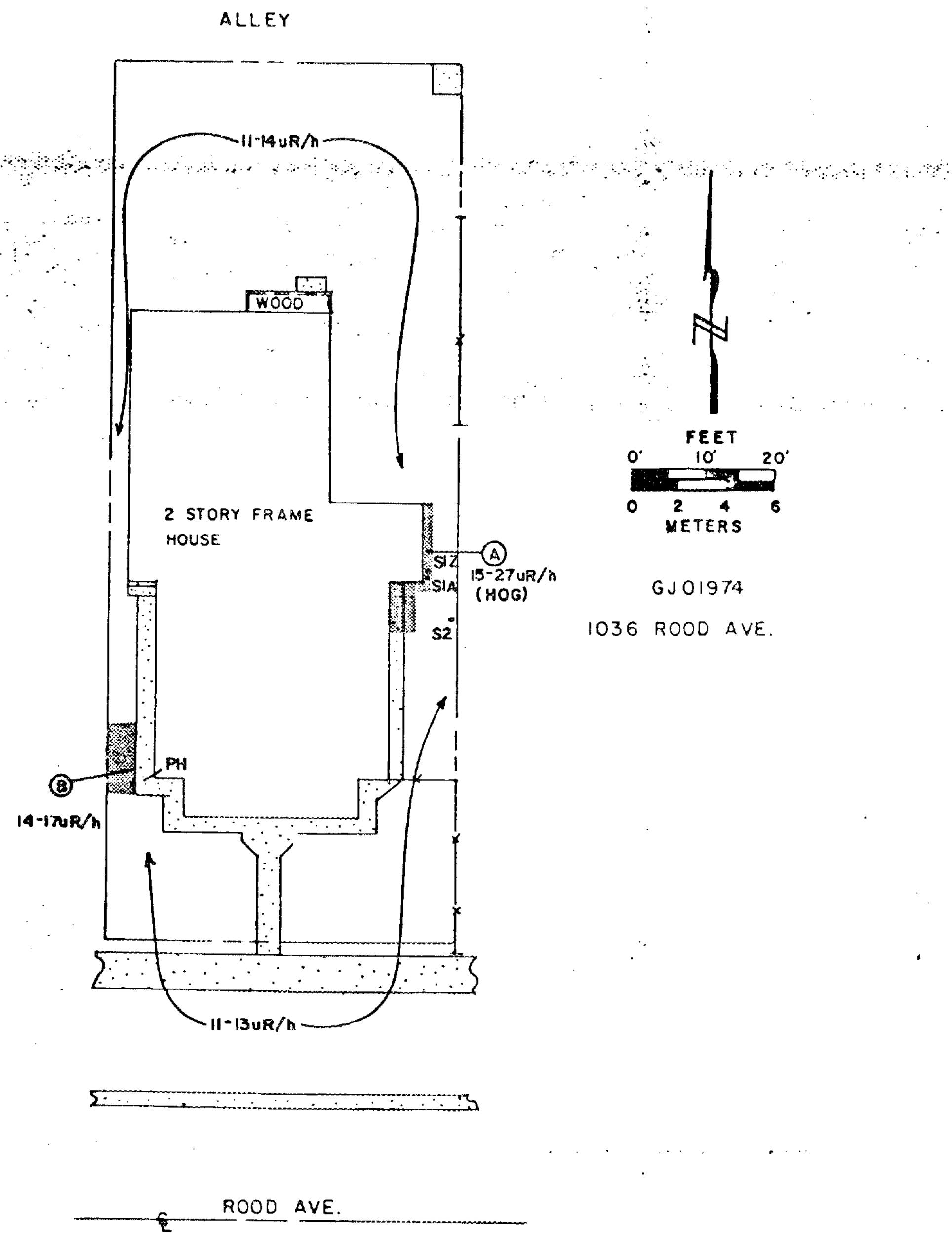


Fig. 1. Location GJ01974, 1036 Rood Avenue, Grand Junction, CO.

EXHIBIT 6.4-1 (Continued)

Fig. 2. Location GJ01974, looking north at the front of the property.

EXHIBIT 6.4-2

EXAMPLE OF A RECOMMENDATION LETTER

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

GRAND JUNCTION OFFICE
P. O. BOX 2567
GRAND JUNCTION, COLORADO 81502

Mr. Merle Crew, Manager
U. S. Department of Energy
Grand Junction Area Office
P. O. Box 2567
Grand Junction, Colorado 81502

Dear Mr. Crew,

Radiation levels at the property identified below appear [] to [x] not to exceed the U.S. Environmental Protection Agency (EPA) standards as specified in 40 CFR 192.

This evaluation is based on [x] indoor [x] outdoor screening measurement criteria, [] indoor [x] outdoor extended measurement criteria of the U.S. Department of Energy Vicinity Properties Management and Implementation Manual (UMTRA-DOE/A1-050601), Appendix A, and/or [] other criteria stated below.

Other:
____
____

This recommendation is based upon the Inclusion Survey Contractor's assessment of the [x] ^{226}Ra concentration in the soil [] indoor radon daughter concentration [x] indoor gamma exposure rate at this property.

Therefore, this property is recommended for [] inclusion in [x] exclusion from the Uranium Mill Tailings Remedial Action Project.

Sincerely,

Craig Little

C. A. Little, Ph.D.
Inclusion Survey Contractor

cc w/o att: B. A. Berven, ORNL

Location Number: GJ01974
Location Address: 1036 Rood Avenue
Grand Junction, CO 81501
Property Owner: Columbia Savings & Loan
(G. H. Mott)
Owner Address: P. O. Box 250
Grand Junction, CO 81502
Tenant Name: Unknown

SECTION 7: PRE-INCLUSION SURVEY ACTIVITIES

7.1 Identification of Properties to be Surveyed

7.2 Consent for Access to Survey Property

7.3 Property Base Map Development

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

7. PRE-INCLUSION SURVEY ACTIVITIES

7.1 IDENTIFICATION OF PROPERTIES TO BE SURVEYED

7.1.1 Purpose

The purpose of this procedure is to describe the methods by which vicinity properties are identified as candidates for inclusion surveys in the RASA/UMTRA project.

7.1.2 Applicability

This procedure applies to all properties that have not already been designated by the DOE for investigation under the UMTRA project.

7.1.3 References

1. Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601
2. RASA/UMTRA Project Management Plan, in review

7.1.4 Definitions and Abbreviations

DOVETAIL PROPERTY. Property which qualifies for possible remediation under both the Grand Junction Remedial Action Program (GJRAP) and the UMTRA project. See 7.6.4, Types of Properties, for further explanation.

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

GRAND JUNCTION REMEDIAL ACTION PROGRAM (GJRAP). Program managed by the State of Colorado which is limited to remedial action on tailings inside structures. See 7.6.4, Types of Properties, for further explanation.

See Sect. 1.5 of this manual, Terminology.

7.1.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.

7.1.6 Procedure

Many properties have been identified and designated for consideration by the RASA/UMTRA project based on the results of earlier aerial radiological surveys and information obtained from earlier mobile and on-site surveys. Additional properties may be identified as candidates for inclusion based on:

1. Detection of anomalous gamma radiation levels by the RASA/UMTRA scanning van on properties not previously listed,
2. Information from knowledgeable sources,
3. Requests from property owners or from the other project participants.

7.1.6.1 RASA/UMTRA Scanning Van

When conducting or analyzing the results of any mobile gamma survey, the RASA/UMTRA staff will be alert to the possibility that some uranium mill tailings deposits may not have been found during earlier survey activities. In the event that a previously unreported deposit is detected, the Mobile Scan Team Leader will report the location of the deposit and pertinent information to the Project Manager. The Project Manager will notify the UMTRA-PO and the TAC of the findings and will request that the property be added to the list of properties to be surveyed.

7.1.6.2 Information From Knowledgeable Sources

Properties potentially contaminated with uranium mill tailings may be identified by various knowledgeable sources, including federal, state, or local officials, and citizens who can reliably recollect transport or placement of tailings on properties. The Public Relations Coordinator, in cooperation with the TAC, will encourage such sources to come forward by making personal contact, holding public meetings, and advertising in the media. If properties are identified in this manner, the Project Manager or the TAC, as is appropriate, will request the UMTRA-PO to add these properties to the list to be surveyed.

7.1.6.3 Requests From Property Owners Or Other Project Participants

Property owners who suspect that their properties are contaminated with mill tailings are encouraged to request the DOE to survey their properties. The media advertising and public meetings used in Procedure 7.1.6.2 also serve to alert these property owners. Requests for property designation follow the procedures mentioned in Procedure 7.1.6.2.

7.1.6.4 Types of Properties

There are three general types of properties which the ISC will evaluate for possible UMTRA remediation:

1. Properties which have qualified for GJRAP remediation,
2. Properties which only qualify for the UMTRA project, and
3. Spillover properties.

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

GJRAP properties

The GJRAP was initiated six years before the UMTRA project and is managed by the state of Colorado. The standards by which the properties are evaluated are different and remediation is performed on structures only. GJRAP properties which have been remediated are certified and the file closed. This historical data should be received by the Team Leader prior to an ISC survey; however, no indoor survey will be done.

The Team Leader must know the "bid group number" of the property to ascertain the extent of the outdoor scan required. The "bid group number" was assigned by the DOE when the remediation subcontract work went out for bid. The ISC has no jurisdiction over specific parts of the property based on the following:

Bid Group Number	Portion Remediated/Certified
1-8	Interior and up to 3 feet away from structure
9-22	Interior and up to 7 feet away from structure
23-69	Interior and up to 10 feet away from structure

Dovetail properties

Dovetail properties are "active" GJRAP properties, meaning that remediation on the structure(s) has/have not yet been closed out. For greater cost and time effectiveness and less property owner inconvenience, GJRAP and UMTRA attempt to "dovetail" their efforts and perform indoor and outdoor remediation concurrently. The ISC currently subcontracts dovetail surveys to ARIX, a Grand Junction subcontractor. The ISC then evaluates the ARIX data and submits a summary report/recommendation to the DOE.

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

UMTRAP properties

The UMTRA project remediates all eligible vicinity properties, including open land. The criteria for inclusion are more stringent and both indoor and outdoor remediation are performed. These DOE designated properties have not been previously considered for remedial action.

Historical files for UMTRA designated properties

Some properties have historical data from the Colorado Department of Health (CDH) radiological studies. The findings of these studies did not dictate inclusion into GJRAP's cleanup; however, the data can be helpful in characterizing a property for an ISC survey. Team Leaders are responsible for reviewing this data. These properties are eligible for both indoor and outdoor radiological measurements.

Spillover properties

An outdoor gamma scan can reveal a deposit which extended onto an adjacent property. This "spillover" property must be investigated further:

1. The spillover and address must be notated on the field map.
2. The Public Relations staff must be notified to determine whether this adjacent property has always been designated; if not yet designated, proceedings to do so will be initiated.
3. A copy of all data and the field map of the surveyed property must be put into the spillover property file.

Once these steps have been taken, the Team Leader will follow the following procedures:

1. Surveyed property deposit is includable: if includable on its own merit (does not depend on spillover property to deem the deposit includable), the report can be written immediately. The report may also be initiated if it appears that a consent cannot be obtained for the spillover property within a reasonable time period. The spillover property must be referenced by address and location number in the report.
2. Surveyed property deposit is not includable: If the contamination on the surveyed property is insufficient to be included on its own merit, the file should be retained until a spillover property consent can be obtained. Once this subsequent survey is conducted, both reports can be written concurrently. Both reports should reference the other by address and location number.
3. Spillover property has historical data: if already designated, the spillover property may have historical data. If careful examination of previous outdoor radiological data indicates elevated gamma levels in the same area as the deposit on the surveyed property, the spillover property can be included without an ISC survey. However, a consent form must still be obtained. This type of inclusion is a "spillover inclusion."

7.1.7 Exhibits

None.

7.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

7.2 CONSENT FOR ACCESS TO SURVEY PROPERTY

7.2.1 Purpose

The purpose of this procedure is to describe the steps taken by the RASA/UMTRA to obtain signed consent-for-access agreements from property owners and tenants.

7.2.2 Applicability

This procedure applies to all properties designated for inclusion in the RASA/UMTRA project, unless a specific procedure states otherwise.

7.2.3 References

None

7.2.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

7.2.5 Responsibilities

1. The UMTRA Project is a cooperative program between the Federal Government and the affected States and Indian Tribes. The responsibility for acquiring consent-for-access agreements, as well as the contents of the agreements, are determined by the Individual States and Tribes in cooperation with the DOE. The following is a partial listing of the entities responsible for obtaining consent-for-access agreements for various property locations.

Property Location	Responsible Entity
Colorado	RASA/UMTRA
Navajo Tribal Lands	The Navajo Nation
Pennsylvania	RASA/UMTRA and State of Pennsylvania
South Dakota	BFEC
Utah	State of Utah
Wyoming	RASA/UMTRA

2. The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.
3. The Public Relations staff is responsible for acquiring consent-for-access agreements that are to be obtained by RASA/UMTRA, and is responsible for keeping records of all consents-for-access that have been obtained or have been refused.

7.2.6 Procedure

The procedure used to acquire a consent-for-access agreement depends on the location of the property being considered. In general, five steps are involved:

1. Location of property and its owners and tenants,
2. Preparation and mailing of a consent-for-access agreement package,
3. Property file initiation,
4. Processing returned consent-for-access agreements, and
5. Follow-up on consent-for-access agreements not returned.

7.2.6.1 Location of Property and its Owners and Tenants

This procedure applies only to properties for which RASA/UMTRA has the responsibilty to obtain consent-for-access agreements.

For a property in Mesa County, CO, the Public Relations staff consults the Mesa County Tax Assessor's files that are contained on the BFEC computerized database. If the computer listing is outdated, the Mesa County Tax Assessor's Office is contacted directly. If these two contacts fail to identify and locate the property owner, a member of the Public Relations staff will visit the property or will contact neighbors.

For a property outside Mesa County, the appropriate community is visited. During this visit, the Public Relations staff obtains the necessary information from local courthouse records or from personal contacts with knowledgeable persons. This visit also allows the staff to resolve problems concerning the location and ownership of a property that is vaguely described on the designation listing. Consent-for-access agreements often are obtained in conjunction with these visits.

7.2.6.2 Preparation and Mailing of a Consent-For-Access Agreement Package

This procedure applies only to properties for which the RASA/UMTRA has the responsibilty to obtain consent-for-access agreements.

Once the necessary property location and ownership information is in hand, the Public Relations staff prepares and mails, by certified mail, the consent-for-access agreement package. This package contains a transmittal letter; two copies of the agreement form; instructions for completing the agreement form; a stamped, self-addressed envelope; and an UMTRA brochure containing information on the cleanup of vicinity properties. The owner's name and address are typed as the inside address on the transmittal letter. The location number and the property address and parcel number are typed on each copy of the agreement form. Examples of transmittal letters and consent-for-access agreement forms are illustrated in Exhibits 7.2.6.2-1 through 7.2.6.2-2.

7.2.6.3 Property File Initiation

This procedure applies only to properties for which the RASA/UMTRA has the responsibilty to obtain consent-for-access agreements.

Prior to mailing the consent-for-access agreement, the location number, which is used as the primary record control, is verified. All needed property data are entered into the RASA/UMTRA data base (see Exhibit 7.2.6.3-1). A folder is used as the property file and a label with the location number is made. When the consent-for-access agreement package is mailed, the folder has a yellow dot affixed on the front. It is then placed in the "consent form mailed" drawer of the location file cabinet.

7.2.6.4 Processing Returned Consent-For-Access Agreements

When the Public Relations staff receives a signed consent-for-access, the date of receipt, any revised owner information, and the consent status are entered in the RASA/UMTRA data base. On properties with granted access, the property file is pulled and merged with the CDH file (when present), and a brown-gold dot is affixed. The file is than placed in the "consent returned - drawing to be assigned" drawer.

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

Each week, a computer print-out is given to the Graphics Department, which lists all properties ready for the drawing assignment. The Graphics Coordinator indicates the assignments on the print-out and returns it to the Public Relations Department.

The property files assigned for drawings are pulled and the location number, date assigned, and person assigned to complete the drawing are entered into the property assignment log book. A copy of the consent form is sent to the Graphics staff, and the property file is placed in the "waiting for drawing" drawer after a color code indicating the draftsman is placed on the front.

Completed and reviewed drawings are received from the Graphics Department and the date of completion is entered in the RASA/UMTRA data base and the property assignment log book. The property file is pulled, the "property file tracking form" is printed out from data in the RASA/UMTRA data base, and stapled inside the folder. A red dot is then applied and the folder is placed in the "ready to be surveyed" drawer.

A weekly print-out is given to the Process Coordinator which lists all properties ready for survey assignment. The Process Coordinator indicates on the print-out those properties assigned the the Team Leader to which the properties are assigned. The files are pulled and given to the Process Coordinator who then distributes the files to the appropriate Team Leader. The Public Relations staff's responsibility for property files ends at this point.

7.2.6.5 Follow-up on Consent-For-Access Agreements Not Returned

This procedure applies only to properties for which the RASA/UMTRA has the responsibilty to obtain consent-for-access agreements.

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

Consent-for-access packages that the postal service is unable to deliver are returned to the Public Relations department. A search of the most recent property files at the appropriate Tax Assessor's Office then is initiated to locate and identify the current owner of the property. If this search fails to yield the required information, searches are made quarterly until the required information is obtained. Then a new consent-for-access package is mailed to the newly identified property owner.

If no response to the original mailing is received within 60 days, a second package is sent by certified mail. This package is similar to the first, except the transmittal letter is modified to stress the desirability of a response and the availability of further information at open meetings.

If no response to the second mailing is received within 60 days, an attempt is made to contact the property owner by telephone. If such contact cannot be made within 15 days, a personal visit is made to the property. This visit is intended to obtain information on the property owner from neighbors. Any information so obtained will be used to contact the property owner by mail or by telephone.

If all of the above attempts fail, the property portfolio is placed in a "dead" file. Final disposition of properties in the "dead" file will be negotiated with the UMTRA-PO during the final year of the ISC's activity in the UMTRA Project.

7.2.7 Exhibits

1. Exhibit 7.2.6.2-1, Example of consent-for-access transmittal letter
2. Exhibit 7.2.6.2-2, Example of consent-for-access agreement for State of Colorado
3. Exhibit 7.2.6.3-1, Data entered in the RASA/UMTRA data base

7.2.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

7.3 PROPERTY BASE MAP DEVELOPMENT

7.3.1 Purpose

The purpose of this procedure is to provide a method to ensure that all base maps prepared by RASA/UMTRA of vicinity properties are correctly drawn and reflect the current status of the property.

7.3.2 Applicability

This procedure applies to vicinity properties that are to be surveyed by the ISC.

7.3.3 References

1. U.S. Department of the Interior, Bureau of Land Management, Manual of Instructions for the Survey of the Public Lands of the United States 1973, Technical Bulletin 6, U.S. Government Printing Office, Washington. D.C.
2. Procedure 7.2.6.4, Processing Returned Consent-for-Access Agreements.

7.3.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

7.3.5 Responsibilities

The RASA/UMTRA Graphics Coordinator is responsible for the implementation of this procedure.

7.3.6 Procedure

Base map preparation requires obtainment of a legal description of the property and preparation of an accurate property sketch.

7.3.6.1 Obtainment of Legal Description

For a property in Mesa County, CO, the Graphics Coordinator may use one of three methods to obtain a legal description:

1. Consult the Mesa County Tax Assessor's files on the BFEC computerized database. These files are updated on a monthly basis and contain most of the needed descriptions,
2. Consult the appropriate subdivision plat in the files maintained by the Mesa County Courthouse and the BFEC. Such consultation is necessary only if a property is described in the designation list by lot and block, without dimensions,
3. Conduct a land title search at the Mesa County Courthouse. Such a search is necessary for a property with multiple ownership or that has been combined from multiple to single ownership. Title searches may be carried out by a qualified subcontractor.

For a property outside Mesa County, the legal description is obtained by normal title search methods at the appropriate county courthouse. These searches may be conducted by a qualified subcontractor.

7.3.6.2 Preparation of Property Sketch

The Graphics staff or a qualified subcontractor visits the property and takes the measurements necessary to determine the placement of any structures on the property. Standard survey techniques are used (see Reference 7.3.3).

Following the visit, an accurate ink drawing of the property is produced using standard drafting procedures, the measurements obtained during the visit, and information from the legal description. The preferred scale of the drawing, 1 inch equals 20 feet, is used unless it is impractical due to the size of the property.

A drawing generated by the RASA/UMTRA is called a property sketch; a drawing generated by a subcontractor is called an improvement location certificate. Exhibit 7.3.6.2-1 is an example of a property sketch.

The finished drawing is reduced in size to 8.5 x 11 inches and is copied for use by RASA/UMTRA staff during the inclusion survey and in the final report. The finished drawing is then given to the Public Relations staff who then copy the drawing and insert it in the property portfolio. The colored dot on the portfolio is changed from brown-gold to red. The Public Relations staff then submit a print-out of properties ready to survey to the Process Coordinator who then assigns them to specific Team Leaders (see Procedure 7.2.6.4, Processing Returned Consent-for-Access Agreements).

7.3.7 Exhibits

1. Exhibit 7.3-1, Example of property sketch

7.3.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

7.4 FIELD VAN PREPARATION

7.4.1 Purpose

The purpose of this procedure is to ensure that all equipment and information needed to conduct an inclusion survey is present in the field van prior to its departure from the RASA/UMTRA Office.

7.4.2 Applicability

This procedure applies to all field vans used by the RASA/UMTRA to conduct inclusion surveys.

7.4.3 References

Sect. 11.2, Field Van Equipment Inventory

7.4.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

7.4.5 Responsibilities

The Field Survey Team Leaders are responsible for the implementation of this procedure.

7.4.6 Procedure

7.4.6.1 Selection of Properties to be Surveyed

The Process Coordinator, in consultation with the Survey Manager, assigns properties on a weekly basis to each Team Leader. The Team Leaders then contact each property owner and/or tenant and arrange a mutually agreeable survey date and time for each property. A survey schedule then is made up by the Team Leader and a copy is given to the Process Coordinator.

7.4.6.2 Van Preparation

The Team Leader ensures that all required servicing and maintenance of the van has been accomplished.

The Team Leader verifies that all required equipment is in the van, using the check list described in Section 11.2. He then notes this inspection by date and initial in the field van log book.

The Team Leader ensures that all property sketches and information that will be needed during the survey trip are in the van.

7.4.7 Exhibits

None.

7.4.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SUBJECT: PRE-INCLUSION SURVEY ACTIVITIES

EXHIBIT 7.2.6.2-1

EXAMPLE OF CONSENT-FOR-ACCESS TRANSMITTAL LETTER

CONSENT FOR ACCESS TO CONDUCT SURVEYS
AND ENGINEERING STUDIES

VICINITY PROPERTY NO.:

PROPERTY ADDRESS:

PROPERTY PARCEL NUMBER OR DESCRIPTION:

I (We) acknowledge that I (We) own the property described above, and grant permission to employees, contractor and subcontractor personnel, and other representatives of the U.S. Department of Energy and the State of ____________________ to enter upon the property at a reasonable time or times during the next 12 months to conduct radiation surveys to determine the nature and extent of any radioactive material that might be present. In addition, permission is given to perform engineering assessments, if necessary, to evaluate the remedial measures that might be taken, as well as to evaluate the extent of the work required and the cost.

I (We) understand that DOE's and the State's responsibility for any damage or disturbance to my (our) property caused by its activities shall be any backfilling, seeding, sodding, landscaping, rebuilding or repair of the property required to restore it to a condition comparable to its apparent physical condition immediately prior to entry upon the property.

I (We) understand that the DOE and the State of ____________________ are not obligated to perform remedial action upon the property. I (We) understand that no remedial action shall be performed until the DOE, the State, and the property owner have entered into a separate written agreement setting forth terms, conditions, and plans for remedial action.

I (We) understand that the DOE and the State have the right to disclose to the public, in the form of technical data and reports, the results of its data-gathering on the above-described property.

( ) I grant access for the conduct of surveys and engineering studies as provided in this Consent-for-Access.

______________________________ Signature of Owner(s) ____________ Date

( ) I have decided not to participate in the UMTRA Project.

______________________________ Signature of Owner(s) ____________ Date

OWNER DATA:

______________________________ Owner's Name

______________________________ Tenant Name (If Applicable)

______________________________ Owner's Address

Phone: ____________________

Home Phone: ____________________

Business Phone: ____________________

EXHIBIT 7.2.6.2-2

EXAMPLE OF CONSENT-FOR-ACCESS AGREEMENT FOR STATE OF COLORADO

CONSENT FOR ACCESS TO CONDUCT SURVEYS
AND ENGINEERING STUDIES

VICINITY PROPERTY NO.:

PROPERTY ADDRESS:

PROPERTY PARCEL NUMBER OR DESCRIPTIION:

I (We) acknowledge that I (We) own the property described above, and grant permission to employees, contractor and subcontractor personnel, and other representatives of the U.S. Department of Energy and the State of ________ to enter upon the property at a reasonable time or times during the next 12 months to conduct radiation surveys to determine the nature and extent of any radioactive material that might be present. In addition, permission is given to perform engineering assessments, if necessary, to evaluate the remedial measures that might be taken, as well as to evaluate the extent of the work required and the cost.

(I) (We) understand that DOE's and the State's responsibility for any damage or disturbance to (my) (our) property caused by its activities shall be any backfilling, seeding, sodding, landscaping, rebuilding or repair of the property required to restore it to a condition comparable to its apparent physical condition immediately prior to entry upon the property.

I (We) understand that the DOE and the State of ________________ are not obligated to perform remedial action upon the property. I (We) understand that no remedial action shall be performed until the DOE, the State, and the property owner have entered into a separate written agreement setting forth terms, conditions, and plans for remedial action.

I (We) understand that the DOE and the State have the right to disclose to the public, in the form of technical data and reports, the results of its data-gathering on the above-described property.

[] I grant access for the conduct of surveys and engineering studies as provided in this consent-for Access.

________________________ ____________
Signature of Owner(s) Date

[] I have decided not to participate in the UMTRA Project.

________________________ ____________
Signature of Owner(s) Date

OWNER DATA:

____
Owner(s) Name

____
Owner(s) Address

Home Phone ____________ Business Phone ____________

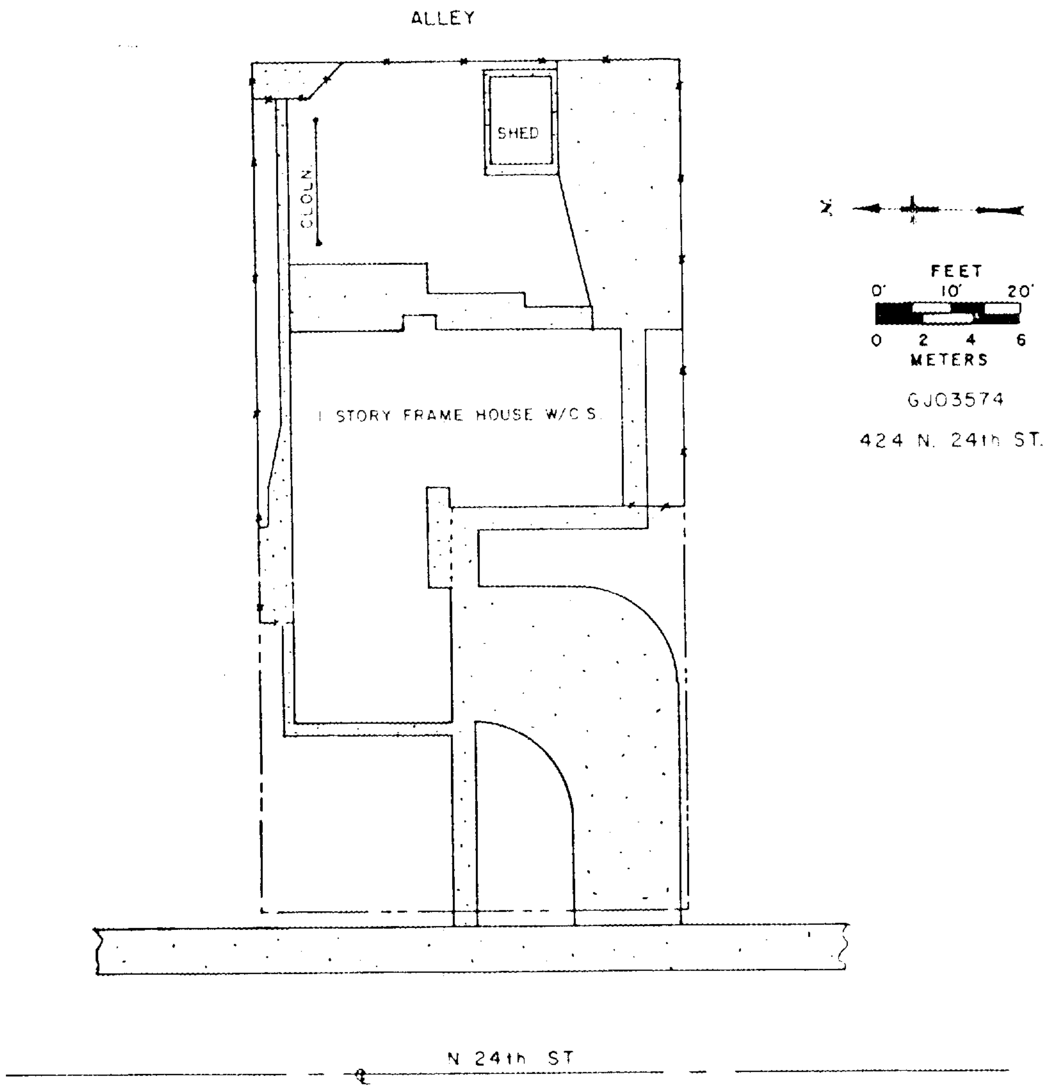
EXHIBIT 7.2.6.3-1

DATA ENTERED IN THE RASA/UMTRA DATABASE

Entry	Meaning
LOCNO	TAC-assigned property location number
STREETNO	Number in property address
STREETNAME	Name of street in property address
CITYSTATE	City, State, and ZIP code in property address
TYPE	Type of property
OWNRLAST	Last name of property owner
OWNRFIRST	First and middle name or initials of property owner
OWNRSTREET	Street address of property owner
OWNRCITY	City in which owner lives
OWNRSTATE	State in which owner lives
TENANT	Name of tenant
DOEREQDATE	Date on which DOE designated the property or asked that survey be conducted
ACCLTRSENT	Date on which access agreement form was sent
NEXCONTAC'	Date of next contact with property owner
FUPSENT	Date on which follow-up letter was sent
RESPONDATE	Date of owner's response
CONSTATUS	Owner's response (CONSENT or DENIAL)
SURVEYDATE	Date on which inclusion survey was conducted
RECMDATION	RASA/UMTRA recommendation to DOE (INCL or EXCL)
RECBASIS	Type of information on which recommendation was based (walk-on, van, or historical
LTRDOE	Date on which recommendation and survey report to DOE
INCLDATE	Date on which DOE decided to include the property
OTHRLOCNO	Other assigned property location numbers, if any

EXHIBIT 7.3.6.2-1

EXAMPLE OF PROPERTY SKETCH



SECTION 8: MOBILE GAMMA SCANNING VAN

SUBJECT: MOBILE GAMMA SCANNING VAN

8. MOBILE GAMMA SCANNING VAN

8.1 PREPARATION OF MOBILE GAMMA SCANNING SURVEY PLAN

8.1.1 Purpose

The purpose of this procedure is to provide guidelines for the preparation of mobile gamma scanning survey plans.

8.1.2 Applicability

This procedure applies to the preparation of mobile gamma scanning survey plans by RASA/UMTRA personnel.

8.1.3 References

1. Previous site aerial survey photographs, if any
2. Previous mobile gamma scanning results, if any

8.1.4 Definitions and Abbreviations

See Sect.1.5 of this manual, Terminology.

8.1.5 Responsibilities

8.1.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager has overall responsibility for the content and adequacy of the mobile gamma scanning survey plan. He will designate a Mobile Scan Team Leader and reviewers for the plan and will be responsible for reviewing, transmitting, and coordinating the review, and submitting the plan for DOE approval.

APPROVED: Craig Little   DATE: 4/14/86

RASA/UMTRA Project Manager

8.1.5.2 Mobile Scan Team Leader

The Mobile Scan Team Leader is responsible for the preparation of the mobile gamma scanning survey plan. He will submit the plan into the review process; final approval is made by the RASA/UMTRA Project Manager.

8.1.5.3 Reviewers

The Reviewers will receive the mobile gamma scanning survey plan from the Mobile Scan Team Leader and will review the plan to ensure that it is prepared according to the requirements of this procedure and that quality assurance and administrative requirements are satisfied. Review comments will be returned to the Mobile Scan Team Leader within three days.

8.1.6 Procedure

8.1.6.1 Develop Mobile Scanning Survey Plan

Obtain, review, and assess information provided by previous aerial survey and mobile scan data, if available. Based on the available information, develop the survey plan following the steps below:

1. Define the scope or boundaries of the survey by outlining on a map of the general survey area, (1) the areas of known contamination as indicated by the aerial survey results, and (2) the extent of previous mobile gamma scans.
2. Using the outline established in the previous step (1), develop a street-by-street scanning plan for the area. Note from the aerial survey or previous mobile scan information specific areas of high radiation levels that require special attention. This plan will normally identify the specific sections of town to be surveyed; or, if the entire city is to be scanned, define the outer limits of the survey.

3. With the results from the previous step (2), estimate the length of time required to complete the mobile gamma scan and develop a schedule for the survey. Provide a tentative date for start of the survey. This date is subject to the RASA/UMTRA Project Manager's approval.
4. Prepare the survey plan for submittal to the RASA/UMTRA Project Manager's review. The plan should include the following:

   a. An introduction summarizing the information on the site obtained from previous aerial surveys and mobile scans, as applicable,
   b. The scope of the present planned survey, including (1) a ground level follow-up of the aerial survey, and (2) the plan for the street-by-street mobile scan; when available, include a map showing the areas and boundaries of the proposed survey plan, and
   c. A schedule for the survey activities showing estimated survey start date, duration, end date, and date on which a report will be submitted to DOE.

8.1.6.2 Plan Submittal, Review, and Approval

The completed survey plan is submitted to the Reviewers. Upon completion of the review, a final version of the plan is submitted to the RASA/UMTRA Project Manager for final review and approval.

8.1.7 Exhibits

None.

8.1.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

8.2 MOBILE GAMMA SCANNING VAN OPERATION

8.2.1 Purpose

The purpose of this procedure is to provide guidelines for operating the mobile gamma scanning van for vicinity properties identification.

8.2.2 Applicability

This procedure applies to the mobile gamma scanning van used by RASA/UMTRA personnel for scanning and identification of vicinity properties.

8.2.3 References

Instruction manuals for the equipment listed in Sect. 6.1 of this procedure, to the extent available.

8.2.4 Definitions and Abbreviations

8.2.4.1 Definitions

INVERTER. A device for converting direct current to alternating current.

Also see Sect. 1.5 of this manual, Terminology.

8.2.4.2 Abbreviations

MCA Multi-channel analyzer

CRT Cathode ray tube - may refer to the computer CRT or MCA CRT in this procedure

Also see Sect. 1.5 of this manual, Terminology

8.2.5 Responsibilities

8.2.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager has overall responsibility for identification of vicinity properties.

8.2.5.2 Mobile Scan Team Leader

The Mobile Scan Team Leader is responsible for the planning and coordination of the mobile gamma scanning activities for identification of vicinity properties.

The mobile scan team leader is also responsible for conducting the field scanning activities. He and two Instrument Technologists operate the van.

In addition, the Mobile Scan Team Leader is responsible for the readiness status of the mobile gamma scanning van and support systems before the van leaves for the site.

8.2.6 Procedure

8.2.6.1 Equipment, Apparatus, and Supplies

The mobile gamma scanning van and support systems consist of a modified Dodge Model 300 van that has a built-in, gasoline-powered electric generator and associated instrumentation, lead storage batteries, battery charger, inverter and associated instrumentation, field office supplies, distance transducer, support equipment, and supplies.

The gamma scanning instrumentation consists of the following:

1. Three 4 x 4 x 16 in. NaI(Tl) Polyscin Log Crystals having integral 3.5-in. photomultiplier tubes mounted on a lead-shielded, hydraulically operated carriage;
2. ORNL designed interface unit;
3. Commodore CBM Model 8032 Computer;
4. Commodore CBM 8050 Dual Drive Floppy Drive;
5. Commodore Tractor Model 4022 Printer;
6. Tracor Northern Display Unit TN 1314;
7. Tracor Northern Pulse Height Analyzer, TN 1706;
8. Ortec Model 113 Preamplifier;
9. ORTEC AMP & SCA, Model 490B;
10. ORTEC LOG/LIN Rate Meter, Model 449;
11. ORTEC High Voltage Power Supply, Model 456, 0-3kV;
12. TENNELEC TENNEBIN 3, Bin Power Supply;
13. Distance transducer;
14. Audio alarm system;
15. Tl-208 Source, no specifications;
16. Co-60 Source, 14182.5, 11.00 uCi (1-1-74) Isotope Products Laboratories;
17. Cs-137 Source, 7286-5, 12.0 uCi (11-1-79) Isotope Products Laboratories;
18. Lead pig for Co-60 and Cs-137 sources; and
19. Floppy Disk Program, CBM Model 8050 Scan Program, 4/8/83.

8.2.6.2 Equipment Setup

The detectors, computer and peripherals, pulse height analyzer components, and support systems are all interconnected and ready for operation. If, for some reason, component disconnect or reconnect is necessary, the Mobile Scan Team Leader may contact an instrument technologist at ORNL and obtain the necessary information to reconnect the system.

8.2.6.3 General Procedure

The following steps are typical in mobile gamma scanning:

1. Start instrument power supply system (see Sect. 6.4),
2. Turn on instrumentation (see Sect. 6.5),
3. Turn on data handling system (see Exhibit 8.2.6.3-1),
4. Calibrate instrumentation (see Exhibit 8.2.6.3-2),
5. Periodic check of distance transducer calibration (see Sect. 6.8),
6. System scanning operation (see Sects. 6.9 through 6.13),
7. System shutdown (see Sect. 6.14), and
8. Field documentation (see Sect. 6.15).

The preceding steps are explained in detail in the referenced succeeding sections and photographs of the mobile gamma scanning van are provided as Exhibits 8.2.6.3-9 through 8.2.6.3-15

For background information, a system description of the mobile scanning van is included as Exhibit 8.2.6.3-16. Exhibit 8.2.6.3-17 presents the computer program for data analysis and some useful computer commands.

8.2.6.4 Instrument Power Supply Startup

1. After checking oil level and securely replacing oil fill/check cap, start the generator by turning on the generator start switch located on the right driver overhead panel. Starting the generator will also activate the clock counter, which will register the number of hours the generator has operated. This counter will be checked by the garage to determine when maintenance is needed.
2. To monitor the condition of the batteries, check the battery charge indicator on the overhead panel above the driver's position and dash ammeter.

3. After generator engine has stabilized (warmed up for 2-3 minutes), turn on the inverter switch located on a panel below the computer. This is the top left switch on the panel.
4. Monitor the voltmeter and ensure that the power supply has stabilized at approximately 110 V before turning on the instrumentation.
5. Watch the voltmeter and frequency meter after generator startup. The voltmeter should indicate 110 V and the frequency meter should indicate 60 Hz (or cycles per second). Notify the scanning team leader if the readings are abnormal when the generator is under load. The ammeter will indicate the load placed on the system.
6. To ventilate the inverter compartment, turn on the blower switch (toggle) located below small vent hole in panel.
7. When the scanning activities for the day are completed, turn off equipment power, inverter, and generator, in that order.

8.2.6.5 Gamma Scanning System Startup

1. Start instrument power supply as in Sect. 6.4.
2. Turn on instrument bin power.
3. Turn on interface unit power and push "reset" on the interface unit.
4. Turn on high-voltage power supply and raise to 1000 V in 500-V increments. Pause for 5 to 10 s at 500 V before increasing to 1000 V.
5. Raise the detectors to the full "up" position by pressing the top button on the hydraulic controller. The hydraulic controller is located on the wall just below the right-rear window of the scanning van. When the full "up" position is reached, a limit switch will stop the pump.
6. Insert the two safety pins into the detector frame (this may require using one or both of the hydraulic control buttons to position the holes so the pins can be inserted).
7. When the safety pins are inserted, push the down button of the controller to release the pressure from the hydraulic system.

8.2.6.6 Instrument Calibration

The scanning instrumentation is calibrated daily after system electronics and van working area have been warmed/cooled to room temperature and before any scanning is performed. If the system has been calibrated, proceed to any of the other program modes (Sects. 6.8 through 6.11). The procedure is detailed in Exhibit 8.2.6.3-2.

8.2.6.7 Distance Transducer Calibration

Calibration (detailed)

1. Check tire pressures; each tire should have 75 psi. Record the tire pressure in the scanning van calibration log book.
2. Lay out a stretch of road or street a minimum of 500 ft long. Mark the beginning and the end of the stretch along the curb and each 50-ft increment in between.
3. Drive the van to the starting point.
4. Mount the slow-moving-vehicle sign and turn on emergency flashers.
5. Set the computer system on Calibration or Identification mode.
6. When the operator signals ready, drive the van slowly toward the end point of the calibrated stretch.
7. Carefully stop the van at the end point of the stretch.
8. The operator reads the distance from the computer display.
9. Repeat this check procedure three to five times. If the computer display is ± 3 % of the true value (500 ft), the distance transducer is ready to be used.
10. If the readings are outside the range, the Mobile Scan Team Leader will notify the Instrument Technologist for further adjustments.

Documentation

Document the results of the calibration check for the distance transducer in the Scanning Van Calibration Log Book. For each calibration check, enter the information indicated in Exhibit 8.2.6.8-1.

An alternative check of the distance transducer can be made in either the Scan or Identification program mode when traveling along a public highway which has mile marker signs. This check will easily give results which indicate qualitatively if a detailed calibration of the distance transducer is required if distance is > ± 50 ft in one mile.

8.2.6.8 Background Mode

The background mode of the scan program is accessed when determining the background radiation level to be used in establishing the "hit" criteria for an area to be scanned. Background radiation levels may be new (to be acquired) or old (previously determined). These two options are addressed in Exhibit 8.2.6.9-1.

8.2.6.9 Scan Mode

The scan mode of the scanning program is used to scan properties for anomalies. The procedure for scan mode operation is detailed in Exhibit 8.2.6.10-1.

8.2.6.10 Identification Mode

The identification mode detailed in Exhibit 8.2.6.11-1 is used to verify or obtain the exact location of hits. No data storage is provided for this mode of operation.

8.2.6.11 Data Dump Mode

This program mode (detailed in Exhibit 8.2.6.12-1) allows for the printing of all recorded raw data obtained during scanning from the disk in drive 1. No computer analysis of the data is performed.

8.2.6.12 File List Mode

The file list program mode detailed in Exhibit 8.2.6.13-1 will print out the computer analyzed data on a file basis for the disk in disk drive 1. This program mode has three options:

1. The scan data can be compared with the hit criteria that were used during the scan, resulting in a printout of the same summary that was provided from the scan mode. This option is accessed by typing U;
2. The scan data can be compared with new hit criteria input by the operator, resulting in a different analysis and summary of data. To access this option, type I and input the appropriate new hit criteria when called for; and
3. All the scan data, including the data on properties where a hit did not occur, are printed. This option can be accessed by typing N and entering 0 and pressing the RETURN key for each of the needed criteria.

8.2.6.13 System Shutdown

1. Remove disks from disk drives 0 and 1.
2. Turn off floppy disk system.
3. Turn off computer.
4. Turn off the interface unit power.
5. Decrease high-voltage by 500 V increments to 0 V.
6. Turn off high-voltage power supply.

7. Turn off instrument bin power.
8. If travel over public roads more than to a local motel or if project is complete, remove safety pins under detector frame (may require use of hydraulic system controls to position detector). If project is incomplete go to 10.
9. Lower detectors to the lowest position, making sure that detector cables are free of obstructions (push in and hold the down button on the hydraulic controller).
10. Turn off the power inverter.
11. Turn off the generator.

8.2.6.15 Documentation

Documentation of the gamma scanning operation is mainly provided by the computer system and floppy disk systems. Data analysis is also provided by the computer system with hard copy printout. The printout and any notes are filed as part of the gamma scanning operation records. The printouts are attached to the Scanning Van Log Book. See the section on Data Storage in Exhibit 8.10 for more details.

8.2.7 Exhibits

1. Exhibit 8.2.6.3-1, Data handling and system startup
2. Exhibit 8.2.6.3-2, Instrumentation calibration
3. Exhibit 8.2.6.9-1, Background mode operation
4. Exhibit 8.2.6.3-4, Scan mode operation
5. Exhibit 8.2.6.3-5, Identification mode
6. Exhibit 8.2.6.3-6, Data dump mode
7. Exhibit 8.2.6.3-7, File list mode

SUBJECT: MOBILE GAMMA SCANNING VAN

8. Exhibit 8.2.6.3-8, Mobile scanning van support equipment and supplies
9. Exhibit 8.2.6.3-9, Mobile gamma scanning van
10. Exhibit 8.2.6.3-10, Mobile gamma scanning van operator console area
11. Exhibit 8.2.6.3-11, CBM Model 8032 Computer
12. Exhibit 8.2.6.3-12, CBM Model 8050 Disk Drive and MFE Recorder
13. Exhibit 8.2.6.3-13, Interface unit and multichannel analyzer
14. Exhibit 8.2.6.3-14, Detectors mounted on carriage/hydraulic system
15. Exhibit 8.2.6.3-15, Closeup view of detectors on carriage
16. Exhibit 8.2.6.3-16, System description of the updated RASA/UMTRA scanning van
17. Exhibit 8.2.6.3-17, Scan program and useful computer commands
18. Exhibit 8.2.6.5-1, Gamma scanning program directory
19. Exhibit 8.2.6.8-1, Distance transducer calibration check data
20. Exhibit 8.2.6.3-18, Background mode CRT display
21. Exhibit 8.2.6.3-19, Background scan CRT display
22. Exhibit 8.2.6.3-20, Background mode printout
23. Exhibit 8.2.6.3-21, Scan mode CRT display
24. Exhibit 8.2.6.3-22, Scan mode printout
25. Exhibit 8.2.6.3-23, Identification mode CRT display

8.2.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-1. Data handling and system startup.

Technologist action	CRT display	Function or comment
1. Turn on computer (switch is located on rear lower left corner)	*** COMMODORE BASIC 4.0 *** 31743 bytes free READY	
2. Turn on floppy disk system (switch is located on rear lower left corner)		Center green light will appear when system is ready
3. Insert scan program disk into the floppy disk drive 0		Disk title is "CBM Model 8050 Scan Program, 6/2/82"
4. Press SHIFT and RUN/STOP keys to load the computer/disk support programs (DOS Support)		Disk drive 0 green light will come on while information is being transferred
	READY	DOS Support is loaded
5. Insert blank disk into Drive 1		To format the blank disk for data storage
6. Type >n1 - disk name,XX		Disk name is any appropriate identifying name of not more than 16 characters. XX is a sequential number from 00 to 99, for use when multiple disks are used on site Disk Drive 1 green light will appear for 3 to 4 min and disappear when formatting is complete
7. Remove the disk from drive 1 and use a felt tip pen to write on the disk the name typed in Step 6 above		Disk should be removed and reinserted to ensure that the disk is registered properly when formatted

Exhibit 8.2.6.3-1. (Continued)

Technologist action	CRT display	Function or comment
8. Type ↑scan and press RETURN key	Input your name	Will load scan program from disk 0
9. Enter your name. Press RETURN key	Input date (e.g. 3/4/82)	After the log-on sequence, the program will automatically address the background program mode. If other modes are desired, go to step 11
10. Enter date. Press RETURN key		
11. Press EXIT key	CRT will display the six program modes that can be accessed (see Exhibit 8.2.6.5-1)	Computer will return to the program mode directory Any of the six program modes can now be accessed by typing the first letter of any program mode

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Exhibit 8.2.6.3-2. Instrument calibration

Technologist action	CRT display	Function or comment
1. Press C key.	The CRT will display the calibration/ instrument settings.	C is the first letter of the calibration program
2. With the CRT display as a guide, check the discriminator window settings on the interface unit. Use the values under UPPER and LOWER columns of the display for the appropriate windows (A1 through A4 and B1 through B4)		
3. Remove the 137 Cs source from the lead pig and place it in the source holder on the power strip in front of the detector support frame		
4. Push the acquire button on the MCA and observe the dead-time meter; it should be less than 10 percent		
5. Move MCA cursor to Channel 111		
6. Observe 137 Cs 0.661 MeV photopeak. If it falls in Channel 111$\pm$1, do nothing. If not, adjust the fine gain on amplifier until the peak falls within the channel range		When adjusting fine gain, always clear the acquired data to minimize confusion on the location of the photopeak

Exhibit 8.2.6.3-2. (Continued)

Technologist action	CRT display	Function or comment
7. Record the 137 Cs photopeak channel number in the Scanning Van Calibration Log Book. Include calibrator's name, date of calibration, and location of calibration		
8. Replace the 137 Cs source with a 60 Co source. Clear data. Again observe the dead time (should be $\leq$ 10%)		
9. Move the analyzer cursor to the center of the 1.17 MeV photopeak (approximately at Channel 192)		
10. If photopeak is ±3 channels of channel 192, go to step 11 below. If not, go back to step 3 above. If the problem cannot be resolved, go to step 21		
11. Record the 60 Co 1.17 MeV photopeak channel number in the Scanning Van Calibration Log Book		
12. Move the analyzer cursor to the center of the 1.33 MeV 60 Co photopeak (approximately channel 217)		
13. If photopeak is ±3 channels of channel 217, go to step 15. If not, return to step 3		
14. If problem cannot be resolved, go to step 21		
15. Record the 60 Co 1.33 MeV photopeak in the Scanning Van Calibration Log Book		

Exhibit 8.2.6.3-2. (Continued)

Technologist action	CRT display	Function or comment
16. Remove the 60 Co source and store in the lead pig. Place the 208 Tl source on the bracket directly in front of the detectors; observe dead time; should be less than 10%		
17. Move the analyzer cursor to the center of the 2.61 MeV 208 Tl photopeak (approximately channel 424)		
18. If the center of the photopeak is ±5 channels of channel 424, go to step 19. If not, go back to step 3. If the problem cannot be resolved, go to step 21		
19. Record the photopeak channel number in the Scanning Van Calibration Log Book		
20. Return 208 Tl source to the source drawer		
21. If the analyzer cannot be calibrated to the required tolerances, the scanning team leader may contact an instrument technologist at ORNL-RASA for further adjustments or repairs		
22. Type any character on the keyboard and observe on the display unit the count rates in the appropriate discriminator regions of interest		

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-2. (Continued)

Technologist action	CRT display	Function or comment
23. Observe the "average count rate" in the Ra (609 keV) region with no source present. (Allow time for average values to stabilize approximately 40 s. Record the average background count rate in the Scanning Van Calibration Log Book		
24. Remove the 137 Cs source from the lead pig and place it at the same location as when calibrating		
25. Observe the average count rate in the Ra (609 keV) region associated with the 137 Cs source (allow approximately 40 s for count rate to stabilize). Record the average source count rate in the Scanning Van Calibration Log Book		
26. Subtract the count rate in step (23) from that in step (25) and record the net count rate in the Scanning Van Calibration Log Book.		

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-2. (Continued)

Technologist action	CRT display	Function or comment
27. If the net count rate is within ±5% of the previous calibration (see the log book), the detector sensitivity is considered unchanged and property scanning can begin. If the net count rate is outside the tolerance range, inform the mobile scan team leader who will contact the appropriate instrument technologist for repairs		
28. Replace the 137 Cs source in the lead pig		
29. Press EXIT key to return to the program mode directory	CRT will display information shown in Exhibit 8.1-19	Calibration is complete, and another program mode may be accessed

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.9-1. Background mode operation.

Technologist action	CRT display	Function or comment
1. Press B key.	See Exhibit 8.2.6.3-18	This will access the background mode of the scan program
2. If a new file is to be established for background of the area, press N key. If data from a previous background file are to be used, go to step (6)	See Exhibit 8.2.6.3-19 Input background filename	
3. Type in filename. Press RETURN key (only when ready to accumulate data)	Accumulated background data and distance	Filename must be less than 24 characters
4. Drive the vehicle at normal driving speed to cover a representative % of the accessible streets to establish the background; the mobile scan team leader has the responsibility of determining if variations in the local geology and/or land use warrant the acquisition of a new background throughout the project		Normal driving speed is the posted speed limit at the particular location being scanned
5. When sufficient coverage has been obtained, press EXIT key to close data acquisition	CRT will display the program directory	The computer will analyze the accumulated data and print out the results. See Exhibit 8.2.6.3-20
6. If a background has been established for the area to be scanned, press O (for old) key	Input total Ra counts (mean)	
7. Enter total Ra counts (mean) from a previous background measurement. Push RETURN key	Input Ra/Th Ratio (mean)	
8. Enter Ra/Th ratio (mean from a previous background measurement. Push RETURN key	Input Ra/Th ratio (std dev)	
9. Enter the Ra/Th ratio standard deviation from previous background measurement. Push RETURN key	Computer will display the new hit criteria for a few seconds and return to the program directory	

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.10-1. Scan mode operation.

Technologist action	CRT display	Function or comment
1. Position the gamma scanning van at an identifiable permanent landmark in an area to be scanned		Landmarks can be cross streets, house number and street, etc.
2. Type S and press RETURN key	Computer will give specifications for filename and an example. See Exhibit 8.2.6.3-21 INPUT FILE NAME	
3. Type file name	Filename typed	Filename should be less than 24 characters
4. When ready, press RETURN key	Computer will display the accumulated data at 1-s intervals for the total distance, total Ra counts, Ra/Th ratio, and the sign of the positive difference analysis technique	Green light on disk drive 1 will appear
5. Type start landmark and press RETURN key		Start landmark is usually a street or house number and street.

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.10-1. (Continued)

Technologist action	CRT display	Function or comment
Drive the scanning van at 5 mph or less as close as possible to the street curb		
6. Type in landmarks and press RETURN key at regular intervals as the scan proceeds		These landmarks will serve as check points when anomalies are detected When entering house and/or business numbers, press return when detector crystals pass the main entrance of the building
7. After all accessible roads within the area have been scanned, press EXIT key to close the file and begin computer analysis of the data		When the computer has completed analysis of the data, the printer will print out the locations where hits occurred. It will also provide location information (distance from last identifiable landmark), appropriate count rate data in the Ra channels, the Ra/Th ratio, and the magnitude of the computer positive difference A remarks column is also provided for any comments the technologist wants to make. See Exhibit 8.2.6.3-22

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.11-1. Identification mode.

Technologist action	CRT display	Function or comment
1. Type I to access the program mode; then follow instructions on CRT - press RETURN key	See Exhibit 8.2.6.3-23	No data analysis is provided in this mode of scanning. Also, the distance can be reset to zero at any time by typing 0
2. Referring to the scan mode printout, find the location of the hit, and drive the van to the vicinity of the hit location		
3. Reset the distance at the positions of nearest landmark.		
4. Start scanning toward the location of hit Drive the van very slowly. Compare CRT displayed distance to that recorded on summary sheet obtained from step 8, Sect. 6.10 of this procedure	Similar information as in scan mode data	
5. Stop the vehicle at the hit location and identify the property where the hit occurred		Identification may be by house number and street or other property descriptions
6. Record the identification information under the remarks column of the summary data sheet		
7. When all hit properties have been identified, press EXIT key to end the identification mode and return to the program mode directory	Program mode directory	

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.12-1. Data dump mode.

Technologist action	CRT display	Function or comment
1. Type D	Filenames of all files on the disk	Computer will read the file directory on the disk in drive 1 The file names are numbered sequentially as they appear on the disk. To dump data from a single file, type the number of that file. To dump data from the entire disk, press RETURN key
2. After obtaining the desired data press EXIT key to return to the program mode directory		

Exhibit 8.2.6.13-1. File list mode.

Technologist action	CRT display	Function or comment
1. Type F.	Filenames of all files on the disk	Computer will read the file directory of the disk. The files are numbered sequentially as they appear on the disk
2. Choose the option desired as discussed at the beginning of this section		
3. Select the number assigned to the desired file, enter it, and press RETURN		
4. When the needed data are printed, press the EXIT key to return to the program mode directory		

Exhibit 8.2.6.3-8. Mobile scanning van support equipment and supplies.

Office supplies:

1. Stapler and staples
2. Three-hole paper punch
3. Paper clips
4. Tape, masking and Scotch
5. Pens, pencils, colored pencils
6. 3-ring binders with inserts

Van accessories:

1. Tire wrench
2. First aid emergency kit
3. Quart of oil
4. Two-ton hydraulic jack
5. Tire pressure gauge, to 100 psi
6. Waste basket
7. Road map
8. Slow-moving-vehicle sign

Electronic tools:

1. Voltmeter (VOM)
2. Tool kit (pliers, cutter, soldering iron, screw driver)
3. ORTEC Model 448 Research Pulser
4. Digital voltmeter
5. Oscilloscope
6. Frequency counter

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-8. (Continued)

Scanning supplies and backup equipment:

1. Tractor printer paper
2. MFE strip chart recorder paper
3. Blank diskettes
4. Backup electronics components

   a. Ortec High Voltage Power Supply Model 456, 0-3kV
   b. Ortec AMP & SCA, Model 490B
   c. Ortec LOG/LIN RATEMETER, Model 449
   d. Ortec Model 113 Preamplifier
   e. Tracor Northern Multichannel Analyzer 1706 and Model 1314 CRT

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Exhibit 8.2.6.3-9. Mobile gamma scanning van.

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Exhibit 8.2.6.3-10. Mobile gamma scanning van operator console area.

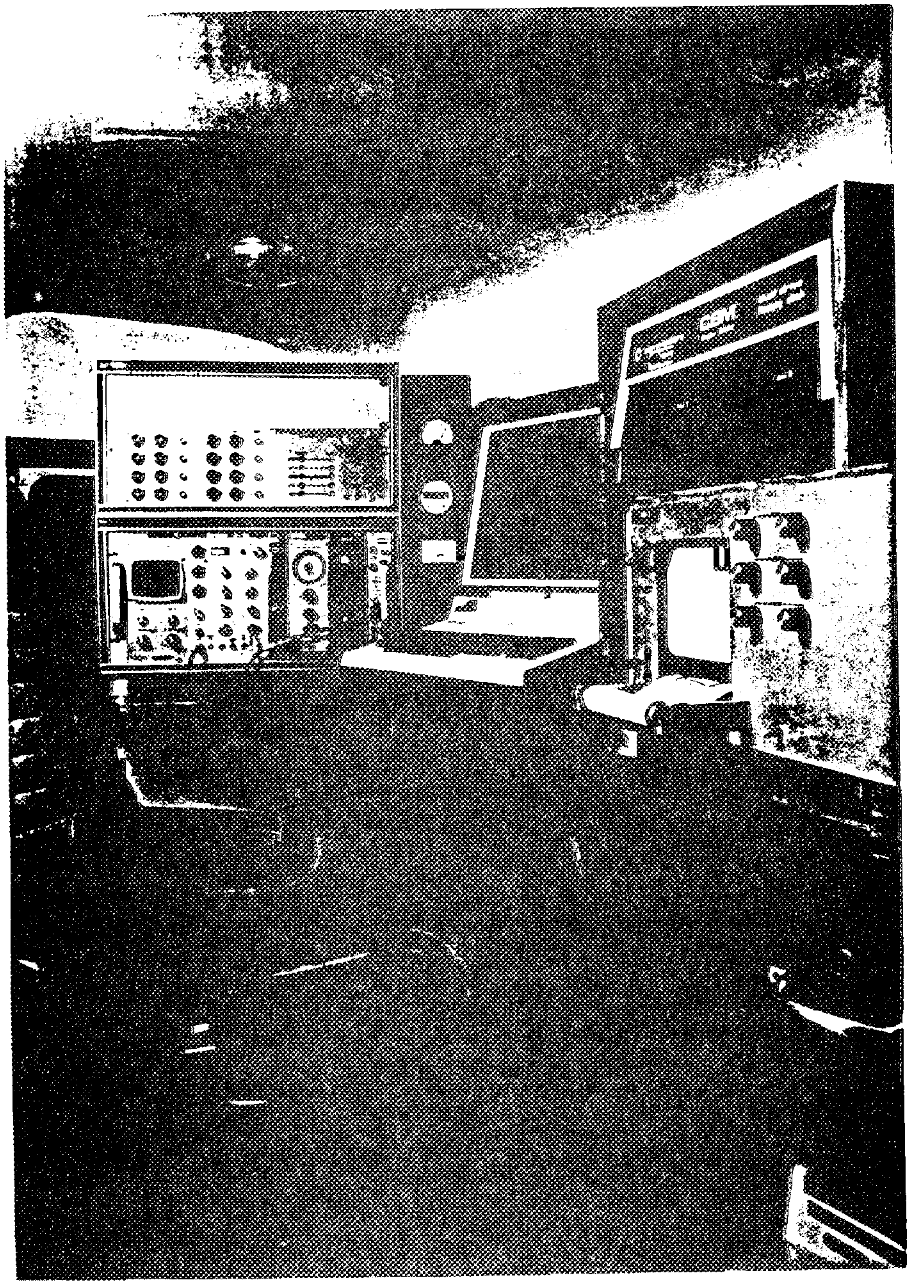

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Exhibit 8.2.6.3-11. CBM Model 8032 computer.

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-12. CBM Model 8050 disk drive and MFE recorder.

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-13. Interface unit and multichannel analyzer.

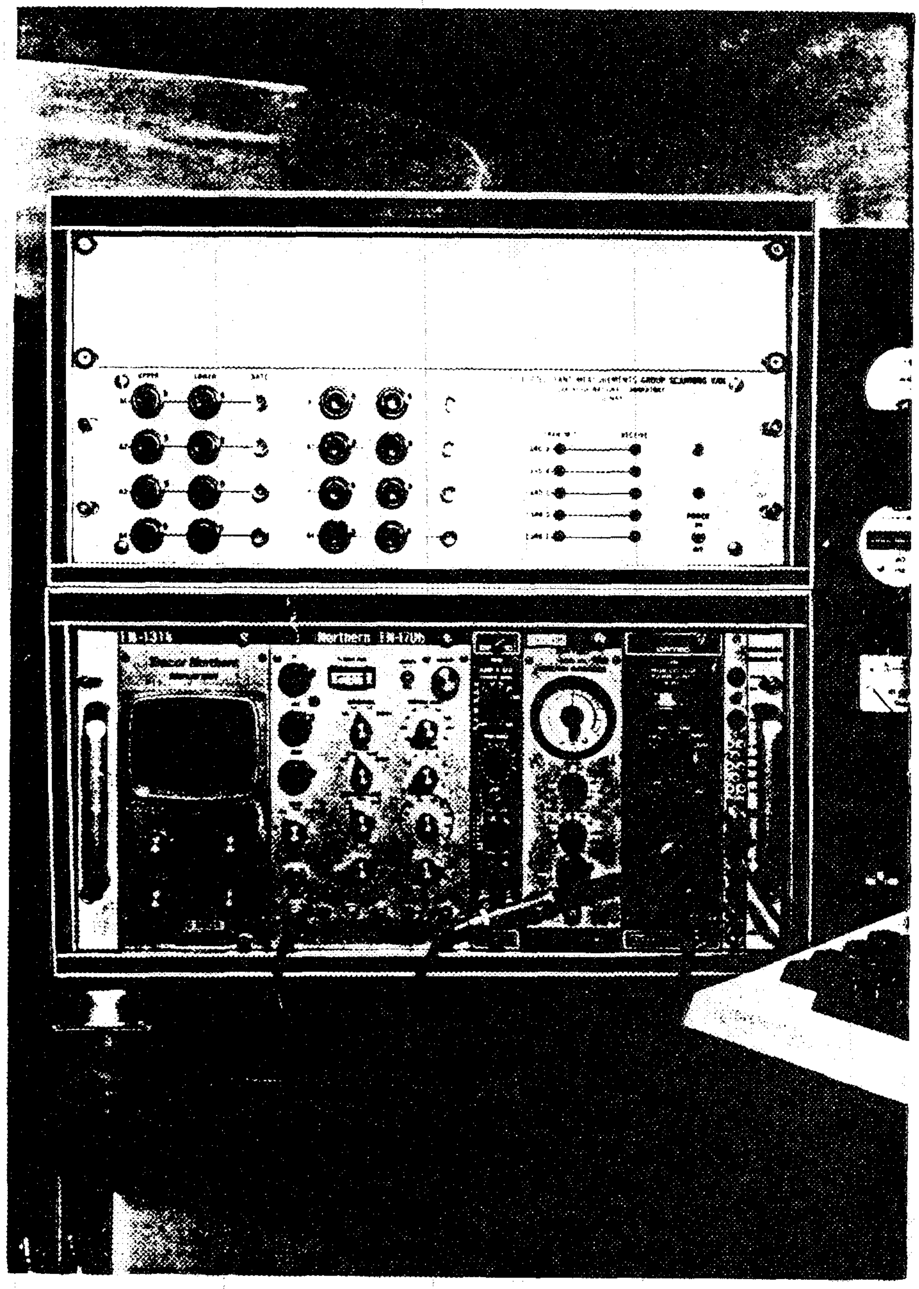
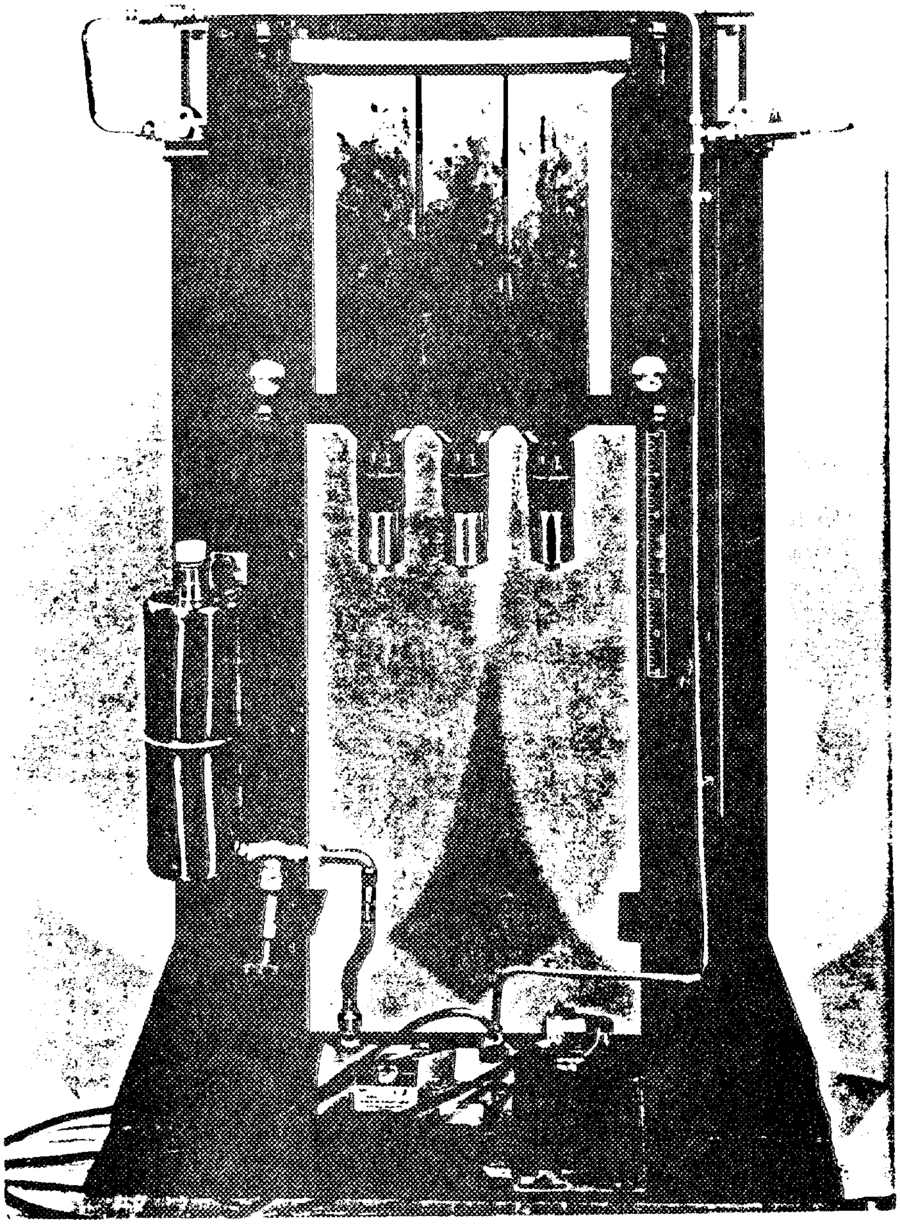
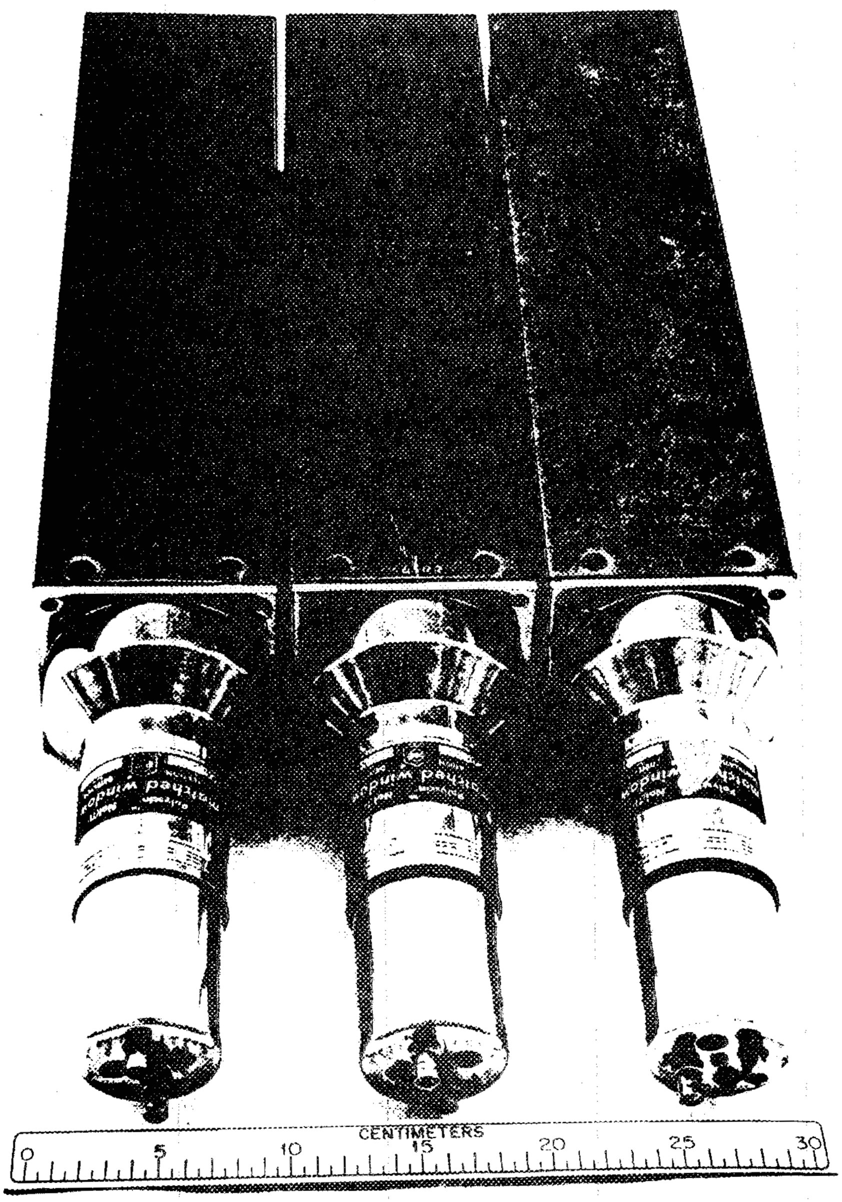


Exhibit 8.2.6.3-14. Detectors mounted on carriage/hydraulic system.



SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-15. Closeup view of detectors on carriage.



SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-16. System description for the updated RASA/UMTRA scanning van

BASIC SYSTEM DESCRIPTION

The gamma-ray detection system now employed in the RASA/UMTRA scanning van consists of three 4 x 4 x 16-in. NaI(Tl) Polyscin log crystals, each having an integral 3.5-in. photomultiplier tube. The crystals are housed in a lead-shielded steel frame to provide a 12 by 16-in. detector surface area for acceptance of gamma rays through one side of the survey van. The detector and shield height can be changed by use of a hydraulic lift mechanism to optimize the detector field-of-view.

The detector output is transferred to a computer-controlled interface designed and fabricated at ORNL. This unit provides for continuous analysis of data inputs for correlation of system location with count rate information. Six separate energy regions-of-interest are analyzed and a ^{226}Ra-specific algorithm is employed to identify locations containing residual radium-bearing materials. Data on other naturally occurring radionuclides (such as K-40 and ^{232}Th) are obtained for comparison as part of the analysis. Multichannel analysis capabilities are included in the system for additional qualitative radionuclide identification.

The system is operator-controlled through keyboard instructions to an on-board minicomputer. Data output is provided on the computer video screen and a printer. Data storage is provided by a dual floppy disk system.

DATA ANALYSIS TECHNIQUE

The algorithm employed for continuous analysis of the scan data was developed from techniques used for aerial scanning of radiologically contaminated areas.* In this analysis, comparison is made between the observed

* Bristow, Q., The Application of Airborne Gamma-ray Spectrometry in the Search for Radioactive Debris from the Russian Satellite Cosmos 954 (Operation Morning Light), Current Research, Part B, Geol. Survey of Canada, Paper 78-1B, pp. 151-162, 1978.

Exhibit 8.2.6.3-16. (Continued)

count rates arising from naturally occurring radionuclides (^{232}Th daughters in our case) and residual radioactive materials (^{226}Ra daughters). Where the observed ratio of these count rates (Ra/Th) is determined to be significantly different from a normal background range, the location is identified as a radiation anomaly.

In the ORNL system, three regions-of-interest for ^{226}Ra are continuously analyzed (the 609 keV, 1120 keV, and 1764 keV energy peaks of Bi-214) and one for ^{232}Th (the 2614 keV energy peak of Tl-208). Based on the observed count rates in these energy regions in a background area, an average background radium-to-thorium ratio (R) can be determined as follows:

$$\bar{R} = Ra/Th = \frac{(609\ keV + 1120\ keV + 1764\ keV)}{(2614\ keV)} .$$

Associated with this average ratio is a standard deviation that is dependent upon the variation of the individual Ra and Th components.

$$\sigma\bar{R} = \bar{R}\left[\left[\frac{Th}{\bar{X}_{Th}}\right]^2 + \left[\frac{Ra}{\bar{X}_{Ra}}\right]^2\right]^{1/2} ,$$

where

$\sigma_{\bar{R}}$ = standard deviation of the Ra/Th ratio,

$\bar{R}$ = average Ra/Th ratio in background area,

σTh = standard deviation of the Th energy region (2614 keV),

$\bar{X}_{Th}$ = average Th count rate in background area,

$\bar{X}_{Ra}$ = average Ra count rate in background area,

σ_{Ra} = standard deviation of the Ra energy region (609 keV + 1120 keV + 1764 keV).

Exhibit 8.2.6.3-16. (Continued)

Thus, for any area to be scanned, some Ra/Th ratio can be computed $\bar{R} \pm k\sigma_{\bar{R}}$ (where k is the specified 2-sided confidence level) that can be used for comparison with the scan data obtained for each street.

In identifying locations containing residual ^{226}Ra-bearing materials, the ORNL system uses three criteria (hit criteria), all based on the observed background Ra and Th count rates and the computed Ra/Th ratio. The first criterion that must be met involves the determination of a minimum count rate in the Ra energy regions that results in a detectable change in the observed Ra/Th ratio. The mathematical expression for this criterion is as follows (adapted from the reference cited above):

$$C_m = 2K\ [\bar{X}_{Ra}(\bar{R} + 1)]^{1/2} + k^2,$$

where

C_m = minimum Ra count rate above background,

k = specified 2-sided confidence level,

$\bar{X}_{Ra}$ = average Ra count rate in background area,

$\bar{R}$ = average Ra/Th ratio in background area.

For a detected count rate to pass this first hit criterion, the total count rate in the three Ra energy windows must exceed $X_{Ra} + C_m$.

The second and third hit criteria, either of which must be met before a location is considered an anomaly, are based on comparison of the observed Ra/Th ratio with the computed background ratio. In the second criterion, the observed and background ratios are directly compared, and if the observed Ra/Th > R = $k\sigma_R$, the location is considered to have exceeded the criterion and the analysis moves to the third criterion. In the third criterion (called the difference techniques), a mathematical difference is computed.

Exhibit 8.2.6.3-16. (Continued)

$$\text{difference} = \text{observed Ra} - [\text{observed Th}\ (\bar{R} + k\sigma_R)].$$

When this difference is positive, the observed count rate is considered above the criterion.

The second and third criteria, although based on the same background ratio, provide different degrees of sensitivity, depending on the magnitude of the observed count rates in the energy windows. Their combined use provides for a reduction in the incidence of false hits, such as the identification of properties containing radiation anomalies when they actually do not and identification of properties as having ^{226}Ra-bearing material (tailings) when they only contain natural variations in the background due to changes in the local geology or counting geometry as is the case of passing close to a masonry wall or rock outcrop.

SCANNING METHOD

Because the data analysis method employed on the ORNL-RASA van is based on computations involving background count rates in various energy regions, these background levels must first be established. To establish background, the city to be scanned is divided into small areas which the mobile scan team leader has determined to represent the areas for which an associated background level will be determined.

In each of these areas, a scan is made at normal driving speed traversing a representative area of the streets included in the section. At the end of this scan, the average count rates and associated standard deviation for each of the energy windows are computed, the average Ra/Th ratio and its standard deviation determined, and the data stored for later use.

After the background level for the survey area has been established, the street-by-street scans of each area can begin. For each street to be scanned, a storage file is opened on the floppy disk system and the file identified by the name of the street and any other descriptive title.

Exhibit 8.2.6.3-16. (Continued)

Scanning is conducted at a maximum speed of 10 ft per second, and an alarm system alerts the driver if this maximum is exceeded. The distance between the van and the property is also maintained at a minimum (i.e., next to the curb unless obstructions such as parked cars prevent it). During the scan, the detectors are secured in the full up position (approximately 6 ft above ground surface) to maximize the field-of-view and minimize the influence of street-side obstructions.

As the scan proceeds, permanent landmarks (house numbers, cross streets) are systematically input to the computer to be stored along with the rest of the scan data for cross reference. If during the scan, a property is passed that exhibits gamma radiation levels exceeding the preset hit criteria, an alarm is sounded and special notation made on the computer video screen. This alarm continues to sound until the anomaly has been passed. At the end of the scan, the data file is closed and computer analysis of the data begins. This analysis results in the printout of a list of all anomalies identified by the scan and provides exact location information in terms of distance from the input permanent landmarks. To further define the locations and additional information, a second scan of each anomaly is performed at an even slower speed to better define the area of concern and allow for detailed description of property (i.e., house address, or if unavailable, a description of the house). If desired at this time, a detailed spectrum analysis can be undertaken utilizing the on-board multichannel analyzer system.

When one side of the street has been analyzed, the other side is scanned in the opposite direction. In addition, all accessible parking areas, alleyways, and other public thoroughfares would be scanned within the survey section. When all the scanning has been completed, the complete set of raw data for the entire surveyed area can be printed out for future reference.

Exhibit 8.2.6.3-16. (Continued)

DATA STORAGE

To maintain accurate and complete records of the scanning activities, the updated ORNL scanning system provides for data storage/recording. The primary data storage system is the floppy disk. This system maintains a continuous permanent record of all raw data obtained during the scan. Retrieval of this data occurs (1) at the end of each scan in the form of the computer-analyzed summary of the anomaly locations or (2) on command at a later time for a complete listing of the raw data or listing of the reduced data used in comparison with the hit criteria. A printed copy of all scan files is kept in a project logbook (3-ring notebook). Also, a copy of the data disks is made each day and stored outside of the scan van to minimize the chance of losing the scan data.

An event marker is also used to identify the location of the permanent landmarks input by the operator into the computer for additional cross-correlation with the data printout.

To ensure that no loss of data occurs when the detector system experiences an unexpected power loss because of generator malfunction or other problem, the van has been provided with an uninterruptable battery power supply for the data handling and storage systems. In the event of a detector system shutdown, the previously stored data is adequately protected and can be retrieved without concern of data deletion.

SYSTEM VERSATILITY

The ORNL scanning van system has been optimized to look for locations containing ^{226}Ra-bearing materials. However, if desired, system modifications could be made to allow for the analysis of other radionuclides. For instance, with the current setup, one of the data channels is used for the acquisition of K-40 data. Although these data are not used in the algorithm for ^{226}Ra analysis, it could be used in determining the presence of highly fertilized fields.

In addition, if the Ra/Th ratio is suppressed due to an increase in ^{232}Th (^{208}Tl), a low ratio hit criteria is displayed on the CRT and listed on the file printout. This is utilized to identify both ^{232}Th contamination and also to identify Th background variations due to causes such as igneous rocks found in the natural environment or used in building materials.

Exhibit 8.2.6.3-17. Scan program and useful computer commands.

General

Command	Function
Place program disk in Drive 0 and press SHIFT and RUN/STOP keys	This loads the DOS program. Once the DOS has been loaded, all communications with the disk can be obtained by the use of the following commands
>$D	Will display the directory of the disk drive indicated by D. D must be either 0 or 1
>iD	Will initialize the disk drive D. (D is either 0 or 1)
↑Program Name	Will load and run the program (for scanning enter ↑scan)
/Program Name	Will load but will not run the program
>nD - name, 00	Will format a disk in Drive D. The name can be no more than 24 characters and must be followed by a two-digit identification number
>c1 = 0	Will copy the files on drive 0 to drive 1
>and press RETURN key	Will print the error message and clear the error channel
Press EXIT[a] key	Will get the computer out of any scan program mode and return to the program mode directory
Load "$D", 8	Loads the directory from drive D
Open 4,4 - CMD4 - LIST	Opens the communication channel to the printer and lists the directory
Print #4 - Close 4	Closes the communication channel to the printer
To print disk directory[b]	

[a]The EXIT key is the CLR-HOME key on the computer keyboard.

[b]This will erase all programs in the computer except the DOS program.

Exhibit 8.2.6.3-17 (Continued)

```
ready.

 20 rem scanning van program 11/5/82 msb
 40 poke 59468,12
 60 open4,4,7:print#4:close4
 80 print""spc(10)"input your name ";:input n$
 100 printspc(10)"input date (3/4/82)";:input n1$
 120 poke 59468,14:dim d$(99)
 140 gosub2720
 160 open5,6,6:print#5,chr$(131);:close5
 161 print"";spc(16);"APPROPRIATE BACKGROUND DATA MUST BE ENTERED"
 162 print spc(17);"PRIOR TO ACCESSING ANY OTHER PROGRAM MODE"
 180 goto4280
 200 print""spc(22)"ORNL RASCA SCANNING VAN":print""
 220 print spc(25)"PROGRAM DIRECTORY";""
 240 print spc(10);"scan: records all street survey data (scan data)
 260 print spc(10);"background: define background for area to be scanned"
 280 print spc(10);"calibration: used for system checkout"
 300 print spc(10);"data dump: prints all stored raw data"
 320 print spc(10);"file list: prints data above hit criteria"
 340 print spc(10)"identification: pinpoint anomaly location"
 360 d=0:d$=""
 380 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE";
 385 print chr$(166)
 400 get i$:if i$="" goto560
 420 if i$="c" goto6240
 440 if i$="b" goto4240
 460 if i$="s" goto640
 480 if i$="i" goto7160
 500 if i$="d" goto8020
 520 if i$="f" goto10220
 540 i$="":goto200
 560 for i=0 to 100:next i
 580 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE      "
 600 for i=0 to 100:next i
 620 print"";:goto380
 640 rem scan program
 660 print""spc(30)"SCAN PROGRAM"
 680 print""spc(5)"The file name should be the major road to be scanned"
 700 print" and the direction of travel should be the last character in the"
 720 print" file name.The file name can be no more than 16 characters."
 740 print""spc(30)"example"
 760 print spc(25)"chartiers ave n"
 780 print spc(25)"road            direction"
 800 print"Input house numbers systematically and all cross streets."
 820 print" Use the exit key to close the scan file and return to the program"
 840 print"directory.":print
 860 c$=i$:i$="":d=0
 880 printspc(25)"INPUT FILE NAME ";
 900 let l=16 :gosub2160
 920 if a$=chr$(19) goto200
 930 gosub 2720
 933 for i=0 to 800:next i
 935 gosub 2720
 940 s$=i$:i$="":l=1
 960 print" TOTAL      TOT Ra      Ra/Th      POS"
 980 print"DISTANCE    COUNTS      RATIO      DIFF"
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
1000 print tab(0);chr$(15);"■■■■■■■■■■■■■■■■■■■■■■■";tab(79);chr$(143);"■"
10[illegible] open5,6,6:print#5,chr$(13);:for i=0 to [illegible]
1040 print#5,s$;:close5
1060 open2,8,2,"1:"+s$+",seq,write"
1061 if ds<>0 then goto 1063
1062 goto 1080
1063 print "■";ds$;"■"
1064 print#2,"initialize"
1065 close 2:goto 880
1080 print#2,t1;chr$(13);t2;chr$(13);th;chr$(13);
1100 print#2,n$;chr$(13);n1$;chr$(13);
1110 d=0
1120 rem loop
1140 for i=0 to 200:next i
1160 gosub2720
1180 gosub2820
1200 open 5,6,6:if l=20 then print#5,d$;:l=0
1220 l=l+1
1221 t4=(r9*r3)/t3:if t4<1 then r0$="":goto 1240
1222 if t4=>2 then r0$="h":goto 1240
1223 if t4=>1.5 then r0$="m":goto 1240
1224 r0$="l"
1240 if r9<t1 goto1340
1250 if r3=<th then r0$="Th":goto 1300
1260 if r3=>t2 goto1300
1280 if r1<0 goto1340
1300 b1=1:if r1>0 then r1$="+"
1320 r=r-50:goto1380
1340 if r1<0 then r1$="-":r0$=""
1360 b1=0
1380 if (a1*0.258)<10 then b3=1:goto1420
1400 b3=0
1420 if b3<>b4 then print#5,chr$(135);:goto1460
1440 if b3<>b4 then print#5,chr$(134);
1460 if b1<>b2 then print#5,chr$(133);:r2$="*":goto1500
1480 if b1<>b2 then print#5,chr$(132);:r2$=""
1500 for i=0to100:next i:print#5,chr$(136);
1520 if r<0 then r=0
1540 g$=a1$+a2$+a3$+a4$+a5$+a6$+a7$+a8$
1560 print#2,g$;chr$(13);
1570 print"                                                  ":print"■";
1580 print spc(8-len(d$));d$;spc(10-len(r9$));r9$;spc(10-len(r3$));r3$;
1600 print"        "r1$"      "r2$" "r0$
1620 print b$;"■"
1640 a$="":print#5,chr$(143);chr$(r);
1660 close 5:b2=b1:b4=b3
1680 get a$:if a$="" goto1120
1700 if a$=chr$(13) goto1760
1720 if a$=chr$(19) goto1900
1730 if a$=chr$(20) goto 1840
1735 if len(b$)=22 goto 1680
1740 b$=b$+a$:goto1680
1760 print#2,b$;chr$(13);
1780 open5,6,6:print#5,chr$(137);:close 5
1800 print b$:b$="":goto1120
1820 d=0:b$="":goto1120
1840 if len(b$)=1 then b$=""
1860 if b$=""goto1680
1880 b$=left$(b$,len(b$)-1):goto1680
1900 b$="end":print"■■"
```

Exhibit 8.2.6.3-17 (Continued)

```
1920 print#2,b$;chr$(13);
1940 b$="":close 2
1960 open5,6,6:print#5,chr$(131);
1980 print#5,chr$(132);chr$(134)::close5
2000 open 2,8,8,"1:"+z$+",seq,read"
2020 sys 53849
2040 input#2,t1:print t1
2060 input#2,t2:print t2
2065 input#2,th:print th
2080 input#2,n$:print n$
2100 input#2,n1$:print n1$
2120 gosub3040
2140 goto200
2160 rem input road name******
2180 print chr$(166)"▌";
2200 get a$ :if a$<>"" goto2300
2220 for i=0 to 50:next i
2240 print" ▌";
2260 for i=0 to 50:next i
2280 goto2160
2300 if a$=chr$(13) goto2620
2320 if a$=chr$(19) goto2620
2340 if a$=chr$(34) goto2200
2360 if z$="b" goto2420
2380 if a$=":"ora$="=" goto2200
2400 if a$="," goto2200
2420 if a$<>chr$(20) goto2520
2440 if i$="" goto2200
2460 if len(i$)=1 then i$="" :goto2500
2480 i$=left$(i$,len(i$)-1)
2500 goto2600
2520 if a$<" " goto2200
2540 if a$>"z"anda$<"▌" goto2200
2560 if len(i$)=1 goto2200
2580 i$=i$+a$
2600 printa$"_▌";:goto2200
2620 print" "; :z$="" :return
2640 rem input from keyboard
2660 get i$ :if i$="" goto2660
2680 if  y=r$ then run
2700 return
2720 rem input 8 channel data******
2740 open6,6,1:open7,6,2
2760 input#6,a1$,a2$,a3$,a4$
2780 input#7,a5$,a6$,a7$,a8$
2800 close6:close7:return
2820 rem cal ratio @ hit*******
2840 a1=val(a1$):a2=val(a2$):a3=val(a3$):a4=val(a4$)
2860 a5=val(a5$):a6=val(a6$):a7=val(a7$):a8=val(a8$)
2880 d=d+a1:d$=str$(int(d*.258))
2900 r1=int((a3+a5+a7)-(a8*t2))
2920 r3=int(((a3+a5+a7)/a8)+0.5):r3$=str$(r3)
2940 g$=a1$+a2$+a3$+a4$+a5$+a6$+a7$+a8$
2960 r6=r5:r5=r4:r4=255-r3*4
2980 r9=a3+a5+a7:r9$=str$(r9)
3000 r=int((r4+r5+r6)/3)
3020 return
3040 rem data list*******
3060 open4,4:l=0:d=0
3080 print#4,chr$(1);"SCAN FILE NAME--▌";z$;chr$(13);chr$(1);"▌"
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
3100 print#4,spc(25);"TOTAL Rs COUNT HIT "+1
3120 print#4,spc(25);"[illegible] HIT              "+[illegible]
3125 print#4,spc(25);"LOW RATIO HIT         "+h
3140 print#4,chr$(13);
3150 t3=t1*t2
3159 if g$="end"goto4140
3160 input#2,g$
3161 if len(g$)<30 then print g$:b$=g$:a9$=d$:a9=int(d):goto 3159
3162 a1$=mid$(g$,3,6):a5$=mid$(g$,36,5):a3$=mid$(g$,20,5):a7$=mid$(g$,52,5)
3163 a1=val(a1$):a5=val(a5$):a3=val(a3$):a7=val(a7$)
3164 d=d+a1:d$=str$(int(d*.258)):d1=d-a9:d1$=str$(int(d1*.258))
3165 r9=a3+a5+a7:if r9<t1 then x=0:goto 3160
3166 gosub 3667
3167 if x=0 goto 3160
3220 l=l+1:if l=1 then gosub4020
3240 r3$=str$(r3):r1$=str$(r1):r9$=str$(r9)
3245 t4=(int(((r3*r9)/t3)*10)/10)
3260 print#4,spc(6-len(a9$));a9$;spc(21-len(b$));b$;
3280 print#4,spc(7-len(d1$));d1$;spc(10-len(r9$));r9$;spc(7-len(r3$));r3$;
3300 print#4,spc(7-len(r1$));r1$;"    ";t4
3320 a9$="":b$=""
3340 for i=1 to 3
3360 gosub3580:rem input data
3380 if g$="end"goto200
3400 iflen(g$)<30 then print#4,spc(6-len(a9$));a9$;spc(21-len(b$));b$;
3420 iflen(g$)<30 then print#4,spc(7-len(d1$));d1$;chr$(13);
3440 if x=1 goto3510
3460 next i
3480 print#4,"================================================================"
3500 goto3160
3510 t4=(int(((r3*r9)/t3)*10)/10)
3520 print#4,spc(34-len(d1$));d1$;spc(10-len(r9$));r9$;spc(7-len(r3$));r3$;
3540 print#4,spc(7-len(r1$));r1$;"    ";t4
3560 goto3340
3580 input#2,g$
3620 if len(g$)<30 then print g$:goto3960
3640 a1$=mid$(g$,3,6):a5$=mid$(g$,36,5):a3$=mid$(g$,20,5):a7$=mid$(g$,52,5)
3645 a1=val(a1$):a5=val(a5$):a3=val(a3$):a7=val(a7$)
3665 d=d+a1:d$=str$(int(d*.258)):d1=d-a9:d1$=str$(int(d1*.258))
3666 r9=a3+a5+a7:if r9<t1 then x=0:return
3667 a2$=mid$(g$,11,6):a6$=mid$(g$,44,5):a4$=mid$(g$,28,5):a8$=mid$(g$,60,5)
3700 a2=val(a2$):a6=val(a6$):a4=val(a4$):a8=val(a8$)
3770 if a8=0 then a8=1
3780 r1=int((a3+a5+a7)-(a8*t2)):r1$=str$(r1):r9$=str$(r9)
3800 r3=int(((a3+a5+a7)/a8)+0.5):r3$=str$(r3)
3860 if r3=<th goto 3920
3880 if r1>0 goto3920
3900 goto3940
3920 x=1:return
3940 x=0:return
3960 if g$="end" goto4140
3980 b$=g$:a9$=d$:a9=int(d)
4000 x=0:return
4020 print#4," TOTAL                    STREET          NET      TOT Rs    Rs/Th    POS"
4040 print#4,"DISTANCE                  NUMBER      DISTANCE COUNTS    RATIO    DIFF";
4060 print#4,spc(3)"INDEX      REMARKS"
4080 print#4,"----------------------------------------------------------------------";
4100 print#4,"-----------------"
4120 return
4140 if l=0 then print#4,spc(24);chr$(1)"NO ANOMALIES"
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
4160 print#4:print#4:print#4,"RRRRRRRRRRRRRRRRRRRRRRR      ";n1$""
4180 print#4,"     "nd:print#4,chr$(13)
4200 close 2:close 4:b$="":d=0
4220 goto200
4240 rem background program******
4260 print ""spc(30)"BACKGROUND PROGRAM"
4280 print""
4300 printspc(10)"BACKGROUND DATA FOR AREA TO BE SCANNED CAN BE OBTAINED FROM"
4320 print""spc(15)"new file: background scan of area"
4340 print spc(15)"old file: data from previous background file"
4360 print""
4380 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE";
4385 print chr$(166)
4400 get i$:if i$="" goto4500
4420 if i$="n" goto4600
4440 if i$="o" goto5860
4460 if i$=chr$(19) goto200
4480 i$="":goto4380
4500 for i=0 to 100:next i
4520 print"";
4540 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE     "
4550 gosub 2720
4560 for i=0 to 100:next i
4580 print"";:goto4380
4600 t=0:i$=""
4620 print""spc(25)"BACKGROUND SCAN"
4640 print""spc(10)"Scan of area should be obtained at normal driving speed"
4660 print""spc(10)"Max length of file name is 16 characters"
4680 print""spc(10)"Use the exit key to close the background file and"
4700 print spc(8)"return to the program directory.":print""
4720 print spc(20)"INPUT BACKGROUND FILE NAME   ";
4740 let l=16 :gosub2160
4760 if a$=chr$(19) goto200
4780 s$=i$:i$=""
4800 print"  TOTAL       TOT Ra      Ra/Th      Th"
4820 print"DISTANCE      COUNTS      RATIO      COUNTS"
4840 print tab(0);chr$(15);"";tab(79);chr$(143);""
4845 gosub 2720
4847 for i=0 to 800:next i
4850 gosub 2720
4860 open2,8,2,"1:"+s$+",seq,write"
4861 if ds<>0 then goto 4863
4862 goto 4880
4863 print "";ds$;""
4864 print#2,"initialize"
4865 close 2:goto 4720
4880 for i=0 to 400:next i
4900 gosub2720
4920 t=t+1:a$=""
4940 gosub2820
4960 m1=a2+m1:m2=m2+a4:m3=a3+m3:m4=m4+a3+a5+a7
4980 m5=m5+a8:m6=m6+a6
5000 g$=a1$+a2$+a3$+a4$+a5$+a6$+a7$+a8$
5020 print#2,g$;chr$(13);
5040 r9$=str$(r9):r3$=str$(r3)
5060 print spc(8-len(d$));d$;spc(10-len(r9$));r9$;spc(10-len(r3$));r3$;
5061 print spc(5);a4
5080 get a$:if a$="" goto4880
5100 if a$=chr$(19) goto5140
5120 goto4880
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
4160 print#4:print#4:print#4,"■FFFFFFFFFFFFFFFFFFFFFFFF        ";n1$"■
4180 print#4,"      ■"rd:print#4,[illegible]
4200 close 2:close 4:b$="":d=0
4220 goto200
4240 rem background program******
4260 print "■■■"spc(30)"■BACKGROUND PROGRAM■"
4280 print"■■■"
4300 printspc(10)"BACKGROUND DATA FOR AREA TO BE SCANNED CAN BE OBTAINED FROM"
4320 print"■"spc(15)"■n■ew file: background scan of area"
4340 print spc(15)"■o■ld file: data from previous background file"
4360 print"■■■■"
4380 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE";
4385 print chr$(166)
4400 get i$:if i$="" goto4500
4420 if i$="n" goto4600
4440 if i$="o" goto5860
4460 if i$=chr$(19) goto200
4480 i$="":goto4380
4500 for i=0 to 100:next i
4520 print"■";
4540 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE      "
4550 gosub 2720
4560 for i=0 to 100:next i
4580 print"■";:goto4380
4600 t=0:i$=""
4620 print"■■■■"spc(25)"BACKGROUND SCAN"
4640 print"■■■"spc(10)"Scan of area should be obtained at normal driving speed"
4660 print"■■"spc(10)"Max length of file name is 16 characters"
4680 print"■■"spc(10)"Use the exit key to close the background file and"
4700 print spc(8)"return to the program directory.":print"■■■"
4720 print spc(20)"INPUT BACKGROUND FILE NAME  ";
4740 let l=16 :gosub2160
4760 if a$=chr$(19) goto200
4780 s$=i$:i$=""
4800 print"■  TOTAL       TOT Ra       Ra/Th       Th"
4820 print"DISTANCE     COUNTS       RATIO       COUNTS"
4840 print tab(0);chr$(15);"■■■■■■■■■■■■■■■■■■■■■■■";tab(79);chr$(14);"■"
4845 gosub 2720
4847 for i=0 to 800:next i
4850 gosub 2720
4860 open2,8,2,"1:"+s$+",seq,write"
4861 if ds<>0 then goto 4863
4862 goto 4880
4863 print "■";ds$;"■"
4864 print#2,"initialize"
4865 close 2:goto 4720
4880 for i=0 to 400:next i
4900 gosub2720
4920 t=t+1:a$=""
4940 gosub2820
4960 m1=a2+m1:m2=m2+a4:m3=a3+m3:m4=m4+a3+a5+a7
4980 m5=m5+a8:m6=m6+a6
5000 g$=a1$+a2$+a3$+a4$+a5$+a6$+a7$+a8$
5020 print#2,g$;chr$(13);
5040 r9$=str$(r9):r3$=str$(r3)
5060 print spc(8-len(d$));d$;spc(10-len(r9$));r9$;spc(10-len(r3$));r3$;
5061 print spc(5);a4
5080 get a$:if a$="" goto4880
5100 if a$=chr$(19) goto5140
5120 goto4880
```

Exhibit 8.2.6.3-17 (Continued)

```
5140 b$="end":print#2,b$;chr$(13);
5160 gosub5680
5180 b$="":close 2
5200 print""
5220 open2,8,2,"1:"+s$+",seq,read"
5240 input#2,g$
5260 print g$
5280 if g$="end" goto5320
5300 g$="":goto5240
5320 close 2:close 5:print""
5340 open4,4:print#4,chr$(1);"BACKGROUND FILE NAME--";s$;chr$(13)""
5360 m1$=str$(int(m1+0.5)):b1$=str$(int(b1+0.5))
5380 m4$=str$(int(m4+0.5)):m5$=str$(int(m5+0.5)):m6$=str$(int(m6+0.5))
5400 m9$=str$(int(m9+0.5)):b4$=str$(int(b4+0.5)):b5$=str$(int(b5+0.5))
5420 b6$=str$(int(b6+0.5)):r3$=str$(int(r3+0.5))
5425 m2$=str$(int(m2+0.5)):b2$=str$(int(b2+0.5))
5440 print#4,spc(16);"MEAN";spc(6);"STD.DEV."
5460 print#4,spc(26);"1 SIGMA"
5480 print#4,"-----------------------------------"
5500 print#4,"GROSS COUNTS";spc(8-len(m1$));m1$;spc(10-len(b1$));b1$
5520 print#4,"TOTAL Ra"spc(12-len(m4$));m4$;spc(10-len(b4$));b4$
5540 print#4,"Th"spc(18-len(m5$));m5$;spc(10-len(b5$));b5$
5560 print#4,"K";spc(19-len(m6$));m6$;spc(10-len(b6$));b6$
5580 print#4,"Ra/Th";spc(15-len(m9$));m9$;spc(10-len(r3$));r3$
5581 print#4,"Th peak";spc(13-len(m2$));m2$;spc(10-len(b2$));b2$
5620 t2=int(m9+(2*r3))
5640 t1=int((2*(sqr(m4*(m9+1))+1))+m4)
5641 th=int(m9-(2*r3))
5643 print#4,""
5650 print#4,"TOTAL Ra COUNTS    "t1
5655 print#4,"RATIO              "t2
5656 print#4,chr$(12):close4
5657 t3=t1*t2
5660 goto200
5680 rem cal mean @ std. dev.*******
5700 m1=m1/t:m2=m2/t:m3=m3/t:m4=m4/t
5720 m5=m5/t:m6=m6/t
5740 b1=sqr(m1):b2=sqr(m2):b3=sqr(m3):b4=sqr(m4)
5760 b5=sqr(m5):b6=sqr(m6)
5780 r3=sqr((b4/m4)*(b4/m4)+(b5/m5)*(b5/m5))
5800 m7=m2/m3:m8=m4/m6:m9=m4/m5
5820 r3=int(m9*sqr((b5/m5)*(b5/m5)+(b4/m4)*(b4/m4)))
5840 return
5860 rem input background data from old file******
5880 print"":l=10:i$=""
5900 print spc(20)"INPUT BACKGROUND DATA FROM OLD FILE"
5920 print spc(10)"INPUT TOTAL Ra COUNTS (MEAN)";
5940 gosub2160
5960 m4=val(i$):i$=""
5980 print:print spc(10)"INPUT Ra/Th RATIO (MEAN)";
6000 gosub2160
6020 m9=val(i$):i$=""
6040 print:print spc(10)"INPUT Ra/Th RATIO (STD. DEV.)";
6060 gosub2160
6080 r3=val(i$):i$=""
6100 t2=int(m9+(2*r3))
6105 th=int(m9-(2*r3))
6120 t1=int((2*(sqr(m4*(m9+1))+1))+m4)
6140 print:print spc(10)"NEW HIT CRITERIA"
6160 print spc(10)"TOTAL Ra"+t1
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
6180 print spc(10)"RATIO"t2
6200 for i=0 to 2000:next i
6210 t3=t1*t2
6220 goto200
6240 rem calibration program******
6260 print"":spc(25)"CALIBRATION/INSTRUMENT SETTINGS"
6280 print spc(25)"PHOTOPEAK CHANNEL SETTINGS"
6300 print spc(25)"Cs-137(0.661MeV) channel 111"
6320 print spc(25)"Co-60(1.170MeV) channel 192"
6340 print spc(25)"Co-60(1.330MeV) channel 217"
6360 print spc(25)"Tl-208(2.614MeV) channel 424"
6380 print spc(30)"WINDOW DISCRIMINATORS"
6400 print"ROI"spc(20)"UPPER   CHANNEL#"spc(10)"LOWER   CHANNEL#":print
6420 print"A1 distance"spc(14)"10.0"spc(21)"1.50"
6440 print"A2 gross counts"spc(10)"7.00"spc(21)"0.06"
6460 print"A3 0.609MeV"spc(14)"1.88      120"spc(13)"1.35       90"
6480 print"A4 2.614MeV"spc(14)"6.97      450"spc(13)"6.08      395"
6500 print"B1 1.120MeV"spc(14)"3.06      200"spc(13)"2.66      170"
6520 print"B2 1.460MeV"spc(14)"4.12      260"spc(13)"3.33      215"
6540 print"B3 1.764MeV"spc(14)"4.81      305"spc(13)"3.75      260"
6560 print"B4 2.614MeV"spc(14)"8.00      500"spc(13)"5.76      362"
6580 print spc(20)"DEPRESS ANY KEY TO START THE PROGRAM"chr$(166)
6600 get i$:if i$="" goto6660
6620 if i$=chr$(19) goto200
6640 goto6740
6660 for i=0 to 50:next i
6680 print""spc(20)"DEPRESS ANY KEY TO START THE PROGRAM      ";""
6700 for i=0 to 50:next i
6710 gosub 2720
6713 for i=0 to 800:next i
6715 gosub 2720
6720 fori=0 to 800:next i
6725 goto6580
6740 a9=0:x$="  ":t=1
6760 gosub2720
6770 gosub 2820
6780 print"dist":"         ";"gross":"         ";"Ra":"        ";"Th"
6800 print"pulse":"        ";"counts":"    ";"0.609MeV":"   ";"2.614MeV"
6820 printspc(8-len(d$));d$;x$;a2$;x$;a3$;x$;a4$:print
6840 print"   Ra          K          Ra          Th"
6860 print"1.120MeV  1.460MeV  1.764MeV  2.614MeV"
6880 printa5$;x$;a6$;x$;a7$;x$;a8$
6900 print:print:print
6920 print:print"10 second count 0.609MeV"
6940 print spc(14-len(a9$));a9$
6950 print:print"average count rate="m4
6960 a3=val(a3$)
7000 a9=a3+a9
7020 if t=10 goto7110
7040 t=t+1
7060 get i$:if i$="" goto6760
7080 if i$=chr$(19) goto200
7090 if i$=chr$(48) then d=0
7100 i$="":goto6760
7110 m3=m2:m2=m1:m1=a9
7115 m4=int((m3+m2+m1)/3)
7120 t=0:a9$=str$(a9):a9=0
7140 goto7040
7160 rem identify program*******
7180 print""spc(27)"IDENTIFICATION PROGRAM"
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
7200 print"THIS PROGRAM IS TO PINPOINT THE EXACT LOCATION OF THE ANOMALIES."
7220 print"The data is not stored in this program.If a permanent record is
7240 print"needed then return to the SCAN program"
7260 print spc(10)"TO RESET DISTANCE,DEPRESS 0"
7280 print spc(10)"TO EXIT PROGRAM,DEPRESS EXIT KEY"
7300 print spc(10)"DEPRESS ANY KEY TO START THE PROGRAM"chr$(166)
7320 get i$:if i$="" goto7380
7340 if i$=chr$(19) goto200
7360 goto7460
7380 for i=0 to 50:next i
7400 print""spc(10)"DEPRESS ANY KEY TO START THE PROGRAM      ";""
7420 for i=0 to 50:next i
7440 goto7300
7460 print"  TOTAL       TOT Ra      Ra/Th      POS"
7480 print"DISTANCE     COUNTS      RATIO      DIFF"
7500 print tab(0);chr$(15);"";tab(79);chr$(143);""
7510 gosub 2720
7513 for i=0 to 800:next i
7515 gosub 2720
7520 open 5,6,6
7540 for i=0 to 400:next i
7560 gosub2720
7580 gosub2820
7590 r0$=""
7600 if r9<t1 goto7700
7610 if r3=<th then r0$="Th":r2$="*":r1$="-":print#5,chr$(133);:goto 7760
7620 if r3<t2 goto7700
7640 if r1<0 goto7700
7660 print#5,chr$(133);:r2$="*"
7680 r1$="+":goto7760
7700 if r1<0 then r1$="-"
7720 if r1>0 then r1$="+"
7740 print#5,chr$(132);:r2$=""
7760 if r<0 then r=0
7780 close 5
7800 r9$=str$(r9)
7840 print spc(8-len(d$));d$;spc(10-len(r9$));r9$;spc(10-len(r3$));r3$;
7860 print"        "r1$"     "r2$"    "r0$
7880 i$=""
7900 get i$:if i$="" goto7520
7920 if i$=chr$(19) goto7980
7940 if i$="0" then d=0
7960 i$="":goto7520
7980 print""
8000 open 5,6,6:print#5,chr$(132):close5:goto200
8020 rem data dump program******
8040 print"";spc(27)"DATA DUMP PROGRAM"
8060 gosub9160
8080 gosub9780
8100 if a$=chr$(19) goto200
8120 if a1$="" goto9060
8140 gosub8200
8160 gosub9800
8180 goto8100
8200 a=val(a1$):d=0
8220 print""
8240 open4,4:print#4,chr$(1);"FILE NAME--";d$(a);chr$(13);chr$(13);""
8260 print#4,chr$(13);chr$(13)
8280 print"     TOTAL                    Ra           Ra    ";
8300 print#4,"     TOTAL                    Ra           Ra    ";
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
8320 print"      K            Ra          Th    "
8340 print#4,"       K            Ra          Th    "
8360 print"  DISTANCE      GROSS  0.609MeV   1.120MeV";
8380 print#4,"  DISTANCE      GROSS  0.609MeV   1.120MeV";
8400 print"  1.460MeV  1.764MeV  2.614MeV"
8420 print#4,"  1.460MeV  1.764MeV  2.614MeV"
8440 print"    (feet)      (cps)     (cps)       (cps) ";
8460 print#4,"    (feet)       (cps)     (cps)       (cps) ";
8480 print"    (cps)       (cps)      (cps)  "
8500 print#4,"    (cps)       (cps)      (cps)  "
8520 print tab(0);chr$(15);"";tab(79);chr$(143)
8540 print""
8560 open 2,8,8,"1:"+d$(a)+",seq,read"
8580 input#2,g$
8600 if g$=""goto8580
8620 if len(g$)<20 goto8980
8640 a1$=mid$(g$,3,6):a2$=mid$(g$,11,6):a3$=mid$(g$,20,5):a4$=mid$(g$,28,5)
8660 a5$=mid$(g$,36,5):a6$=mid$(g$,44,5):a7$=mid$(g$,52,5):a8$=mid$(g$,60,5)
8680 a1=val(a1$):a2=val(a2$):a3=val(a3$):a4=val(a4$)
8700 a5=val(a5$):a6=val(a6$):a7=val(a7$):a8=val(a8$)
8720 if a8=0 then a8=1
8740 if g$=g1$goto9020
8760 g1$=g$
8780 d=d+a1:d$=str$(int(d*.258))
8800 a2$=str$(a2):a3$=str$(a3):a5$=str$(a5)
8820 a6$=str$(a6):a7$=str$(a7):a8$=str$(a8)
8840 print spc(10-len(d$))d$;spc(10-len(a2$))a2$;spc(8-len(a3$))a3$;
8860 print#4,spc(10-len(d$))d$;spc(10-len(a2$))a2$;spc(8-len(a3$))a3$;
8880 print spc(10-len(a5$))a5$;spc(10-len(a6$))a6$;spc(10-len(a7$))a7$;
8900 print#4,spc(10-len(a5$))a5$;spc(10-len(a6$))a6$;spc(10-len(a7$))a7$;
8920 print spc(10-len(a8$))a8$
8940 print#4,spc(10-len(a8$))a8$
8960 goto8580
8980 if g$="end" goto9020
9000 print g$:print#4,g$:goto8580
9020 print"":close 2
9040 print#4,chr$(19):close 4:return
9060 for a=1 to 1
9080 d=0
9100 gosub8220
9120 next a
9140 goto200
9160 rem read directory******
9180 print""spc(20)"READING DIRECTORY PLEASE WAIT"
9200 open 1,8,15:print#1,"i1":close1
9220 open 2,8,4,"#5"
9240 open 15,8,15:x2=1:a=39:l=1
9260 print#15,"u1"4,1,a,x2
9280 get#2,a$:if a$="" goto 9280
9285 a=asc(a$)
9286 get#2,a$:if a$="" goto 9286
9287 x2=asc(a$):if x2>29 then x2=0:get#2,a$:get#2,a$:goto9300
9290 get#2,a$:get#2,a$:get#2,a$:get#2,a$
9300 for j=0 to 7
9310 for i=0 to 31
9320 d$=d$+a$
9340 get#2,a$:if a$<" " then a$=""
9345 next i
9350 d$(l)=left$(d$,16):print d$(l):l=l+1
9355 if d$="" goto 9400
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
9370 d$=""
93[illegible] next i
9385 if x2=0 goto 9400
9390 goto9260
9400 close2:close15:return
9780 rem list directory******
9800 print"█":l=l-1
9820 for i=1 to l
9840 print i"  "d$(i);:i=i+1:if d$(i)="" goto9900
9860 printtab(25)i"  "d$(i);:i=i+1:if d$(i)="" goto9900
9880 printtab(50)i"  "d$(i):if d$(i)="" goto9900
9900 next i
9920 print"██"
9940 print"To print a file enter the number of that file."
9960 print"To print all files depress only the return key."
9980 print"To return to the program directory depress the exit key."
10000 print"██":a1$=""
10020 printspc(26)"INPUT FILE NUMBER "a1$:chr$(166)
10040 get a$:if a$="" goto10120
10060 if a$=chr$(19) goto10200
10080 if a$=chr$(13) goto10200
10100 a1$=a1$+a$
10120 fori=0 to 50:nexti
10140 print spc(26)"█INPUT FILE NUMBER "a1$"      █"
10160 fori=0 to 50:nexti
10180 goto10020
10200 print"█":d$(val(a1$)):return
10220 rem file list program******
10240 print"█"spc(30)"█FILE LIST PROGRAM████"
10260 print spc(10)" THIS PROGRAM WILL LIST ALL DATA ABOVE HIT CRITERIA.███"
10280 print spc(20)"█u█se stored hit criteria"
10300 print spc(20)"█i█nput new hit criteria"
10320 print spc(20)"█l█ist all data████"
10340 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM "chr$(166
)
10360 get i$:if i$="" goto10480
10380 if i$="u" goto10580
10400 if i$="i" goto10900
10420 if i$="l" goto11220
10440 if i$=chr$(19) goto200
10460 i$="":goto10340
10480 for i=0 to 100:next i
10500 print"█";
10520 printspc(10)"ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM      "
10540 for i=0 to 100:next i
10560 print"█"::goto10340
10580 rem use stored hit criteria
10600 print"█"spc(20)"█LIST DATA USING STORED HIT CRITERIA█"
10620 gosub9160
10640 gosub9780
10660 if a$=chr$(19)goto200
10680 if a$="" goto10880
10700 a=val(a1$):d=0
10720 s$=d$(a)
10740 open 2,8,8,"1:"+s$+",seq,read"
10760 input#2,g$:if g$="" goto10760
10780 t1=val(g$)
10800 input#2,g$:if g$="" goto10800
10820 t2=val(g$)
10821 input#2,n$:print n$
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-17 (Continued)

```
10820 input#2,n1$:print n1$
10840 gosub [illegible]
10860 goto200
10880 rem
10900 rem input new hit criteria
10920 print"S"spc(20)"▮INPUT NEW HIT CRITERIA"
10940 gosub9160
10960 gosub9780
10980 if a$=chr$(19)goto200
11000 if a$="" goto11200
11020 a=val(a1$):d=0
11040 s$=d$(a)
11060 open 2,8,8,"1:"+d$(a)+",seq,read"
11080 print"input total Ra counts";:input t1
11100 print"input ratio hit";:input t2
11120 gosub3040
11140 gosub9800
11160 goto10980
11180 end
11200 rem
11220 rem list all data
11240 print"S"spc(20)"▮LIST ALL DATA"
11260 gosub9160
11280 gosub9780
11300 if a$=chr$(19)goto200
11320 if a$="" goto11520
11340 a=val(a1$):d=0
11360 s$=d$(a)
11380 open 2,8,8,"1:"+s$+",seq,read"
11400 input#2,g$:if g$="" goto11400
11420 t1=0
11440 input#2,g$:if g$="" goto11440
11460 t2=0
11480 gosub9800
11500 goto11300
11520 rem
ready.
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-18. Background mode CRT display.

```
APPROPRIATE BACKGROUND DATA MUST BE ENTERED
PRIOR TO ACCESSING ANY OTHER PROGRAM MODE

BACKGROUND DATA FOR AREA TO BE SCANNED CAN BE OBTAINED FROM
     NEW FILE: BACKGROUND SCAN OF AREA
     Old file: data from previous background file

ENTER ONLY THE FIRST LETTER OF THE DESIRED PROGRAM MODE
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-19. Background scan CRT display.

BACKGROUND SCAN
Scan of area should be obtained at normal driving speed

Max length of file name is 16 characters

Use the exit key to close the background file and
return to the program directory.

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-20. Background mode printout.

BACKGROUND FILE NAME--BKGD 001

	MEAN	STD.DEV. 1 SIGMA
GROSS COUNTS	1800	42
TOTAL Ra	244	16
Th	22	5
K	79	9
Ra/Th	11	2

HIT CRITERIA

TOTAL Ra COUNTS	355
RATIO	15

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-21. Scan mode CRT display.

SCAN PROGRAM

The file name should be the primary road to be scanned and the direction of travel should be the last character in the file name.The file name can be no more than 16 characters.

example
chartiers av n
↑road ↑direction
Input house numbers systematically and all cross streets.

Use the exit key to close the scan file and return to the program directory.

INPUT FILE NAME ░

Exhibit 8.2.6.3-22. Scan mode printout.

SCAN FILE NAME---300 'E NORTH

TOTAL Ra COUNT HIT 505
RATIO HIT 21

TOTAL DISTANCE	STREET NUMBER	NET DISTANCE	TOT Ra COUNTS	Ra/Th RATIO	POS DIFF	REMARKS, LOCATION
586	right	392	536	21	11	
		410	555	24	72	
		414	570	34	213	
		419	565	27	124	
		423	536	36	221	
		427	534	28	135	
		433	534	21	-12	
		436	553	31	175	
		437	606	21	-3	
		441	602	35	245	
		444	527	24	65	
		448	542	39	248	
		455	522	29	144	
		459	572	27	131	
		461	584	29	164	
		564	2151	37	933	
		569	2251	45	1201	
		574	2260	43	1168	
		578	2323	52	1378	
		582	2259	37	978	
		584	2353	44	1240	
		584	2290	43	1177	
		584	2260	54	1378	
		584	2279	37	977	
		584	2312	41	1115	
		584	2333	38	1031	
		586	2257	42	1123	
		590	2131	40	1018	
		596	2088	41	1017	
		603	1853	43	950	
		610	1474	46	802	
		618	849	35	345	

T E MYRICK   5/3/82

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.3-23. Identification mode CRT display.

```
                            [illegible]
THIS PROGRAM IS TO PINPOINT THE EXACT LOCATION OF THE ANOMALIES.
The data is not stored in this program.If a permanent record is
needed then return to the SCAN program
        TO RESET DISTANCE.DEPRESS 0
        TO EXIT PROGRAM.DEPRESS EXIT KEY
        DEPRESS ANY KEY TO START THE PROGRAM
```

SUBJECT: MOBILE GAMMA SCANNING VAN

Exhibit 8.2.6.5-1. Gamma scanning program directory.[a]

Program	Function
Scan	Records all street survey data (scan data)
Background	Defines background for areas to be scanned
Calibration	Used for system checkout
Data Dump	Prints all stored raw data
File List	Prints data above hit criteria
Identification	Pinpoints anomaly location

[a]Enter only the first letter of the desired program mode.

Exhibit 8.2.6.8-1. Distance transducer calibration check data.

Date:______________________________

Technologist:______________________________

Other members:______________________________

____

Tire pressure:______________psi

Distance measurements:

1. ______________ ft ________ % error

2. ______________ ft ________ % error

3. ______________ ft ________ % error

4. ______________ ft ________ % error

5. ______________ ft ________ % error

Average______________ ft ________ % error

$$\% \text{ error} = \frac{500-\text{reading}}{500} \times 100^{a}$$

[a] If % error >3% notify scanning team leader.

SECTION 9: INCLUSION SURVEY ACTIVITIES

SUBJECT: INCLUSION SURVEY ACTIVITIES

9. INCLUSION SURVEY ACTIVITIES

9.1 EQUIPMENT USE

9.1.1 Purpose

The purpose of the following procedure is to provide guidelines for use of equipment needed to perform the radiological measurements at RASA/UMTRA survey sites.

9.1.2 Applicability

This procedure applies to the outdoor and indoor gamma radiation measurements made using portable gamma scintillometers and pressurized ionization chambers (PIC).

9.1.3 References

1. Sect. 7.1, Type of Properties
2. Sect. 7.3, Property Base Map Development
3. Sect. 12.1, Calibration of Measurement and Test Equipment
4. Sect. 12.1.6.5, Calibration Procedures.
5. Victoreen, Inc., Instruction Manual for Model 490, THYAC III, Victoreen Pat. No. 490-1A, Victoreen, Inc.
6. ANSI N323-1978, American National Standard, Radiation Protection Instrumentation Test and Calibration, The Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, New York 10017, 1978 (for guidance only).
7. Instruction Manual for Environmental Radiation Monitor, Model R55-11, Reuter Stokes, Cleveland, Ohio.

APPROVED: Craig Little DATE: 4/14/86

RASA/UMTRA Project Manager

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.1.4 Definitions and Abbreviations

9.1.4.1 Definitions

See Sect. 1.5 of this manual, Terminology.

9.1.4.2 Abbreviations

NBS National Bureau Standard

NEDA National Electronics Distributors Association

kcpm Thousand counts per minute

Also see Sect. 1.5 of this manual, Terminology

9.1.5 Responsibility

9.1.5.1 Team Leader

The Team Leader is responsible for the implementation of this procedure.

9.1.5.2 Team Member

The Team Members are responsible for measuring gamma radiation exposure rates at a survey site according to this procedure.

9.1.6 Procedure

These procedures are brief descriptions of the operation of gamma scintillation detectors and PICs. For more detailed information about the instrument, refer to the manufacturers' Instruction Manuals (references 3 and 5).

9.1.6.1 Gamma Scintillation Detector

SUBJECT: INCLUSION SURVEY ACTIVITIES

Equipment and supplies

1. Victoreen Portable Ratemeter, Model 490, THYAC III, 0-800, 0-8,000, 0-80,000, 0-800,000 counts per minute, Victoreen Instrument Company (see Exhibit 9.1.6.1)
2. Battery - two size D flashlight cells, NEDA Type 13
3. Gamma scintillation probe, Model 489-50, [1.25-in. by 1.50-in. sodium iodide (thallium activated) scintillation crystal], Victoreen Instrument Company, to match corresponding ratemeter
4. Headphone set that attaches to ratemeter
5. A 6-ft nylon cord attached to the top of the scintillation probe for use in handling the probe while surveying

Equipment set up (scintillometer)

1. Remove the ratemeter and corresponding probe from storage in the field van and visually check for physical damage. If physically damaged, do not use, and report damage to the Team Leader.
2. Connect the probe cable to the ratemeter.
3. Attach the headphone set to the phone connector of the instrument. The headphone is used to provide an audio indication of gamma radiation intensity.
4. See field check procedure, Sect. 12.1, Calibration Measurement and Test Equipment and Exhibit 9.1.6-3.
5. Periodic performance tests of the instrument should be made according to paragraphs 4.5 and 5.4 of the Victoreen Instrument Manual for Model 490, THYAC III, and records are to be kept in general conformance with guidelines in paragraph 4.5 of ANSI N323-1978.
6. Initially set the range at the highest level (x 1000). If the meter reading is less than ten percent of full scale, switch to the range of the next lower level (x 100). Repeat this procedure until the reading is over 10% of full scale.

7. The Model 490 Ratemeter has three response times designated slow, med, or fast, which correspond to approximately 15 s, 5 s, and 1.5 s, respectively. Generally, the slow response is used with the two most sensitive ranges for very accurate reading; the med response is used for the majority of the readings; and the fast response is used with the x 1000 range. Set the response switch to med.

Instrument operation

Discrete measurements (gamma scintillometer)

1. Place the scintillator against or at a specified distance from the surface to be surveyed (e.g. 3 ft).
2. Observe the count rate as displayed on the ratemeter. Note the average value in cpm and record on the Radiological Survey Summary page of the field data sheets (Exhibit 9.2.6-3).
3. When the survey is complete, turn the instrument off.

Scanning (gamma scintillometer)

1. Traverse the property to be surveyed by following parallel, adjacent but slightly overlapping, three to four feet wide paths. While traversing the property, the surveyor should move the detector from side to side (covering a three to four feet width) while holding it as close to the ground as possible (<six inches); see Exhibit 9.1.6-3. (The presence of rocks and other objects may not permit holding the detector at a constant height.)
2. Use the audio response of the detector to identify areas of anomalous radiation levels. Periodically observe the meter response to obtain an estimate of the average levels measured.

SUBJECT: INCLUSION SURVEY ACTIVITIES

3. Note average background levels and the locations and associated surface responses at all locations with elevated radioactivity. Enter the average observed detector response (cpm) on the Radiological Screening Summary field data sheet (Exhibit 9.2.6-3) for the appropriate surveyed site. Also record all meter readings from locations of elevated gamma activity.
4. When the entire survey site has been scanned, turn the instrument off.

9.1.6.2 Pressurized Ionization Chamber (PIC)

Equipment and supplies

Reuter Stokes Portable Environmental Radiation Monitor Model RSS-111. This system includes the following:

Monitor
Digital display
Auto-disconnect battery pack with batteries
Tripod
Integrating digital read-out apparatus with timer (see Exhibit 9.1.6-2)

Equipment setup and operation (PIC)

1. Normally for RASA/UMTRA measurements, the sensor head is placed directly on the surface to be measured with handle facing upward. However, if the situation dictates, attach the tripod with the sensor head housing, handle, and connectors facing upward. (The tripod is equipped with a mounting stud modified from a stainless steel socket head cap screw that is held in place on the tripod.) Secure tripod to sensor head.

2. Extend the legs of the tripod to a position so that the center of the ion chamber housing is approximately 3 ft above the floor or ground surface.
3. Set the sensor head upright and connect cable.
4. Place the control and read-out housing 10 to 15 ft from the sensor head.
5. Ensure that the ELECTROMETER and MODE switches are both in the OFF position, then connect the cable to the readout housing.
6. If the system is to be operated on A.C. power, connect the line cord to the control housing.

   CAUTION: Do not operate the system on A.C. line voltage with the battery pack removed or permanent damage will result.
7. Determine the charge status of the 300 V dry cell battery (bias voltage supply to sensor) by the following procedure: turn on DISPLAY/RECORDER switch to BATT position and depress two switches; the one immediately below the digital display device, designated PUSH-TO-READ, and the one designated 300 V. The charge status of the 300 V battery will appear on the digital display in percent of charge remaining. Display will appear for approximately 30 seconds. There is essentially no drain on this battery, but it is subject to normal deterioration as indicated by the manufacturer's shelf-life specification. This battery should be replaced when the charge degrades to approximately 85%. Refer to paragraph 4.3 of the Instruction Manual for instruction.

   To determine charge status of the -14-, +14- and +12-V lead-acid type batteries, individual voltmeters, depress a switch immediately below the meters. If needle is in or near shaded area of meter, a recharge is recommended. See the appropriate section of the Instruction Manual.

Place the MODE switch in BATT or A.C. position. Place the ELECTROMETER switch in its ZERO position; wait approximately 60 s before proceeding, to allow transient charging currents to die out. Place the ELECTROMETER switch in it READ position; after a delay of approximately 10 s the signal will appear on the chart recorder. The auto-ranging recorder sensitivity is electronically switched over two ranges; 0–50 μR/h (low range) then switching to 250 μR/h (high range) and back to low range again.

To have the signal appear on the display, turn on the DISPLAY/RECORDER switch and depress the PUSH-TO-READ switch. The signal will appear for approximately 30 s.

NOTE: Although the display is not illuminated after the 30 s, the unit is still operating causing a drain on the battery. For economical power usage while in BATT mode, turn the DISPLAY/RECORDER switch off when a displayed signal is no longer necessary.

When measurement is finished, turn ELECTROMETER and MODE switches off. Dismantle the instrument and return to storage.

8. Field check (see Exhibit 9.1-6.5 and Sect. 12.2, Calibration of Pressurized Ionization Chambers).

Discrete measurements (PIC)

1. After the entire survey site has been scannned with the gamma scintillometer, Place PIC sensor head on average background region as assigned by survey site Team Leader. The head faces are numbered 1-4; always place face #1 to north as indicated by Team Leader's compass.
2. Read and record measurement.

3. Remove sensor head and place scintillator probe 15 cm above surface of assigned sensor head location; read and record scintillator measurement for Field Data Sheets.
4. Repeat steps 2-4 as indicated by Team Leader on HOG, HIG, and any other desired anomalies and/or background activity locations.
5. When desired measurements have been taken, turn off instruments.

   Note 1: This procedure is used on sites where conversion equations do not apply.

   Note 2: When using sensor head on tripod, six scintillator values are measured--one measurement taken in the middle of each face, one measurement at 1 m above surface and one surface measurement.

Equipment use during inclement conditions

Note: Both the scintillators and PICs need to be protected as much as possible during periods of inclement weather to reduce risk of instrument malfunction (see Instruction Manuals - Ref. 3 and 5).

1. Gamma Scintillation Detector - cover each probe and ratemeter with a plastic sample bag and secure at open end with tape; use instrument as indicated in Sect. 9.1.6.1; remove bags prior to prolonged storage.
2. PIC - cover each sensor head and monitor with large plastic storage bags and secure at open end with tape; use instrument as indicated in Sect. 9.1.6.2, remove bags prior to prolonged storage.

9.1.6.3 Field Photography

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Equipment and supplies

Camera	35mm single lens reflex camera
Lenses	50mm 1:1.4, S.S.C., standard lens
Flash	Self-contained or electronic flash
Miscellaneous	Carrying case, tripod, photograph archive notebook (looseleaf with plastic photograph and negative inserts)

Technical operation

The technical operation of photographic equipment is beyond the scope of this procedure. The Team Leader or his designated Team Member will have the technical skills necessary to implement this procedure (e.g,, exposure control, lens selection and effect, etc.). The Team Leader will record photograph number and review description on field data sheets (see Exhibit 9.2.6-1), and will maintain a photograph archive notebook including copy of site photos and their negatives. The photographs are labelled as follows: AB85JD05-01

AB - site location code

85 - year roll shot

JD - initials of Team Leader

05 - Team Leader's roll number

01 - frame number of corresponding roll

Procedure

1. The general purpose of site photography is to document the site surveyed. The site photograph can be taken at any time before the team leaves the survey site.

2. Photograph general site outdoor views of the property from a vantage point that provides a reasonable understanding of the property, including relative size, structures, and terrain. A front view of the property is most commonly taken (a back view is taken if a front view cannot be obtained). Subsequent photographs (i.e. indoor photographs) are not needed unless property is exceptionally large or is in some way peculiar.
3. Once a roll of film is used, it is taken to a designated processor for developing. Three copies of each site photo are always obtained (for inclusion report and archiving purposes).
4. After the photographs are retrieved from the processor, they are labelled as described in this procedure and are placed in the Inclusion Survey Report and in the Team Leader's photograph archive notebook (see Sects. 10.1 and 10.6, Team Leader Pre-Report Activities and Report Drafting).

9.1.7 <u>Exhibits</u>

1. Exhibit 9.1.6-1, Victoreen Portable Ratemeter, Model 490 THYAC III
2. Exhibit 9.1.6-2, Pressurized Ion Chamber
3. Exhibit 9.1.6-3, Field Check (Gamma Scintillator Detectors)
4. Exhibit 9.1.6-4, Scanning Technique
5. Exhibit 9.1.6-5, Field Check (PIC)

9.1.8 <u>Revision History</u>

Rev. 1	Date: 03/31/86	First Revision

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.2 DATA RECORDING

9.2.1 Purpose

The purpose of this procedure is to define data records related to site survey and soil sample data collection.

9.2.2 Applicability

All data gathered by ISC personnel shall be recorded according to this procedure and its references.

9.2.3 References

1. Section 9.1, Equipment Use
2. Section 9.4, Background Measurements
3. Section 9.6, Sample Collection

9.2.4 Definitions and Abbreviations

See Section 1.5, Terminology.

9.2.5 Responsibilities

9.2.5.1 Team Leader

The Team Leader is responsible for implementation of this procedure.

9.2.5.2 Team Members

The Team Members are responsible for complying with this procedure.

9.2.6 Procedure

9.2.6.1 Types of Data Records

Eight types of data forms are used by the ISC to record data collected for the UMTRA project including: (1) field map; (2) field data sheets; (3) soil sample analysis form; (4) soil quality check form; (5) photograph archive notebook; (6) post-inclusion survey site tracking log; (7) personal log books; and (8) survey activity report.

Field Map

The field map is used to illustrate the locations of tailings deposits and point sources, indicate gamma radiation measurements at appropriate locations, and provide any other pertinent information (see Sects. 9.4, Background Measurement, 9.5, Deposit Definition, and 10.5, Labeling of a Field Drawing). Examples of field maps are given in Exhibits 9.5-1, 10.5-1, and 10.5-2. The Team Leader is responsible for making copies of the mylar map for all Team Members.

Field Data Sheets

The three field data sheets are used to record all non-graphic data collected at an inclusion survey site. The Team Leader is responsible for keeping data properly recorded on the sheets. All appropriate blanks must be completed before the team leaves the site. The site number, taken from the label on the property folder, and the survey date are recorded in the space provided at the top of all three field data sheets. The field data sheets are shown in Exhibits 9.2-1, 9.2-2, and 9.2-3.

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Survey site information:

See Exhibit 9.2-1, Example of Field Data Sheet - Survey Site Information

1. Owner data

Normally, this section is completed by the team leader prior to the site visit and after an appointment for the site survey has been made. The required information is taken from the consent form and/or from the site owner contact.

2. Land use

This section is appropriately completed during the inclusion survey. Each structure located on the survey site must be adequately described to aid in report writing. Entries in this section are self-explanatory.

3. Photographs

This section is completed after survey-site photograph(s) have been taken according to Sect. 9.1.6.3.

4. Spillover

If any deposit continues onto an adjacent property, it must be noted as "spillover" in this section. The address of the adjacent property should be recorded if at all possible in the space provided. The Team Leader is responsible to notifying the RASA/UMTRA Public Relations staff that a spillover condition exists. The Public Relations staff will determine whether or not that property has already been designated for a survey, and, if not, will notify the TAC to initiate proceedings to designate that property. It is preferable to wait until the spillover property has been designated and surveyed before writing the Inclusion Survey Report for the primary or initial property; both reports should reference the other. See Sect. 7.1.6.4, Types of Properties, for an in-depth discussion.

Radiological screening summary:

See Exhibit 9.2-2, Example of Field Data Sheet - Radiological Screening Summary.

1. The radiological survey Team Members' initials are entered in appropriate spaces.
2. The remaining entries on page two are self-explanatory (see Exhibit 9.2-2). Normally, the "μR/h conversion" category and "μR/h" values are not entered during the survey, but done as part of Sect. 10.1, Team Leader Pre-Report Activities.

Soil sample data field forms:

See Exhibit 9.2-3, Example of Field Data Sheet - Soil Sample Data Field Forms.

1. Each sample location should be described adequately. When possible, measurements from easily relocatable points are used.
2. "Area Rep:" refers to total measured surface area that the collected sample represents. The remaining categories on this page are self-explanatory.
3. Normally, the "gamma, μR/h" blanks are filled in as part of Sect. 10.1, Team Leader Pre-Report Activities. The "^{226}Ra, pCi/g" blanks are completed once the respective sample has been analyzed.

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Soil Sample Analysis Form

The Team Leader is responsible for providing copies of the Soil Sample Analysis Form (see Exhibit 9.2-4). The Sample Technician is responsible for completion of appropriate categories on this form. The form should be completed at time of sample collection. The following categories are completed prior to turning over to the Soils Laboratory for analysis:

1. The address is copied from the Survey Site Information Field Data Sheet.
2. The "Sample No." and "Date Taken" are taken from the labelled sample bag (see Sect. 9.6, Sample Collection).
3. The Team Leader is required to check the Soil Sample Analysis Form for accuracy at the end of each scanning day, prior to turning over samples to the Soils Laboratory for analysis. Once the form has been checked for accuracy, the Team Leader is required to initial and date the sheet in the upper left hand corner.

Photograph Archive Notebook

Each Team Leader is responsible for labelling photographs according to corresponding field data sheets and archiving photographs in a looseleaf notebook designated for this purpose. This notebook consists of individual plastic photograph and negative storage pages. The photographs are labelled in accordance with Sect. 9.1.6.3.

Post-Inclusion Survey Site Tracking Log Book

Each Team Leader is responsible for initiating and maintaining a tracking log book, the format of which is at the discretion of the Team Leader. This document monitors the progress of each inclusion survey from the survey date to the date the written report is submitted to the technical editors for review.

Each Team Leader and Team Member is responsible for initiating and maintaining a personal log book, the format of which is at the discretion of each individual. This document serves to notate any observations or occurrences during a survey, which would be incorporated into the Inclusion Survey Report.

Each Team Leader is responsible for reporting survey site numbers and dates surveyed to the RASA/UMTRA Public Relations Coordinator on a weekly basis (see Sect. 15.6, Inspection, Test, and Operating Status and Sect. 15.10, Project Document Control). The format in which the data are reported is at the discretion of the Team Leader. In addition, each Team Leader submits a report of all week's activities (surveys and reports written and reviewed) to the Survey Manager and Process Coordinator.

9.2.7 Exhibits

1. Exhibit 9.2-1, Example of Field Data Sheet - Survey Site Information
2. Exhibit 9.2-2, Example of Field Data Sheet - Radiological Screening Summary
3. Exhibit 9.2-3, Example of Field Data Sheet - Soil Sample Data Field Form
4. Exhibit 9.2-4, Example of Soil Sample Analysis Form

9.2.8 Revision History

Revision 1 date: 03/31/86 First Revision

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.3 EXTENT OF INCLUSION SURVEY

9.3.1 Purpose

The purpose of this procedure is to provide guidelines on the extent of data to be collected during an inclusion survey. These guidelines are intended to allow the greatest possible cost efficiency commensurate with collection of data sufficient to make an inclusion/exclusion recommendation.

9.3.2 Applicability

This procedure applies to the performance of inclusion surveys by RASA/UMTRA personnel in support of Inclusion Survey Contractor activities for the UMTRA project.

9.3.3 References

1. ISC Implementation Plan for Fiscal Years 1985-1988 (in review)
2. Sect. 7.1.6.4, Types of Procedures
3. Sect. 10.6.1, Calculations for Report Drafting

9.3.4 Definitions and Abbreviations

See Section 1.5 of this manual, Terminology.

9.3.5 Responsibilities

9.3.5.1 RASA/UMTRA Survey Manager

The RASA/UMTRA Survey Manager has the overall responsibility for the conducting of the inclusion surveys. He will appoint Team Leaders and Members and is responsible for providing guidance to the teams and reviewing the team's activities.

9.3.5.2 Team Leader

The Team Leader is responsible for conducting of specific inclusion surveys. The Team Leader bears the responsibility for interpreting survey data and for determining the extent of the inclusion survey at each assigned property.

9.3.6 Procedure

The extent of an inclusion survey is guided by a decision matrix based on the EPA standards; it is designed to minimize the effort necessary to make a defensible inclusion/exclusion recommendation. In addition, the Team Leader must determine whether or not the property is a GJRAP property, either active or inactive; no indoor survey is conducted on this type of property. See Sect. 7.1.6.4, Type of Properties, for an explanation of GJRAP properties. In general, when an includable deposit is discovered on a property, further survey activities are not required (see Exhibit 9.3-1, Guidelines to the Extent of Inclusion Surveys). Guidelines for what defines an includable deposit have been developed for use in the field and are described below.

9.3.6.1 Gamma Screening

A gamma scan of the property is conducted, beginning with a scan of the interior of any habitable structures. If interior access is denied, no data will be collected indoors. At the discretion of the Team Leader, the gamma scan of the outdoor areas can wait until the interior scan is completed or can begin simultaneously with the interior scan. During the scanning, if any contiguous 100 m^2 outdoor area averages more than 25 μR/h above background, or, if any room of a building averages more than 20 μR/h above background, then a recommendation for inclusion can be made and the survey is ended. Under these circumstances, it is not necessary to perform a gamma scan of the entire property. Conversely, when an entire property has been scanned and no contiguous 100 m^2 outdoor area and no room of a building emit exposure rate averages greater than background plus one standard deviation (one sigma), a recommendation for exclusion can be made with no further measurements; see Sect. 10.6.1, Calculations, for specific methods of obtaining the average gamma exposure rates.

The Team Leader is responsible for determining average gamma rates for outdoor areas and rooms. Outdoor regions where gamma rates are elevated should be measured by tape or paced where practical, or should be estimated for areas greater than 35 m in any one dimension. Average interior gamma rates can be determined by calculating the mean of measurements taken from the middle of each wall and the center of a room. A "room" may be either a room or an interior area large enough to be partitioned from a larger area to make a room (approximately 10 m^2).

If a recommendation for inclusion or exclusion cannot be made based on the above guidelines after an entire property has been scanned, extended measurements are required. If levels of gamma exposure between background plsu one standard deviation and background plus 25 μR/h outdoors or 20 μR/h indoors are measured, or, if the Team Leader is not satisfied with the adequacy of the data to make a recommendation, extended measurements must be made.

9.3.6.2 Extended Measurements

Extended measurements consist of either soil sampling outdoors or radon daughter concentration (RDC) sampling indoors. Soil samples may represent the topmost 15 cm soil layer (surface samples) or successive 15 cm thick soil layers (subsurface samples). RDC measurements may be either instantaneous (grab) samples or annual average measurements.

For purposes of inclusion survey cost-effectiveness, soil samples are always taken before RDC measurements. Each soil sample represents a definite area, determined in the field by the Team Leader, except for samples collected for representative concentrations of Ra-226 in soil. Using the analytical results, if ^{226}Ra concentrations exceed 5 pCi/g above background in the surface or 15 pCi/g above background in the subsurface sample when averaged over a 100 m^2 area, then an inclusion recommendation is warranted. If ^{226}Ra concentrations do not exceed these limits and indoor gamma levels do not exceed background plus one sigma, an exclusion recommendation is warranted.

RDC measurements are made only if indoor gamma levels are measured between background plus one sigma and background plus 20 μR/h, and the property cannot be recommended for inclusion based on Ra-226 concentrations in the soil. Before a property is scheduled for RDC measurements, all available data are entered and the file given to the Technical Assistant and/or designated Team Leader to verify the necessity to take RDC measurements.

When RDC measurements are required, the inclusion/exclusion criteria are in terms of working levels (WL). A grab RDC measurement of <0.01 WL requires an exclusion recommendation, and a grab RDC measurement of >0.04 WL requires an inclusion recommendation. Grab RDC measurements between these two values dictate an annual average RDC determination. An annual average RDC value of 0.02 WL or greater results in an inclusion recommendation and a value of <0.02 WL results in an exclusion recommendation.

9.3.7 Exhibits

Exhibit 9.3-1, Guidelines on the Extent of Inclusion Surveys

9.3.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.4 MEASUREMENTS IN UNCONTAMINATED AREAS

9.4.1 Purpose

The purpose of this procedure is to describe the techniques used to obtain representative measurements and soil samples.

9.4.2 Applicability

This procedure applies to representative measurements by RASA/UMTRA personnel in support of the UMTRA Program Inclusion Survey Contractor activities.

9.4.3 References

1. Sect. 9.1, Equipment Use
2. Sect. 9.6, Soil Sample Collection

9.4.4 Definitions and Abbreviations

9.4.1.1 Definitions

REPRESENTATIVE. That which does not exhibit elevated gamma exposure rates due to mill tailings, ore, or other anthropogenic sources.

Also see Sect. 1.5 of this manual, Terminology.

9.4.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

9.4.5 Responsibilities

9.4.5.1 Team Leader

The Team Leader is responsible for the implementation of this procedure.

9.4.5.2 Team Members

The Team Members will make representative measurements according to this procedure.

9.4.6 Procedure

9.4.6.1 Locating Representative Areas

An indoor and outdoor gamma scan is performed on every property. Every room in the lowest habitable or potentially habitable level of each building is scanned (except for GJRAP properties), and all accessible outdoor areas are scanned. Once the entire survey site has been gamma scanned, the exposure rates detected are recorded on the field data sheets, and the locations are indicated on the field map. If the entire property exhibits elevated count rates, a representative value may be obtained from a previously surveyed and uncontaminated property in the area. Each Team Member will shade in the portions of the property they surveyed to ensure complete coverage of the site. Refer to Sect. 9.1.6.1, Gamma Scintillation Detector, for the scanning technique.

9.4.6.2 Representative Measurements and Sampling

Once all the scintillometer count rates have been determined and recorded, they must be converted from cpm to μR/h units. For sites which have empirically determined conversion tables, PIC measurements are not necessary (see Sect. 10.1.6.1, Conversion of Scintillometer Count Rates to Exposure Rates). For those sites with no established conversion tables a direct conversion must be obtained with a PIC. The PIC location is selected by the Team Leader and will be as distant from any contamination (elevated gamma readings) as is conveniently possible.

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At least one soil sample (surface) shall be taken on every property. If a property exhibits regions with different representative ranges, a sample shall be taken in each representative region. Additionally, if the entire property is contaminated, a representative sample may be used from a previously surveyed and uncontaminated property in the area.

9.4.7 Exhibits

None.

9.4.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

9.5 DEPOSIT DEFINITION

9.5.1 Purpose

The purpose of this procedure is to describe the technique for defining a deposit of residual radioactive contamination.

9.5.2 Applicability

This procedure applies to all deposits, both indoor and outdoor, of radioactive contamination associated with the RASA/UMTRA program.

9.5.3 References

1. Section 9.1, Equipment Use
2. Section 9.3, Extent of Survey
3. Section 9.4, Background Measurements
4. Section 9.6, Soil Sample Collection
5. Section 9.7.1, Removal of Point Source
6. VPMIM

9.5.4 Definitions and Abbreviations

REGION. Portion of property that contains gamma exposure rates which exceed one standard deviation above background.

Also see Section 1.5, Terminology.

9.5.5 Responsibility

9.5.5.1 Team Leader

The Team Leader is responsible for implementation of this procedure.

9.5.5.2 Team Members

The Team Members are responsible for characterization of a deposit according to this procedure.

9.5.6 Procedure

Once an entire site has been gamma scanned (Section 9.3, Extent of Survey) and representative regions have been characterized and noted (Section 9.4, Measurements in Uncontaminated Areas), the deposits of radioactive contamination are defined in the following manner:

1. Any gamma measurement which exceeds the highest value of the representative rate range by 1000 cpm is either kept in mind or is marked with flags or other appropriate markers by a Team Member. When the site scan has been completed, the contaminated regions are revisited by the team.

2. A gamma scintillation measurement range and a field (mode) average are determined for the deposit by Team Leader inspection with a specified scintillometer (normally the Team Leader's). The gamma rate range should not exceed 50,000 cpm. If the range exceeds this maximum value, the deposit should be broken down further into isopleths of equal rates to facilitate averaging of values found. Note: it is possible to have a deposit with a determined gamma rate range that contains spots of contamination [>0.5 m^2] exceeding the highest range value. The spots must be discrete and few.) The ranges, averages, any extraordinary notes, and the identity of scintillometers used are recorded in appropriate places on the field data sheets and on the field map.
3. The square footage of the deposit is then measured as follows:

   For deposits <930 m^2, a measuring tape is stretched across the surface of the deposit in varying directions as often as deemed necessary by the Team Leader to obtain accurate shape of the deposit. The shape, location, and area are then recorded (to scale) on the field map by the Team Leader.

   For deposits >930 m^2, the deposit is "paced-off" by the Team Leader or Team Member whose pace has been pre-determined. The deposit is "paced-off" in as many directions as deemed necessary by the Team Leader to obtain an accurate shape of the deposit. The shape, location, and square footage of the deposit are then recorded (to scale) on the field map by the Team Leader.
4. Once a gamma rate range has been defined and area determined, soil samples are taken from outdoor deposits (Section 9.6, Sample Collection) as dictated by the inclusion criteria contained within the VPMIM (Reference 4). Once a gamma rate range has been defined and area determined for indoor deposits, RDC samples are taken as dictated by the inclusion criteria contained within the VPMIM. PIC measurements are taken (indoors and outdoors) in regions where a conversion equation does not apply (Section 9.1, Equipment Usage).

SUBJECT: INCLUSION SURVEY ACTIVITIES

5. Once an includable deposit has been found, located, and sampled, the site survey can be terminated at the Team Leader's discretion (Section 9.3, Extent of Survey).

6. "Point Sources"

   Deposits exhibiting elevated gamma rate ranges that, after investigation according to the procedures described above, are <0.5 square meters in area and/or contain radioactive material that is found not to be mill tailings, are deemed "point sources" (i.e., ore, petrified wood, and dinosaur bones). These deposits are represented on the field map with an asterisk (*) and the gamma rate range indicated. Ore samples may be removed by the site survey team only after the site owner has been consulted and his permission obtained. The samples are bagged and labelled as soil samples (Section 9.6, Sample Collection) and stored at the laboratory in barrels (Section 10.4, Sample Storage). Notes must be made on the field map that show the remediated location and gamma rate range of the removed point source. See Section 9.7.1, Removal of Point Sources, for detailed instruction.

   Normally, if a point source gives the highest gamma rate measurement on the survey site, it is not considered to be the site HOG and should not be recorded as such. Point sources should be merely defined and noted; no further investigation or measurements (e.g., PIC measurements) are necessary.

7. If the outlying boundaries of the deposit are too gradational to be easily defined (or undefineable for any reason), post holes are dug and gamma scintillation measurements taken within the holes. The intervals at which the postholing is done, and the spacing and frequency are determined by the Team Leader according to rate measured (refer to 9.5.6 of this procedure). Note: post holes are reclaimed in the same manner as soil sample locations. The locations of the post holes should be indicated on the field map.

8. Normally, when a drawing is prepared by the Graphics Coordinator, floor plans of the structures are not included. When an indoor deposit of contamination is detected, floor plans of the affected structures are required and should be added by a designated Team Member at time of the site survey.

9.5.7 Exhibits

1. Exhibit 9.5-1, Example of Field Map

9.5.8 Revision History

Revision 1	Date: 03/31/86	First Revision

9.6 SOIL SAMPLE COLLECTION

9.6.1 Purpose

The purpose of this procedure is to establish the guidelines for collecting and labelling soil samples at survey sites.

9.6.2 Applicability

This procedure applies to soil sample collections at all survey sites by RASA/UMTRA personnel.

9.6.3 References

Section 9.4, Measurements in Uncontaminated Areas

9.6.4 Definitions and Abbreviations

TURKEY BAG. Large plastic bag in which all individual soil sample bags for one survey site are placed for transport to the Soils Laboratory.

Also see Sect. 1.5 of this manual, Terminology.

9.6.5 Responsibilities

9.6.5.1 Team Leader

The Team Leader is responsible for the implementation of this procedure at the survey site.

9.6.5.2 Team Members

The Team Members are responsible for collection of soil samples in accordance with this section.

9.6.6 Procedure

9.6.6.1 Locations and Depths of Samples

The Team Leader will specify the sampling locations at the survey site. Those locations are determined after the gamma scan of the property is completed. Normally, a surface sample is taken at the representative area (see Section 9.4, Measurements in Uncontaminated Areas), surface and subsurface samples (if necessary) are taken at the HOG, and extraordinary samples are taken as deemed necessary by the Team Leader for complete deposit definition. See Exhibit 9.6-1, Proper Sampling Technique.

A gamma scintillometer measurement must be taken on the surface and recorded on the field data sheets prior to sampling. A gamma scintillometer measurement is taken at each subsequent depth after each sample is taken.

If the gamma scintillometer measurement increases by more than 20% (a maximum of 20% increase due to the effect of the geometry of the sample hole on the scintillometer probe), sampling at subsequent depths must continue until measurement begins to stabilize (in representative samples) or decreases (in regions of contamination). Before the sample hole is reclaimed, the probe is inserted in the hole and measurements and thickness of contaminated layer(s) noted on field data sheets (see Exhibit 9.6-2, Probe Measurements in Sample Hole). If tailings are suspected to be within the concrete, a sample of the concrete can be taken, as discreetly as possible, if deemed necessary by the Team Leader. It is suggested that site owner compliance precede concrete slab sampling. In areas of "windblown" contamination, a 0-3 cm sample is separated out from the surface sample for purposes of definition of deposit.

9.6.6.2 Types of Samples

There are normally two types of samples taken, systematic and biased.

Systematic samples

Random samples are taken from some survey sites. The Team Leader will determine the number and locations of these samples. Normally, these samples are taken in regions where the effects of radiation from extraneous sources are present (emanation), and true contamination cannot be concretely defined; these are informally referred to as "shine regions."

Biased samples

Biased samples are taken from locations with measurements of at least 1000 cpm above the high representative measurement. These samples are the most common type taken at UMTRAP vicinity property sites.

9.6.6.3 Sampling Equipment

Soil sampling equipment consists of simple implements such as gardening trowels, post hole diggers, or any implement that can be used for this purpose (see Exhibit 9.6-3, Sampling Equipment).

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9.6.6.4 Sample Size and Packaging

Approximately 500 grams of soil per sample are obtained in the field and packaged in aluminum pans with lids. The address, sample ID#, date, and sample depth are written on the lid. The sample is then put in a "zip-loc" plastic sample bag. It is then labelled with the identification number and address (see Sect. 9.6.5, Sample Labelling), and the appropriate data are recorded on the soil data sample form field data sheet. All sample bags for one survey site are placed in a larger plastic bag (turkey bag) and the bag labelled with the location number and address. The samples are later transferred to the Soils Laboratory for analysis.

9.6.6.5 Sample Labelling

Each sample shall be assigned a unique alphanumeric identification having seven characters and one hyphen with no imbedded blanks or punctuation. Samples are labeled (written on zip-loc sample back with permanent marker) as follows:

The alphanumeric designation must appear on each sample bag.

1. AB01234-S1 (for surface only samples)

   or

   AB01234-S1A
   -S1B
   -S1C, etc. (for surface plus subsurface samples)
   -S1Z (indicates concrete sample)

where: AB - area location code
01234 - location number
S1(A,B,C...) - sample number.

Note: The "S" stands for "sample" not "systematic" in UMTRAP site sampling procedures.

2. It is not necessary to indicate the deposits in the "comments" section of the soil sample field data sheet unless the designated letters do not correspond to the given deposits. The comments section can be used to indicate visible tailings (VT), ore, the HOG, gamma ranges, etc.
3. The property address and Sample Technician's initials must appear on all the samples taken at the survey site.
4. The depth of the sample must appear on each sample bag.
5. The date must appear on each sample bag (see Exhibit 9.6-4, Sample Labelling).

9.6.6.6 Soil Data Sheets

Soil data sheets (see Sect. 9.2, Data Recording) are to be completed appropriately on a daily basis by the Team Leader, initialed, and turned over to the Soil Coordinator (accompanying samples) at the close of each scanning day.

9.6.6.7 Sample Hole Reclamation

Once samples have been collected, an effort must be made to restore the area to as close to its original state as is possible. If grass lawn is present, a top grass "plug" is removed before samples are taken and saved for replacement. Fill dirt may be required to replace soil collected as sample material.

9.6.7 Exhibits

1. Exhibit 9.6-1, Proper Sampling Technique
2. Exhibit 9.6-2, Probe Measurements in Sample Hole
3. Exhibit 9.6-3, Sampling Equipment
4. Exhibit 9.6-4, Sample Labelling

9.6.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

9.7 SAFETY PROCEDURES

9.7.1 Purpose

The purpose of this section is to establish various safety procedures for RASA/UMTRA personnel while conducting ISC activities.

9.7.2 Applicability

These safety procedures will apply to all ISC activities (especially inclusion surveys and soil laboratory activities).

9.7.3 References

None.

9.7.4 Definitions and Abbreviations

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.7.4.1 Definitions

GEIGER-MUELLER COUNTER. Radiation detection device which utilizes an ionization chamber to measure the pulses of energy released by the original particle or photon; also known as G-M tube.

ALPHA COUNTER. Scintillation detector using zinc sulfide crystals for alpha particle detection.

9.7.4.2 Abbreviations

d/m disintegrations per minute

Also see Section 1.5, Terminology.

9.7.5 Responsibilities

All RASA/UMTRA personnel responsible for conducting inclusion surveys and/or Soil Laboratory duties will comply with these procedures.

9.7.6 Removal of Point Sources

9.7.6.1 Point Sources Within Gamma Scintillation Range ($\leq$800 kcpm or 1400 μR/h)

1. The point source location is noted on the field maps by an asterisk and exposure rate; the exposure rate is also noted on the appropriate field data sheet.
2. The property owner is consulted regarding removal, as point sources are removed only upon owner permission.
3. If removed, the point source(s) should be double-bagged and labelled with site number and address.
4. The point source is then brought back to the Soils Laboratory where it is placed in the currently assigned site "excess" barrel for storage.

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.7.6.2 Point Sources Outside Gamma Scintillation Range (>800 kcpm or 1400 μR/h)

1. The Team Member finding the point source should note the general location and notify the Team Leader.
2. The Team Leader will terminate the survey in the noted region and will obtain a G-M tube and alpha counter from the Soils Laboratory. Pregnant women and small children should not be allowed in the region of the point source.
3. The investigation should continue by using the G-M tube and alpha counter until the source is located. The location, exposure rate, and disintegrations/minute (d/m) should be noted on the field map and appropriate field sheets.
4. If the source measures <0.5 R/h and/or <300 d/m, it can be handled doubled-bagged. If the team is working in Mesa County and the surrounding area, the source is taken directly to the compound for evaluation and appropriate storage. If the team is working outside the Mesa County area, the source should be double-bagged and appropriate waste disposal authorities contacted regarding disposal.
5. If the source measures >0.5 R/h and/or >300 d/m, it should not be handled, and proper waste disposal authorities should be consulted regarding handling and disposal.

9.7.6.3 Alpha Counting Equipment

If any personnel working in the Soils Laboratory and/or the field suspects an excess of alpha-radiation contamination on body/clothes, two ORNL (Q227A) Alpha-Probe Instruments are available for self-examination. These instruments are located in the Soil Laboratory and are continuously turned on.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Care must be exercised when examining as the mylar covers on the probes are very fragile. A red light will illuminate when a measurement of >440 d/m is detected. If this should occur, remove the contaminated clothing, place it in a plastic bag, and take it to a designated laundry for cleaning.

Affected personnel should then be re-examined for contamination. If skin appears contaminated, a shower should be taken. Affected personnel should then be re-examined until no evidence of contamination remains.

9.7.7 Exhibits

None.

9.7.8

Rev. 1	Date: 03/31/86	First Revision

9.8 INSPECTION AND DECONTAMINATION OF EQUIPMENT AND PERSONNEL

9.8.1 Purpose

The purpose of this procedure is to describe procedures for inspection of equipment and personnel for contamination and for decontamination of equipment and personnel, when necessary.

9.8.2 Applicability

This procedure applies to the inspection and decontamination of all equipment and personnel involved in the conduct of ORNL's activities as the UMTRA Project Inclusion Survey Contractor.

9.8.3 References

None.

SUBJECT: INCLUSION SURVEY ACTIVITIES

9.8.4 Definitions and Abbreviations

See Section 1.5, Terminology.

9.8.5 Responsibilities

9.8.5.1 Team Leader

The Team Leader is responsible for implementation of this procedure. He will ensure that equipment and personnel are inspected and, if necessary, decontaminated.

9.8.5.2 Team Members

Team Members shall follow this procedure.

9.8.5.3 Sample Coordinator

The Sample Coordinator is responsible for the implementation of the portions of this procedure applicable to equipment and personnel in the Soils Laboratory.

9.8.6 Procedure

9.8.6.1 Equipment

Gamma detection equipment will be inspected for visible contamination after surveying each property. Visible contamination will be removed using a brush, paper towels, and/or water before returning the equipment to the survey vehicle.

Sample collection equipment will be inspected for visible contamination after collecting each sample. Visible contamination will be removed using a brush, paper towels, and/or water before collecting the next sample or returning the equipment to the survey vehicle.

After the inspection and decontamination of equipment is completed at the end of each inclusion survey, the Team Leader will mark the appropriate space on the field survey data sheets to verify performance of the procedure.

The Soils Laboratory and the equipment in it will be kept free of visible contamination, which may be removed by broom, brush, wet paper towels, or other appropriate means.

9.8.6.2 Personnel

Following the completion of each inclusion survey, personnel will inspect themselves for visible contamination. Visible contamination will be removed using a brush, paper towels, and/or water. When field conditions are muddy, shoe or boot coverings will be used. Following an inclusion survey during muddy conditions, shoes, boots, and/or coverings are to be washed free of visible contamination using water, with paper towels or a brush, as appropriate.

Following sample handling or field work, hands are to be washed before eating.

9.8.7 Exhibits

None.

9.8.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

Section 9.9 - RESERVED

Section 9.10 - RESERVED

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.1.6-1, Victoreen portable ratemeter, Model 490 THYAC III.

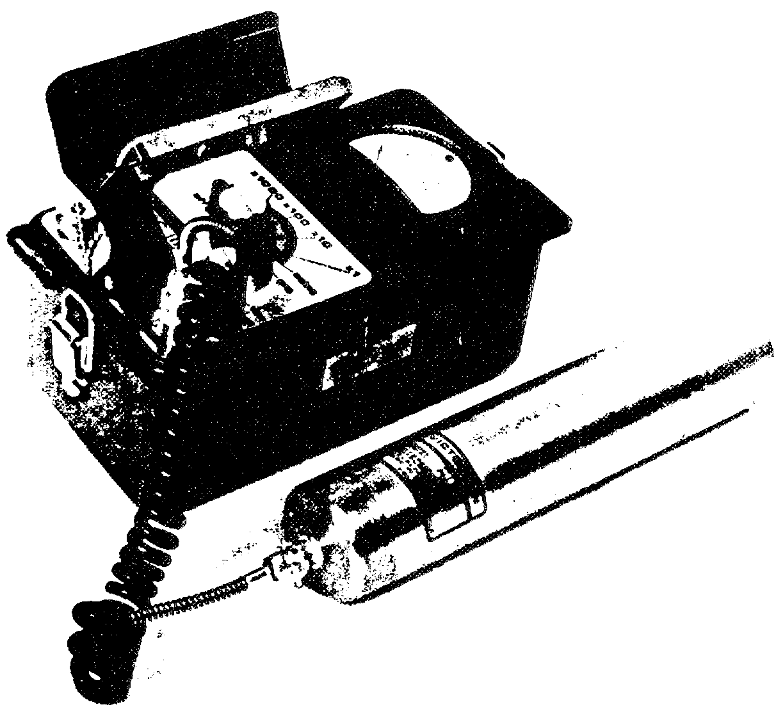
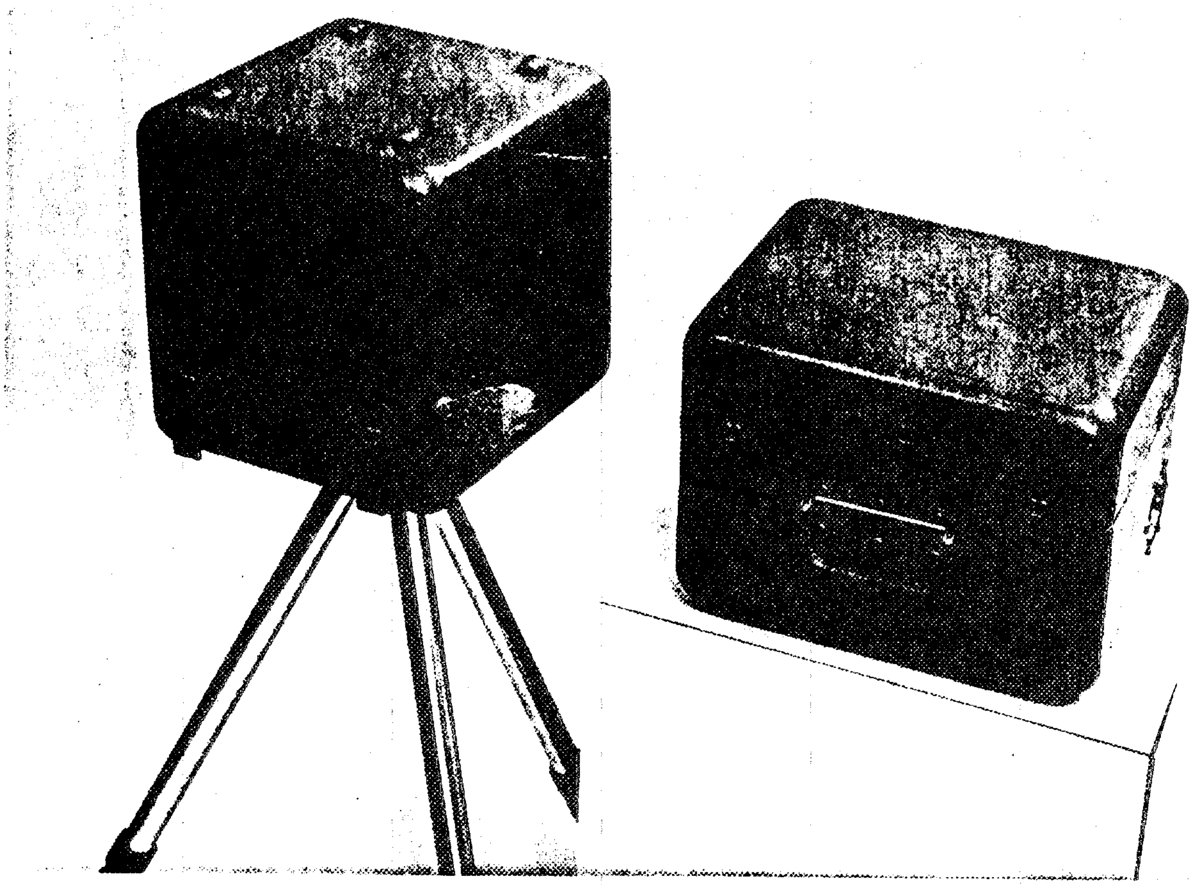


Exhibit 9.1.6-2, Pressurized ion chamber.



SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.1.6-3. Field check of gamma scintillation detector.

1. Scintillators, field check notebook, and CAM-1 depleted uranium source are assigned to each field vehicle (and corresponding Team Leader). At the beginning of the field check, the scintillators are removed from vehicle storage and placed together in a line of a flat surface (outdoors) away from known extraordinary radiation sources.
2. The notebook is retrieved from storage and set-up for field check as follows:

Date:

Team Member's Initials:

Meter No.

Battery Check

Background (kcpm)

Source (kcpm)

Net (kcpm)

3. Data are collected and recorded in field check book as follows:

Meter No. - record the assigned GJ number written in marker on the ratemeter. The I&C number need not be recorded.

Battery Check - check the battery condition by turning the function switch to the "BAT" position; if needle registers within the redscale, an O.K. is recorded; if needle register outside the red scale, then replace batteries as indicated in Step 3.1, page 8 of the Instruction Manual and record date batteries replaced.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.1.6-3 (Continued)

Background (kcpm) - turn function switch to "X10" and record corresponding value registering on scale.

Source (kcpm) - turn function switch to "X100" and place depleted uranium source on probe (number side up and horizontal line on source even with crystal end of probe), record corresponding value registering on scale.

Net (kcpm) - calculate net values by subtracting Background (kcpm) from source (kcpm) and record difference; any net values that differ more than 20% (laboratory acceptance limits) of mean net value should be noted and corresponding scintillator taken for maintenance and/or calibration as indicated in Sect. 11.2.

4. Scintillators, field check book, and source should be replaced in respective vehicle storage locations.
5. This field check is performed daily during active radiological site scanning. On-site cross-calibration of instrument reading with PIC exposure rate measurements are performed at each survey site in locations where a conversion equation does not apply. See Sect. 12.1.6.5, Calibration Procedures, for an in-depth discussion.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.1.6-4. Scanning technique.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.1.6-5. Field check of PIC.

1. PIC and field check notebook are assigned to each field vehicle (and corresponding Team Leader). A NBS ^{60}Co source is stored in the mobile field laboratory vehicle. At the beginning of the field check, the PIC is removed from vehicle storage and placed on a surface (outdoors) away from known extraordinary radiation sources and set up according to Sect. 9.1.6.2.
2. The notebook is retrieved from vehicle storage and set up for field check as follows:

Date:

Team Member's Initials:

PIC No.	Battery Check	Background (μR/h)	Source (h)
			Face 1:
			Face 2:
			Face 3:
			Face 4:
			Top:
			Surface:

3. Data are collected and recorded in field check book as follows:

PIC No. - record the designated GJ number written in marker on the PIC monitor.

Battery Check - check batteries' conditions as indicated in Sect. 9.1.6.2; if battery charge status is within recommended limits on all batteries, an "O.K." is recorded; if charge status on any/or all batteries is outside set limits, replace batteries or

Exhibit 9.1.6-5 (Continued)

recharge batteries and indicate date and situation in notebook (e.g. "6/12/82 - recharge," etc.).

Background (μR/h) - take an exposure rate measurement (180 second duration) without the ^{60}Co source in proximity; record μR/h value registered on monitor.

Source (μR/h) - retrieve ^{60}Co source and place in the center directly on face 1 of PIC sensor head; take an exposure rate measurement (180 second duration) and record μR/h value registered on monitor; repeat this step until measurements have been taken with ^{60}Co source on each of four numbered sensor head faces if sensor head is directly on ground, and all four faces, on the top of the sensor head, and on the ground surface, if the sensor head is set up on the tripod.

4. If μR/h value determined differs from last field check value by less than the laboratory acceptance limits (approximately $\pm$20%) the instrument is ready for use. If μR/h determined differs from last field check value by more than the laboratory acceptance limits (approximately $\pm$20%) notify the Electronic Technician.
5. PIC, field check book, and source should be replaced in their respective storage locations.
6. This field check is performed monthly during active survey site scanning. On-site cross calibration of scintillometer readings with PIC exposure rate measurements are performed at each survey site in locations where a conversion equation does not apply.
7. Normally for RASA/UMTRA measurements, the integrating digital readout apparatus with timer is used with timer set at 180 seconds; to initiate read-out, the STOP button is always depressed before the START button is depressed; the tone indicates end of read-out and corresponding values are recorded on field data sheets.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.2-1. Example of field data sheet - survey site information

OAK RIDGE NATIONAL LABORATORY SITE#________

SURVEY SITE INFORMATION SURVEY DATE________

OWNER DATA:

NAME:________ LOCATION:________
ADDRESS:________
TENANT:________
PHONE:________ PHONE:________

LAND USE

RESIDENTIAL___: SINGLE FAMILY___ MULTI-FAMILY___

COMMERCIAL___ RETAIL STORE___ OFFICE___ MANUFACTURE___ MOTEL, HOTEL___

PUBLIC BLDG.___: SCHOOL___ CHURCH___

VACANT LOT___
OPEN LAND___

OTHER________ DESCRIPTION________

NUMBER OF STRUCTURES:______

TYPE OF CONSTRUCTION: (# of levels, frame/masonry, basement /crawl/space/slab-on-grade, etc.)

Bldg. #1: ________
Bldg. #2: ________
Bldg. #3: ________
Bldg. #4: ________

PHOTOGRAPH(S): FILM ROLL #______

		(compass direction)		(description)
FRAME #___	LOOKING:	___	AT	___
___	LOOKING:	___	AT	___
___	LOOKING:	___	AT	___
___	LOOKING:	___	AT	___

SPILLOVER:___ NO ___ YES

ADJACENT PROPERTIES:________

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.2-2. Example of field data sheet - radiological screening summary

OAK RIDGE NATIONAL LABORATORY SITE #________

RADIOLOGICAL SCREENING SUMMARY SURVEY DATE________

SURVEY TEAM:________(leader) ________ ________

________ ________ ________

SURVEY INSTRUMENTS USED FOR CORRELATION

gamma-rate meter #________

PIC #________

μR/h CONVERSION FORMULA USED

____ μR/h = 1.69 K + 3.45

____ OTHER μR/h

____

____ DIRECT CONVERSION cpm/μR/h (see below)

LOCATION	PIC (μR/h)	(cpm x 1000) GAMMA-RATE METER - 6"	CONVERSION(cpm/μR/h)

BACKGROUND GAMMA-SCAN RANGE

Outdoor

____to____ cpm x 1000

____to____ μR/h

Indoor

____to____ cpm x 1000

____to____ μR/h

GAMMA SCAN SUMMARY OF CONTAMINATED AREAS

INDOOR SCAN RANGE: (SKETCH OF INDOOR FLOOR PLAN:____NO ____YES)

____to____ cpm x 100 HIG____ cpm x 1000

____to____ μR/h ____ μR/h

LOCATION OF HIG:________

DESCRIPTION OF HIG:________

ELEVATED READINGS:________

OUTDOOR SCAN RANGE:

Region A:____kcpm ____μR/h Average:____kcpm ____μR/h Area____m^2

B:____kcpm ____μR/h Average:____kcpm ____μR/h Area____m^2

C:____kcpm ____μR/h Average:____kcpm ____μR/h Area____m^2

D:____kcpm ____μR/h Average:____kcpm ____μR/h Area____m^2

E:____kcpm ____μR/h Average:____kcpm ____μR/h Area____m^2

TOTAL AREA:____m^2

Non-point source HOG:____kcpm ____μR/h Location________

Point source HOG: ____kcpm ____μR/h Location________

PROPERTY RECOMMENDED FOR: EXCLUSION____INCLUSION____(see addtl. data sheets)

SOIL ANALYSIS REQUIRED FOR DETERMINATION:____YES ____NO

INDOOR EXTENDED MEASUREMENTS REQUIRED: ____YES ____NO

PERSONNEL & EQUIPMENT INSPECTED & DECONTAMINATED: ____YES

Exhibit 9.2-3. Example of field data sheet - soil sample data field form

OAK RIDGE NATIONAL LABORATORY SITE #________

SOIL SAMPLE DATA FIELD FORM SURVEY DATE________

	VISIBLE TAILING	SAMPLE NUMBER	DEPTH (M)	GAMMA kcpm	GAMMA µR/h	^{226}Ra pCi/g
SAMPLE LOCATION:________						
VISIBLE ORE __yes__no		___	Surface	___	___	___
BACKGROUND SAMPLE __yes__no	___	___	___	___	___	___
AREA REP:________						
OTHER DESCRIPTION:	___	___	___	___	___	___
________	___	___	___	___	___	___
________	___	___	___	___	___	___
SAMPLE LOCATION:________						
VISIBLE ORE __yes__no		___	Surface	___	___	___
BACKGROUND SAMPLE __yes__no	___	___	___	___	___	___
AREA REP:________						
OTHER DESCRIPTION:	___	___	___	___	___	___
________	___	___	___	___	___	___
________	___	___	___	___	___	___
SAMPLE LOCATION:________						
VISIBLE ORE __yes__no		___	Surface	___	___	___
BACKGROUND SAMPLE __yes__no	___	___	___	___	___	___
AREA REP:________						
OTHER DESCRIPTION:	___	___	___	___	___	___
________	___	___	___	___	___	___
________	___	___	___	___	___	___
SAMPLE LOCATION:________						
VISIBLE ORE __yes__no		___	Surface	___	___	___
BACKGROUND SAMPLE __yes__no	___	___	___	___	___	___
AREA REP:________						
OTHER DESCRIPTION:	___	___	___	___	___	___
________	___	___	___	___	___	___

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.2-4. Example of soil sample analysis form.

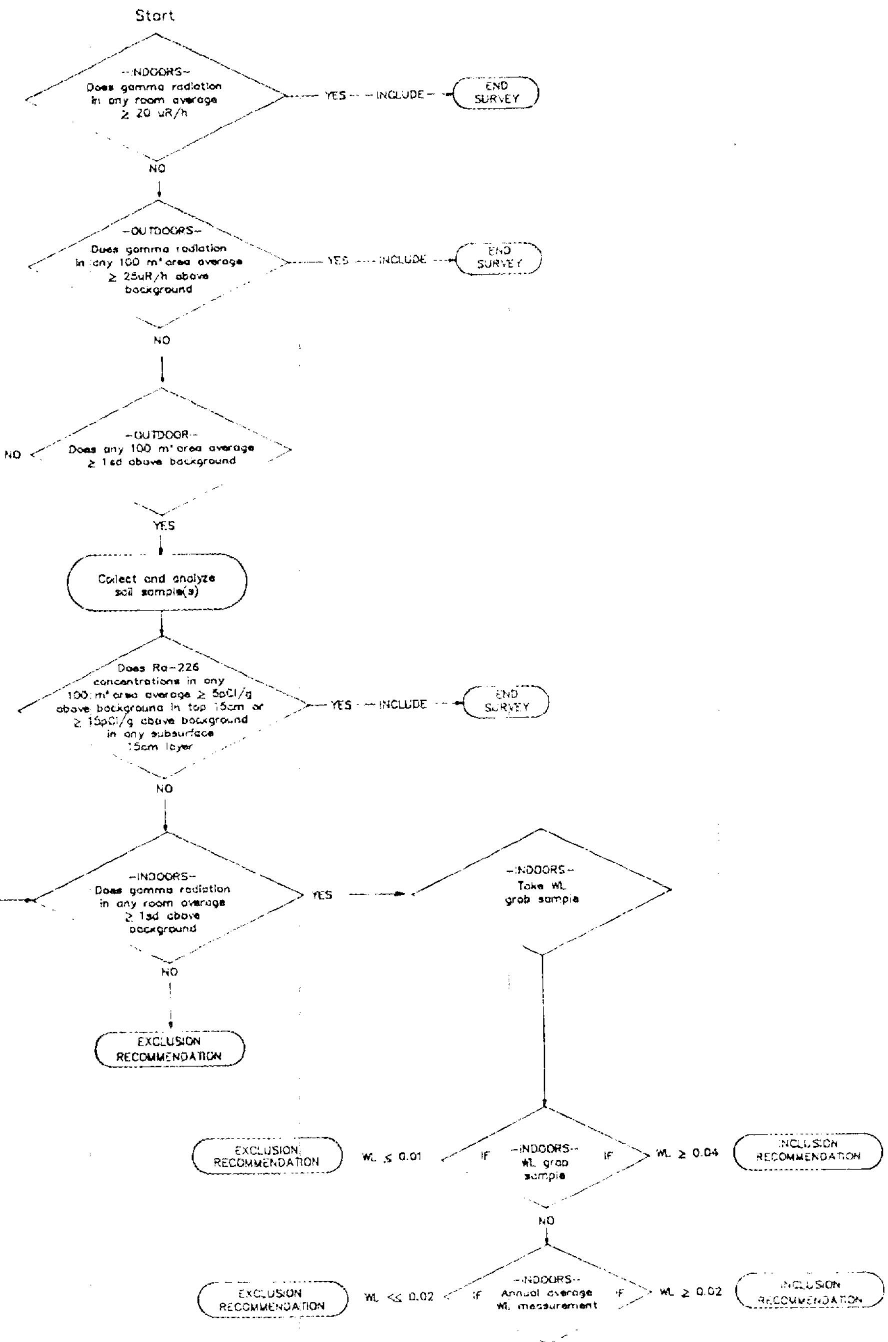
OAK RIDGE NATIONAL LABORATORY
SOIL SAMPLE ANALYSIS FORM

Team Leader
Team Member
" "
" "

Address	Sample No.	Pan No.	Date Taken	Date Bottled	Date Analyzed	Disk No.	Sample Weight (g)	^{226}Ra (pCi/g)	Barrel No.	Comments

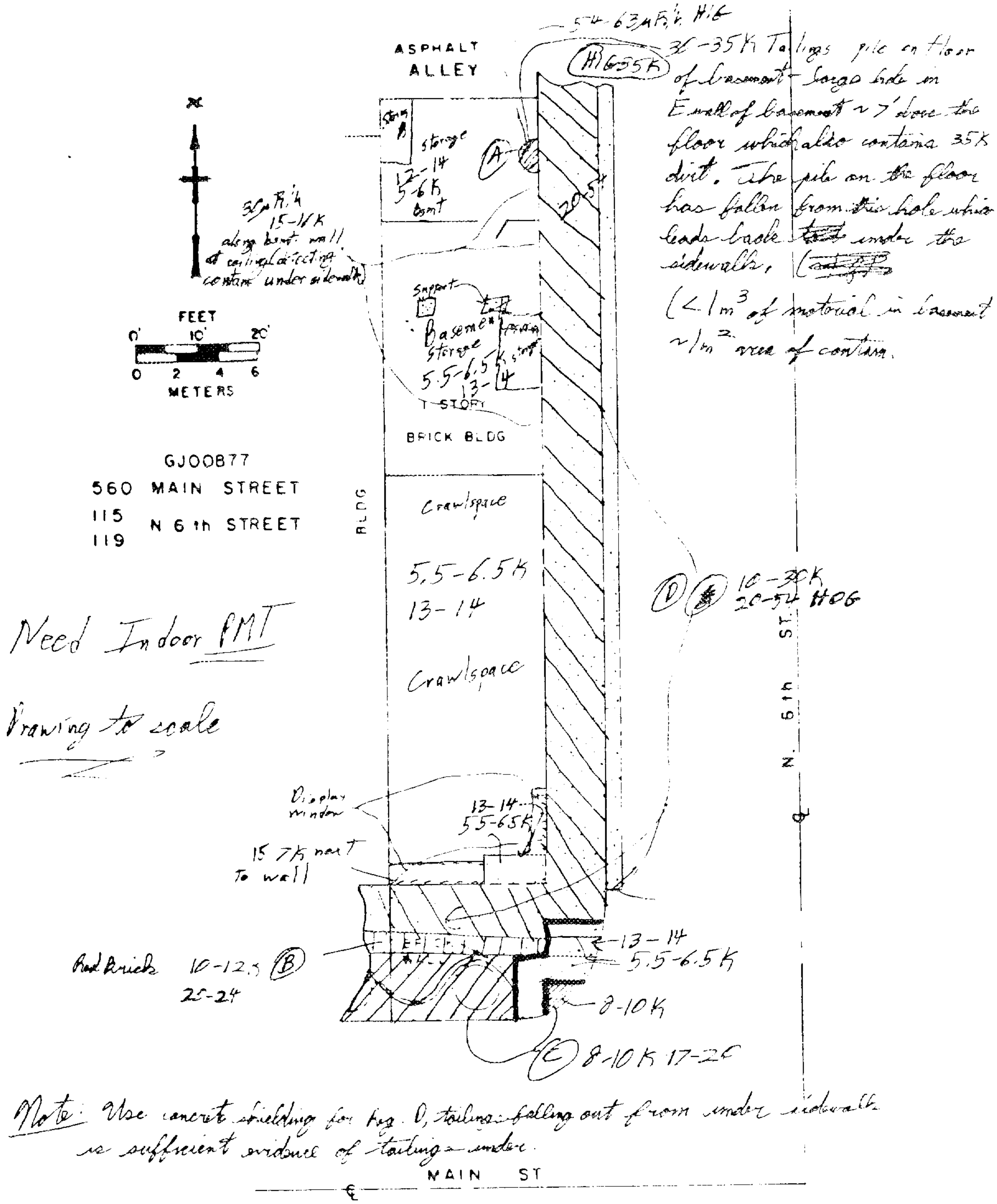
SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.3-1. Guidelines on the extent of inclusion surveys.



SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.5-1. Example of field map.

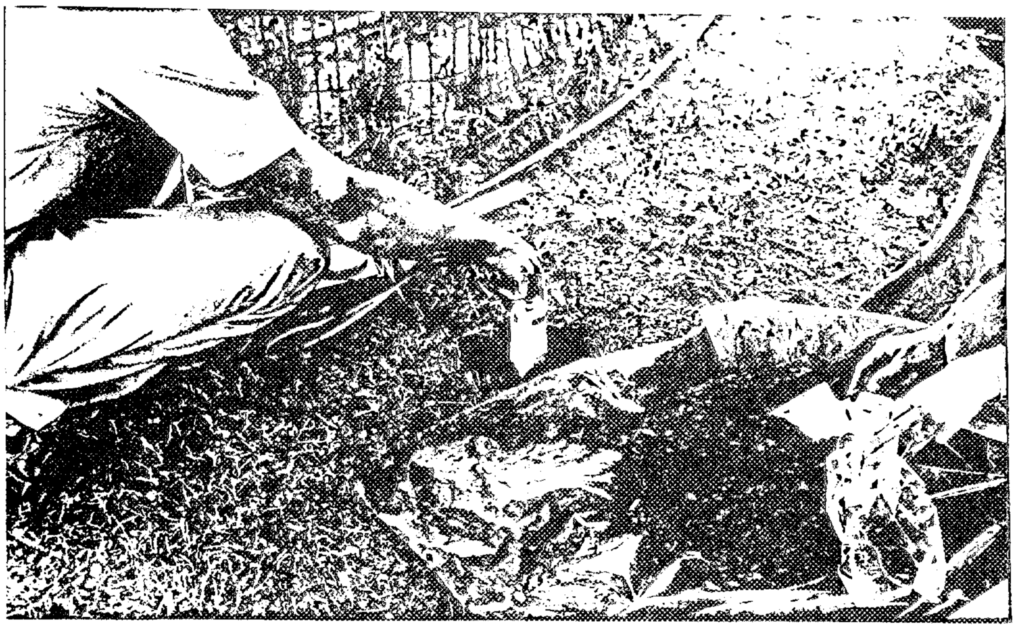


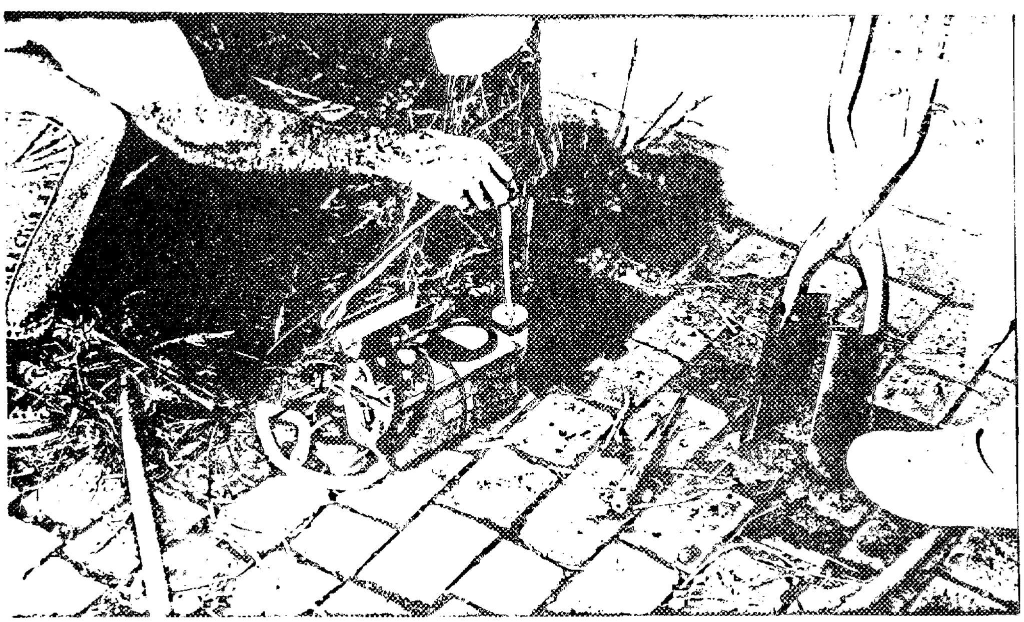
SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.6-1. Proper sampling technique.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.6-2. Probe measurements in sample holes.





SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.6-3. Sampling equipment.

SUBJECT: INCLUSION SURVEY ACTIVITIES

Exhibit 9.6-4. Sample labelling.

SECTION 10: POST-INCLUSION SURVEY ACTIVITIES

10.1 Team Leader Pre-Report Activities

10.2 Soil Sample Preparation

10.3 Soil Radium Content Analysis

10.4 Soil Sample Storage

10.5 Labelling of Field Drawings

10.6 Report Drafting

10.7 Report Review

10.8 File Transmittal to DOE

10.9 DOE Action and Data Archival

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

10. POST-INCLUSION SURVEY ACTIVITIES

10.1 TEAM LEADER PRE-REPORT ACTIVITIES

10.1.1 Purpose

The purpose of this procedure is to provide guidelines for Team Leader responsibilities prior to preparation of an Inclusion Survey Report.

10.1.2 Applicability

This procedure applies to all Team Leader post-survey activities, including data conversion, entry, archiving, and photograph archiving.

10.1.3 References

1. Section 9.1, Equipment Usage
2. Section 9.2, Data Recording

10.1.4 Definitions and Abbreviations

See Sect. 1.5, Terminology.

10.1.5 Responsibility

10.1.5.1 Team Leader

The Team Leader is responsible for implementation of this procedure.

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

10.1.6 Procedure

After a radiological survey is completed and all pertinent data are collected, the Team Leader initials the property file tracking form in the appropriate space (see Exhibit 10.1-2) and completes the data needed for the Inclusion Survey Report. The following activities are included.

10.1.6.1 Conversion of Scintillometer Count Rates to Exposure Rates

Conversion refers to converting kcpm gamma scintillometer count rates to exposure rates (μR/h). Gamma rates are converted in either of two methods, as follows:

Calculations for sites with no derived conversion factor

1. This direct conversion requires a conversion factor (CF) obtained by dividing the scintillometer count rate by the corresponding exposure rate μR/h measured by a PIC.

$$CF = \frac{x\ \mu R/h}{y\ cpm}$$

where

x = PIC value (μR/h)

y = average gamma scintillometer value (kcpm)

2. The resulting conversion factor is then divided into all the remaining scintillometer rates. The calculated exposure rates are then recorded on the field data sheets and the field map.

Calculation for sites with a pre-determined conversion factor

This equation conversion involves use of a linear regression equation has been evaluated for a specific rate that has exposure rates (y axis) measured for the specific region. When the number of pairs plotted includes

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

at least 100 points for all applicable rate ranges (including those for contaminated and representative, indoor and outdoor areas), a best-fit linear regression line is drawn and used to evaluate m and b. (For the Grand Junction region, the best-fit values are m = 1.69 and b = 3.45.) The line must have an acceptable correlation coefficient (r value), be within specified confidence limits, and have an acceptable standard deviation. Each regression line should be re-evaluated as appropriate throughout the life of the RASA/UMTRA project.

Once a regression line (equation) has been determined for a region, it can be used to convert all scintillometer count rates measured in the region to exposure rates. These rates can be entered on the field data sheets (Radiological Screening Summary and Soil Sample Data Field Form) and the field map. The sites for which an equation has been determined have the conversion tables provided in Exhibits 10.1-1A-C.

NOTE: the conversion type must be indicated on page two of the field data sheet to ensure data reproducibility and report writer insight.

10.1.6.2 Field Map

The following data must appear highlighted on the field map prior to report initiation:

1. All exposure rate ranges in μR/h
2. HOG and HIG locations and values
3. Soil sample locations and identification symbols
4. Point source locations and exposure rates
5. Deposit locations and shapes (to scale) with exposure rate ranges
6. Adjacent property address and location number (if a spillover is present)

Refer to Exhibit 9.5-1, Example of Field Map.

10.1.6.3 Soil Sample Data

The Team Leader is responsible for completing the "^{226}Ra, pCi/g" blanks on the Soil Sample Data Field Form once the sample has been analyzed by Soils Laboratory personnel. The Sample Coordinator provides Team Leaders and the Process Coordinator with a weekly print-out of samples analyzed and their respective ^{226}Ra concentrations. The tracking and manner in which these data are transferred is at the discretion of the Team Leader. All previously described pre-report activities must be completed before site information is sent to the report writer.

10.1.6.4 Data Archival

For survey sites within Mesa County, only the field map will be copied and placed in a separate binder by the Team Leader. For all survey sites outside of Mesa County, copies of all field data sheets and the field map will be made and filed in a separate binder. The data archival notebooks will be organized by month for easy reference.

10.1.6.5 Field Photography

All respective photographs must be processed, labelled, and archived before site information is sent to the report writer. Refer to Sects. 9.1, Equipment Use, and 9.2, Data Recording, for description of labelling and archiving processes.

Note: For all UMTRA sites except Grand Junction, Colorado, and Edgemont, South Dakota, two photographs are to accompany the report and one is catalogued. For Grand Junction and Edgemont sites, one photograph accompanies the report and two photographs are archived. Photographs should be attached to the property portfolio prior to report initiation.

10.1.7 Exhibits

1. Exhibit 10.1-1a-c, Conversion Tables for Converting Scintillometer Readings in cpm to μR/h
2. Exhibit 10.1-2, Property Field Tracking Form

10.1.8 Revision History

Revision 1	Date: 03/31/86	First Revision

10.2 SOIL SAMPLE PREPARATION

10.2.1 Purpose

The purpose of this procedure is to describe the methods used to prepare soil samples for analysis of ^{226}Ra concentrations.

10.2.2 Applicability

This procedure applies to the analysis of soil samples with the sodium iodide (NaI) well-crystal detector system.

10.2.3 References

1. Sect. 9.2, Data Recording
2. Sect 10.4, Soil Sample Storage

10.2.4 Definitions and Abbreviations

See Section 1.5, Terminology.

10.2.5 Responsibilities

10.2.5.1 Sample Coordinator

The Sample Coordinator is responsible for the implementation of this procedure.

10.2.5.2 Team Member/Sample Technician

Team Members designated as Sample Technicians (by the Survey Manager) are responsible for the preparation of samples according to this procedure.

10.2.6 Procedure

A list of the Soil Preparation Laboratory equipment is provided in Exhibit 10.2-1.

10.2.6.1 Drying the Samples

1. Turn on the oven to 110° Fahrenheit (setting '6') and allow it to warm up (Exhibit 10.2-2 displays the ovens used).
2. Number aluminum drying pans; pan numbers run from 000 to 999 and then repeat. Assign a pan to each sample and record the pan numbers on the Soil Sample Analysis Form and the pan and sample numbers in the sample log book. Pan numbers should be systematically assigned in ascending numeric order to samples.
3. Place samples in the corresponding pans, place the pans in the oven and allow to dry for 12 hours. Samples should always be loaded in the oven from the top rack down and removed from the bottom rack upward to prevent contamination.
4. Inspect the area and oneself for contamination and clean up and dispose of any visible contamination. Place any excess sample material in turkey bags, mark the bags with the appropriate site code (e.g. GJ for Grand Junction, RF for Rifle, and so on) and the date; then place it in a sample excess barrel according to the Sample Storage procedure (Sect. 10.4, Soil Sample Storage).
5. Make certain that all data are recorded on the Soil Sample Analysis Form and in the sample log book.

10.2.6.2 Sample Weighing

1. Turn on the electronic scale and allow it to warm up for 30 minutes. When it is warmed up, check its calibration using the 2-kg standard weight located in drawer 15. Record weight, scale, date, and initials in back of Soil Preparation Book. The Mettler PE 6000 scale used is shown in Exhibit 10.2-3.
2. Prepare plastic sample bottles by measuring 2-1/2 in. up from the inside base and marking a line on the outside of each bottle at that level.
3. Prepare a label for each lid. Data should include pan number (in the upper right hand corner), sample ID number, and date bottled. Remove pans from ovens and place them on the counter to the right of the exhaust hood. Place lids in the corresponding pans.
4. Tare a bottle on the scale (place a bottle on the scale, depress the tare key, scale should zero).
5. Place the 1/4 in. classifier on top of the bottle filler located under the hood. Turn hood fan on. Place tared bottle under filler and pour sample through. Crush remaining sample in the jaw crusher and mix with the material in the bottle. Pour entire sample into the drying pan used to dry the sample. Place bottle under bottle filler and pour through contents in pan. Fill bottle up to but not over the previously marked line. Tamp bottle on counter to settle sample. Continue filling until contents have reached line. If there is not enough sample to fill the bottle up to the marked line, measure the height of the sample and record that value in the field sheet and log book.
6. Place bottle on scale and record weight on the field sheet, log book, and on the label attached to the lid. Secure lid tightly onto bottle and tape the gap between the lid and the wall of the bottle. Wipe off bottle and place in plastic bag. Tie top of bag.
7. Clean bottle filler and jaw crusher with compressed air between each sample. Place sample excess in turkey bag and dispose as in Sect. 10.2.6.1.

8. Place bottle samples in an empty cabinet in the Soil Analysis Lab. Write the date bottled, date due, and the number of samples on the sheet attached to the door.
9. Clean area under hood and wipe down all counter tops. Check oneself for visible contamination.

10.2.7 Exhibits

1. Exhibit 10.2-1, Soil Preparation
2. Exhibit 10.2-2, Drying Ovens
3. Exhibit 10.2-3, Mettler PE 6000 Electronic Scale

10.2.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

10.3 SOIL RADIUM CONTENT ANALYSIS

10.3.1 Purpose

The purpose of this procedure is to describe the methods used to analyze soil samples for ^{226}Ra concentration and perform quality assurance cross-checks.

10.3.2 Applicability

This procedure applies to all samples analyzed using the sodium iodide (NaI) well-crystal detector system.

10.3.3 References

See Sect. 9.1, Equipment Usage

10.3.4 Definitions and Abbreviations

10.3.5 Responsibilities

10.3.5.1 Sample Coordinator

The Sample Coordinator is responsible for implementing and performing this procedure.

10.3.5.2 Team Member/Sample Technician

The Team Member designated as Sample Technician (by the Survey Manager) is responsible for performing this procedure under the guidance of the Sample Coordinator.

10.3.6 Procedure

10.3.6.1 Equipment and Apparatus

The soil analysis system consists of:

1. NaI(Tl) crystal in lead pig with hydraulic lifting unit
2. ORTEC model 113 preamplifier
3. ORTEC model 490B amplifier
4. ND575 analog-digital converter
5. ORTEC model 456 high voltage power supply
6. ND-66 multi-channel analyzer
7. IBM portable PC computer
8. Gemini-15 printer

There are three each of items 1-4, two of item 5, and one each of items 6-8 in the Soils Laboratory used by ORNL/RASA personnel in support of UMTRA activities. Exhibit 10.3-4 provides a view of the layout of this equipment. The lead pig with hydraulic lifting unit is shown in Exhibit 10.3-5.

10.3.6.2 Start-up and Soil Analysis Procedures

See Exhibit 10.3-1, Start-up and Analysis Procedures

10.3.6.3 End of Day Procedures

1. Make a print-out of all samples analyzed that day and place in the back of the soil data sheet binder (see Exhibit 9.3-2, Soil Data Base Procedures).
2. Create a "Knowledgeman Disk" for input into networked computers (see Exhibit 9.3-2, Soil Data Base Procedures).
3. Turn screen down on IBM PC.

10.3.6.4 Soil Sample Analysis Quality Assurance

Each month 5% of all RASA/UMTRA-analyzed soil samples are sent to either the BFEC Environmental Laboratory or to the ORNL Analytical Chemistry Laboratory for the purpose of cross-checking the ORNL/GJ NaI well-crystal system. Those samples are randomly selected on a daily basis and placed in a separate container. The analyzed samples selected for cross-check are appropriately noted in the comments column of the Soil Sample Analysis form, and the ^{226}Ra concentration recorded in the Soil Analysis Laboratory Book and on the Soil Quality Check form (Exhibit 10.3-3). A copy of the Soil Quality Check form without the radium concentration recorded is sent along with the cross-check samples to the cross-check laboratory. A sixty-day turnaround of cross-check results is required.

Upon receipt of the cross-check sample results, the data are entered into the Soil Quality Control Database. A hard copy of the data is generated and placed in the Soil Quality Control Binder. A copy of this cross-check data is simultaneously transmitted to the Process Coordinator for analysis and use.

The Sample Coordinator will analyze the cross-check data to discern whether or not the mean concentrations of the N cross-checked samples is significantly different ($p < 0.05$) from the mean concentration originally detected by the ORNL/GJ NaI well-crystal system. A t-test of the means will be used to make this determination. Individual sample pairs that differ by more than two standard deviations (measurement error) in either direction will not be included in the t-test data. If more than 5% of the total pairs are excluded, then corrective action will be required. If the t-test indicates that the two sample groups (NaI analysis and cross-check analysis) are significantly different, then corrective action will also be required (see Section 10.3.6.5, below).

Any soil analysis quality assurance discrepancy will be reported to the RASA/UMTRA Process Coordinator, Project Manager, and Quality Assurance Coordinator.

10.3.6.5 Sample Analysis Corrective Action

If any set of N randomly chosen cross-check samples fails either the t-test or the means, or if any subset of 5% of the N samples falls outside the 95% confidence interval of the measurement errors for both samples, then corrective action will be required.

Corrective action will be stratified according to increasing difficulty to perform as follows:

1. The nonagreeing sample pairs should be re-analyzed by both methods and the results again compared. If nonagreement still exists, proceed to level two corrective action.
2. Recalibration of the NaI well-crystal should be scheduled and all sample analysis halted until calibration is completed.
3. Following recalibration of the NaI system, samples analyzed in the interim period since the cross-checks were originally analyzed will be re-analyzed.
4. DOE will be informed immediately of any reports and inclusion/exclusion recommendations that are affected by re-analyzation. Those recommendations will be revised to reflect the re-analyzed soil results.

10.3.7 Exhibits

1. Exhibit 10.3-1, Start-up and Analysis Procedures
2. Exhibit 10.3-2, Soil Database Procedures
3. Exhibit 10.3-3, Soil Quality Check Form
4. Exhibit 10.3-4, Soil Laboratory Equipment
5. Exhibit 10.3-5, Lead Pig with Hydraulic Lifting Unit

10.3.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

10.4 SOIL SAMPLE STORAGE

10.4.1 Purpose

The purpose of this procedure is to describe the methods to be used to store analyzed soil samples and excess sample materials.

10.4.2 Applicability

This procedure applies to all soil samples analyzed using the NaI well-crystal system in support of the UMTRA Project's Inclusion Survey Contractor activities.

10.4.3 References

None.

10.4.4 Definitions and Abbreviations

See Sect 1.5, Terminology.

10.4.5 Responsibilities

The Sample Coordinator is responsible for the implementation and performance of this procedure.

10.4.5.1 Sample Coordinator

The Sample Coordinator is responsible for the implementation and performance of this procedure.

10.4.5.2 Team Member/Sample Technician

The Team Member designated as Sample Technician (by the Survey Manager) is responsible for the performance of this procedure under the direction of the Sample Coordinator.

10.4.6 Procedure

Samples that have been analyzed are stored in 55 gallon drums referred to as "barrels." Barrels are numbered in numerically ascending order. Each barrel number corresponds to a vicinity property city location code (i.e. GJ, DU, ED ...). Barrel number assignments are recorded in the Barrel Log Book and on the reference sheets posted in the Soils Laboratory. Samples that have been analyzed and are ready for storage are placed in the appropriate barrel. When a barrel is full it is sealed with the rings and lids provided, and BFEC is to be called for removal. An empty barrel (stored by B.O.D.) is to be delivered by BFEC and assigned a number and a corresponding vicinity property city code.

Sample material in excess of that required to fill the pans or bottles may remain after drying and bottling. Excess sample material is placed in a plastic bag, marked with the date and the appropriate city code (e.g. GJ for

Grand Junction, ED for Edgemont, etc.) and then placed in the barrel assigned to sample excess. Sample excess barrel numbers are assigned in the same manner as the vicinity property samples.

10.4.7 Exhibits

None.

10.4.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

10.5 LABELLING OF FIELD DRAWING

10.5.1 Purpose

The purpose of this procedure is to establish the guidelines for manual and automated methods of labelling field drawings.

10.5.2 Applicability

These procedures apply to the labelling of field drawings for use in Inclusion Survey Reports submitted to the DOE.

10.5.3 References

1. Sect. 7.3, Base Map Development
2. Sect. 9.4, Measurements in Uncontaminated Areas
3. Sect. 9.5, Deposit Definition
4. Sect. 10.1, Team Leader Pre-Report Activities
5. AUTOCAD User Reference Manual

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10.5.4 Definitions and Abbreviations

AUTOCAD. Computer-aided drafting software package for microcomputers, which allows any hand-drawn graphics to be generated by a computer.

Also, see also Sect. 1.5, Terminology.

10.5.5 Responsibilities

10.5.5.1 Graphics Coordinator and Team Member

The Graphics Coordinator is responsible for training a Team Member with delegated graphics responsibilities in the proper methods of labelling the field drawing in accordance with this procedure. The Team Member utilizing AUTOCAD for field drawing labelling will also provide for data archival by making backup copies of all data onto hard disc and into tape storage.

10.5.5.2 Report Writer

The Report Writer is responsible for making a copy(ies) of the labelled field drawing(s) for filing in the field drawing archival notebook.

10.5.6 Procedures

10.5.6.1 Manual Method of Labelling Indoor and Outdoor Field Drawings

Outdoor drawings

Data collected on outdoor areas are labelled on a PMT containing only outdoor information, as shown in Exhibit 10.5-1.

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Methods:

1. All information needed for labelling will be on the field map given to the Team Member by the Team Leader (see Section 10.1, Team Leader Pre-Report Activities).
2. Any errors (e.g. spelling of the street address) will be corrected.
3. Cut replicas of all contaminated areas shown on the field map from Chartpak Shading Film. Use different Shading Film densities to indicate deposits of varying levels of contamination.
4. Draft gamma exposure ranges and other comments onto stickers (see Label Types, below).
5. Cut stickers apart and apply to the PMT as indicated on field map.
6. Label the outdoor field drawing as "Figure 1a" if an indoor field drawing is also required.
7. If an inked drawing is used as opposed to a PMT, label using the same methods. However, gamma exposure rates and comments may be drawn directly on the drawing rather than on stickers which are then applied to the PMT.

Label types

Refer to Exhibit 10.5-1 for the examples cited below.

1. Uncontaminated range: gamma exposure rates that are representative of the normal values found on uncontaminated portions of the property, labelled in μR/h (e.g. 11-14 μR/h); see Sect. 9.4, Measurements in Uncontaminated Areas.
2. Contaminated range: increased gamma exposure rates indicative of the contaminated regions are labelled A, B, C, etc. with their corresponding exposure rates (e.g. A 20-34 μR/h and B 20-27 μR/h). See Sect. 9.5, Deposit Definitions, for an explanation of a contaminated region.

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3. High outdoor gamma (HOG): the highest gamma exposure rate found on the property in a contaminated region, excluding ore samples and point sources, is labelled as the HOG with its corresponding exposure rate (e.g. HOG 34 μR/h). This label is omitted if a contaminated region is not found.
4. Sample location: soil sample locations are indicated by a dot (.) and are labelled as S1, S2,......SN.
5. Posthole location: postholes taken to investigate the extent of contamination without obtaining a soil sample are represented by a dot (.) and are labelled as PH1, PH2,......PHN.
6. Ore sample/point source: increased gamma exposure rates resulting from an ore sample or point source are represented by an asterisk (*), identified as ore or point source, and labelled with the appropriate gamma exposure rate in μR/h (e.g. *ore 172 μR/h - not shown in Exhibit 10.5-1).
7. Spillover: a deposit that extends onto more than one property is indicated as "spillover" with a comment containing the adjoining property address and location number if available (e.g. spillover to 123 Main Street, GJ00000 - not shown in Exhibit 10.5-1).
8. Unsurveyed area: areas that are not surveyed because an inclusion recommendation could be made without the additional information must be indicated on the PMT with comment or explanation.
9. Miscellaneous: several comments may be added to further identify the area and/or conditions (e.g. 15-19 μR/h on concrete curbs and 20-27 μR/h on contact with foundation).

Indoor drawings

Methods

NOTE: Data collected on indoor areas are labelled onto a drawing containing only indoor information, as shown in Exhibit 10.5-2.

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1. Make a final indoor drawing by adding the interior floor plan of the structure to scale, provided by the Team Leader. Identify rooms as necessary and include the address, location number, scale, and north arrow.
2. Indoor drawings are required only when increased indoor gamma exposure rates are found. All final indoor drawings are labelled as "Figure 1b."
3. Repeat steps 3-5 and 7 of Methods, above.

<u>Label Types</u>

NOTE: see Exhibit 10.5-2 for the examples cited below.

1. Uncontaminated range: gamma exposure rates representative of normal values are labelled in μR/h in each representative area.
2. Contaminated range: increased gamma exposure rates are labelled in μR/h for each deposit found in the structure, and each deposit is represented by a number (e.g. #1, 17-27 μR/h).
3. High indoor gamma (HIG): the highest indoor gamma exposure rate is indicated by HIG and the exposure rate in μR/h (e.g. HIG 37 μR/h).
4. Ore sample/point source: increased gamma exposure rates resulting from an ore sample or a point source are located with an asterisk (*), identified as ore or point source, and labelled with the appropriate gamma exposure rate in μR/h (e.g. *ore 172 μR/h, not shown in exhibit 10.5-2).
5. Miscellaneous: several comments may be added to further identify the area and/or conditions (e.g. 15-20 μR/h on all interior walls).

<u>Labelling equipment</u>

Equipment used for labelling field drawings include several standard drafting utensils. Necessary items are a drafting board, technical reservoir pens size 00 and 3, template size 100, scribe, several gradients of Chartpak Shading Film ranging in density from 20% to 30%, and some form of white or clear stickers that can be drawn on and then applied to the PMT.

Note: knowledge of drafting equipment and its use is assumed of the Team Member with delegated graphics responsibilities.

10.5.6.2 Automated Method of Labelling Indoor and Outdoor Field Drawings

Training (methods)

AUTOCAD training consists of a three day course conducted by the Graphics Coordinator or his designee. The syllabus is provided in Exhibit 10.5-3, AUTOCAD Training Course. All oral/written instruction is supported by the use of an IBM AT microcomputer for hands-on application of principles.

Labelling of indoor and outdoor field drawings

Refer to Label Types, Sect. 10.5.6.1, Manual Method of Labelling Indoor and Outdoor Field Drawings, as the same conventions are observed for labelling contaminated and uncontaminated regions, HIG, HOG, point sources, etc.

Equipment, apparatus, and supplies

The AUTOCAD system will consist of the following:

1. IBM AT microcomputer, minimum 640K RAM
2. Tecmar color graphics board
3. AST advantage board with 128K RAM
4. Orchard PC net adaptor card
5. IBM serial parallel adaptor card
6. Gould colorwriter 6320 plotter with rollfeed attachments
7. Hitachi Tiger tablet with 12 button mouse and/or Logitech R-7 mouse
8. Amdek 710 color monitor.

10.5.6.3 Data Archival

Manual method

Upon completion of labelling of outdoor and indoor field drawings and subsequent review, the Alternate Team Review Person will make copies to be filed in the field drawing archive notebook.

Automated method

Upon completion of labelling of outdoor and indoor field drawings, the Team Member performing the graphics will backup the data onto a hard disc. In addition, a backup copy of the data will be put into tape storage upon completion of all ISC activities for the report. The Alternate Team Review Person will make hard copies to be filed in the field drawing archive notebook.

10.5.6.4 Property Field Tracking Sheet

The person performing the labelling of the field drawing (manual or automated) will initial and date the property file tracking sheet in the appropriate space.

10.5.7 Exhibits

1. Exhibit 10.5-1, Example of Outdoor Field Drawing
2. Exhibit 10.5-2, Example of Indoor Field Drawing
3. Exhibit 10.5-3, AUTOCAD Training Course

10.5.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

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10.6 REPORT DRAFTING

10.6.1 Purpose

The purpose of this procedure is to provide guidance for writing Inclusion Survey Reports.

10.6.2 Applicability

All Inclusion Survey Rports written for RASA/UMTRA will follow this procedure and its references.

10.6.3 References

1. Sect. 7.1.6.4, Types of Properties
2. Sect. 10.1, Team Leader Pre-report Activities
3. VPMIM
4. EPA Standards for Remedial Action at Inactive Uranium Mill Processing Sites, Federal Register, Code of Federal Regulations, Sect. 40, Part 192, Wednesday, January 5, 1983.
5. <u>State Background Radiation Levels: Results of Measurements Taken During 1975-1979</u>, T. E. Myrick, B. A. Berven, and F. F. Haywood.

10.6.4 Definitions and Abbreviations

AREA-WEIGHTED AVERAGE. A calculated value that averages a field measurement over a specified area.

Also see Sect. 1.5, Terminology.

10.6.5 Responsibilities

All RASA/UMTRA personnel responsible for authoring Inclusion Survey Reports will comply with this procedure.

10.6.6 Procedure

Once the Team Leader's pre-report activities are complete, the Team Leader affixes a blue dot label on the front of the folder and gives the complete property portfolio to a designated Report Writer. Normally, the Report Writer is a Team Member who participated in the radiological survey.

10.6.6.1 Calculations

Pertinent inclusion/exclusion recommendation calculations must be performed by the Report Writer prior to completion of the report skeleton. The calculations performed shall be recorded and attached to the field data sheets prior to submittal of the report for typing and review. The format of the calculations record is provided in the Gamma Analysis Worksheet and Soil Analysis Worksheet.

The following calculations may be performed:

1. Areas are converted from feet to square meters by the following equation:

$$y = (f_1 \times f_2) \quad (.0929)$$

where

y = area in [m^2]

f_1 = surface measurement in [feet] of deposit

f_2 = surface measurement in [feet] of deposit

.0929 = conversion factor in $m^2/feet^2$

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The total area (m^2 of the site surveyed must be calculated in addition to areas of deposit. Normally, this total value is computed from measurements scaled from the field map.

2. Outdoor area-weighted elevated exposure rate values are calculated as follows:

$$\frac{G_{AW} = \sum_{i=1}^{n} G_i A_i}{100}$$

where

GAW = the area-weighted exposure rate is [μR/h]

G_i = net average exposure rate in [μR/h] ($G_i = G_{Gross} - G_{background}$)

Ai = area of region involved in m^2 and must $\leq$ 100 m^2

G_{bkgd} (background exposure rate) is taken to be the mode average exposure rate measured in the field on a site-by-site basis. This rate is synonymous with the "representative" exposure rate. If a site contains no background exposure rates, a regional average is used in the calculation. A regional background is calculated by averaging a random sample of measured background exposure rates from a region. A chi-square distribution must be performed to insure normal distribution of data (random sampling) within specified confidence limits.

An inclusion/exclusion recommendation decision for regions of outdoor contamination is made by comparing the calculated area-weighted exposure rate to the inclusion guideline of 25 μR/h above background averaged over 100 m^2 (see reference 2, VPMIM).

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Note: This calculation is to be used only for deposits less than 100 m^2 and in the absence of measured field mode averages. The Team Leader is required to record exposure rate averages for respective deposits on the field data sheets. This field exposure rate average is an accepted area-weighted average for deposits deemed includable (and/or greater than 100 m^2) in the field by the Team Leader. It is recommended that the following area-weighted ^{226}Ra concentration be calculated and compared to respective inclusion criteria before the area-weighted exposure rate value is used for inclusion/exclusion recommendation, as the outdoor gamma criterion is actually only a guideline and the Ra-in-soil is an actual EPA standard.

3. Field average elevated exposure rates for indoors and outdoors should be noted on the field data sheets by Team Leader. In the absence of this average, a median average is calculated by the following equation:

$$G_{AV} = \frac{(G_l + G_h)}{2}$$

where

GAV = average scintillometer measurement in [kcpm]
G_l = low value of scintillometer measurement range in [kcpm]
G_h = high value of scintillometer measurement range in [kcpm]

4. Outdoor area-weighted ^{226}Ra values are calculated as follows:

$$C_{AW} = \frac{\sum_{i=1}^{n} C_i A_i D_i}{(100)\ (.15)}$$

where

C_{AW} = area-weighted ^{226}Ra concentration in [pCi/g]

C_i = net ^{226}Ra concentration in pCi/g (C_i = [analysis - background])

A_i = area of region that sample represents in m^2 and must be less than 100 m^2

D_i = thickness of sample in [m]

100 = threshold area in [m^2], and

0.15 = layer of thickness

Note: The resulting ^{226}Ra concentration should be rounded to two significant digits for reporting purposes.

5. C_{bkgd} (regional background ^{226}Ra concentration in pCi/g) is taken from Reference 4, State Background Radiation Levels: Results of Measurements Taken During 1975-1979.

Where average background ^{226}Ra concentrations were calculated on a state-by-state basis (i.e. the average ^{226}Ra concentration calculated for Colorado is 1.4 pCi/g). An inclusion/exclusion recommendation decision is made by comparing the calculated area-weighted ^{226}Ra concentration to the inclusion criterion of 5 pCi/g (surface) or 15 pCi/g (subsurface), averaged over a 100 m^2 area (see Reference 2, VPMIM).

Note: The writer must be aware of the exclusion/inclusion blanks marked by the Team Leader in the field on the field data sheets (Sect. 9.2, Data Recording). Every effort must be made by the writer to comply to the Team Leader's cogitated field recommendation. If the recommendation must be changed, the Team leader must be be notified. The manner of notification is at the discretion of the Report Writer; however, the Team Leader will become aware of the change during the review process.

6. If the field investigation demonstrates that mill tailings underlie a concrete slab or asphalt covering, the "shielding effect" can be applied to the average exposure rate and then compared to inclusion/exclusion guidelines for recommendation. This is done by doubling the average exposure rate measurement. This calculation does not apply to mill tailings apparent within the concrete, or to indoor structures composed of or containing concrete.

7. Background (μR/h) + one standard deviation is computed by multiplying the average background exposure rate by the accepted 30% standard deviation (also known as one sigma) and then adding the result to the background value as follows:

   $B_{SD} = [(B_{AV})\ \ (.300] + B_{AV}$,

   where

   B_{SD} = background exposure rate in [μR/h] plus one standard deviation

   B_{AU} = average background exposure rate in [μR/h].

   A standard deviation is not calculated on a site-by-site basis; 30% is normally used at all sites.

8. Historical data may be used if necessary to help make a recommendation decision, but must be properly referenced in the "Significance of Findings."

9. Discrete deposits can be considered as one only if a 17 ft x 40 ft (91 m^2) rectangle (size of average trailer house) can reasonably and sufficiently cover the deposits for the most part. This is known as the "trailer-house rule." The "trailer-house rule" is intended for use with small discrete deposits whose contaminated areas are not sufficient (when considered separately) to qualify as includable under present guidelines, but may qualify as a single includable deposit when grouped together with other closely related contaminated regions within approximately 100 m^2 area. The actual dimensions of the "trailer-house rule" may be modified slightly, within reasonable limits (i.e. 10% either direction), to account for irregular deposits. However, the rectangle cannot pass through a permanent structure (e.g. connecting deposits on either side of a house). See Exhibit 10.6-1, "Trailer-House Rule," for estimation of area contaminated.
10. An exclusion recommendation requires that two of the three standards set out in the Federal Register (Reference 3) be satisfied. Only one said standard need be satisfied for an inclusion recommendation.
11. Normally, no average exposure rate calculations need be performed for indoor deposits of contamination as the field average is compared to the indoor inclusion criterion for determination of the recommendation decision (see Reference 2, VPMIM). If the deposit is such that area-weighted averages need to be calculated, the following applies:

$$x = \frac{\sum_{i=n}^{n} G_i A_i}{9.3}$$

where

X = area-weighted gamma exposure rate in [μR/h]

G_i = net gamma exposure rate in [μR/h]

A_i = area of deposit in [m^2]

9.3 = area of "average" indoor room (10' x 10') in [m^2].

12. The net indoor gamma exposure rate is calculated as follows:

$$G_i = G_{Gross} - G_{Bkgd}$$

where

G_i = net gamma exposure rate in [μR/h]

G_{Gross} = field measured gamma exposure rate in [μR/h]

G_{Bkgd} = background gamma exposure rate in [μR/h]

NOTE: See calculation 2 of this procedure for background gamma exposure rate explanation.

13. If the calculated indoor area-weighted average yields an exposure rate which lies between background (μR/h) plus one standard deviation and 20 μR/h above background when averaged over a room, extended (radon) measurements must be made before a property can be included on indoor standards. However, the use of historical RDC data may alleviate the need for ISC extended measurements.

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The Writer should complete the report skeleton and accompanying sheets as much as possible and then submit the file to the Technical Assistant for a review of the data. The file is then given to the Document Control Department for retention until the radon sampling can be scheduled and the report subsequently completed.

14. In certain instances, the radiological results may indicate that an inclusion recommendation be given but that such may be inappropriate; examples of such instances follow:

    a. Remediation may result in higher health risk to workers or the public.
    b. Harm to environment outweighs potential health benefits to persons living near the site.
    c. Cost of remediation outweighs the long-term benefits due to current and anticipated future use of site (e.g. tailings under roads, sidewalks, or site is unoccupied (railroad crossing, vacant lot, etc.).
    d. No known remedial action.
    e. Radionuclides other than ^{226}Ra and its decay products are present. See the Federal Register, Section 192.21, "Criteria for Applying Supplemental Standards," Reference 3.

15. If any of the above situations exists, a recommendation for "Supplemental Standards" may be made. If effect, this suggests that DOE give further consideration before including the property and invoking RAC participation. When recommending such, the underlying reason does not have to be given; merely state that supplemental standards are suggested in the "Significance of Findings" and "Recommendation" sections of the report skeleton, in the DOE cover letter of recommendation, and in the summary evaluation sheets. Explanation of these forms follows.

10.6.6.2 Report Skeleton

Once the necessary calculations have been performed and recorded, the report skeleton (Exhibit 10.6-2) is completed by the Writer as follows:

1. The site location number must appear in the upper right-hand corner of each page of the report in the space provided.
2. Cover page

   Pertinent information is taken from Page 1 (Survey Site Information) of the field data sheets (Exhibit 9.2-1) and the appropriate entries are made.
3. Introduction

   This section of the report explains the purpose of the survey, when and by whom it was conducted, the classification of the property, and methods by which it was conducted. The "survdate" must be replaced by the date of radiological survey by the ISC. The type of conversion (data conversion of gamma scintillator measurements (kcpm) to exposure rates (μR/h) method used is inserted as is appropriate.
4. Significance of Findings

   The main purpose of the Significance of Findings is to describe idiosyncrasies not found in the tables. The Writer should provide a brief discuss of radiological results found on the respective site, both indoors and outdoors. Also stated are the inclusion/exclusion criteria used as the basis for the recommendation. It is suggested that the calculated area-weighted average be stated to support the discussion. The last sentence shall contain the site location number and recommendation for inclusion or exclusion by UMTRAP. The exact verbiage is left to the discretion of the individual author.

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5. Recommendation

This section of the report simply states the recommendation and the basis of such. After "Recommended for:" only the applicable one of two words shall appear "inclusion" or "exclusion." The "basis" section shall state almost verbatim the applicable criteria that the site do/do not exceed (Reference 3).

6. Table 1. Location Information

The applicable information is taken from Page 1 of the Field Data Sheets and entries are made appropriately. The phone number shall include the area code, and the zip code of the address (if available) should be provided. All structures present on the respective site need to be adequately described.

7. Table 2. Radiological Screening Survey Results

The applicable radiological survey information is completed in this section. A separate Table 2 will be completed for indoor and outdoor screening data. In addition, a separate Table 2 (Indoor) will be filled out for each structure surveyed. A high outdoor gamma (HOG) and high indoor gamma (HIG) must be provided in every report. A point source <u>cannot</u> be a HOG. The categories may be adapted (within reason) for word processing to fit the respective site (i.e. if exposure rates other than measured background are present on a site but are known not to be associated with mill tailings, the word "contaminated" may be deleted from the fourth category - "exposure rate range in contaminated regions").

8. Table 3. Extended Survey Results

The applicable radiological survey information is provided in this section. The categories in either the Outdoor or Indoor portions of this section may be adapted (within reason) for word processing to fit the respective site. The formula(s) used to calculate the area-weighted averages must appear in the space provided at the bottom of the page.

9. Captions of Figures

"Fig. 1." is the site location map. The caption shall include the location number and complete address. If an indoor map is required, there shall be a "Fig. 1a" (outdoor) and a "Fig. 1b" (indoor), both bearing an appropriate caption. Figs. 2 through 5 are the property photographs and shall be labelled with the site location and description (direction) of the view shown in the photograph. This information is taken from Page 1 (Survey Site Information) of field data sheets. The number of the figure is written on the back of the respective photograph, but the photograph is not affixed to the page by the writer.

10.6.6.3 Letter of Recommendation (Exhibit 10.6-2)

The final typed copy of this letter is the official notification to DOE indicating the ISC recommendation decision. Appropriate categories must be checked and site information at the bottom of the page completed by the Report Writer. The Writer may complete this form in pencil. The evaluation basis shall reflect the measurements taken in the field. The recommendation basis shall reflect the laws set out in the Federal Register (Reference 3). Since the outdoor screening criteria is a guideline used to approximate ^{226}Ra concentration in soil, the appropriate Ra-in-soil box shall be checked when "outdoor screening measurement" is the recommendation basis. This letter is addressed to Merle Crew for Grand Junction, CO, and Edgemont, SD Inclusion Survey Reports. It is addressed to John Themelis for all other UMTRAP site reports.

10.6.6.4 VP Summary Evaluation and Recommendation (Exhibit 10.6-4)

These sheets are another means by which information regarding the radiological survey and ISC recommendation is exchanged between the ISC and DOE. Concurrence by both parties in all categories precedes RAC involvement. The first three pages are appropriately completed by the Report Writer as a representative of the ISC. The final page is completed by a designated DOE representative. For Grand Junction, CO and Edgemont, SD, VPs, the DOE representative is Larry Ball. For all other UMTRAP sites, Mary White is the DOE representative. The appropriate summary evaluation must be used, since the copy completed by the Report Writer is the final copy forwarded to the DOE representative. All sheets (pertinent to ISC) shall be completed in permanent, black ink and as neatly as possible. If an error is made, the form must be redone (no white-out). If a "yes" box is checked for either ^{226}Ra concentration categories, a "yes" must also appear in the "total activity" box.

10.6.6.5 VPDMS (Vicinity Property Data Management System) Form

This form (Exhibit 10.6-3) is used for data entry at at the UMTRA Project Office by the TAC and is to be filled out by the Report Writer and placed in the location folder. The following fields need to be completed according to the code sheet (Exhibit 10.6-5).

DMS1 Code Types

Field	Field Name
-Table 1:	Site location number
-Table 2:	Site classification
-3 :	Date consent form sent, taken from property file tracking form

DMS1 Code Types (Continued)

Field		Field Name
-9	:	Tailings location from Table 4 of code sheet 0 = No Tailings--definition implicit 1 = Tailings Under--implies structural involvement and/or tailings directly associated with the structure only 2 = Tailings Away--implies contamination not associated with the structure 3 = Tailings Under and Away--combination of '1' and '2' 4 = Possible structural involvement--implies probable or suspected structural involvement and/or tailings associated with the structure 5 = Possible neighboring lot contamination--implies 'spillover' deposit suspected 6 = Unknown Tailings--definition inplicit 'Structure' refers to habitable or potentially habitable structures only (not sidewalk)
-17	:	HIG reading source from Table 6 of code sheet; and "I" is always recorded in the blank (if any structure surveyed)
-18	:	HOG reading source; an "I" is always recorded in the blank
-19	:	RDC reading source (if applicable)
-20	:	RDC measurement type from Table 7 of code sheet (if applicable)

DMS1 - Survey Results

-1	:	Initial HIG (μR/h); the HIG value is recorded (if applicable)
-3	:	Initial HOG (μR/h): the HOG value is recorded
-4	:	Initial RDC reading (WL), if applicable

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DMS1 - Property Schedule "A"

-3 : Actual date consent form received; taken from property file tracking form

-5 : Actual DOE inclusion survey date; the radiological survey date is recorded

-6 : Type of inclusion survey; taken from Table 8 of code sheet; an "E" is always recorded

DMS5 - Owner/Tenant Information

- Appropriate information is taken from Table 1 of the ISC report and recorded. Two separate sheets must be completed if the respective location has both owner and tenant (one with owner information and one with tenant information). Sections DMS1 - Code Types, DMS1 - Survey Results, and DMS2 - Property Schedule "A" may be deleted from the second sheet.

Note: If the Report Writer cannot formulate an answer to complete any of the required fields, an "X" must be clearly marked in the blank. This indicates that all blanks have been considered and aids in the report final review process.

10.6.6.7 ISC Condensed Exclusion Report

Frequently, the properties that do not appear on the UMTRAP designation list are investigated as a result of a DOE-solicited advertising campaign. These properties rarely exhibit evidence of a residual radiation contamination. Because of this lack of contamination and related reasons, an ISC Condensed Exclusion Report has been developed as a time-saving device for use with those properties.

As Exhibit 10.6-6 indicates, the report provides for the reporting of pertinent radiological data and the ISC exclusion recommendation. The Report Writer will still need to complete the VPDMS form, summary evaluation sheets, and provide a PMT and photograph(s).

10.6.6.8 Report Completion

Once the report skeleton has been completed by the Writer, it is placed in the respective location folder. A copy of the completed PMT is made and put in the PMT archive notebook. The Report Writer's initials and the date the draft was completed are indicated on the appropriate line of the property file tracking form (see Exhibit 10.1-2). The location folder, complete with all data and completed report skeleton, is submitted for typing. The Writer should be sure a green dot is affixed on the folder front also.

10.6.7 Exhibits

1. Exhibit 10.6-1, "Trailer House Rule"
2. Exhibit 10.6-2, Report Skeleton
3. Exhibit 10.6-3, Letter of Recommendation
4. Exhibit 10.6-4, VP Summary Evaluation and Recommendation
5. Exhibit 10.6-5, Code Sheet
6. Exhibit 10.6-6, ISC Condensed Exclusion Report

10.6.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

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10.7 REPORT REVIEW

10.7.1 Purpose

The purpose of this procedure is to provide guidance for the review of Inclusion Survey Reports.

10.7.2 Applicability

All RASA/UMTRA personnel reviewing Inclusion Survey Reports shall follow this procedure and its references.

10.7.3 References

1. Sect. 10.5, Labelling of Field Drawing
2. Sect. 10.6, Report Drafting

10.7.4 Definitions and Abbreviations

See Sect. 1.5, Terminology.

10.7.5 Responsibility

10.7.5.1 Team Leader

The Team Leader is responsible for the "initial review" of Inclusion Survey Reports.

10.7.5.2 Team Members

Team members are responsible for activities included in the final review of ISC reports - coined "Final Review."

10.7.5.3 Process Coordinator

All Inclusion Survey Reports will go through a cursory check by the Process Coordinator or designee before being submitted for final typing.

10.7.6 Procedure

The ISC report review process includes two major types of reviews: initial "Team Leader" reviews and final reviews.

10.7.6.1 Initial "Team Leader" Review

After the draft has been typed, the report and its property portfolio are forwarded to the Team Leader who conducted the radiological survey of the site. The following items are included in the Team Leader review:

1. Introduction: the conversion formula is checked to ensure correct usage and results.
2. Significance of Findings: the verbiage is checked for correctness and completeness, assumptions, inferences, recommendations, and interpretations are checked for conformity.
3. Recommendation: the recommendation is checked for consistency and verified. If the report recommendation is different from the Team Leader's original recommendation, a consultation with the Report Writer occurs to ensure that correct interpretations were made by the Report Writer.
4. All calculations are checked.
5. A general overview for report completeness is made and any omissions and/or incorrect data noted.
6. When the Team Leader's review is complete, the Team Leader initials and dates the appropriate space on the property file tracking form, and then forwards the report and portfolio to a team that was not present at the time of the radiological survey. This team is able to provide an objective final review.

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10.7.6.2 Final Review

All field personnel (Team Leaders, Team Members, and their supervisors) are qualified to perform final reviews and shall perform them as requested. The final review includes checks for correctness, consistency, and completeness of several items:

Report, Letter of Recommendation, VP Summary Evaluation and Recommendation, and VPDMS Form

1. Site location number on all appropriate pages
2. Site address on all appropriate pages
3. Team Leader name on cover page
4. Report date on cover page
5. Radiological survey date on all appropriate pages
6. Inclusion/exclusion recommendation on all appropriate pages
7. Owner information on all appropriate pages
8. Property structure descriptions on field data sheets
9. All outdoor exposure rates and areas on all appropriate pages
10. All indoor exposure rates and areas on all appropriate pages
11. All extended measurements and corresponding regions on all appropriate pages
12. Figure captions and number of figures with respective data on field data sheets
13. Appropriate consent form dates on VPDMS form
14. Verification of greater than (>) and less than (<) signs on all appropriate pages

6.2.2 Final Outdoor Field Map

1. Exposure rate ranges with report and draft field map
2. Size, shape, and location of contaminated (shaded) deposits with draft field map

3. Sample locations and labels with draft field map and report
4. HOG with draft field map and report
5. Indoor regions are not labelled on final outdoor map
6. Spillover deposits and point sources with draft field map and report

Final Indoor Field Map (PMT)

If indoor floor plan is required (Sect. 10.5, Labelling of Field Drawing), evaluate presence of:

1. Exposure rate ranges with report and draft field map
2. Size, shape, and location of contaminated (shaded) deposits with draft map
3. Sample locations and labels with draft field map and report
4. HIG with draft field map and report
5. Outdoor regions are not labelled on final indoor map

Once the final review is complete, the final reviewer intitials and dates the property file tracking sheet in appropriate spaces. The report and it portfolio, forms, and letters are submitted to the Report Typist for final processing.

10.7.7 Exhibits

None.

10.7.8 Review History

Rev. 1 Date: 03/31/86 First Revision

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10.8 FILE TRANSMITTAL

10.8.1 Purpose

The purpose of this procedure is to provide guidelines for the transmittal of "the official location folders" to the DOE.

10.8.2 Applicability

This procedure applies to all (property-file) transmittal by RASA/UMTRA personnel in support of UMTRA Project Inclusion Survey Contractor activities.

10.8.3 References

1. Sect. 10.6, Report Drafting

Also see Sect. 1.5, Terminology.

10.8.4 Definitions and Abbreviations

OFFICIAL LOCATION FOLDER. Property portfolio containing all DOE requested data for a specific vicinity property

Also see Sect. 1.5, Terminology.

10.8.5 Responsibilities

10.8.5.1 UMTRA Project Manager or Designee

The UMTRA Project Manager or his designee has the overall responsibility for ensuring the adequacy of the data used as the basis for inclusion/exclusion recommendations and is responsible for signing transmittal cover letters and Vicinity Property Summary Evaluation and Recommendation forms.

10.8.5.2 Survey Manager

The Survey Manager shares signature authority with the Project Manager, provides interface with the DOE, and is responsible for providing control of the quality of the file contents.

10.8.5.3 Computer System Manager

The Computer System Manager is responsible for recording the ISC recommendations in the database and transmitting the VPDMS Input Form to the TAC by the 25th of each month.

10.8.5.4 Process Coordinator

The Process Coordinator is responsible for ensuring the completeness of files that are to be transmitted to the DOE.

10.8.5.5 Report Typists

The Report Typists are responsible for preparing the files for transmittal after affixing a purple dot on the file folder and dating and initialing the appropriate space on the property file tracking sheet.

10.8.5.6 Document Control

The Document Control Department is responsible for maintaining all ISC property files.

10.8.6 Procedure

Recommendations and the corresponding property files for vicinity properties in Grand Junction and Edgemont are transmitted to the inclusion authority at the GJPO. Recommendations and the corresponding property files for vicinity properties at all other UMTRA Project sites are transmitted to the inclusion authority at the UMTRA Project Office in Albuquerque. Copies of the recommendation letters, without attachments, are sent to the appropriate RAC.

10.8.6.1 File Transmittal for Properties Surveyed by the ISC

After the UMTRA Project Manager or his designee has signed the recommendation letter and summary evaluation form for a given property, the following information is transmitted to the DOE.

1. Cover letter summarizing the recommendation and the survey procedures that were used.
2. Vicinity Property Summary Evaluation and Recommendation form.
3. Two copies of the finished inclusion survey report.
4. Original color photographs copied in the report.
5. Scale drawing of the property (PMT).
6. Original signed access consent form.
7. Complete historical data file.
8. Field map with raw and converted data.

All of these items are placed in a manila folder stamped "Official Location Folder." This folder is transmitted to the appropriate inclusion authority, and a copy of all transmitted materials is retained in the original property file by the ISC.

The Computer System Department enters the ISC inclusion/exclusion recommendation in the database and transmits the VPDMS form (Sect. 10.6, Report Drafting) to the TAC by the 25th of each month.

10.8.6.2 Transmittal of Grand Junction Dovetail Files

The ISC has engaged ARIX as subcontractor to conduct inclusion surveys or to supply existing radiological data for Grand Junction dovetail properties. The ISC reviews these data and makes an inclusion/exclusion recommendation to the DOE without collecting further data. For these properties, the following information is transmitted to the inclusion authority at the GJPO.

1. Cover letter summarizing the recommendation.
2. Vicinity Property Summary Evaluation and Recommendation form.
3. Complete file of all available data for the property.
4. Original signed access consent form.

All of these items are placed in a manila folder stamped "Official Location Folder" and forwarded to the DOE. A hard copy of all transmitted material is retained in the original property file by the ISC.

10.8.6.3 Transmittal of Other Property Files

Occasionally, the DOE requests the ISC to review the available data for selected properties and make an inclusion/exclusion recommendation on that basis. In these circumstances, the following information is transmitted to the DOE.

1. Cover letter summarizing the pertinent data and the recommendation.
2. Complete file of all available data for the property.

These items are placed in a manila folder stamped "Official Location Folder" and are transmitted to the appropriate inclusion authority. A hard copy of all transmitted material is retained in the original property file by the ISC.

10.8.7 Exhibits

None.

10.8.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

10.9 DOE ACTION AND DATA ARCHIVAL

10.9.1 Purpose

The purpose of this procedure is to provide guidelines for ISC response to DOE actions regarding inclusion/exclusion recommendations. It also provides guidelines for the archiving and storage of property data.

10.9.2 Applicability

This procedure applies to all data and files pertaining to all properties for which the UMTRA Project Inclusion Survey Contractor makes inclusion/exclusion recommendations.

10.9.3 References

None.

10.9.4 Definitions and Abbreviations

See Sect. 1.5, Terminology.

10.9.5 Responsibilities

10.9.5.1 Process Coordinator and/or Technical Assistant

The Process Coordinator and/or Technical Assistant provide the interface with the DOE for all property files that are returned for modifications, and is responsible for assigning property files that require modification to Report Writers. In addition, the Process Coordinator is responsible for tracking the progress of the files during their modification, and reporting this progress to the RASA/UMTRA Project Manager and Quality Assurance Coordinator on a monthly basis.

10.9.5.2 Report Writer

The Report Writer who authored the report is responsible for modifying the property file as requested.

10.9.5.3 Report Typists

The Reports Typists are responsible for preparing modified property files to transmittal and archiving of hard data.

10.9.5.4 Computer System Manager

The Computer System Manager is responsible for recording DOE inclusion/exclusion decisions into the database.

10.9.6 Procedure

10.9.6.1 Recommendation Follow-up

The DOE inclusion authority may not concur with the ISC's recommendation, may require further information to make an inclusion/exclusion decision, or may require modifications to the Inclusion Survey Report. When this occurs, the Inclusion Officer is to write appropriate comments on the Vicinity Property Summary Evaluation and Recommendation form and return the entire offical location folder to the ISC's Survey Manager.

The Survey Manager will contact the Inclusion Officer if further clarification is required. If possible, the Survey Manager will satisfy the Inclusion Officer's requirements. If not, the file is given to the Process Coordinator, who will assign the file to the same Team Leader who conducted the survey. The Team Leader will make the requested revision, enter the appropriate notations on the property file tracking sheet, and return the file to the Process Coordinator, who will arrange for the re-transmittal of the property file to the DOE.

If no additional field work is required to revise the files, folders will be resubmitted to the DOE within one month of their return to the ISC. Folders for Grand Junction locations requiring additional field work will be returned to the DOE within two months. Remote locations requiring additional field work will be scheduled in accordance with other field work requirements and will be revised as quickly as possible. The exception to these schedules will be those properties requiring RDC sampling. RDC measurements will be initiated within one month of a file's return to the ISC, and the revised file will be resubmitted as soon as the RDC measurements are completed.

10.9.6.2 Data Archival

After the DOE has made an exclusion/inclusion decision on a property, the Computer System Manager will record the decision and the data of the decision on the ISC's computerized database. A hard copy of all data and other material related to the property will be filed in the Document Control Department by UMTRA Project site and location number. The property numbers and recommendation date will be transmitted electronically to the TAC on a monthly basis.

10.9.7 Exhibits

None.

10.9.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

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Exhibit 10.1-1a. Conversion table for Grand Junction sites.

CONVERSION FROM CPM TO uR/h

SCINT.=	1	MICRO R/h=	5.140001
SCINT.=	1.5	MICRO R/h=	5.985
SCINT.=	2	MICRO R/h=	6.83
SCINT.=	2.5	MICRO R/h=	7.675
SCINT.=	3	MICRO R/h=	8.520001
SCINT.=	3.5	MICRO R/h=	9.365
SCINT.=	4	MICRO R/h=	10.21
SCINT.=	4.5	MICRO R/h=	11.055
SCINT.=	5	MICRO R/h=	11.9
SCINT.=	5.5	MICRO R/h=	12.745
SCINT.=	6	MICRO R/h=	13.59
SCINT.=	6.5	MICRO R/h=	14.435
SCINT.=	7	MICRO R/h=	15.28
SCINT.=	7.5	MICRO R/h=	16.125
SCINT.=	8	MICRO R/h=	16.97
SCINT.=	8.5	MICRO R/h=	17.815
SCINT.=	9	MICRO R/h=	18.66
SCINT.=	9.5	MICRO R/h=	19.505
SCINT.=	10	MICRO R/h=	20.35
SCINT.=	10.5	MICRO R/h=	21.195
SCINT.=	11	MICRO R/h=	22.04
SCINT.=	12	MICRO R/h=	23.73
SCINT.=	13	MICRO R/h=	25.42
SCINT.=	14	MICRO R/h=	27.11
SCINT.=	15	MICRO R/h=	28.8
SCINT.=	16	MICRO R/h=	30.49
SCINT.=	17	MICRO R/h=	32.18
SCINT.=	18	MICRO R/h=	33.87
SCINT.=	19	MICRO R/h=	35.56
SCINT.=	20	MICRO R/h=	37.25001
SCINT.=	21	MICRO R/h=	38.94
SCINT.=	22	MICRO R/h=	40.63
SCINT.=	23	MICRO R/h=	42.32001
SCINT.=	24	MICRO R/h=	44.01
SCINT.=	25	MICRO R/h=	45.7
SCINT.=	26	MICRO R/h=	47.39001
SCINT.=	27	MICRO R/h=	49.08
SCINT.=	28	MICRO R/h=	50.77
SCINT.=	29	MICRO R/h=	52.46001
SCINT.=	30	MICRO R/h=	54.15
SCINT.=	31	MICRO R/h=	55.84001
SCINT.=	32	MICRO R/h=	57.53001
SCINT.=	33	MICRO R/h=	59.22
SCINT.=	34	MICRO R/h=	60.91001
SCINT.=	35	MICRO R/h=	62.6
SCINT.=	36	MICRO R/h=	64.29
SCINT.=	37	MICRO R/h=	65.98001
SCINT.=	38	MICRO R/h=	67.67
SCINT.=	39	MICRO R/h=	69.36
SCINT.=	40	MICRO R/h=	71.05
SCINT.=	41	MICRO R/h=	72.74
SCINT.=	42	MICRO R/h=	74.43
SCINT.=	43	MICRO R/h=	76.12
SCINT.=	44	MICRO R/h=	77.81
SCINT.=	45	MICRO R/h=	79.5
SCINT.=	46	MICRO R/h=	81.19
SCINT.=	47	MICRO R/h=	82.88
SCINT.=	48	MICRO R/h=	84.57
SCINT.=	49	MICRO R/h=	86.26
SCINT.=	50	MICRO R/h=	87.95
SCINT.=	51	MICRO R/h=	89.64
SCINT.=	52	MICRO R/h=	[illegible]
SCINT.=	53	MICRO R/h=	93.01999
SCINT.=	54	MICRO R/h=	94.71
SCINT.=	55	MICRO R/h=	96.4
SCINT.=	56	MICRO R/h=	98.08999
SCINT.=	57	MICRO R/h=	99.78
SCINT.=	58	MICRO R/h=	101.47
SCINT.=	59	MICRO R/h=	103.16
SCINT.=	60	MICRO R/h=	104.85
SCINT.=	61	MICRO R/h=	106.54
SCINT.=	62	MICRO R/h=	108.23
SCINT.=	63	MICRO R/h=	109.92
SCINT.=	64	MICRO R/h=	111.61
SCINT.=	65	MICRO R/h=	113.3
SCINT.=	66	MICRO R/h=	114.99
SCINT.=	67	MICRO R/h=	116.68
SCINT.=	68	MICRO R/h=	118.37
SCINT.=	69	MICRO R/h=	120.06
SCINT.=	70	MICRO R/h=	121.75
SCINT.=	71	MICRO R/h=	123.44
SCINT.=	72	MICRO R/h=	125.13
SCINT.=	73	MICRO R/h=	126.82
SCINT.=	74	MICRO R/h=	128.51
SCINT.=	75	MICRO R/h=	130.2
SCINT.=	76	MICRO R/h=	131.89
SCINT.=	77	MICRO R/h=	133.58
SCINT.=	78	MICRO R/h=	135.27
SCINT.=	79	MICRO R/h=	136.96
SCINT.=	80	MICRO R/h=	138.65
SCINT.=	81	MICRO R/h=	140.34
SCINT.=	82	MICRO R/h=	142.03
SCINT.=	83	MICRO R/h=	143.72
SCINT.=	84	MICRO R/h=	145.41
SCINT.=	85	MICRO R/h=	147.1
SCINT.=	86	MICRO R/h=	148.79
SCINT.=	87	MICRO R/h=	150.48
SCINT.=	88	MICRO R/h=	152.17
SCINT.=	89	MICRO R/h=	153.86
SCINT.=	90	MICRO R/h=	155.55
SCINT.=	91	MICRO R/h=	157.24
SCINT.=	92	MICRO R/h=	158.93
SCINT.=	93	MICRO R/h=	160.62
SCINT.=	94	MICRO R/h=	162.31
SCINT.=	95	MICRO R/h=	164
SCINT.=	96	MICRO R/h=	165.69
SCINT.=	97	MICRO R/h=	167.38
SCINT.=	98	MICRO R/h=	169.07
SCINT.=	99	MICRO R/h=	170.76
SCINT.=	100	MICRO R/h=	172.45
SCINT.=	101	MICRO R/h=	174.14
SCINT.=	102	MICRO R/h=	175.83
SCINT.=	103	MICRO R/h=	177.52
SCINT.=	104	MICRO R/h=	179.21
SCINT.=	105	MICRO R/h=	180.9
SCINT.=	106	MICRO R/h=	182.59
SCINT.=	107	MICRO R/h=	184.28
SCINT.=	108	MICRO R/h=	185.97
SCINT.=	109	MICRO R/h=	187.66
SCINT.=	110	MICRO R/h=	189.35
SCINT.=	111	MICRO R/h=	191.04
SCINT.=	112	MICRO R/h=	192.73
SCINT.=	113	MICRO R/h=	194.42
SCINT.=	114	MICRO R/h=	196.11
SCINT.=	115	MICRO R/h=	197.8
SCINT.=	116	MICRO R/h=	199.49
SCINT.=	117	MICRO R/h=	201.18

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Exhibit 10.1-1a (Continued)

[illegible]	[illegible]	[illegible]	[illegible]
SCINT.=	119	MICRO R/h=	204.56
SCINT.=	120	MICRO R/h=	206.25
SCINT.=	121	MICRO R/h=	207.94
SCINT.=	122	MICRO R/h=	209.63
SCINT.=	123	MICRO R/h=	211.32
SCINT.=	124	MICRO R/h=	213.01
SCINT.=	125	MICRO R/h=	214.7
SCINT.=	126	MICRO R/h=	216.39
SCINT.=	127	MICRO R/h=	218.08
SCINT.=	128	MICRO R/h=	219.77
SCINT.=	129	MICRO R/h=	221.46
SCINT.=	130	MICRO R/h=	223.15
SCINT.=	131	MICRO R/h=	224.84
SCINT.=	132	MICRO R/h=	226.53
SCINT.=	133	MICRO R/h=	228.22
SCINT.=	134	MICRO R/h=	229.91
SCINT.=	135	MICRO R/h=	231.6
SCINT.=	136	MICRO R/h=	233.29
SCINT.=	137	MICRO R/h=	234.98
SCINT.=	138	MICRO R/h=	236.67
SCINT.=	139	MICRO R/h=	238.36
SCINT.=	140	MICRO R/h=	240.05
SCINT.=	141	MICRO R/h=	241.74
SCINT.=	142	MICRO R/h=	243.43
SCINT.=	143	MICRO R/h=	245.12
SCINT.=	144	MICRO R/h=	246.81
SCINT.=	145	MICRO R/h=	248.5
SCINT.=	146	MICRO R/h=	250.19
SCINT.=	147	MICRO R/h=	251.88
SCINT.=	148	MICRO R/h=	253.57
SCINT.=	149	MICRO R/h=	255.26
SCINT.=	150	MICRO R/h=	256.95
SCINT.=	151	MICRO R/h=	258.64
SCINT.=	152	MICRO R/h=	260.33
SCINT.=	153	MICRO R/h=	262.02
SCINT.=	154	MICRO R/h=	263.71
SCINT.=	155	MICRO R/h=	265.4
SCINT.=	156	MICRO R/h=	267.09
SCINT.=	157	MICRO R/h=	268.78
SCINT.=	158	MICRO R/h=	270.47
SCINT.=	159	MICRO R/h=	272.16
SCINT.=	160	MICRO R/h=	273.85
SCINT.=	161	MICRO R/h=	275.54
SCINT.=	162	MICRO R/h=	277.23
SCINT.=	163	MICRO R/h=	278.92
SCINT.=	164	MICRO R/h=	280.61
SCINT.=	165	MICRO R/h=	282.3
SCINT.=	166	MICRO R/h=	283.99
SCINT.=	167	MICRO R/h=	285.68
SCINT.=	168	MICRO R/h=	287.37
SCINT.=	169	MICRO R/h=	289.06
SCINT.=	170	MICRO R/h=	290.75
SCINT.=	171	MICRO R/h=	292.44
SCINT.=	172	MICRO R/h=	294.13
SCINT.=	173	MICRO R/h=	295.82
SCINT.=	174	MICRO R/h=	297.51
SCINT.=	175	MICRO R/h=	299.2
SCINT.=	176	MICRO R/h=	300.89
SCINT.=	177	MICRO R/h=	302.58
SCINT.=	178	MICRO R/h=	304.27
SCINT.=	179	MICRO R/h=	305.96
SCINT.=	180	MICRO R/h=	307.65
SCINT.=	181	MICRO R/h=	309.34
SCINT.=	182	MICRO R/h=	311.03
SCINT.=	183	MICRO R/h=	312.72
[illegible]	[illegible]	[illegible]	[illegible]
SCINT.=	185	MICRO R/h=	316.1
SCINT.=	186	MICRO R/h=	317.79
SCINT.=	187	MICRO R/h=	319.48
SCINT.=	188	MICRO R/h=	321.17
SCINT.=	189	MICRO R/h=	322.86
SCINT.=	190	MICRO R/h=	324.55
SCINT.=	191	MICRO R/h=	326.24
SCINT.=	192	MICRO R/h=	327.93
SCINT.=	193	MICRO R/h=	329.62
SCINT.=	194	MICRO R/h=	331.31
SCINT.=	195	MICRO R/h=	333
SCINT.=	196	MICRO R/h=	334.69
SCINT.=	197	MICRO R/h=	336.38
SCINT.=	198	MICRO R/h=	338.07
SCINT.=	199	MICRO R/h=	339.76
SCINT.=	200	MICRO R/h=	341.45

FORMULA USED: SCINT. X 1.69 + 3.45 = MICRO [illegible]

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.1-1b. Conversion table for Durango sites.

THE FORMULA IS SCINT.X 1.55 + 5.28 = MICRO R/h

SCINT.=	1	MICRO R/h=	6.83
SCINT.=	1.5	MICRO R/h=	7.605
SCINT.=	2	MICRO R/h=	8.38
SCINT.=	2.5	MICRO R/h=	9.155001
SCINT.=	3	MICRO R/h=	9.93
SCINT.=	3.5	MICRO R/h=	10.705
SCINT.=	4	MICRO R/h=	11.48
SCINT.=	4.5	MICRO R/h=	12.255
SCINT.=	5	MICRO R/h=	13.03
SCINT.=	5.5	MICRO R/h=	13.805
SCINT.=	6	MICRO R/h=	14.58
SCINT.=	6.5	MICRO R/h=	15.355
SCINT.=	7	MICRO R/h=	16.13
SCINT.=	7.5	MICRO R/h=	16.905
SCINT.=	8	MICRO R/h=	17.68
SCINT.=	8.5	MICRO R/h=	18.455
SCINT.=	9	MICRO R/h=	19.23
SCINT.=	9.5	MICRO R/h=	20.005
SCINT.=	10	MICRO R/h=	20.78
SCINT.=	10.5	MICRO R/h=	21.555
SCINT.=	11	MICRO R/h=	22.33
SCINT.=	12	MICRO R/h=	23.88
SCINT.=	13	MICRO R/h=	25.43
SCINT.=	14	MICRO R/h=	26.98
SCINT.=	15	MICRO R/h=	28.53
SCINT.=	16	MICRO R/h=	30.08
SCINT.=	17	MICRO R/h=	31.63
SCINT.=	18	MICRO R/h=	33.18
SCINT.=	19	MICRO R/h=	34.73
SCINT.=	20	MICRO R/h=	36.28
SCINT.=	21	MICRO R/h=	37.83
SCINT.=	22	MICRO R/h=	39.38
SCINT.=	23	MICRO R/h=	40.93
SCINT.=	24	MICRO R/h=	42.48
SCINT.=	25	MICRO R/h=	44.03
SCINT.=	26	MICRO R/h=	45.58
SCINT.=	27	MICRO R/h=	47.13
SCINT.=	28	MICRO R/h=	48.68
SCINT.=	29	MICRO R/h=	50.23
SCINT.=	30	MICRO R/h=	51.78
SCINT.=	31	MICRO R/h=	53.33
SCINT.=	32	MICRO R/h=	54.88
SCINT.=	33	MICRO R/h=	56.43
SCINT.=	34	MICRO R/h=	57.98
SCINT.=	35	MICRO R/h=	59.53
SCINT.=	36	MICRO R/h=	61.08
SCINT.=	37	MICRO R/h=	62.63
SCINT.=	38	MICRO R/h=	64.18
SCINT.=	39	MICRO R/h=	65.73
SCINT.=	40	MICRO R/h=	67.28
SCINT.=	41	MICRO R/h=	68.83
SCINT.=	42	MICRO R/h=	70.38
SCINT.=	43	MICRO R/h=	71.93
SCINT.=	44	MICRO R/h=	73.48
SCINT.=	45	MICRO R/h=	75.03
SCINT.=	46	MICRO R/h=	76.58
SCINT.=	47	MICRO R/h=	78.13
SCINT.=	48	MICRO R/h=	79.68
SCINT.=	49	MICRO R/h=	81.23
SCINT.=	51	MICRO R/h=	84.32
SCINT.=	52	MICRO R/h=	85.88
SCINT.=	53	MICRO R/h=	87.42
SCINT.=	54	MICRO R/h=	88.97
SCINT.=	55	MICRO R/h=	90.53
SCINT.=	56	MICRO R/h=	92.07
SCINT.=	57	MICRO R/h=	93.63
SCINT.=	58	MICRO R/h=	95.17
SCINT.=	59	MICRO R/h=	96.72
SCINT.=	60	MICRO R/h=	98.28
SCINT.=	61	MICRO R/h=	99.82
SCINT.=	62	MICRO R/h=	101.3
SCINT.=	63	MICRO R/h=	102.9
SCINT.=	64	MICRO R/h=	104.4
SCINT.=	65	MICRO R/h=	106.0
SCINT.=	66	MICRO R/h=	107.5
SCINT.=	67	MICRO R/h=	109.1
SCINT.=	68	MICRO R/h=	110.6
SCINT.=	69	MICRO R/h=	112.2
SCINT.=	70	MICRO R/h=	113.7
SCINT.=	71	MICRO R/h=	115.3
SCINT.=	72	MICRO R/h=	116.8
SCINT.=	73	MICRO R/h=	118.4
SCINT.=	74	MICRO R/h=	119.9
SCINT.=	75	MICRO R/h=	121.5
SCINT.=	76	MICRO R/h=	123.0
SCINT.=	77	MICRO R/h=	124.6
SCINT.=	78	MICRO R/h=	126.1
SCINT.=	79	MICRO R/h=	127.7
SCINT.=	80	MICRO R/h=	129.2
SCINT.=	81	MICRO R/h=	130.8
SCINT.=	82	MICRO R/h=	132.3
SCINT.=	83	MICRO R/h=	133.9
SCINT.=	84	MICRO R/h=	135.4
SCINT.=	85	MICRO R/h=	137.0
SCINT.=	86	MICRO R/h=	138.5
SCINT.=	87	MICRO R/h=	140.1
SCINT.=	88	MICRO R/h=	141.6
SCINT.=	89	MICRO R/h=	143.2
SCINT.=	90	MICRO R/h=	144.7
SCINT.=	91	MICRO R/h=	146.3
SCINT.=	92	MICRO R/h=	147.8
SCINT.=	93	MICRO R/h=	149.4
SCINT.=	94	MICRO R/h=	150.9
SCINT.=	95	MICRO R/h=	152.5
SCINT.=	96	MICRO R/h=	154.0
SCINT.=	97	MICRO R/h=	155.6
SCINT.=	98	MICRO R/h=	157.1
SCINT.=	99	MICRO R/h=	158.7
SCINT.=	100	MICRO R/h=	160.
SCINT.=	101	MICRO R/h=	161.
SCINT.=	102	MICRO R/h=	163.
SCINT.=	103	MICRO R/h=	164.
SCINT.=	104	MICRO R/h=	166.
SCINT.=	105	MICRO R/h=	168.
SCINT.=	106	MICRO R/h=	169.
SCINT.=	107	MICRO R/h=	171.
SCINT.=	108	MICRO R/h=	172.
SCINT.=	109	MICRO R/h=	174.
SCINT.=	110	MICRO R/h=	175.
SCINT.=	111	MICRO R/h=	177.
SCINT.=	112	MICRO R/h=	178.
SCINT.=	113	MICRO R/h=	180.
SCINT.=	114	MICRO R/h=	181.
SCINT.=	115	MICRO R/h=	183.

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.1-1b (Continued)

SCINT.=	118	MICRO R/h=	188.18
SCINT.=	119	MICRO R/h=	189.73
SCINT.=	120	MICRO R/h=	191.28
SCINT.=	121	MICRO R/h=	192.83
SCINT.=	122	MICRO R/h=	194.38
SCINT.=	123	MICRO R/h=	195.93
SCINT.=	124	MICRO R/h=	197.48
SCINT.=	125	MICRO R/h=	199.03
SCINT.=	126	MICRO R/h=	200.58
SCINT.=	127	MICRO R/h=	202.13
SCINT.=	128	MICRO R/h=	203.68
SCINT.=	129	MICRO R/h=	205.23
SCINT.=	130	MICRO R/h=	206.78
SCINT.=	131	MICRO R/h=	208.33
SCINT.=	132	MICRO R/h=	209.88
SCINT.=	133	MICRO R/h=	211.43
SCINT.=	134	MICRO R/h=	212.98
SCINT.=	135	MICRO R/h=	214.53
SCINT.=	136	MICRO R/h=	216.08
SCINT.=	137	MICRO R/h=	217.63
SCINT.=	138	MICRO R/h=	219.18
SCINT.=	139	MICRO R/h=	220.73
SCINT.=	140	MICRO R/h=	222.28
SCINT.=	141	MICRO R/h=	223.83
SCINT.=	142	MICRO R/h=	225.38
SCINT.=	143	MICRO R/h=	226.93
SCINT.=	144	MICRO R/h=	228.48
SCINT.=	145	MICRO R/h=	230.03
SCINT.=	146	MICRO R/h=	231.58
SCINT.=	147	MICRO R/h=	233.13
SCINT.=	148	MICRO R/h=	234.68
SCINT.=	149	MICRO R/h=	236.23
SCINT.=	150	MICRO R/h=	237.78
SCINT.=	151	MICRO R/h=	239.33
SCINT.=	152	MICRO R/h=	240.88
SCINT.=	153	MICRO R/h=	242.43
SCINT.=	154	MICRO R/h=	243.98
SCINT.=	155	MICRO R/h=	245.53
SCINT.=	156	MICRO R/h=	247.08
SCINT.=	157	MICRO R/h=	248.63
SCINT.=	158	MICRO R/h=	250.18
SCINT.=	159	MICRO R/h=	251.73
SCINT.=	160	MICRO R/h=	253.28
SCINT.=	161	MICRO R/h=	254.83
SCINT.=	162	MICRO R/h=	256.38
SCINT.=	163	MICRO R/h=	257.93
SCINT.=	164	MICRO R/h=	259.48
SCINT.=	165	MICRO R/h=	261.03
SCINT.=	166	MICRO R/h=	262.58
SCINT.=	167	MICRO R/h=	264.13
SCINT.=	168	MICRO R/h=	265.68
SCINT.=	169	MICRO R/h=	267.23
SCINT.=	170	MICRO R/h=	268.78
SCINT.=	171	MICRO R/h=	270.33
SCINT.=	172	MICRO R/h=	271.88
SCINT.=	173	MICRO R/h=	273.43
SCINT.=	174	MICRO R/h=	274.98
SCINT.=	175	MICRO R/h=	276.53
SCINT.=	176	MICRO R/h=	278.08
SCINT.=	177	MICRO R/h=	279.63
SCINT.=	178	MICRO R/h=	281.18
SCINT.=	179	MICRO R/h=	282.73
SCINT.=	180	MICRO R/h=	284.28
SCINT.=	181	MICRO R/h=	285.83
SCINT.=	182	MICRO R/h=	287.38
SCINT.=	183	MICRO R/h=	288.93
SCINT.=	184	MICRO R/h=	290.48
SCINT.=	185	MICRO R/h=	292.03
SCINT.=	186	MICRO R/h=	293.58
SCINT.=	187	MICRO R/h=	295.13
SCINT.=	188	MICRO R/h=	296.68
SCINT.=	189	MICRO R/h=	298.23
SCINT.=	190	MICRO R/h=	299.78
SCINT.=	191	MICRO R/h=	301.33
SCINT.=	192	MICRO R/h=	302.88
SCINT.=	193	MICRO R/h=	304.43
SCINT.=	194	MICRO R/h=	305.98
SCINT.=	195	MICRO R/h=	307.53
SCINT.=	196	MICRO R/h=	309.08
SCINT.=	197	MICRO R/h=	310.63
SCINT.=	198	MICRO R/h=	312.18
SCINT.=	199	MICRO R/h=	313.73
SCINT.=	200	MICRO R/h=	315.28

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.1-1c. Conversion factor for Canonsburg, Pennsylvania.

Listed below are some conversion values received from using the PIC on various streets in the Canonsburg area:

Street address	PIC uR/h	Scintillator measurement x 1000 cpm	uR/h/cpm (x 1000) conversion
132 Latimer	13	7	1.93
20 Latimer	12	7.5	1.6
158 Alexander	14	6.5	2.15
332 W. Pike	11	5	2.2
616 Spruce	11	5	2.2
293 Wylie	11	5	2.2

By taking the average of the conversion factors, an value of 2 uR/h/cpm (x 1000) was obtained. This average conversion factor of 2 is used for all properties surveyed in Canonsburg.

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.1-2. Property file tracking form.

SITE NUMBER GJ10633 | PARCEL NUMBER | PROPERTY CLASS

	Date Sent	Date Received	Status
Consent Form Follow-up			

	Date Tel.	Personal Visit	Status
Other Contact			

	Assigned	Completed	Drawing By
Graphics			

**************** RADIATION SURVEY AND REPORT TRACKING *********************

SURVEY DATE	ASSIGNED/INITIALS	COMPLETED/INITIALS
	________	________

Team Leader Pre-Report Review

	IN/INITIALS	OUT/INITIALS		IN/INITIALS	OUT/INITIALS
Soils	____	____	Data Conversion	____	____
Data Archiving	____	____	Photos	____	____
Report Writing	____	____	Typing	____	____

Technical Review	IN/INITIALS	OUT/INITIALS	TYPING	IN/INITIALS	OUT/INITIALS
Team Leader	____	____	Report	____	____
Alternate Team	____	____	Transmittal Letter	____	____
Process Coordinator	____	____			

SPILLOVER DATA

Loc.No.	Parcel No.	Address
____	____	____
____	____	____
____	____	____
____	____	____

DOE Action INCL/EXCL ____ DATE ____ RETURNED DATE ____

Comments ______________________________

RESUBMITTAL Initials: ______ Date: ________ CHANGES Initials: ______ Date: ________
Typing Initials: ______ Date: ________
Transmittal Letter Initials: ______ Date: ________

DOE Action INCL/EXCL ____ DATE ____ RETURNED DATE ____

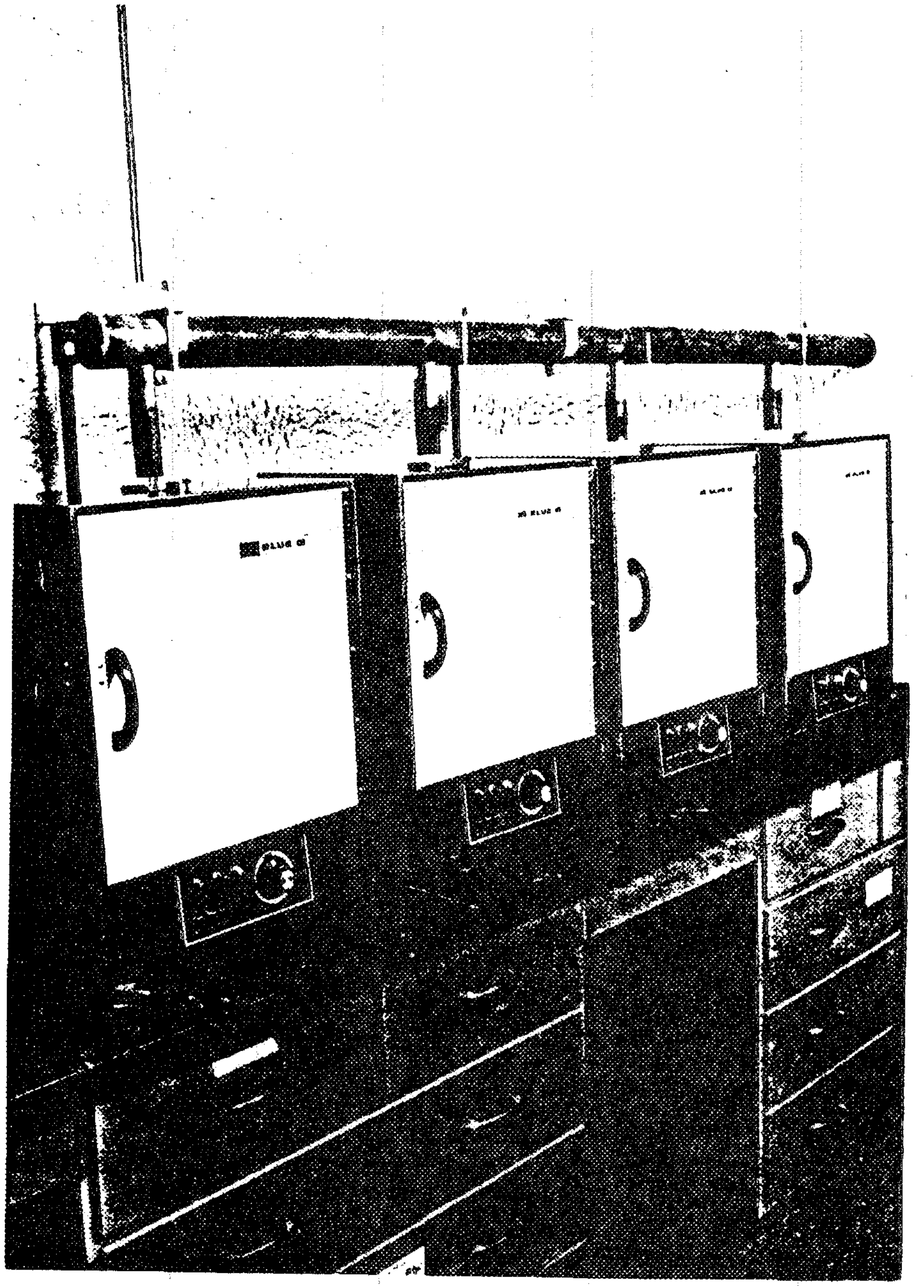
Comments

Exhibit 10.2-1. Soils preparation laboratory equipment.

1. Mettler PE 6000 balance
2. Scientech 3350 balance
3. VWR 1330 ovens
4. 3/4" deep aluminum pans (4" x 3")
5. 16 oz. polyethylene bottles
6. Teflon sealed plastic lids
7. 15" x 5" plastic (chicken) bags
8. 3/4" electrician tape
9. Power pal (100 psi) compressor
10. Manual jaw crusher
11. 1/4" sieve
12. Funnel
13. Labconco hood
14. Scott utility wipes
15. Safety glasses
16. Laboratory coats
17. Filter masks
18. Gloves
19. Tingley rubber knee boots

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.2-2. Drying ovens.



SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.2-3. Mettler PE 6000 electronic scale.

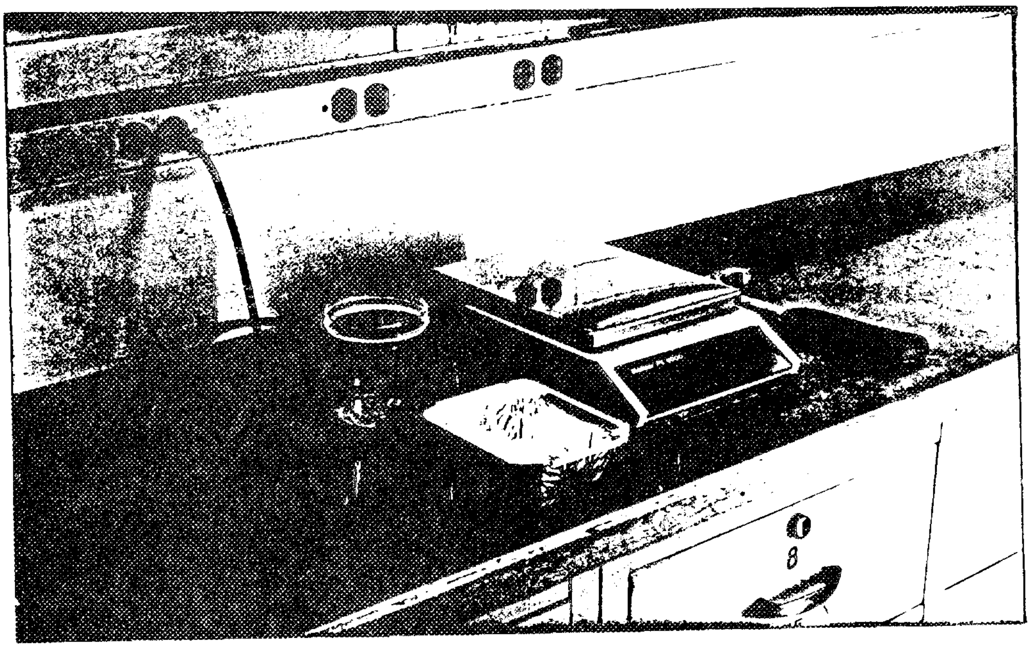


Exhibit 10.3-1. Start-up and analysis procedure.

Technologist action	Terminal response	Function/comment
1. Turn on ND66 Turn on IBM PC	Blank spectrum and flashing "Hello" displayed on ND	
2. Turn on high voltage power supply first to 500; let set a minute then to 1000; let system warm up for at least one hour	Power light on	Warm up system
3. Insert "soil prog." disk in Drive A (upper drive on IBM) and "Soil Data" disk in Drive B (lower drive); press "CRNL-ALT-DEL" keys simultaneously	IBM will prompt for correct time and day; if day and time are correct then press any key; main menu will appear in screen	IBM interfaces with ND66 to acquire and analyze sample data
4. Clean inside of PIG well with rubbing alcchol		Assures no contamination exists in PIG well
5. Select Option "1" "Initialize ND System" on IBM menu	ROI, time, date, & real time will be set on ND screen	Initializes ND for data acquisition; Note: make sure ROI, date, time and real time (5:00) are set correctly; if not, go to step 5
6. Place the CS^{137} source in a PIG well; press the "ADC" key on the ND until the "SF=" display on the upper part of the ND screen corresponds with the PIG well the CS^{137} was placed in	Spectral data corresponding with each PIG well & ADC will appear on ND screen	View spectrum in each PIG well
7. Type on ND keyboard "CD 111" [R] "CF 2544" [R]	Cursor will move from the left part of screen to just right of the center	Sets cursor at channel 111: sets count full scale at 2544

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-1 (Continued)

Technologist action	Terminal response	Function/comment
8. Press "AQR" "INT" keys on ND	Spectrum will accumulate on ND screen	
9. Check to see if cursor lies on top of and in in the middle of the Cs^{137} peak; if not adjust "fine gain" knob on ND amplifier for the corresponding ADC	Cursor will move to the left or right of the peak upon adjustment of the "fine gain" knob	checks calibration of NaI crystal; adjusts for drift
10. Press "ACQ" "INT" keys to stop acquisition; press "ERS" "INT" keys to clear spectral data; Record firegain adjustment (if any) in lab book	Spectrum stops acquiring: spectral data cleared from screen	
11. Perform steps 6 through 10 for each ADC		
12. Place a KCL background standard in PIG well 1; close lid by centering the lid over the PIG and pulling up on the hydraulic release lever		Seals lid on PIG well for data acquisition
13. Set "SF" at 1 with "ADC" key; press "AQR" "INT" keys	Live time and actual time counters in lower right of screen will begin counting (counting time = 5 min)	Acquire background data
14. Select "Record Background" option on IBM menu after ND has "timed out" (actual time = 5 min) input ADC number as required	IBM will prompt for ADC to read: spectral data will appear on IBM screen, then return to main menu	Stores background spectrum in ND and IBM

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-1 (Continued)

Technologist action	Terminal response	Function/comment
15. Check to see if BKG was stored; press GRP key on ND; to the right of the "SF", the GP display at the top of the screen should read 2; see if the spectrum acquired in GRP 1 has been stored in GRP 2; go to GRP 1, press "ERS" "INT" keys; go to GRP 2; the BKG spectrum should remain	The same spectrum acquired in GRP 1 is stored in GRP 2	Check to see if BKG spectrum is stored
16. Perform steps 12-16 for each ADC		
17. Type "PA 6" on ND	ND screen blanks	Brings up a blank page on the ND
18. Type DDDU 1	Drive unit 1 directory listed	To find background file number and record in lab book
19. Record background file names in lab book		
20. Press "PAGE" key to to return to spectral count page (see ND 66 manual)	With each page command a different page appears	Prepare for sample analysis
21. Remove KCL BKG: raise lid by pressing hydraulic pump button: when lid clears PIG well swing it clear and remove sample		

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-1 (Continued)

Technologist action	Terminal response	Function/comment
22. Record samples to be analyzed in lab book		
23. Place sample in PIG well and perform steps 12 & 13		
24. When analysis time is finished, select option 3 on IBM "Analyze Sample" input data as requested	Upon selection of option 3 IBM will prompt for ADC to read: spectral data will appear on screen in the same manner as in step 14	Records spectral data on IBM and ND floppy disks
25. Input data as requested	IBM will prompt for Sample ID: Weight: Days in bottle: IBM will print Ra^{226} Conc. and record number on screen sample ID, ND number and pCi/g sent to printer	
26. When IBM has accepted sample data, record Ra^{226} conc. in lab book and field sheet, cross out sample in lab book with yellow highlighter to indicate sample data acceptance into data base		
27. Perform steps 22 through 26 for each sample		

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-2. Soil database procedures.

Technologist action	Terminal response	Function/comment
A. Hardcopy of soil results		
1. Select "Data Base Menu" from "Main Menu"	Data base menu appears	
2. Select "Hardcopy of Soil Results" option on IBM	Computer prompt for single day printout or full day	Selects option
3. Select single day P/O or complete list	If single day is selected, computer will prompt for day of analysis	Selects option
4. Input day	Single day analysis data sent to printer; program will return to main menu	Produces H/C P/O
5. Place hard copy	in back of Soil Analysis Form Binder	
B. KMAN file created		
Select "Data Base Menu" option	Data Base Menu	
Select "KMAN Disk" option option from "Data Base Menu"	Prompt to place formatted disk in B drive	
Input date of analysis	Sample analyzed for given date printed on screen-prompt to put spectral data disk in B drive	KMAN disk written

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-3. Soil quality check form.

OAK RIDGE NATL. LABS

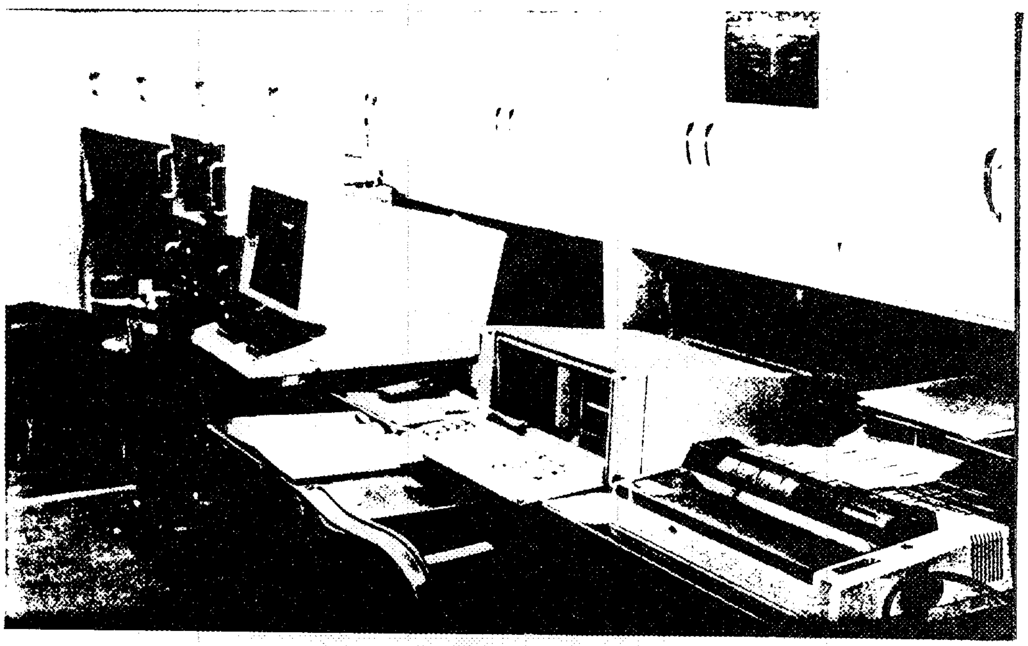
SOIL QUALITY CHECK FORM

MONTH ______
DATE SUBMITTED ______
DATE RECIEVED ______
SPECIAL COMMENTS ______

ORNL NAI GJ OFFICE						CHECK LAB			
ND NO.	SAMPLE ID	DATE ANA.	DAYS IN	RA-226 PCI/G	ERROR	DATE ANA	RA-226 PCI/G	ERROR	COMMENTS

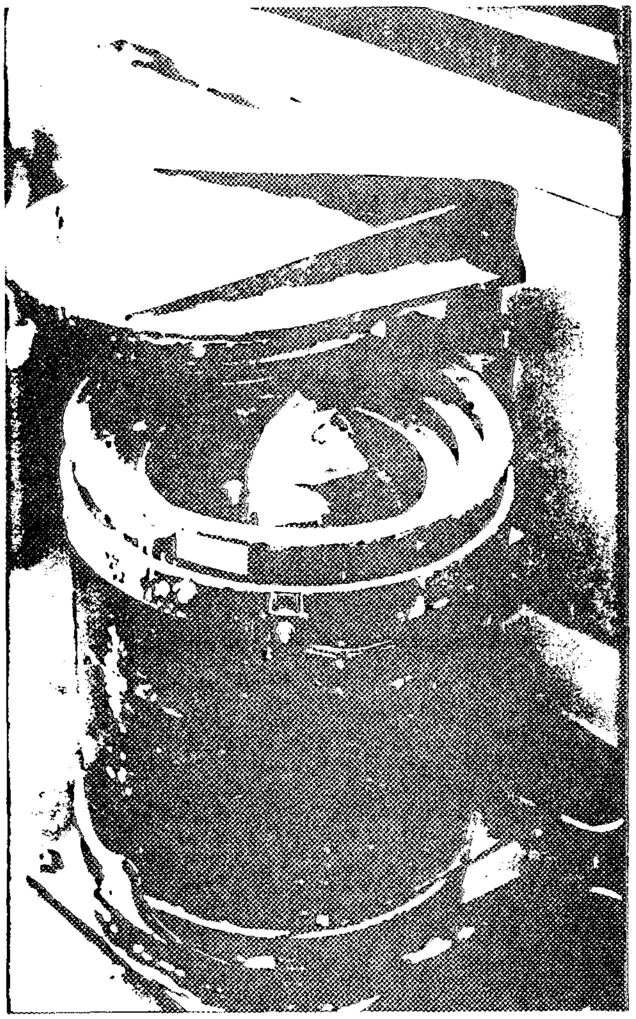
SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-4. Soil laboratory equipment.



SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.3-5. Lead pig with hydraulic lifting unit.



SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.5-1. Example of outdoor field drawing.

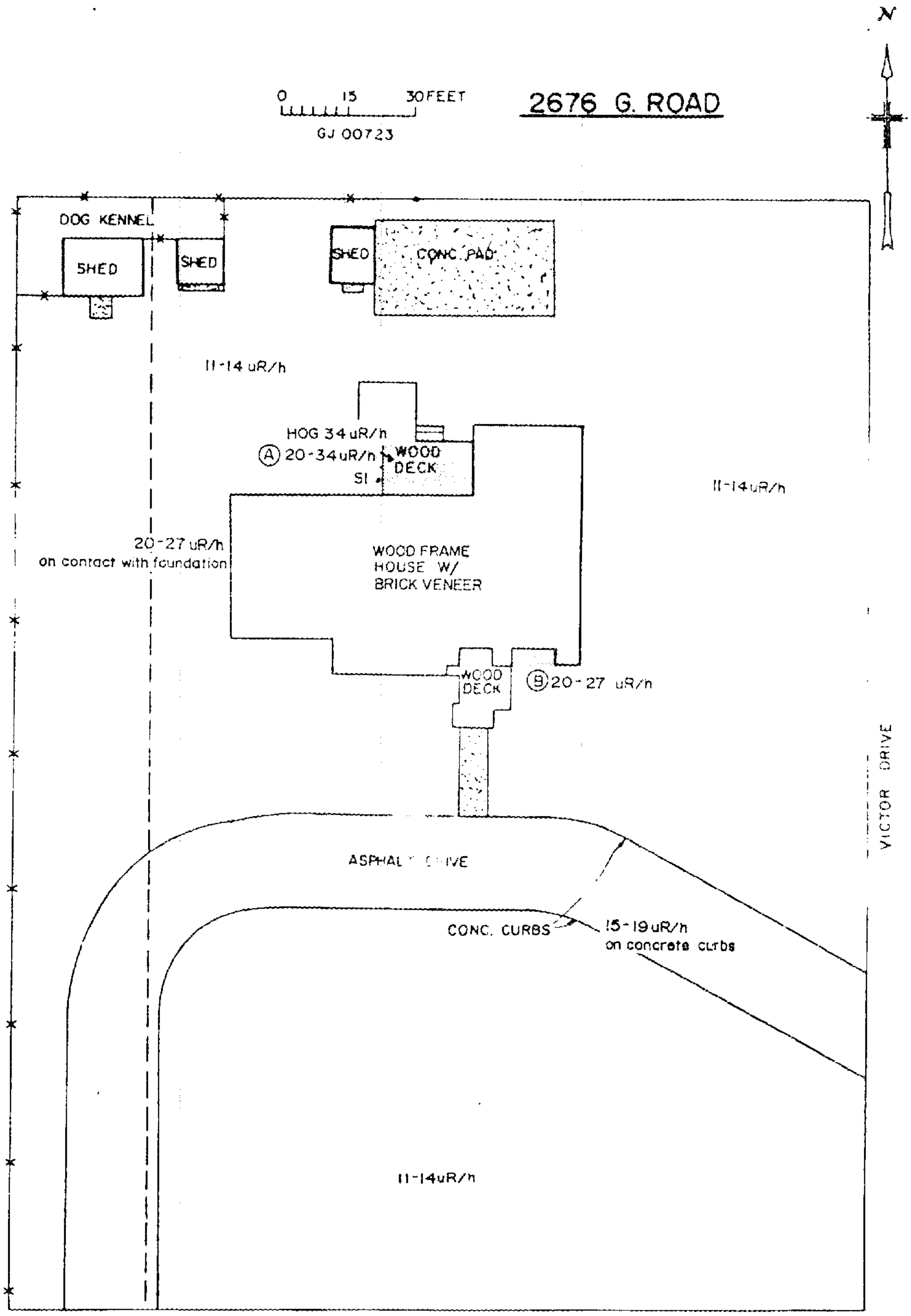


Exhibit 10.5-1. Example of Outdoor Field Drawing

Exhibit 10.5-2. Example of indoor field drawing.

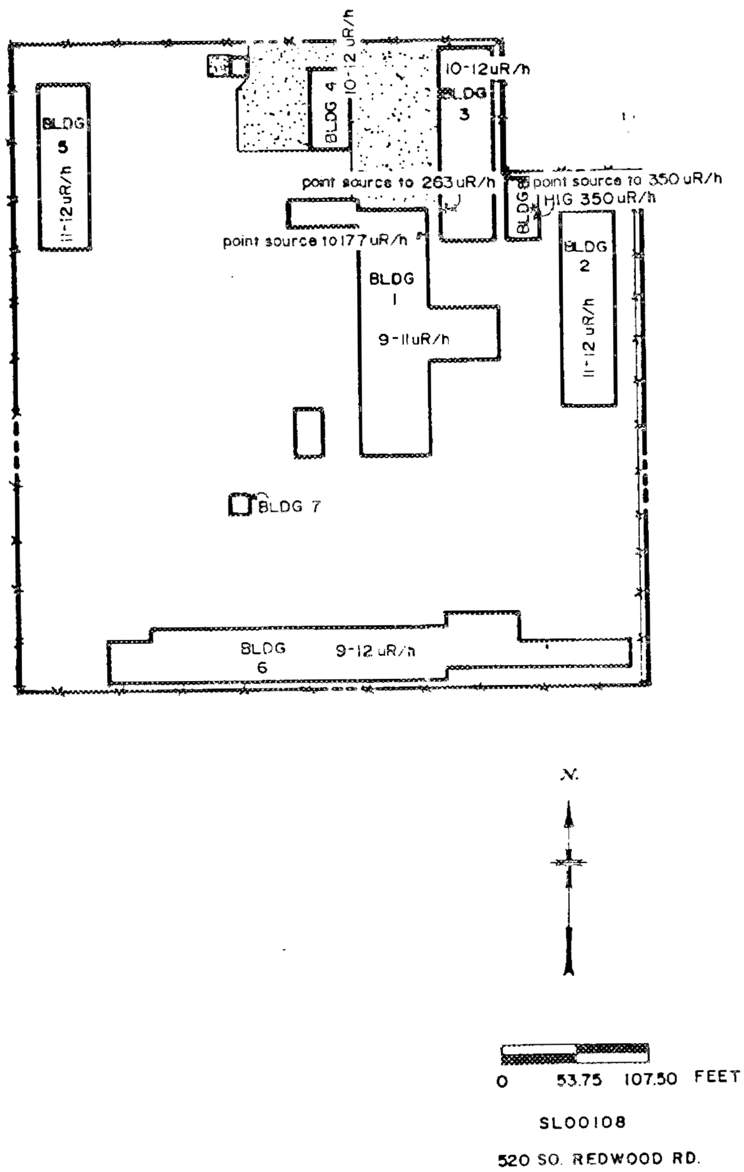


Exhibit 10.5-2, Example of Indoor Field Drawing

Exhibit 10.5-3. AutoCAD training course.

A) TRAINING PROCEDURES

1) Familiarize Trainee With Basic Drawing Commands
  a) Line
    1) Methods of Input
      aa) Pointing Device
      bb) Cursor Controls
      cc) Absolute Coordinates
      dd) Relative Positioning
        1) Rectangular Coordinates
        2 Polar Coordinates

  b) Arc
    1) Methods of Input
      aa) 3 Point - 3 Points on an Arc
      bb) S,C,E, - start point, center, end point
      cc) S,C,A - start point, center, included angle
      dd) S,C,L - start point, center, length of cord
      ee) S,E,A - start point, end point, included angle
      ff) S,E,R - start point, end point, radius
      gg) S,E,D - start point, end point, diameter
      hh) C,S,E - center point, start point, end point
      ii) C,S,A - center point, start point, included angle
      jj) C,S,L - center point, start point, length of cord
      kk) Contin - continuation of previous arc

  c) Circle
    1) Methods of Input
      aa) Cen, Rad - center point, radius
      bb) Cen, Dia - center point, diameter
      cc) 2 point - 2 points on a circle
      dd) 3 point - 3 points on a circle

  d) Text
    1) Methods of Input
      aa) Left justified (default)
      bb) Aligned - Text aligned between 2 points
      cc) Centered - Text centered around a point
      dd) Right - Right justified
      ee) Style - Allows modification in text type

  e) Editing Commands
    1) Erase
      aa) Objects
      bb) Window
      cc) Last
    2) Oops - Allows last object erased to be brought back to drawing

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.5-3 (Continued)

2) Autocad Drawing Format
   a) Limits
   b) Units
   c) Grid
   d) Snap

3) Individual Hands-on Application

4) Hands-on Individual Sample Drawing Input

5) Review Period

6) Question and Answer Period

7) Familiarize Trainee With Advanced Drawing Commands
   a) Blocks
      1) Block
      2) Insert
      3) W Block

   b) Drawing Commands
      1) Insert
      2) Pline
      3) Point
      4) Sketch
      5) Solid
      6) Trace

   c) Display Commands
      1) Pan
      2) QText
      3) Redraw
      4) Regen
      5) View
      6) Zoom

   d) Editing Commands
      1) Array
      2) Break
      3) Change
      4) Copy
      5) Erase
      6) Fillet
      7) Mirror
      8) Move
      9) Pedit
      10) Style

   e) Layers
      1) Layer
         aa) Listing
         bb) Set
         cc) New
         dd) Color
         ee) On
         ff) Off

Exhibit 10.5-3 (Continued)

gg) Ltype
2) Linetype
aa) Load
bb) Listing
cc) Yes
dd) No
3) Ltscale

f) Modes
1) Axis
aa) On
bb) Off
2) Coords
aa) Rectangular
bb) Polar
3) Dragmod
aa) On
bb) Off
4) Grid
aa) On
bb) Off
5) Ortho
aa) On
bb) Off
6) Osnap
aa) Center
bb) Endpoint
cc) Insert
dd) Intersec
ee) Midpoint
ff) Nearest
gg) Node
hh) Perpend
ii) Quadrant
jj) Tangent
kk) None
7) Snap
aa) On
bb) Off
cc) Set Value

8) Input Individual Drawings Using Advanced Techniques

9) Review Period

10) Question and Answer Period

11) Individual Hands on Training

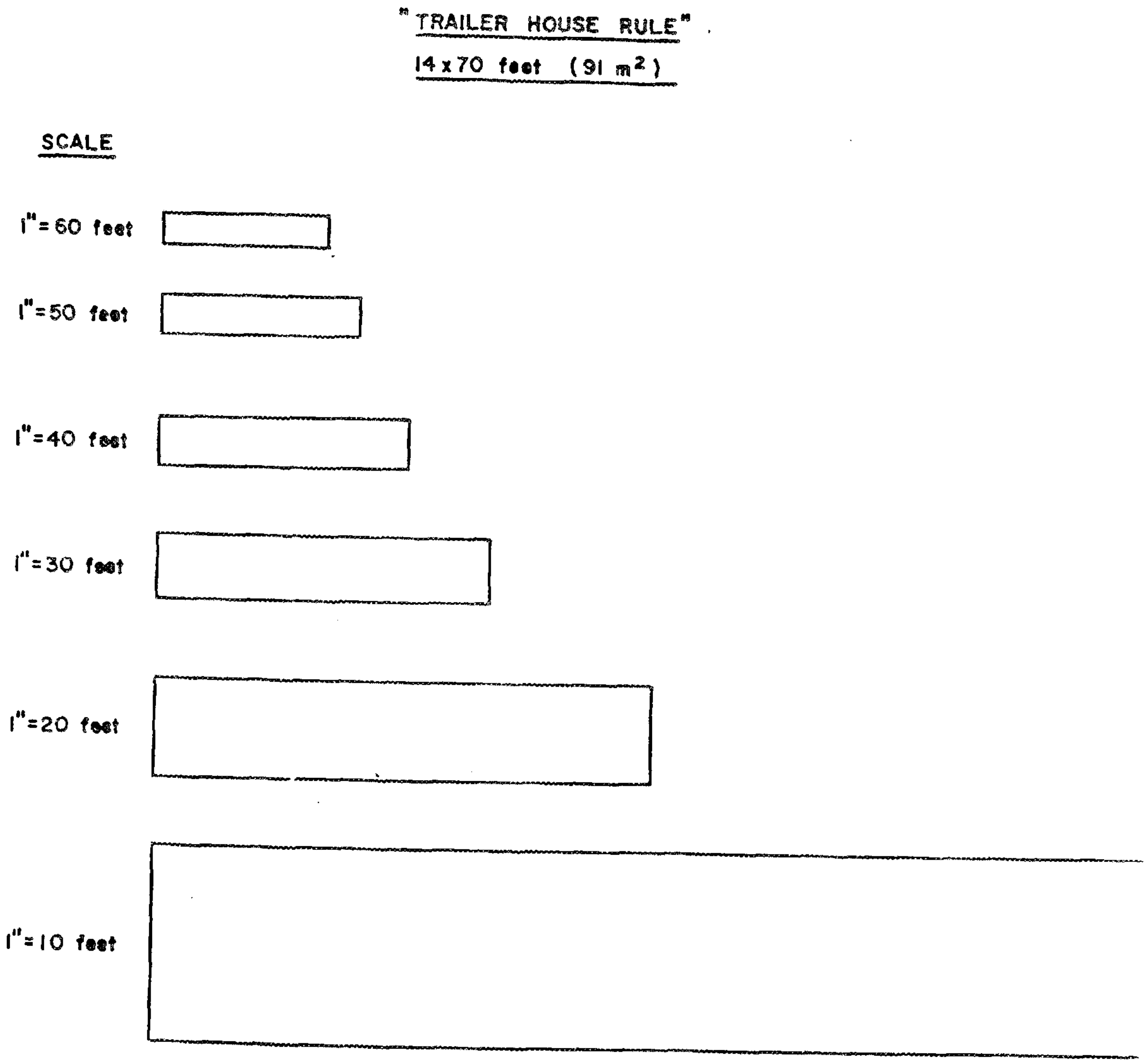
12) Familiarize Trainee with Plotting Commands and Plotter Set-Up

13) Review Period

14) Question and Answer Period

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-1. "Trailer house rule."



SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-2. Report skeleton.

Location Number: (xx???)

HEALTH AND SAFETY RESEARCH DIVISION

REPORT OF INCLUSION SURVEY AT LOCATION xx???
(address)
(address)

Investigation Team

B. A. Berven - RASA Program Manager
C. A. Little - RASA/UMTRA Project Director
- Survey Team Leader

(Author's name)

(Date) 1985

WORK PERFORMED AS PART OF THE
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Grand Junction Office
Grand Junction, Colorado 81502
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC-5-84OR21400

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-2 (Continued)

Location Number: xx???

INTRODUCTION

An inclusion radiological survey of location xx??? was conducted on survdate by Oak Ridge National Laboratory. This property, located at consists of . This survey was conducted using methods as defined in the Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601 (June 1984) and the Procedures Manual for the ORNL Remedial Action Survey and Certification Activities (RASCA) Program (September 1982). General location information is provided in Table 1, radiological survey results are given in Table 2 and 3, and supporting graphics are provided in Figure 1. Different views of the property are provided on Figures 2 and 3. All measurements are gross readings; background has not been subtracted.

(Insert for Direct Conversion):
The conversion formula used is y = x/CF, where 'y' equals the exposure rate in μR/h, 'x' equals the scintillometer measurements in kcpm, and 'CF' equals the conversions factor determined in the field through a direct correlation between PIC and scintillometer measurements in kcpm/μR/h. For this property, CF equals . for uncontaminated regions, . for contaminated regions, and . for indoor/other regions.

(or Insert for Conversion Equation):
The conversion formula used is y = mx + b, where 'y' equals the exposure rate in μR/h, 'x' equals scintillometer measurement in kcpm, and 'm' and 'b' are predetermined constants. On this property, 'm' equals and 'b' equals .

SIGNIFICANCE OF FINDINGS

Exhibit 10.6-2 (Continued)

RECOMMENDATION

RECOMMENDED FOR: Inclusion
RECOMMENDED FOR: Exclusion

RECOMMENDATION BASIS: Outdoor gamma is >25 μR/h above background averaged over 100 m^2

RECOMMENDATION BASIS: Outdoor gamma is <background plus 1 standard deviation or 30% averaged over 100 m^2

RECOMMENDATION BASIS: ^{226}Ra is >5 pCi/g above background in surface 15 cm soil layer averaged over 100 m^2

RECOMMENDATION BASIS: ^{226}Ra is >15 pCi/g above background in any subsurface 15 cm soil layer averaged over 100 m^2

RECOMMENDATION BASIS: Spillover from includable deposit on an adjoining property

RECOMMENDATION BASIS: Indoor gamma is >20 μR/h above background averaged in any room

RECOMMENDATION BASIS: Indoor gamma is <1 standard deviation or 30% above background in all rooms

RECOMMENDATION BASIS: Grab sample radon daughter concentration is >0.04 WL

RECOMMENDATION BASIS: Grab sample radon daughter concentration is <0.01 WL

RECOMMENDATION BASIS: Annual average radon daughter concentration is >0.02 WL

RECOMMENDATION BASIS: Annual average radon daughter concentration is <0.02 WL

Exhibit 10.6-2 (Continued)

Location Number: xx???

Table 1. Location Information

Property Information

LOCATION:

OCCUPANT/TENANT:

TELEPHONE:

Owner Information

OWNER:

ADDRESS:

TELEPHONE:

PROPERTY CLASSIFICATION:

TOTAL AREA OF PROPERTY:

STRUCTURES ON PROPERTY:

Exhibit 10.6-2 (Continued)

Location Number: xx???

Table 2. Radiological Screening Survey Results

Outdoor Screening Data

BACKGROUND EXPOSURE RATE:		μR/h
BACKGROUND + 1 STANDARD DEVIATION:		μR/h
BACKGROUND EXPOSURE RATE RANGE:		μR/h
EXPOSURE RATE RANGE IN CONTAMINATED REGIONS:	A:	μR/h
	B:	μR/h
	C:	μR/h
HIGHEST OUTDOOR GAMMA (HOG) IN CONTAMINATED REGION:		μR/h
LOCATION OF HOG:	Region ______	
POINT SOURCE*:		μR/h
ESTIMATED AREA OF OUTDOOR CONTAMINATION BY REGION:	A:	m^2
	B:	m^2
	C:	m^2
NET ESTIMATED AREA-WEIGHTED AVERAGE BY REGION**:	A:	μR/h
	B:	μR/h
	C:	μR/h

*Point source measurements are discussed in "Significance of Findings" section.

**Formula used: $G_{AW} = \dfrac{\sum_{i=1}^{n} G_i A_i}{100}$

where:

G_{AW} = the area-weighted exposure rate in [μR/h]
G_i = net average exposure rate in [μR/h]
($G_i = G_{Gross} - G_{Background}$)
A_i = area of region involved in [m^2] and,
100 = threshold area in [m^2]

Exhibit 10.6-2 (Continued)

Location Number: xx???

Table 2. Radiological Screening Survey Results (Continued)

Indoor Screening Data

STRUCTURE DESCRIPTION OR NUMBER:		
BACKGROUND EXPOSURE RATE:		μR/h
BACKGROUND + ONE STANDARD DEVIATION:		μR/h
BACKGROUND EXPOSURE RATE RANGE:		μR/h
EXPOSURE RATE RANGE IN CONTAMINATED REGIONS:	A:	μR/h
	B:	μR/h
	C:	μR/h
HIGHEST INDOOR GAMMA (HIG) IN CONTAMINATED REGION:		μR/h
LOCATION OF HIG:	Region______	
POINT SOURCE*:		
ESTIMATED AREA OF INDOOR CONTAMINATION BY REGION:	A:	m^2
	B:	m^2
	C:	m^2
NET ESTIMATED AREA-WEIGHTED AVERAGE BY REGION/ROOM**:	A:	μR/h
	B:	μR/h
	C:	μR/h

*Point source measurements are discussed in "Significance of Findings" section.

**Formula used: $x = \dfrac{\sum_{i=1}^{n} G_i A_i}{9.3}$

where:

x = area-weighted gamma exposure rate in [μR/h]
G_i = net gamma exposure rate in [μR/h]
A_i = area of deposit in [m^2]
9.3 = threshold area in [m^2]

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-2 (Continued)

Location Number: xx???

Table 3. Extended Survey Results

Outdoor Extended Data

Soil Sample Summary

Soil Sample Number	Region Sampled	Sample Depth (cm)	^{226}Ra Concentration (pCi/g) (Canalysis)	Representative (Biased) Sampling Area m^2	Net Estimated Area-Weighted Average* (pCi/g, CAW)

Indoor Extended Data

Radon Daughter Concentration (RDC) Data Summary

Bldg. ID	Room ID	Grab RDC (WL)	Annual average RDC (WL)**

*Formula used: $C_{AW} = \dfrac{\sum_{i=1}^{n} C_i A_i D_i}{(100)(.15)}$

where

C_{AW} = area-weighted ^{226}Ra concentration in [pCi/g]

C_i = net ^{226}Ra concentration in [pCi/g] and

(C_i = $C_{analysis}$ − $C_{background}$)

A_i = area of region that sample represents in [m^2]

D_i = thickness of sample in [m]

100 = threshold area in [m^2], and

.15 = threshold thickness in [m]

**Annual average (WL) determined by:____________________

Exhibit 10.6-2 (Continued)

Fig. 1. Location xx???

Exhibit 10.6-2 (Continued)

Fig. 2. Location xx???

Fig. 3. Location xx???

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-3. Letter of recommendation.

Mr. John G. Themelis
UMTRA Project Manager
U.S. Department of Energy
P.O. Box 5400
Albuquerque, NM 87108

Dear Mr. Themelis:

Radiation levels at the property identified below appear [] to [] not to exceed the U.S. Environmental Protection Agency (EPA) standards as specified in 40 CFR 192.

This evaluation is based on [] indoor [] outdoor screening measurement criteria, [] indoor [] outdoor extended measurement criteria of the U.S. Department of Energy _Vicinity Properties Management and Implementation Manual_ (UMTRA-DOE/A1-050601), Appendix A, and/or [] other criteria stated below.

Other:
____

____

This recommendation is based upon the Inclusion Survey Contractor's assessment of the [] ^{226}Ra concentration in the soil [] indoor radon daughter concentration [] indoor gamma exposure rate at this property.

Therefore, this property is recommended for [] inclusion in [] exclusion from the Uranium Mill Tailings Remedial Action Project.

Sincerely,

C. A. Little, Ph.D.
Inclusion Survey Contractor

cc w/o att: B. A. Berven, ORNL
P. Stassi, JEG

Location Number:____________________
Location Address:____________________
Property Owner:____________________
Owner Address:____________________
Tenant Name:____________________

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-4. VP summary evaluation and recommendation.

Location Number:__________

VICINITY PROPERTY SUMMARY EVALUATION AND RECOMMENDATION

1. SUMMARY EVALUATION

1.1 OUTDOOR MEASUREMENTS

	Inclusion Survey Contractor (ISC)			U. S. Department of Energy (DOE)		
	Yes	No	Not Taken*	Yes	No	Not Taken*
Gamma is >25 μR/h above background averaged over 100 m^2	[]	[]	[]	[]	[]	[]
Gamma is <1 standard deviation or 30% above background averaged over 100 m^2	[]	[]	[]	[]	[]	[]
^{226}Ra is >5 pCi/g above background in top 15 cm layer averaged over 100 m^2	[]	[]	[]	[]	[]	[]
^{226}Ra is >15 pCi/g above background in any subsurface 15 cm layer averaged over 100 m^2	[]	[]	[]	[]	[]	[]
Total activity of deposit(s) exceeds the total activity criterion	[]	[]	[]	[]	[]	[]

Exhibit 10.6-4 (Continued)

Location Number: ________

1.2 INDOOR MEASUREMENTS

	Inclusion Survey Contractor (ISC)			U.S. Department of Energy (DOE)		
	Yes	No	Not Taken*	Yes	No	Not Taken*
Gamma is >20 μR/h above background averaged in any room	[]	[]	[]	[]	[]	[]
Gamma is <1 standard deviation or 30% above background in all rooms	[]	[]	[]	[]	[]	[]
Grab sample radon daughter concentration is >0.04 WL	[]	[]	[]	[]	[]	[]
Grab sample radon daughter concentration is <0.01 WL	[]	[]	[]	[]	[]	[]
Annual average radon daughter concentration is >0.02 WL	[]	[]	[]	[]	[]	[]
Annual average radon daughter concentration is <0.02 WL	[]	[]	[]	[]	[]	[]

Other: ____

____

____

____

*Data were not taken because:

[] Data were not required to derive inclusion/exclusion recommendation.
[] This is a dovetail property.
[] Property owner did not authorize access for interior sampling.

Exhibit 10.6-4 (Continued)

Location Number: __________

2. INCLUSION SURVEY CONTRACTOR RECOMMENDATION

Based on the ISC's evalution, I recommend this property for [] inclusion in [] exclusion from the Uranium Mill Tailings Remedial Action Project.

______________________ ______________

C. A. Little, Ph.D. Date
Inclusion Survey Contractor

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-4 (Continued)

Location Number: ________

3. DOE EVALUATION

Based on the DOE's evalution, [] this property should be included, [] this property should be excluded, or [] additional data are required to support a determination.

____________________ ____________

DOE Evaluator Date

3.1 ADDITIONAL DATA REQUIRED:

3.2 ISC'S RESPONSE TO DOE'S REQUEST FOR ADDITIONAL DATA:

3.3 DOE APPROVAL OF RESPONSE:

Based on the DOE's review of this evaluation, including the further information provided by the ISC in Sect. 3.2 above, this property should be an [] inclusion [] exclusion.

____________________ ____________

DOE Evaluator Date

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-5. Code sheet for VPDMS.

___ Site Code (Table 1)	___ Location Number	___ Location Class (Table 2)

FIELD	ENTRY	FIELD NAME
		DMS1 - CODE TYPES
3	___/___/___	Date consent form sent
4	___	Inclusion/Exclusion Decision (I or E)
9	___	Tailings location (Table 3)
17	___	HIG reading source (Table 4)
18	___	HOG reading source
19	___	RDC reading source
20	___	RDC measurement type (Table 5)
		DMS1 - SURVEY RESULTS
1	______	Initial high inside gamma (microR/hr)
3	______	Initial high outside gamma (microR/hr)
4	______	Initial RDC reading (WL)
9	______	Maximum soil radium content (100m^2 average)
		DMS2 - PROPERTY SCHEDULE "A"
2	___/___/___	Forecasted date consent form received
3	___/___/___	Actual date consent form received
4	___/___/___	Forecasted DOE inclusion survey date
5	___/___/___	Actual DOE inclusion survey date
6	___	Type of inclusion survey (Table 6)
7	___/___/___	Inclusion/Exclusion Decision Date

DMS3 - OWNER/TENANT INFORMATION

___ Owner/Tenant Code

O = The following address is that of owner; owner does not reside at the property.
P = The following is property address (include tenant's name, if applicable).
B = Both (the owner resides on property).

2. ______________________________
Owner/Tenant Name (Last Name First) or Legal Title

3. ______________________________
Street Address if Property; Mailing Address if Owner

4. ______________ City 5. ______ State 6. ______ Zip

7. (_____) Area Code 8. ______________ Phone No.

SUBJECT: POST-INCLUSION SURVEY ACTIVITIES

Exhibit 10.6-6. ISC condensed exclusion report.

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC

GRAND JUNCTION OFFICE
P.O. BOX 2567
GRAND JUNCTION, COLORADO 81502

Location Number: ______
Location Address: ______
______

Date of Issue: ______
Survey Date: ______

ISC CONDENSED EXCLUSION REPORT
ORNL Health and Safety Research Division
Work performed as part of the Radiological Activities Program

This radiological survey was conducted using methods as defined in the Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601 (June 1984) and the RASA/UMTRA Procedures Manual (September 1985). This property is recommended for exclusion from further consideration by the UMTRA Project based on: (recommendation basis)
______
______.

Supporting graphics, views and data are as follows:

-Owner Information-
Owner Name(s): ______
Owner Address: ______
______

-Outdoor Screening Data-
Exposure Rate Range(s): ______ uR/hr
______ uR/hr
______ uR/hr
Background Exposure Rate + 1 Standard Deviation: ______ uR/hr
High Outdoor Gamma(HOG): ______ uR/hr
Point Source(*): ______ uR/hr

-Indoor Screening Data-
Structure(s) Description: ______
Exposure Rate Range(s): ______ uR/hr
______ uR/hr
______ uR/hr
Background Exposure Rate + 1 Standard Deviation: ______ uR/hr
High Indoor Gamma(HIG): ______ uR/hr
Point Source(*): ______ uR/hr

-Soil Sample Data-

Soil Sample Number	Sample Depth (cm)	226Ra Concentration (pCi/g)	Sample Area (m^2)	Net Estimated Area-Weighted Average(pCi/g)

Comments: ______
______
______

______ Inclusion Survey Contractor

______ DOE Evaluator

SECTION 11: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11. EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11.1 MOBILE LABORATORY EQUIPMENT INVENTORY

11.1.1 Purpose

The purpose of this procedure is to establish a minimum inventory of equipment and supplies for the mobile scan van and provide a method for maintaining the minimum inventory levels.

11.1.2 Applicability

This procedure applies to the mobile scan van used in the RASA/UMTRA program.

11.1.3 References

None.

11.1.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

11.1.5 Responsibilities

11.1.5.1 Mobile Scan Team Leader

The Mobile Scan Team Leader is responsible for the implementation of this procedure.

11.1.6 Procedure

11.1.6.1 Mobile Gamma Scan Van

The Mobile Scan Team Leader ensures that the vehicle is in proper operating condition before it leaves ORNL and that all servicing has been completed according to ORNL garage scheduled maintenance.

11.1.6.2 Equipment

Before the vehicle leaves ORNL, the Mobile Scan Team Leader conducts an inventory of the equipment and supplies. The quantities of each item are compared with those of the equipment list and any deficiencies are brought up to standard inventory level prior to departure on a field assignment.

11.1.7 Exhibits

1. Exhibit 11.1-1, Mobile scanning van equipment inventory levels

11.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

11.2 FIELD VAN EQUIPMENT INVENTORY

11.2.1 Purpose

The purpose of this procedure is to establish a minimum inventory of equipment and supplies for the field vans and to provide a method for maintaining the minimum inventory levels.

11.2.2 Applicability

This procedure applies to all field vans in the ORNL/RASA UMTRA project.

11.2.3 References

None.

11.2.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

11.2.5 Responsibilities

11.2.5.1 Team Leader

The Team Leader is responsible for the implementation of this procedure.

11.2.6 Procedure

11.2.6.1 Field Van

The Team Leader ensures that the vehicle is in proper operating condition before it leaves ORNL/RASA UMTRA headquarters and that all scheduled maintenance has been completed.

11.2.6.2 Equipment

Before the van leaves ORNL/RASA UMTRA headquarters, the Team Leader conducts an inventory of the equipment and supplies in the field van. The quantities of each item are compared with those of the equipment list (Exhibit 11.2-1), and any deficiencies are brought up to standard inventory level prior to departure on a field assignment.

11.2.7 Exhibits

1. Exhibit 11.2-1, Field van equipment inventory levels

11.2.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

11.3 EQUIPMENT MAINTENANCE LOGS

11.3.1 Purpose

The purpose of this procedure is to describe the maintenance logs for instruments, equipment, and vehicles used in the RASA/UMTRA project and to define the requirements for maintenance entries into appropriate log books for RASA/UMTRA maintained instruments and equipment.

11.3.2 Applicability

This procedure applies to all maintained instruments, equipment, and vehicles utilized in the RASA/UMTRA project.

11.3.3 References

None.

11.3.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

11.3.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure, and the Electronics Technician performing the maintenance function on RASA/UMTRA maintained instruments and equipment is responsible for incorporating the maintenance entry into the appropriate log book.

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11.3.6 Procedure

Maintenance logs for maintained equipment include three categories.

1. Vehicle maintenance logs,
2. BFEC calibrated instrument maintenance logs, and
3. RASA/UMTRA maintained instrument logs.

11.3.6.1 Vehicle Maintenance Logs

All vehicle maintenance is entered into a log book maintained and controlled by the BFEC garage. The BFEC garage facility has total responsibility for entering service, maintenance, and repairs into the appropriate log book.

11.3.6.2 BFEC Calibrated Instrument Maintenance Log

All maintenance performed on instruments calibrated by BFEC is entered into a log book maintained and controlled by BFEC. The BFEC facility has total responsibility for entering service, maintenance, and repairs into the appropriate log book. BFEC calibrated instruments include: pressurized ion chambers, portable gamma scintillation detectors, and the soil lab analysis equipment.

11.3.6.3 Other Instrument Calibration

The mass scales located in the soil preparation trailer are calibrated by QA Balance Service in Denver, Colorado. The RASA/UMTRA Electronics Technician has responsibility for entering service, maintenance, and repairs into the appropriate log book.

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11.3.6.4 RASA/UMTRA Maintained Instrument Logs

RASA/UMTRA maintained equipment and instruments

RASA/UMTRA maintained instruments and equipment include all instruments and equipment not covered in Sects. 6.1, 6.2, and 6.3 of this procedure. RASA/UMTRA personnel also perform minor maintenance functions on instruments and equipment covered under Sect. 6.2 of this procedure.

Log book entries

The Electronics Technician will enter into the calibrated instrument log book the following information.

1. Date
2. Identification number of the equipment
3. Date of last calibration
4. Date of next calibration scheduled

The information on the lab calibration data sheet sent with the returned equipment will be verified and initialed by the Electronics Technician and placed in the individual equipment file.

11.3.7 Exhibits

None.

11.3.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

11.4 EQUIPMENT CALIBRATION RECORDS

11.4.1 Purpose

The purpose of this procedure is to describe the equipment calibration records maintained by RASA/UMTRA for instrumentation used in the RASA/UMTRA project.

11.4.2 Applicability

This procedure applies to all instrument calibration records maintained by RASA/UMTRA in support of the RASA/UMTRA project.

11.4.3 References

1. Sect. 12, Calibration of Measurement and Test Equipment

11.4.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

11.4.5 Responsibilities

1. The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.
2. The Electronics Technician is responsible for the entry of calibration data into the calibration records.

11.4.6 Procedure

RASA/UMTRA maintains two calibration databases for calibrated instruments, as follows: the calibrated instrument file and the log book calibration entries.

11.4.6.1 Calibrated Instrument File

The calibrated instrument file is organized and maintained in a data retrievable manner by the Electronics Technician at the RASA/UMTRA facility.

Instrument calibration data included in the calibrated instrument file include all calibrations on the following instruments.

1. Pressurized ion chambers
2. Gamma scintillation detectors
3. Mass scales

Following calibration, upon return of the instrument, the Electronics Technician records the calibration data from the calibration sticker placed on the instrument(s) by BFEC or QA and enters the information in the calibrated instrument file. Calibrated data requirements are contained in the individual calibration procedures for the appropriate instrument (see Sect. 12 of this manual, Calibration of Measurement and Test Equipment).

11.4.6.2 Log Book Calibration Entries

Calibration information is entered in appropriate log books located at the RASA/UMTRA facility and at survey sites as follows.

1. Na(I) detector log book (located at the RASA/UMTRA soils laboratory);
2. Instrument calibration log book (located at the RASA/UMTRA Instrumentation office);
3. Field van log book (one located on each field van); and
4. Air pump and mass flow meter calibration log book (located at the RASA/UMTRA laboratory);

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

Calibration data requirements are contained in the individual calibration procedures for the appropriate instrument (see Sect. 12 of this manual, Calibration of Measurement and Test Equipment).

11.4.7 Exhibits

None.

11.4.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

11.5 NEW EQUIPMENT CERTIFICATION

11.5.1 Purpose

The purpose of this procedure is to provide a method to ensure that all new equipment is certified to meet intended performance specifications prior to initial use in the RASA/UMTRA project.

11.5.2 Applicability

This procedure applies to all new equipment and instrumentation to be utilized in the RASA/UMTRA project. The instrumentation and equipment include commercially available, custom made, and ORNL prototype devices.

11.5.3 References

Sect. 15.3, Procedure Preparation

11.5.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11.5.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure, and the Electronics Technician is responsible for performance of this procedure.

11.5.6 Procedure

Instrumentation and equipment requiring certification fall into two general classes as follows.

1. Instrumentation and test equipment (commercial construction, including factory modifications) and
2. Prototype instrumentation and equipment (including vendor and ORNL construction).

11.5.6.1 Instrumentation and Test Equipment

Prior to use in the RASA/UMTRA project, all new instrumentation and test equipment is assigned a control number and is appropriately marked (labelled, etc.) by the Electronics Technician or other designated individual. The device is then taken to an appropriate testing facility (either the ORNL Instrumentation & Controls shop or the Bendix Field Engineering Instrument Test & Calibration Facility). A preliminary check is made of the device to ensure conformance to design specifications and performance requirements. Maintenance and calibration records are established by the control number. Modifications should be documented on the instrument and a record of the modification maintained by RASA/UMTRA. The device is calibrated according to the appropriate calibration procedure.

Following successful completion of the testing and calibration, the device is returned to RASA/UMTRA for use. If, however, the device fails any required performance test or fails to meet design specifications, the device is returned to RASA/UMTRA with a notation to that effect. RASA/UMTRA disposition options of the nonconforming device include: return to vendor for repair, return to vendor for exchange, return to vendor for credit, or return to ORNL for repair. The disposition option exercised is dependent on a series of judgment factors unique to each situation.

11.5.6.2 Prototype Instrumentation and Equipment

All prototype instrumentation and equipment has its own set of design specifications, performance requirements, and acceptance criteria established prior to device construction. Following completion of the device construction, the Electronics Technician determines if assistance external to RASA/UMTRA will be required to verify that the device conforms to previously determined acceptance criteria.

If external assistance is required, the Electronics Technician makes all necessary arrangements with the appropriate organization (internal or external to ORNL) to verify conformance with the acceptance criteria. If external assistance is not required, the Electronics Technician performs all testing and calibration necessary to verify that the prototype device meets the acceptance criteria. If the development of a specific calibration procedure is required, Sect. 15.3, Procedure Preparation, is consulted. Following successful completion of the testing, the device is placed in service, and calibration and maintenance records are generated, if appropriate.

If the prototype device fails to meet acceptance criteria, RASA/UMTRA disposition of the nonconforming device may include: repair, redesign, and construction to meet established acceptance criteria; re-evaluation of acceptance criteria based on operational needs for the device; or abandonment of the device.

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

11.5.7 Exhibits

None.

11.5.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

Exhibit 11.1.7-1. Mobile scanning van support equipment and supplies.

Office supplies:

1. Stapler and staples
2. Three-hole paper punch
3. Paper clips
4. Tape, masking and Scotch
5. Pens, pencils, colored pencils
6. 3-ring binders with inserts

Van accessories:

1. Tire wrench
2. First aid emergency kit
3. Quart of oil
4. Two-ton hydraulic jack
5. Tire pressure gauge, to 100 psi
6. Waste basket
7. Road map
8. Slow-moving-vehicle sign

Electronic tools:

1. Voltmeter (VOM)
2. Tool kit (pliers, cutter, soldering iron, screw driver)
3. ORTEC Model 448 Research Pulser
4. Digital voltmeter
5. Frequency counter

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

Exhibit 11.1.7-1 (Continued)

Scanning supplies and backup equipment:

1. Tractor printer paper
2. Blank diskettes
3. Backup electronics components

    a. Ortec High Voltage Power Supply Model 456, 0-3kV
    b. Ortec AMP & SCA, Model 490B
    c. Ortec LOG/LIN RATEMETER, Model 449
    d. Ortec Model 113 Preamplifier
    e. Tracor Northern Multichannel Analyzer 1706 and Model 1314 CRT

Exhibit 11.2.6-1. Field van equipment inventory levels.

Item	Quantity required	Quantity on hand	Supplies needed
	Supplies		
Large plastic bags (garbage type)	1 roll	________	________
Aluminum foil pans	50	________	________
Foil pan lids	50	________	________
"Turkey bags" (large plastic)	200 ea	________	________
Kleenex	3 boxes	________	________
"D" cell batteries (Duracell)	24 ea	________	________
Gloves, leather (small)	6 pair	________	________
Gloves, leather (medium)	6 pair	________	________
Gloves, leather (large)	6 pair	________	________
Gloves, cotton (one size)	12 pair	________	________
Gloves, rubber (one size)	12 pair	________	________
	Office supplies and forms		
Scotch tape	2 rolls	________	________
Ball point pens	36 ea	________	________
Black sharpies (fine line pens)	2 boxes	________	________
Log book - small (150 pages)	2 ea	________	________

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

Exhibit 11.2.6-1 (Continued)

Item	Quantity required	Quantity on hand	Supplies needed
Office supplies and forms (continued)			
Scheduling sheet	1 ea	______	______
City map	1 ea	______	______
Field forms	6 ea	______	______
Soil data sheets	6 ea	______	______
Scale card	1 ea	______	______
Property map	1 ea	______	______
Consent to access form	1 ea	______	______
Tools			
100 ft crank tape	2 ea	______	______
25 ft tapes	2 ea	______	______
Posthole digger	1 ea	______	______
Shovel (long-handle, round point)	1 ea	______	______
Pick	1 ea	______	______
Scoops (sampling)	2 ea	______	______
Buckets	12 ea	______	______
Hand tools	1 tool chest	______	______
Vehicle			
Field van keys	3 sets	______	______
U.S. government credit card	1 ea	______	______

SUBJECT: EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE

Exhibit 11.2.6-1 (Continued)

Item	Quantity required	Quantity on hand	Supplies required
Instrumentation			
Gamma scintillators/ headphones	6 ea	______	______
Logging shield for scintillator	1 ea	______	______
Pressurized ion chamber	1 ea	______	______
Calibration sources[a]			
Equipment			
Photographic equipment	1 ea	______	______
BNC connectors	24 ea	______	______
Spare scintillator cables	6 ea	______	______
Spare scintillator earphones	6 ea	______	______
0.05 mm mechanical pencil	3 ea	______	______
Rain boots (1 per crew member)	4 ea	______	______
Rain hat (1 per crew member)	4 ea	______	______
Rain pants (1 per crew member)	4 ea	______	______
Rain coats (1 per crew member)	4 ea	______	______

[a]See procedures for appropriate instrumentation to determine which field check sources to include in inventory.

SECTION 12: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12. CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.1 CALIBRATION OF PORTABLE GAMMA-SCINTILLATION DETECTORS

12.1.1 Purpose

The purpose of this procedure is to provide a method for the laboratory calibration, field check, and onsite cross-calibration of portable gamma-scintillation detectors.

12.1.2 Applicability

This procedure applies to all standard portable gamma-scintillation detectors used in the RASA/UMTRA project.

12.1.3 References

1. Sect. 9.4, Background Measurements
2. Sect. 10.1.6.1, Conversion of Scintillometer Count Rates to Exposure Rates
3. Sect. 11.4, Equipment Calibration Records
4. Sect. 12.2, Calibration of Pressurized Ion Chamber
5. Instruction Manual for Model 490, THYAC III, (Victoreen Inc.)
6. ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration

12.1.4 Definitions and Abbreviations

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.1.4.1 Definitions

LOG BOOK. An instrument calibration log book will be used for all laboratory calibration data and is located at the Electronic Technician's office. At a vicinity property survey location, the field van log book will be used for all calibration-related field activities.

Also see Sect. 1.5 of this manual, Terminology.

12.1.4.2 Abbreviations

CAM-1 Depleted uranium check source

Also see Sect. 1.5 of this manual, Terminology.

12.1.5 Responsibilities

The Electronics Technician and field survey Team Leaders are responsible for implementing this procedure.

12.1.6 Procedure

12.1.6.1 Equipment and Supplies

1. Portable Gamma-Scintillation Detector (Victoreen Model 490 THYAC III) Ratemeter with 489-55 NaI(Tl) Scintillation Probe.

12.1.6.2 Radiation Sources

CAM-1 depleted uranium check source. Nominally, 18,000 net cpm using portable gamma-scintillation detector.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.1.6.3 Calibration Frequency

Primary laboratory calibration will be performed at least quarterly and immediately following any adjustment to or maintenance of the instrument. A field operation check is performed daily during use. Onsite cross-calibration of instrument readings with PIC exposure rate measurement is performed as necessary.

12.1.6.4 Applicable Standards

1. ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration (for guidance only).

12.1.6.5 Calibration Procedure

Laboratory calibration

1. The Electronics Technician should notify the Team Leader to whom the instrument has been assigned that the instrument is due for calibration.
2. The Electronics Technician shall collect the instrument and take it to the BFEC Electronics Shop for calibration.
3. Following calibration and upon receipt of the instrument, the Electronics Technician will verify the instrument identification and probe numbers and that BFEC has affixed a calibration tag to the instrument.
4. The Electronics Technician will enter into the instrument calibration log book the instrument number and date of calibration.

Field check

1. Check battery condition by setting range switch to BAT position and observing THYAC III meter. Indicator should be in Bat.Check region or battery replacement is mandatory. (See Instruction Manual for Model 490, THYAC III, and step 2, Sect. 6.9.)
2. Set Response switch to MEDIUM position and the Range switch to appropriate position (maximum upscale deflection without going off scale).

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

3. Determine background level and record background cpm in the field van log book. This is usually done at a reference site for the area to be surveyed.
4. Place probe in contact with the CAM-1 depleted uranium check source and read gross cpm. This is usually done at the survey site.
5. The net cpm reading must agree within Laboratory accepted limits (approximately ±20%) of the reading taken during the previous field check. (See System Adjustments, Sect. 6.8 of this procedure.)
6. If the reading obtained in step 5 is within the acceptable range, the instrument is now ready for use. If the reading is out of the acceptable range, change batteries and repeat steps 4 through 5. If reading is still out of acceptable range, return instrument to RASA/UMTRA Electronics Technician for repair and recalibration according to Sect. 6.5.1 of this procedure.
7. Enter into the field van log book the instrument number, source number, net cpm, date, location at which check was made, and initials of person making the check.

Cross-Calibration with PIC (Sites Outside Grand Junction)

1. Set up PIC at an outdoor location according to Sect. 9.4, Background Measurements.
2. Perform PIC field check according to Sect. 12.2, Calibration of Pressurized Ion Chamber.
3. Hold portable gamma scintillator at a height of six inches above the ground. Record gamma scintillator reading in cpm.
4. Place the PIC with the handle up directly on the spot measured with the scintillator, with #1 side position oriented to the north.
5. Record PIC reading in μR/h.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

6. Record data in field van log book.
7. Repeat steps 1 through 8 for an indoor location, if necessary.
8. Calculate cross-calibration factor for each location according to Sect. 10.1.6.1 of this procedure, Conversion of Scintillometer Count Rates to Exposure Rates.

12.1.6.6 Log Book Entries

All log book entries should be made in the appropriate log book in accordance with this procedure and Equipment Calibration Records, Sect. 11.4.

12.1.6.7 System Adjustments

High voltage may be adjusted only by the Electronics Technician.

12.1.6.8 Special Notes and Instructions

1. Instrument may be calibrated to thorium or other source, instead of radium, upon request.
2. Replace batteries after every 24 hours of use, or when check readings taken in accordance with Sect. 12.1.6.5 are unacceptable.

12.1.7 Exhibits

None.

12.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.2 CALIBRATION OF PRESSURIZED ION CHAMBER

12.2.1 Purpose

The purpose of this procedure is to provide a method for the laboratory calibration and field check of Pressurized Ionization Chambers.

12.2.2 Applicability

This procedure applies to all standard pressurized ionization chambers used in the RASA/UMTRA program.

12.1.3 References

1. Sect. 9.4, Background Measurements
2. Sect. 11.4, Equipment Calibration Records
3. Sect. 14.1, Procurement of Services and Equipment
4. ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration (for guidance only)
5. Reuter-Stokes RSS-111, Area Monitor System Operational Manual

12.1.4 Definitions and Abbreviations

12.1.4.1 Definitions

LOG BOOK. At the RASA/UMTRA Instrument Office, the Instrument Calibration Log Book will be used for all laboratory calibration. At a survey site, the Field Van Log Book will be used for all calibration related field activities.

Also see Sect. 1.5 of this manual, Terminology.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.2.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

12.2.5 Responsibilities

The Electronics Technician and the field survey Team Leaders are responsible for implementing this procedure.

12.2.6 Procedure

12.2.6.1 Equipment and Supplies

A Reuter-Stokes RSS-111, Area Monitoring System (PIC).

12.2.6.2 Calibration Frequency

Primary laboratory calibration will be performed bi-annually by BFEC. No field calibration is performed; field operational check is performed before each use (see Sect. 12.4.2).

12.2.6.3 Applicable Standards

1. ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration is the applicable standard to be used (for guidance only).

12.2.6.4 Calibration Procedure

Laboratory calibration

1. The Electronics Technician shall notify the Team Leader to whom the instrument has been assigned that it is due for calibration.
2. The Electronics Technician shall take it to the BFEC Electronics Shop for calibration.

3. Following calibration and upon receipt of the instrument, the Electronics Technician will verify the instrument identification and probe numbers and that the calibration facility has provided adequate calibration data on the instrument.
4. The Electronics Technician will enter into the instrument calibration log book the instrument number and the date of calibration. The calibration data sheet is then placed in the appropriate PIC file.

Field check

NOTE: Make sure all switches are in OFF position before connecting or disconnecting cable.

Battery check.

1. Test 300 V dry cell by turning on DISPLAY/RECORDER switch, turn ELECTROMETER switch to zero, MODE switch to BATT position, and simultaneously press PUSH TO READ and 300 V push buttons. The percentage of charge status will appear on digital display. If percentage of charge falls below 85%, replace battery according to paragraph 4.3 of Reuter-Stokes RSS-111 Area Monitor System Operational Manual.
2. Test -14, +14, and +12 batteries by depressing each of the three push buttons marked -14, +14, and +12 and noting the meter indication on one of the three meters immediately above the push button. If meter indicator is in or near the shaded area of the meter, recharge batteries according to paragraph 4.2 of Reuter-Stokes RSS-111 Area Monitor System Operational Manual.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

Check source test.

1. Following the procedure in 9.6.2.2, Equipment Set-up and Operation, determine instrument background by pressing PUSH TO READ and reading μR/h value. (Verify that no gamma radiation sources are in the proximity of the detector.)
2. Place check source on top of PIC detector assembly and align with source position marker outlined on body of detector.
3. Wait a minimum of 5 s, press PUSH TO READ, and read μR/h value.
4. Enter net μR/h value in portable instrument log book.
5. If μR/h value determined differs from last field check value by less than the Laboratory acceptance limits (approximately ±20%) the instrument is ready for use. If μR/h determined differs from last field check value by more than the Laboratory acceptance limits (approximately ±20%) send instrument out for laboratory calibration following Sect. 6.4.1 of this procedure.

12.2.6.5 Calculations

$$\text{Net } \mu R/h = \text{gross } \mu R/h - \text{background } \mu R/h.$$

12.2.6.6 Log Book Entries

All log book entries should be made in accordance with this procedure and Equipment Calibration Records, Sect. 11.4.

12.2.7 Exhibits

None.

12.2.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.3 CALIBRATION OF SOIL LABORATORY GAMMA SPECTROMETRY SYSTEM

12.3.1 Purpose

The purpose of this procedure is to provide a method for calibration of the soil laboratory gamma spectrometry system.

12.3.2 Applicability

This procedure applies to the gamma spectrometry system used in the RASA/UMTRA soil laboratory, including the thallium-activated sodium iodide [NaI(Tl)] well crystals and the Nuclear Data (ND) counting system.

12.3.3 References

1. ND66 Operating Manual
2. ND66 Basic Programming Manual
3. ND575 Operating Manual
4. ORTEC 456 Operating Manual
5. ORTEC 490B Operating Manual
6. ORTEC 113 Operating Manual
7. R. W. Doane, B. A. Berven, and M. S. Blair, "A Computer-Controlled System for Rapid Soil Analysis of ^{226}Ra," pp. 7.173-7.178 in Proceedings of 17th Mid-Year Symposium of the Health Physics Society (1984).
8. IBM Basic A Programming Manual

12.3.4 Definitions and Abbreviations

12.3.4.1 Definitions

CALIBRATED INSTRUMENT FILE. Calibration records shall be maintained by the Sample Coordinator.

See Sect. 1.5 of this manual, Terminology.

12.3.4.2 Abbreviations

ND66	Nuclear Data Model 66 gamma spectrometry system
ADC	analog to digital converter
Preamp	preamplifier
Amp	amplifier
H.V.	high voltage
ROI	regions-of-interest
CRT	cathode ray tube

Also see Sect. 1.5 of this manual, Terminology.

12.3.5 Responsibilities

The Sample Coordinator is responsible for the implementation of this procedure. The ORNL Instrumentation & Controls (I&C) Division is responsible for computer software maintenance and development, and the Bendix Electronics Laboratory is responsible for the electronics calibration and repair.

12.3.6 Procedure

12.3.6.1 Equipment

ND66/NaI(Tl) Well Detector System as specified by Sect. 10.3, Soil Radium Content Analysis.

12.3.6.2 Radiation Sources

1. ^{226}Ra Standard Reference Materials from DOE Technical Measurements Center

   a. 5.12 ± 0.2 pCi/g at 2σ

   b. 15.12 ± 0.45 pCi/g at 2σ

   c. 50.2 ± 1.57 pCi/g at 2σ

2. ^{137}Cs, ^{40}K, and ^{232}Th sources used only for gamma energy calibration.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.3.6.3 Energy Calibration

Frequency

Energy calibration is necessary at the start of a counting session, when system operation is suspect, and immediately following maintenance or adjustment of the instrument.

Procedure

1. Clean both well detectors with laboratory grade alcohol using a clean paper towel.
2. Place ^{137}Cs source in well 1.
3. Begin data acquisition using procedures described in "Keyboard Commands," Reference 1, ND66 Operating Manual.
4. Set cursor channel at 111.
5. Observe gamma spectrum on the CRT.
6. Adjust "fine gain" control on the front panel of the amplifier for ADC #1 so that the 0.661 MeV gamma peak is centered on the cursor (channel 111).
7. Place ^{40}K source in well 1; set cursor at channel 243.
8. Observe gamma spectrum on CRT.
9. Check to see that the 1.460 MeV gamma peak is at 243 $\pm$1 channel.
10. Adjust the fine gain control if needed; if needed repeat steps 2-9.
11. Place ^{232}Th sources in well 1; set cursor at channel 433.
12. Observe gamma spectrum on CRT.
13. Check to see that the 2.614 MeV peak is at 433 $\pm$ 5 channels.
14. If peak is not within given channel range, repeat steps 2-13.
15. If peak is still not within given channel ranges, notify the RASA/UMTRA Electronics Technician.
16. Repeat steps 2-15 for wells 2 and 3 and their corresponding amplifiers.

SUBJECT: CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

12.3.6.4 Counting Accuracy Check

Frequency

Weekly or when system operation is suspect.

Procedure

1. Insert appropriate ^{226}Ra standard reference material in well counter.
2. Count sample as described in Sect. 10.3, Soil Radium Content Analysis.
3. Verify that counting system results agree with the standard value (within the specified deviation at 2σ).
4. If system results do not agree with the standard value, initiate Energy Calibration or Electronics Calibration, as necessary.

12.3.6.5 Electronics Calibration

Frequency

Every six months or when system operation is suspect.

Procedure

Electronics calibration is performed using standard methods by the Bendix Electronics Laboratory. These personnel perform zero intercept, high-voltage settings, initial amplifier settings, and other adjustments using procedures described primarily in Reference 3, ND575 Operating Manual. Other calibrations are performed according to device-specific procedures given in the operating manuals referenced in Sect. 3 of this procedure.

Electronics Settings

(Existing on original form.)

ND66/NaI(Tl) Well Detector Systems Electronic Settings

1. ORTEC Model 456 high voltage power supply: 1000 VDC
2. ORTEC Model 490B amplifier: side panel: input polarity = negative unipolar pulses

   ADC #1 front panel: course gain = 16
   fine gain = 9.4 (or as needed)

   ADC #2 course gain = 16
   fine gain = 8.5 (or as neded)

   DIFF/INT switch = INT for both ADCs
3. ORTEC Model 113 preamplifier: 200 pf input capacities for ADC #1

   500 pf input capacities for ADC #2
4. ND 575 ADC: Conversion gain = 512
   ACQ switch = up
   COIN switch = off

Note: Do not apply full 1000 VDC to detectors all at once. Switch to 500 V setting first, wait approximately 5-10 seconds then switch to 1000 V setting.

12.3.6.6 Calibration Records

1. The Sample Coordinator shall record all energy calibration and counting accuracy check data in soils laboratory log book. The dates and findings of all electronics calibrations and the resulting electronics settings also will be recorded in the log book.
2. The Bendix Electronics Laboratory shall maintain an electronics calibration log book for the RASA/UMTRA soil counting system.

12.3.6.7 Computer Software

The computer software used to acquire, interpret, and store soil counting data is based on the algorithm described in Reference 7 and was implemented using the programming techniques of Reference 2 and 8. The RASA/UMTRA Sample Coordinator and I&C Division personnel collaborate to maintain the software and to improve it from time to time. The current version is in the copyright/patent process, and, therefore, cannot be listed in this manual.

12.3.7 Exhibits

None.

12.3.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SECTION 13: DATA MANAGEMENT

13.1 Applications Software Documentation

13.2 Software Configuration Control

13.3 Software Verification and Validation

13.4 Data Storage and Archival

13. DATA MANAGEMENT

13.1 APPLICATIONS SOFTWARE DOCUMENTATION

13.1.1 Purpose

The purpose of this procedure is to provide recommended guidance in the preparation of computer program documentation.

13.1.2 Applicability

This procedure applies to all computer programs generated by RASA/UMTRA for internal use on systems controlled exclusively by RASA/UMTRA.

13.1.3 References

1. Sect. 13.3, Software Verification and Validation
2. ANSI N413-1974, Guidelines for the Documentation of Digital Computer Programs (for guidance only)

13.1.4 Definitions and Abbreviations

13.1.4.1 Definitions

DOCUMENTATION. All supporting data used to produce a computer program and explain the operation of the program.

REMARKS. Explanatory statements within the body of the program serving no function with respect to the operation of the program.

PROGRAMMER. Author of computer program.

PROGRAM FILE FOLDER. Repository for all program documentation.

SUBJECT: DATA MANAGEMENT

13.1.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.

The Computer Systems Manager or personnel generating the program is responsible for the documentation of the program and retention of all documentation.

13.1.6 Procedure

13.1.6.1 Format

A free style format is employed by RASA/UMTRA in the generation of computer documentation, enabling the programmer to use his or her judgement and discretion.

13.1.6.2 Recommended Content

1. Identification or name to uniquely identify the program;
2. Abstract definition of what the program does;
3. Methodology summarizing the input and output ranges and constraints, theory and mathematical derivations employed;
4. Subroutines and libraries used in the program;
5. Author of program;
6. References used in program development;
7. Error messages and their interpretation; and
8. Program listing (a hard copy listing of the computer code).

13.1.6.3 Program Modification

All program changes should be documented and the documentation placed in the program file folder.

13.1.7 Exhibits

None.

SUBJECT: DATA MANAGEMENT

13.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

13.2 SOFTWARE CONFIGURATION CONTROL

13.2.1 Purpose

The purpose of this procedure is to maintain control of production copies of applications software. Control of the software consists of use, system authorization, backup, and update of software and magnetic media.

13.2.2 Applicability

This procedure applies to all computer programs generated by RASA/UMTRA for internal use on systems controlled by RASA/UMTRA.

13.2.3 References

ADP Management Manual, Martin Marietta Energy Systems, Inc., Policy Procedure d-2-xx (Draft), 12/84, Software Quality Assurance Procedure.

13.2.4 Definitions

See Sect. 1.5, Terminology.

13.2.5 Responsibility

1. The RASA/UMTRA Project Manager is responsible for the implementation of this procedure.
2. The RASA/UMTRA Computer System Manager is responsible for procedural implementation and will overview the compliance of such. He will also conduct periodic internal audits and report all discrepancies to the Project Manager.
3. The RASA/UMTRA personnel with authorized use of software and magnetic media will be responsible for compliance with this procedure for all software in their use.

13.2.6 Procedure

1. An audit log of all available software is to be maintained by the Computer System Manager or his alternate with the following information.

   a. Program source
   b. Program documentation file number
   c. Number of backup copies
   d. Location of backup copies
   e. List of authorized users or user group
   f. List of authorized PC locations
   g. List of production copies and location of use
   h. List of updates, revisions and/or modifications

2. On a monthly basis, changes to the log are compiled by the computer system staff and forwarded to the RASA/UMTRA Project Manager.
3. All systems under use by RASA/UMTRA are open for audit by the Computer System Manager. Audits of software use will be conducted on a quarterly basis and a summary report documented. The audit results will be submitted to the RASA/UMTRA Project Manager and the QA Coordinator.
4. New users are added to the log only after a training session from computer system staff.
5. New user passwords and system authorizations are assigned by the Computer System Manager. System authorization is required for all personal computers in the RASA/UMTRA project that handle vital data (i.e. PC/IX, Orchid PCNET, all database management systems, soil analysis system, Lotus QA system, and AutoCAD graphics system). Passwords and system authorization can be changed or revoked at any time by the Computer System Manager. Revoked password/authorization is reported to the RASA/UMTRA Project Manager for further action.

6. Users are required to abide by copyright laws and guidelines. Any infringements or copyright violations can be grounds for legal action.
7. Users are required to comply with security measures in each software package. The Computer System Manager audit will review program use and proper handling of the software package. Violations of the system authorization will be reported to the RASA/UMTRA Project Manager for further action.
8. Programs no longer in use or obselete by new system implementation will be archived and all copies will be destroyed. Production copies designated for destruction will be processed according to sanitization procedures described in the ADP Management Manual. The archival activity and sanitization procedure will be overviewed and certified by the Computer System Manager.

13.2.7 Exhibits

None.

13.2.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

13.3 SOFTWARE VERIFICATION AND VALIDATION

13.3.1 Purpose

The purpose of this procedure is to provide recommended guidance for the verification and validation of computer programs prior to use in the RASA/UMTRA program.

SUBJECT: DATA MANAGEMENT

13.3.2 Applicability

This procedure applies to all computer programs generated by RASA/UMTRA for internal use on systems controlled exclusively by RASA/UMTRA.

13.3.3 References

1. Sect. 13.1, Applications Software Documentation

13.3.4 Definitions and Abbreviations

13.3.4.1 Definitions

VERIFICATION. The process of assuring that a computer program functions in an error-free manner.

VALIDATION. The process of testing the theoretical and predictive capabilities of a computer program for proper representation of reality.

DEBUGGING. Modification of a computer program to eliminate program errors and malfunctions.

BRANCHING. A decision point in the computer program in which the program follows one of two or more paths.

PROGRAM FILE FOLDER. Repository of all program documentation.

13.3.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure. The Computer System Manager is responsible for the verification and validation of the program.

13.3.6 Procedure

1. Verification and validation will be performed following debugging and prior to implementation as an operating system in the RASA/UMTRA program.
2. All mathematical functions will be verified and validated using hand calculations (calculators), established literature values, where applicable, or other operating computer systems, and comparing the results with the output of the computer program.
3. A series of verification and validation calculations should be performed which tests the accuracy of the program throughout the usable range of input and output values.
4. An effort should be made by proper adjustment of input data values to force the program through all elements of branching points in the program.
5. All verification and validation documentation will be placed in the program file folder according to Sect. 13.1, Applications Software Documentation.

13.3.7 Exhibits

None.

13.3.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

13.4 DATA STORAGE AND ARCHIVAL

13.4.1 Purpose

The purpose of this procedure is to provide guidance for the storage and archival of vital data generated by data processing methods in the RASA/UMTRA program.

13.4.2 Applicability

This procedure applies to all computer programs generated by RASA/UMTRA for internal use on systems controlled exclusively by RASA/UMTRA.

13.4.3 References

1. Sect. 13.1, Applications Software Documentation

13.4.4 Definitions and Abbreviations

13.4.4.1 Definitions

MAGNETIC MEDIA. Storage media used in the computer interface. Most common is 5-1/4 in. floppy disks. Can refer to 1/4 in. tape, floppy disks or hard-disk cartridge.

BACKUP COPY. Temporary copy of data. Use is limited to recovery of short-term data (less than ten working days of data). Not considered permanent. Media used is floppy disks or tape.

ARCHIVE COPY. Permanent storage copy of data. Use represents finalized copy of data on magnetic media with hardcopy on file. Storage media used is floppy disks, laser (optical write only) disks or magnetic tape. Archival procedure requires two physical copies made and retained at different locations.

13.4.4.2 Abbreviations

DBMS. Data Base Management System.

13.4.5 Responsibilities

The RASA/UMTRA Project Manager is responsible for the implementation of this procedure, and the Computer System Manager is responsible for storage of archive copies of vital magnetic media data.

The individual users are responsible for short-term backup of their work areas and for providing archive copies for permanent storage to the Computer System Manager.

The Computer System Manager is also responsible for archival of the main DBS, the radiation survey DBMS and the public relations DBMS.

13.4.6 Procedure

13.4.6.1 Daily Backups

1. Work areas with a high volume of changes on a daily basis (i.e. report typists, drafting, and soils lab) will make daily backups of their data onto floppy disks.
2. Daily backups are numbered sequentially to cover a period of no less than ten days.
3. The backup is prepared at the end of the work day by the local user. The date is entered on the label (temporary), and the disk is stored at the work location.
4. The recovery of data from a backup copy should be overviewed by the Computer System Manager. When data loss is due to equipment failure, the recovery process will be performed by the Computer System Manager or his alternate.

13.4.6.2 Archival

1. On a monthly basis, the Report Typists will archive the inclusion survey reports generated for the month to magnetic media. The hardcopy of the report is kept on file and the computer archive is submitted to the Computer System Manager for permanent storage.

2. The Graphics Coordinator will submit archive copies of completed drawings on floppy disks on a weekly basis. The archive disk must have on the permanent label for each drawing

   a. location number

   b. draftsman's initials

   c. drawing date/archive date

3. The computer system staff will be responsible for generating an archive tape of the main, the public relations, the soil analysis, and the radiation survey databases. The archive procedure will be completed on a monthly basis. The Computer System Manager will verify and log the archive when completed.

13.4.6.3 Storage

1. Backup floppies and tapes are kept within the work area that generated the backup.
2. Archival floppies and tapes are duplicated by the computer system staff and one copy will be stored in locked storage at the data management office area. The remaining copy will be transferred to the RASA facility in Oak Ridge, Tennessee, for storage.
3. Quarterly reports of the archive log are to be transmitted to the RASA/UMTRA Project Manager.
4. The Computer System Manager will maintain an archive log with a list of archived material, the date of archival, and locations of storage.

13.4.7 Exhibits

None.

13.4.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SECTION 14: SUBCONTRACT SERVICES AND ADMINISTRATION

14.1 Procurement of Equipment and Services

14.2 Administration of Subcontracts

14.3 Subcontractor Reporting

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

14. SUBCONTRACT SERVICES AND ADMINISTRATION

14.1 PROCUREMENT OF SERVICES AND EQUIPMENT

14.1.1 Purpose

The purpose of this procedure is to provide complete information and sources to enable procurement of services and equipment outside of the Oak Ridge National Laboratory.

14.1.2 Applicability

14.1.2.1 Services

This procedure is applicable to RASA staff requiring other technical subcontractor services. Typical subcontractual needs may include

1. Industrial cleaners - used for clearing and cleaning of buildings before indoor surveys are begun;
2. Landscape maintenance - used for clearing vegetation and rubble before the outdoor surveys are made;
3. Land surveyors - establishment of measurement grid system, property lines, and preparing base maps for use in documentation of survey results; D & H Services currently prepare base maps for Grand Junction and Rifle, and Ernst Engineering lends similar support for Durango properties;
4. Construction contractors - used for earth and large debris removal (i.e., backhoe, caterpillar, front-end loader, etc.) to improve site accessibility;

5. Drilling and auger contractors - provide drilling services for subsurface sampling, including augering and continuous core sampling, as part of onsite surveys;
6. Technical support - used for obtaining technicians and professional radiological health personnel to conduct radiological surveys or for other RASA technical needs such as property title research. Oak Ridge Associated Universities (ORAU) currently provides technical support.
7. Aerial or ground-level photography - provide photographs of sites, vicinity properties or sections of the city to provide site historical documentation.
8. Video taping support - provide training or documentary video tapes for use in training new staff or providing administrative information about the RASA/UMTRA project; and
9. Training - provide technical training of RASA/UMTRA staff.

14.1.2.2 Equipment

Purchase of necessary equipment for operation of technical support activities will be performed as needed. At present, equipment is obtained from Bendix Procurement, Valley Office Supply, Plaza Engineering, LK Surveying Instrument, and Coast to Coast Hardware.

14.1.3 References

1. Sect. 4.1, Subcontract Planning
2. ORNL/CF-79/53, Guidelines for Subcontracting at ORNL.
3. D-2-16, Standard Practice Procedure Martin Marietta Energy Systems, Quality Assurance Program
4. D-2-16S, ORNL Supplement, Standard Practice Procedure Martin Marietta Energy Systems, Quality Assurance Program
5. D-2-8, Standard Practice Procedure Martin Marietta Energy Systems, Consultant and Special Services

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

6. D-2-8S, ORNL Supplement Standard Practice Procedure Martin Marietta Energy Systems, Consultant and Special Services
7. D-2-1, Standard Practice Procedure Martin Marietta Energy Systems, Procurement of Material
8. <u>Martin Marietta Energy Systems Purchasing Division Manual</u>

14.1.4 <u>Definitions and Abbreviations</u>

14.1.4.1 <u>Definitions</u>

SUBCONTRACTS. Written agreements between the company and others to obtain (1) consultant service, (2) research and development services, and (3) other professional and technical services.

Also see Sect. 1.5 of this manual, Terminology.

14.1.4.2 <u>Abbreviations</u>

See Sect. 1.5 of this manual, Terminology.

14.1.5 <u>Responsibilities</u>

14.1.5.1 <u>RASA Program Manager</u>

The RASA Program Manager is responsible for the overall management of all contracts required for the program. If the need for services or equipment is deemed appropriate, the RASA Program Manager may inititate the procurement or assign a person responsible for procurement. The person initiating the procurement is called the Requestor.

14.1.5.2 <u>Technical Staff Member</u>

<u>Services</u>

A Requestor for procuring out-of-laboratory services (except those provided by BFEC) is responsible for the following duties.

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

1. Services requiring Form UCN-1127, Request for Individual Consultant or Research and Development Subcontract

   a. Initiates subcontract request (Form UCN-1127, Exhibit 14.1-1),
   b. Expedites approval (see Exhibits 14.1-4 and 14.1-5,
   c. Provides technical work statements and related cost estimate,
   d. Provides sole-source justifications, as required,
   e. Interfaces with ORNL Subcontracts Coordinator as to type of contract and final QA function,
   f. Assists Purchasing in evaluation of vendor proposals (if using Subcontracts Form UCN-1127), and
   g. Serves as source for any technical documents required.

2. Services requiring Form UCN-3324, Purchase Order Form

   a. Initiates Purchase Order Form (see Example UCN-3324, Exhibit 14.1-3),
   b. Expedites approval. Sign-off will be obtained from (1) RASA program manager, (2) DABTS Head, and (3) HASRD Director and
   c. Forwards form to Division Finance Office for review and submission to Purchasing Division.

3. Services procured by BFEC or DOE Form 90

   a. Initiates From 90,
   b. Expedites approval by RASA/UMTRA Project Manager or Survey Manager, and
   c. Forwards form to BFEC procurement.

Equipment

The technical staff member is responsible for the following when procuring equipment.

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

1. Initiates Purchase Order Form (see Example UCN-3324, Exhibit 14.1-3) or From DOE 90, if item is to be purchased by BFEC;
2. Expedites approvals. Purchase Order Form requires sign-off by (a) RASA program manager, (b) DABTS Head, and (c) HASRD Director; and (d) Form DOE 90 requires sign-off by RASA/UMTRA Project Manager; and
3. Forwards form to Division Finance Officer for review and submission to Purchasing Division.

14.1.5.3 Martin Marietta Energy Systems Purchasing

1. Negotiates vendor rates and fees and writes the body of the subcontract.
2. Initiates consultant contract renewal using Form UCN-1226, if applicable.
3. Determines winner of bids on Purchase Order Form UCN-3324 for services or equipment (Exhibit 14.1-3), and notifies RASA.

14.1.5.4 Allied Bendix Field Engineering Corporation Purchasing

1. Negotiates vendor rates and fees and writes body of contract.
2. Determines winner of bid for services or equipment and notifies the RASA/UMTRA Project Manager.

14.1.6 Procedure

The procedure for using Form UCN-1127 (Exhibit 14.1-1), Request for Individual Consultant or Research and Development Contract Services, applies here.

14.1.6.1 Statement of Work

The RASA Program Manager or his authorized agent shall prepare a detailed statement of work that can meet the needs of the job and cannot be accomplished with ORNL capabilities. This statement of work will form the basis of the body of a subcontract written by the Purchasing Division.

14.1.6.2 Initiation of Subcontract

The person who initiates a subcontract shall refer to the ORNL standard procedures for purchasing and subcontracting. See all references. The formal procedure guide source is the Martin Marietta Energy Systems Purchasing Division Manual, and a general guideline for subcontracting is Guidelines for Subcontracting at ORNL, ORNL/CF-79/53.

14.1.6.3 Subcontract Preparation Participants

RASA Subcontractor Requestor

Follow the guidelines (Ref. 2, Sect. 14.1.3) for establishing the subcontract. Interfaces will be made with the Division Finance Officer, the ORNL Subcontract Coordinator, and the Purchasing Division.

Division Finance Officer

The Division Finance Officer provides assistance in the preparation of Form UCN-1127, Request for Individual Consultant or Research and Development Subcontract. (See Exhibit 14.1-1.)

ORNL Subcontract Coordinator

The ORNL Subcontract Coordinator assists the technical staff member in the preparation of a descriptive statement of work adequate for needs of the Purchasing Division. This statement will clearly and completely describe the work to be done for a definitive contract to be written and provide a legal basis for defining completion of the work and approval of payments to the vendor. Other considerations such as sole-source justification shall be discussed with the coordinator, documented, and attached to the request.

The coordinator also provides counsel to the RASA Subcontractor Requestor regarding type of contract best suited for the task and, generally, the entire procedure to finalize the subcontract. He also provides a quality control function for the completed request before it is submitted to Martin Marietta Energy Systems Purchasing. This quality control function generally consists of ensuring that all applicable ORNL requirements have been met and included in the subcontractor request documents. He should also be involved in any problems arising with administration of on-going contracts.

Purchasing Agent, Martin Marietta Energy Systems

Counsel with the purchasing agent is helpful during the formative discussions about a subcontract, especially in determination of contract type. He can help identify the content of supporting documents to accompany Form UCN-1127 and can work through the ORNL Subcontract Coordinator to identify the proper purchasing agent to contact.

14.1.6.4 ORNL Subcontract Approval Requirements

Subcontracts create a legally binding obligation of federal funds, and, therefore, Federal Procurement Regulations and other federal policies and regulations must be followed. Designated approvals must be obtained (see Exhibit 14.1-4). Nominal processing time of the initiating documents is shown in Exhibit 14.1-5.

14.1.6.5 Procedure for Using Form UCN-3324, Purchase Order Form for Services or Equipment

Use of Form UCN-3324 (see Exhibit 14.1-3)

This form is used for

1. Purchase of necessary equipment and materials and
2. Obtaining onsite services such as drilling, land surveyor gridding, landscape maintenance, industrial cleaners, construction contractors, photography, and/or video taping support.

RASA Subcontract Requestor

1. Prepares form UCN-3324, Exhibit 14.1-3, and any required technical specifications;
2. Obtains approval sign-offs; and
3. Submits to Purchasing Division via Division Finance Officer.

Award

The Purchasing Division selects the winning bidder and informs the RASA Program Manager.

14.1.7 Exhibits

1. Exhibit 14.1-1, Request for Individual Consultant or Research and Development Contract - Form UCN-1127
2. Exhibit 14.1-2, Request for Payment to Guest Lecturers or Agreement for Short-Term Consulting or Professional Services - Form UCN-237
3. Exhibit 14.1-3, Purchase Order Form, UCN-3324
4. Exhibit 14.1-4, ORNL, Subcontract Approval Chain
5. Exhibit 14.1-5, Processing Time, Sequence of Events, ORNL Contracts

14.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

14.2 ADMINISTRATION OF SUBCONTRACTS

14.2.1 Purpose

The purpose of this procedure is to establish the requirements and responsibilities of RASA Subcontract Requestor for administering an active subcontract.

14.2.2 Applicability

This procedure applies to all subcontracts initiated for support of the work and functions of the RASA program.

14.2.3 References

1. Sect. 14.3, Subcontractor Reporting
2. ORNL/CF-79/53, Guidelines for Subcontracting at ORNL
3. D-2-16, Standard Practice Procedure, Martin Marietta Energy Systems, Quality Assurance Program
4. D-2-8, Standard Practice Procedure, Martin Marietta Energy Systems, Consultant and Special Services
5. Martin Marietta Energy Systems Purchasing Division Manual

14.2.4 Definitions and Abbreviations

14.2.4.1 Definitions

See Sect. 1.5 of this manual, Terminology.

14.2.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

14.2.5 Responsibilities

14.2.5.1 RASA Program Manager

The RASA program manager has the responsibility to ensure that all subcontracted work has adequate funding and that all subcontracted work is technically adequate within the defined scope of work.

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

14.2.5.2 RASA Subcontract Requestor

The RASA Subcontract Requestor responsible for initiating the subcontract will be responsible for administrative tasks dealing with the subcontract.

14.2.6 Procedure

14.2.6.1 RASA Subcontract Requestor Actions

The RASA Subcontract Requestor shall perform these duties when administering the subcontract.

1. Prevent potential subcontractor from starting work in advance of official authorization from Martin Marietta Energy Systems Purchasing;
2. Serve as the source of technical documents and direction for the subcontractor;
3. Provide Martin Marietta Energy Systems Purchasing (via RASA Program Manager) with confirmation of work done to enable vendor payments;
4. Interface with the RASA Program Manager and ORNL Subcontracts Coordinator if problems arise in administration of the contract;
5. Initiate and provide technical support for subcontract modification when required; and
6. Advise RASA Program Manager of special year-end accounting problems when required. See Martin Marietta Energy Systems Purchasing Division Manual.

14.2.6.2 Other Directives

1. The RASA Subcontract Requestor will direct the technical performance of the vendor in required tasks. He will ensure that performance of the tasks is properly completed and that quality assurance has been effected according to the subcontract requirements. See D-2-16, Martin Marietta Energy Systems Quality Assurance Program.

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

2. The RASA Subcontract Requestor should review ORNL/CF-79/53, Guidelines for Subcontracting at ORNL.
3. He will keep the RASA Program Manager informed of the status of the subcontracted job and follow any directives.
4. He will review and approve the subcontractor's final report. See Sect. 14.3, Subcontractor Reporting.

14.2.7 Exhibits

None.

14.2.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

14.3 SUBCONTRACTOR REPORTING

14.3.1 Purpose

This procedure is for use by RASA Subcontract Requestor for guidance in subcontractor contract report requirements.

14.3.2 Applicability

This procedure will be used to prepare every RASA subcontractor contract and onsite services purchase order.

14.3.3 References

1. Sect. 14.1, Procurement of Services and Equipment

14.3.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

SUBJECT: SUBCONTRACT SERVICES AND ADMINISTRATION

14.3.5 Responsibilities

The RASA Subcontract Requestor will implement and comply with this procedure.

14.3.6 Procedure

14.3.6.1 Types of Subcontractor Reports

1. Letter Report
2. Environmental Impact Assessment and/or Statement
3. Radiological Survey Report
4. Drillers Report

14.3.6.2 General

The RASA Subcontract Requestor includes in the contract for each subcontractor certain specifications and guidance for the reports he requires from them, such as

1. The subcontractor will respond to schedule and all reporting requirements of his particular contract, including information such as driller's log, surveyor's maps, water sampling data, and subsurface data.
2. The subcontractor will respond to RASA guidance during report preparation.
3. The subcontractor will respond to RASA review comments of his report when provided.
4. Publication and distribution requirements will be stated in the contract. There may be certain property identification limitations per contract terms and conditions.
5. The subcontractor will use a RASA specified format, or may use his own format to supply the required information, if acceptable to the RASA Subcontract Requestor.

14.3.7 Exhibits

None.

14.3.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

Exhibit 14.1-1. Request for individual consultant or research and development subcontract – Form UCN-1127

REQUEST FOR INDIVIDUAL CONSULTANT OR RESEARCH AND DEVELOPMENT SUBCONTRACT

INSTALLATION
☐ OAK RIDGE GASEOUS DIFFUSION PLANT
☐ OAK RIDGE NATIONAL LABORATORY
☐ OAK RIDGE Y-12 PLANT
☐ PADUCAH GASEOUS DIFFUSION PLANT

☐ APPLIED RESEARCH
☐ BASIC RESEARCH (REQUIRES PROGRAMMATIC DOE HDQTRS. APPROVAL)

Date	Division Name/ Code Number	Request Number

TO: PURCHASING DIVISION
SUBCONTRACT SECTION

NAME AND ADDRESS OF CONSULTANT OR SUBCONTRACTOR:

Former Employee ☐ Yes ☐ No

☐ New Subcontract ☐ Renewal
☐ Modification ☐ Cancellation
☐ Establish Accrual (over)

Subcontract No. ______
Basic Order Agreemt. No. ______
Letter Release No. ______
Original Beginning Date ______
Current Exp. Date ______
Beginning Date This Proposal ______
Period Of Contract This Proposal ______

ATTACHMENTS:
☐ Sole Source Justification
☐ Technical Review
☐ Statement of Work
☐ Other ______

NUCLEAR MATERIAL REQUIRED:
☐ No ☐ Yes - Quantity and Form

SECURITY REQUIREMENTS

Will Restricted Data Be Transferred Outside Of Oak Ridge Or Paducah?	Will Consultant Or Subcontractor's Personnel Have Access To Restricted Data?	Will Consultant Or Subcontractor's Personnel Have Access To Exclusion Area?
☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

COMPLETE THIS SECTION FOR INDIVIDUAL CONSULTANT OR PERSONAL SERVICES CONTRACT

☐ Personal Services ☐ Consultant	Citizenship	Account Charge - 61 -	B & R Number	FTP A Number	Work Order Number

Employer			Justification For Rate Of Compensation
Position	Compensation	Highest Degree-YR.	
Maximum No. Days	Recommended Rate Per Day		MISC. EXPENSES ☐ No ☐ Yes - Itemize TRAVEL ALLOWANCE ☐ No ☐ Yes

COMPLETE THIS SECTION FOR R&D SUBCONTRACT

COMMITMENT (Including Fee)					TOTAL
Work Order Number					
Account Charge					
B&R Number					
FTP/A Number					
Amount Previously Committed	$	$	$	$	$
Amount Committed This Proposal	$	$	$	$	$
Amount Uncommitted This Proposal	$	$	$	$	$
TOTAL	$	$	$	$	$
COST (Including Fee)					
Amount Prior FYs	$	$	$	$	$
Amount This FY (Current)	$	$	$	$	$
Amount Future FYs	$	$	$	$	$
TOTAL	$	$	$	$	$

PURPOSE AND SCOPE OF SUBCONTRACT

APPROVALS:		Technical Contact	Date
Division Director	Date	Finance & Materials	Date
Assoc. Lab Director	Date	Installation Head	Date
Subcontract/Consultant Coordinator	Date	Purchasing Division	Date

SUBJECT: PROCUREMENT OF SERVICES AND EQUIPMENT

Exhibit 14.1-2. Request for payment to guest lecturers or agreement for short-term consulting or professional services (UCN-237)

REQUEST FOR PAYMENT TO GUEST LECTURERS OR AGREEMENT FOR SHORT-TERM CONSULTING OR PROFESSIONAL SERVICES

INSTALLATION: ☐ ORGDP ORM 1201 ☐ Y-12 ORM 1101 ☐ ORNL ORM 2101 ☐ PADUCAH ORM 1202

FORMER EMPLOYEE ☐ YES ☐ NO

☐ Guest Lecturer ☐ Short-Term Consulting or ☐ Professional Service (Requires Signature of Individual on reverse side)

DATE	TRAVEL ORDER NO.

I. REQUEST FOR PAYMENT

INDIVIDUAL'S NAME		SOCIAL SECURITY OR TAXPAYER'S ACCOUNT NUMBER	CHARGE ACCOUNT NUMBER
MAILING ADDRESS		ORGANIZATION REPRESENTED AND POSITION	B & R NUMBER
TRAVEL FROM	TO	REGULAR EMPLOYER CODE	AREA OF SPECIALIZATION
RETURN TO		FORMER EMPLOYER	FORMER EMPLOYER CODE
TRAVEL EXPENSES REQUESTED ☐ YES ☐ NO — IF YES, REIMBURSE ☐ UCN POLICY ☐ OTHER (SEE S.P.P.O.-2-8)		SERVICES CATEGORY CODE	
HONORARIUM OR FLAT FEE REQUESTED ☐ YES ☐ NO	IF YES, TOTAL AMOUNT $	BEGINNING DATE / ENDING DATE	NUMBER OF DAYS
DAILY FEE REQUESTED ☐ YES ☐ NO	IF YES, RATE PER DAY $		

DAILY FEE TO:	A.	☐ INCLUDE	☐ EXCLUDE TRAVEL TIME	☐ CLASSIFIED INFORMATION INVOLVED
	B.	☐ INCLUDE	☐ EXCLUDE WEEK ENDS	☐ NO CLASSIFIED INFORMATION INVOLVED

II. PURPOSE OF VISIT OR REMARKS (EXPLAIN FULLY)

III. ALIEN TAX CLASSIFICATION

If individual is a citizen of another country, part III must be completed prior to submission to travel office.

CITIZENSHIP	TYPE VISA

CHECK APPROPRIATE BOX: ☐ RESIDENT ALIEN (1) ☐ NONRESIDENT ALIEN ☐ TAX TREATY - WITHHOLDING EXEMPTION (2)

(1) IRS Form 1078, Certificate of Alien Claiming Residence in the U.S., must be completed in duplicate by the resident alien and submitted to the Travel Office prior to payment.

(2) If nonresident aliens claim they should be exempted from withholding due to existing tax treaty conditions, they must submit a written statement to the Travel Office stating their claim and specifically indicating the number of days they 'have been' and 'will be' in the U.S. and the amount of their earnings in the U.S. to date.

NOTE: IRS Regulations require UCN to withhold income tax from all honoraria or fees paid to nonresident aliens unless specifically exempted by tax treaty conditions.

IV. APPROVAL

DISTRIBUTION: Copies 1-3 Travel Section
Copy 4 Division Head

INSTALLATION HEAD OR DESIGNATED REPRESENTATIVE

UCN-237
(1235 2-83)

SUBJECT: PROCUREMENT OF SERVICES AND EQUIPMENT

Exhibit 14.1-3. Purchase order form, UCN-14715

PURCHASE REQUISITION

NOTE: *HEAVY OUTLINED BOXES ARE REQUIRED ENTRIES*

Total Items | Page of

Requisition No. D- 4273	Date Prepared	Wanted by Date	URGENCY ☐ Critical ☐ Urgent ☐ Routine	Urgency Approval Signature	Employee No.	Call-in

INSPECTION ☐ Receiving ☐ Special	Special Inspection Name/Instructions	Code	HAZARDOUS No / Yes / U	Use Code	Hazard Employee No.

Refer Technical Questions to: *(If different from requester)*

Name	Phone	BM Number	Priority	DOD Program	Commodity Code

Suggested Vendor(s)

Attachment(s) Indicator(s):
☐ 1. Classified ☐ 2. Drawings ☐ 3. Specifications ☐ 4. Sole Source ☐ 5. Samples ☐ 6. Controlled Subst. ☐ 7. Del. Sch. ☐ 8. Other

Requester Identification/Justification

Remarks to Purchasing

Item No. 001	Acct., T.E., Sub. No., or W.O.	Deliver to Name	Location	Wanted by Date	Del. Schedule ☐ Attached

Hazard Code(s): H__ F__ R__ A__ S__	BM Item No.	Property Item ☐ Yes	Replacement Parts for

Noun	Vendor Part Number	Quantity	Unit	Est. Unit Price

Description

Item No. 002	Acct., T.E., Sub. No., or W.O.	Deliver to Name	Location	Wanted by Date	Del. Schedule ☐ Attached

Hazard Code(s): H__ F__ R__ A__ S__	BM Item No.	Property Item ☐ Yes	Replacement Parts for

Noun	Vendor Part Number	Quantity	Unit	Est. Unit Price

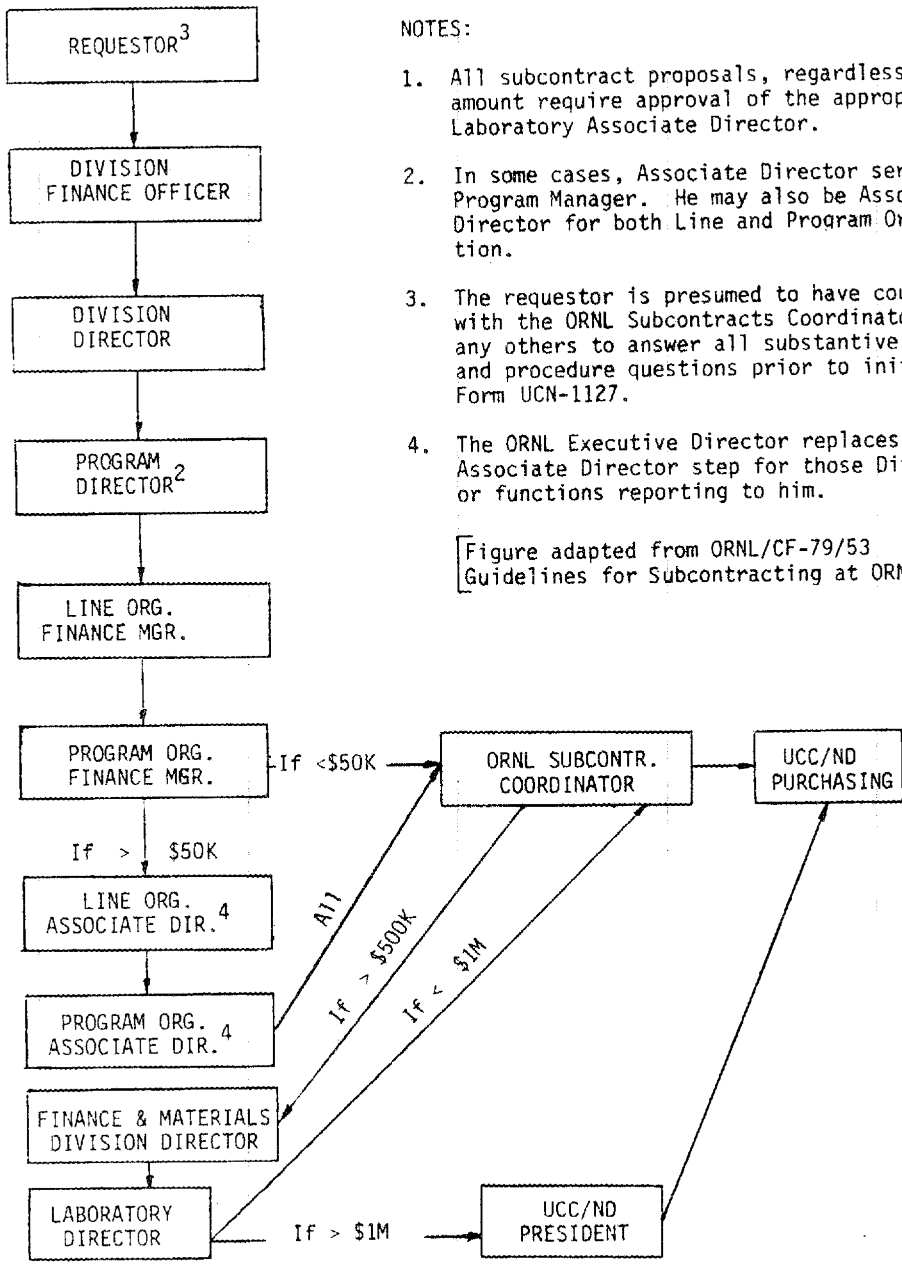
Description

Requester Signature	Requester Employee Number	Phone	Date
Installation Head or Authorization Representative Signature	Approval Employee Number	Date	

UCN-14715 (126 6-83)

SUBJECT: PROCUREMENT OF SERVICES AND EQUIPMENT

Exhibit 14.1-4. ORNL subcontract approval chain



NOTES:

1. All subcontract proposals, regardless of amount require approval of the appropriate Laboratory Associate Director.

2. In some cases, Associate Director serves as Program Manager. He may also be Associate Director for both Line and Program Organization.

3. The requestor is presumed to have counseled with the ORNL Subcontracts Coordinator and any others to answer all substantive category and procedure questions prior to initiating Form UCN-1127.

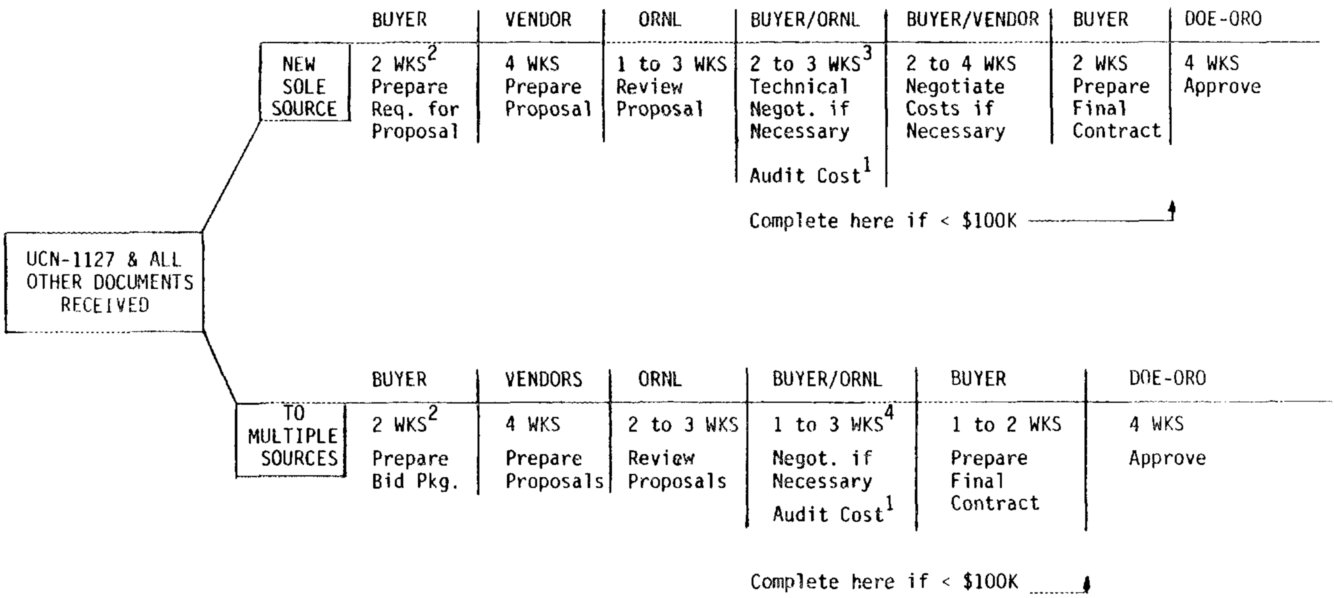
4. The ORNL Executive Director replaces the Associate Director step for those Divisions or functions reporting to him.

[Figure adapted from ORNL/CF-79/53 Guidelines for Subcontracting at ORNL]

SUBJECT: PROCUREMENT OF SERVICES AND EQUIPMENT

Exhibit 14.1-5. Processing time, sequence of events, ORNL contracts

PROCESSING TIME - SEQUENCE OF EVENTS
ORNL SUBCONTRACTS



RENEWALS OR REVISIONS SAME AS NEW SOLE-SOURCE

NOTES:
1. New vendors with no prior gov't contracts - 2 additional months for audit.
2. If advertising in Commerce Business Daily is req'd - 4 to 6 weeks additional.
3. Can be much longer if vendor negotiations are difficult.
4. If apparent first choice is difficult in negotiations, reject, and negotiate with others.

[Figure adapted from ORNL/CF-79/53
Guidelines for Subcontracting at ORNL]

January 1979

SECTION 15: QUALITY ASSURANCE PROCEDURES

15.1 Interface Control

15.2 Indoctrination, Training, Qualifications, and Backup of Personnel

15.3 Procedure Preparation

15.4 Control of Purchased Items and Services

15.5 Identification and Control of Material and Equipment

15.6 Inspection, Test, and Operating Status

15.7 Sample Collection, Control, and Documentation

15.8 Reserved

15.9 Reserved

15.10 Project Document Control

15.11 Control of Deficient Items, Equipment, and Processes

15.12 Surveillance/Audit Program

SUBJECT: QUALITY ASSURANCE PROCEDURES

15. QUALITY ASSURANCE PROCEDURES

15.1 INTERFACE CONTROL

15.1.1 Purpose

The purpose of this procedure is to describe the various types of organizational interfaces that occur during the activities conducted through the RASA/UMTRA program.

15.1.2 Applicability

This procedure applies to those activities that form a part of the RASA/UMTRA program. The intent of this procedure is to list those organizations with whom contact is made and to describe restrictions on interface, by position. Interface between procedures and sections of the RASA/UMTRA Procedures Manual is discussed in Sect. 1.4, QA Policy Manual and, therefore, does not apply to this procedure.

15.1.3 References

1. Sect. 1.4, QA Policy Manual
2. Sect. 2.3, RASA/UMTRA Administrative Organization
3. Sect. 10.3, Soil Radium Content Analysis
4. Sect. 12, Measuring and Test Equipment Calibration
5. Sect. 14, Subcontract Services and Administration

15.1.4 Definitions and Abbreviations

PROJECT MANAGER. An individual appointed by the RASA Program Manager to coordinate all personnel matters, product quality, milestone achievement, planning, interface with the DOE and other contractors, and all other functions of the ISC's Grand Junction office.

APPROVED: Craig Little
RASA/UMTRA Project Manager

DATE: 4/14/86

SUBJECT: QUALITY ASSURANCE PROCEDURES

Also see Sect. 1.5 of this manual, Terminology.

15.1.5 Responsibilities

The RASA Program Manager is responsible for ensuring that all interfaces with outside organizations are performed by designated personnel in accordance with established procedures.

15.1.6 Procedure

15.1.6.1 DOE

Interface with the UMTRA Project Office of the DOE will be performed only by the RASA Program Manager, RASA/UMTRA Project Manager, and those personnel specifically designated by him. This activity may consist of the following, as applicable:

1. Scheduling and milestones
2. Development and change of survey scope
3. Submittal of vicinity property inclusion survey reports
4. Other discussions as necessary

15.1.6.2 ORNL Purchasing

The RASA Program Manager or his designee will have the responsibility of interfacing with ORNL Purchasing as described in Sect. 14, Subcontract Services and Administration.

15.1.6.3 Subcontractors

Once contractual obligations are established, interface between the RASA/UMTRA Project Manager or other designated representative and the subcontractor may consist of scheduling and ensuring final submittal of required data and/or reports as well as ensuring that services are performed as requested.

15.1.6.4 Instrumentation & Controls Division (I&C)

The RASA Program Manager or his designated representative may initiate inspection, calibration, and maintenance of equipment and will be responsible for interfacing with responsible personnel in the I&C Division.

15.1.6.5 Analytical Chemistry Division

The RASA/UMTRA Project Manager or Sample Coordinator will be responsible for interfacing with the Analytical Chemistry Division for submittal of samples collected from survey sites and obtaining results of analyses as applicable in accordance with Sect. 10.3, Soil Radium Content Analyses. Requirements for sample analysis techniques to be employed can be identified only by the RASA Program Manager or his designee.

15.1.6.6 HASRD

All interface with HASRD is administrative in nature and will be accomplished through the RASA Group Leader as described in Sect. 2.3, ORNL-RASA Administrative Organization.

15.1.7 Exhibits

None.

15.1.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.2 INDOCTRINATION, TRAINING, AND QUALIFICATION OF PERSONNEL

15.2.1 Purpose

The purpose of this procedure is to describe the indoctrination, training, and qualification requirements for RASA/UMTRA project personnel.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.2.2 Applicability

This procedure applies to all personnel performing tasks associated with the RASA/UMTRA project.

15.2.3 References

1. Martin Marietta Energy Systems Standard Practice Procedure D-3-1, "Employment"

15.2.4 Definitions and Abbreviations

15.2.4.1 Definitions

QUALIFICATIONS. The characteristics or abilities gained through training or experience, or both, that enable an individual to perform a specified function.

PERFORMANCE STANDARDS and MEASURES of PERFORMANCE. A document, maintained by the RASA Program Manager or Project Manager that contains expected position responsibilities for members of the RASA/UMTRA technical staff.

PERSONNEL. RASA/UMTRA personnel, including ORAU staff subcontracted to ORNL.

Also see Sect. 1.5 of this manual, Terminology.

15.2.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.2.5 Responsibilities

15.2.5.1 RASA Program Manager

The RASA Program Manager will be responsible for the following with respect to qualifications and training of personnel assigned to the RASA program.

1. Establish job descriptions;
2. Ensure that the employment procedures defined in D-3-1 of the UCC-ND Standard Practice Procedure are followed;
3. Maintain "Performance Standards and Measures of Performance;"
4. Ensure that RASA/UMTRA Project Managers are designated based on experience and ability.

15.2.5.2 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for the indoctrination and training of all personnel. This entails:

1. Ensuring that all personnel within the RASA/UMTRA project have become familiarized with those procedures that affect their assigned area, by reviewing appropriate documentation of on-the-job-training;
2. Determining any specialized training requirements that may be necessary; and
3. Ensuring that personnel are selected based on established experience in a given area.

15.2.5.3 Technical Assistant, Process Coordinator, Electronics Technician Sample Coordinator, and Quality Assurance Coordinator

1. All incoming field people (Team Members) will be given a package of documentation composed of the VPMIM, RASA/UMTRA Quality Assurance Program Plan, Procedures Manual, report writing guidelines, and the General Information Guide for Employees of the ORNL/GJ Office.
2. Each above-captioned person will be responsible for conducting oral indoctrination in their respective area: technical objectives of the project, the standards to be used, safety techniques, equipment operation; Soils Laboratory protocol, and the quality assurance elements that are to be applied.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.2.5.4 Team Leader

The Team Leader is responsible for ensuring that selected team members develop profficiency in necessary field survey techniques, such as equipment operation, sampling techniques, and gamma scan techniques.

15.2.5.3 Quality Assurance Coordinator

The Quality Assurance Coordinator will periodically evaluate the selection of personnel for survey teams to ensure that only properly qualified individuals have been selected and that appropriate indoctrination and training have been provided. The Quality Assurance Coordinator will also document successful completion of training by approved forms in the personnel file. In addition, a current listing of "backup" personnel for key positions will be updated on an as needed basis and distributed to appropriate people.

15.2.6 Procedure

The nature of this procedure is such that a sequential listing of specific actions is neither practical nor necessary.

15.2.7 Exhibits

None.

15.2.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.3 PROCEDURE PREPARATION

15.3.1 Purpose

The purpose of this procedure is to establish the outline, format, and standard procedures to be used in preparing, revising, and deleting the procedures in the Procedures Manual for the UMTRA project.

15.3.2 Applicability

This procedure applies to all procedures prepared for the Procedures Manual for the UMTRA project. Sect. 1 (Introduction) and Sect. 2 (Integrated Activity Functional Description) of the manual contain background and descriptive information only and will be exempt from the format requirements of this procedure.

15.3.3 References

1. Sect. 15.10, Project Document Control

15.3.4 Definitions and Abbreviations

15.3.4.1 Definitions

REVIEWERS. Those individuals who have been assigned the responsibilities for administrative, QA, and operations activities.

Also see Sect. 1.5 of this manual, Terminology.

15.3.4.2 Abbreviations

PDN Procedure Deletion Notification
PRF Procedure Review Form
RPD Request for Procedure Deletion

Also see Sect. 1.5 of this manual, Terminology

15.3.5 Responsibilities

15.3.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for the review and approval of all procedures contained in the Procedures Manual for the UMTRA project. He is also responsible for the assignment of reviewers.

15.3.5.2 Reviewers

The reviewers review the procedures for proper integration of administrative, QA, and operational activities.

15.3.6 Procedure

15.3.6.1 Outline and Content

A procedure is normally prepared to respond to an administrative, QA, or operations requirement and to define how a particular activity is to be conducted. The outline for the content of Sects. 1 through 8 of each procedure (except Introduction and Integrated Activity Functional Description) will be the same for all procedures and will be the same as the outline used for this procedure. The content of each section of a procedure will be as follows.

Purpose

State the purpose or objective of the procedure. This statement will explain why the procedure is being written, as in Sect. 1 of this procedure.

Applicability

The application of the procedure will be stated in Sect. 2. The statement will clearly define the specific applicability and boundaries of the procedure and list any exceptions.

SUBJECT: QUALITY ASSURANCE PROCEDURES

References

All documents referenced in the text of a procedure will be listed under Sect. 3. If no reference is used, place the word "None." under the heading.

Definitions and Abbreviations

Special definitions and abbreviations may be listed to clarify the terminology used in the procedure. When required, they will be included under their respective headings as shown in Sects. 4, 4.1, and 4.2 of this procedure. Following the entries include "Also see Sect. 1.5 of this manual, Terminology." If there are no definitions or abbreviations to list, include "See Sect. 1.5 of this manual, Terminology" under the heading.

Responsibilities

The title(s) of the individual(s) responsible for compliance with the procedure will be identified in Sect. 5. These titles are those on the GJO organization chart (Exhibit 2.2-2).

Procedure

Subsection headings in Sect. 6 will reflect the specific subject matter being presented in the procedure. The subject matter will establish and detail the procedure steps required to implement the function or task to be performed in a manner that is fully responsive to applicable requirements, codes, and standards.

When making reference to other sections or procedures, the following standard format will be used, as applicable:

1. See Sect._____ (when an entire section of the manual is to be referenced).
2. See Procedure_____ (when an entire procedure is to be referenced).

When making reference to exhibits, the standard format will consist of the exhibit title followed by the exhibit number in parentheses.

Exhibits

Tables, figures, attachments, and enclosures that are provided in the procedure will be placed at the end of the section. These exhibits will be listed in Sect. 7.

Revision history

The revision history of the procedure will be tabulated in Sect. 8.

15.3.6.2 Format

Procedure format

The procedure form will be the same as that used for this procedure.

Procedure number, revision, date, and page numbers

All procedures will be numbered per the guidelines established in the Procedure Numbering System (Exhibit 15.3-1).

The applicable procedure number, revision number, revision date, and page numbers will be entered in their respective spaces on each page.

Section headings

Section headings will be capitalized and underlined in accordance with the following scheme:

1. SECTION HEADING

1.1 SUBSECTION HEADING

1.1.1 Subsection Heading

1.1.1.1 Subsection Heading

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Spacing

Draft versions may be double-spaced to facilitate review, mark-up, and commentary. Final drafts will be in 12-pitch type with no spaces between lines and one space between paragraphs.

Listed items

Items may be listed below any paragraph heading within the following limitations.

1. Items will be listed by a sequential number.
2. The second line of an item shall start directly under the first letter of the first line of each item.

Exhibits

All exhibits will be identified as Exhibit X.Y, where X is the section number and Y is the sequential exhibit number. Exhibits requiring more than one page will carry at the top of the page the notation "Exhibit_____ (continued)."

15.3.6.3 Procedure Preparation, Review, and Approval

Origination of new procedures

When a new procedure is required, a draft will be prepared using the standard format (see Sect. 6.2 of this procedure). In preparing the draft, the originator will ensure that all applicable requirements and current standards and guides have been incorporated as appropriate. An originator may be any member of the RASA/UMTRA staff or personnel specified for this purpose by the RASA/UMTRA Project Manager.

The originator will complete and sign Part 1 of the Procedure Review Form (Exhibit 15.3-2) and submit it and the procedure draft to the RASA/UMTRA Project Manager. He and his reviewers will review the draft and will check for impact and conformance of the procedure with administrative, QA, and operations requirements.

If no significant errors are detected, the RASA/UMTRA Project Manager will sign Part 2 of the Procedure Review Form (PRF) and return it and the draft to the originator.

If significant errors are detected during the above reviews, the draft and comments are returned to the originator for correction. Following correction the procedure starts the review cycle again using the original PRF.

When the draft is approved, the originator will submit the procedure for final typing and will submit the original, in its final form, to the RASA/UMTRA Project Manager for signatory approval. Distribution of the approved procedure will be as described in Sect. 15.10, Project Document Control.

The PRF and an associated procedure copy will be forwarded to the QA Coordinator for retention in the history file.

Revision of existing procedures

When a procedure is to be revised, the originator will obtain a current copy and indicate the appropriate changes. After completing and signing Part 1 of the PRF, the originator will submit the marked up copy and the PRF to the same cycle as described in Sect. 6.3.1 of this procedure for review, approval, and distribution.

When a revised procedure is issued, the revised portion(s) will be identified by a vertical line in the right-hand margin. Previous revision marks, if any, will be removed. All successive revisions of each procedure will be retained by the QA Coordinator in the history file.

Deletion of procedure

When a procedure is to be deleted, a Request for Procedure Deletion (RPD) (Exhibit 15.3-3) will be initiated and forwarded to the RASA/UMTRA Project Manager. If the manager and his reviewers concur, the procedure will be deleted. If objections are raised, the procedure remains valid until sufficient justification for deletion is presented and approved by the RASA/UMTRA Project Manager.

Once a procedure has been deleted, a Procedure Deletion Notification (PDN) (Exhibit 15.3-4) will be completed by the RASA/UMTRA Project Manager. It will be distributed to all holders of controlled copies of the Procedures Manual by the QA Coordinator, with instructions to discard the subject procedure in their possession.

The originals of the RPD and the PDN will be forwarded to the QA Coordinator for retention in the procedure master file (history file).

15.3.7 Exhibits

1. Exhibit 15.3-1, Procedure Numbering System
2. Exhibit 15.3-2, Procedure Review Form (PRF)
3. Exhibit 15.3-3, Request for Procedure Deletion (RPD)
4. Exhibit 15.3-4, Procedure Deletion Notification (PDN)

15.3.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

15.4 CONTROL OF PURCHASED ITEMS AND SERVICES

15.4.1 Purpose

The purpose of this procedure is to describe the internal RASA/UMTRA controls to ensure that purchased items and services conform to procurement documents.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.4.2 Applicability

This procedure applies to items and services required to implement activities associated with the RASA/UMTRA project. Items and services are purchased through the Purchasing Department of Martin Marietta Energy Systems, Inc.; however, the ORNL Standard Practices and Guidelines apply. Others are purchased by BFEC Procurement after request by ORNL/GJ. A few items are purchased with funds from a Petty Cash/Travel Fund kept by the Grand Junction office.

15.4.3 References

1. Sect. 2.3, RASA/UMTRA Administrative Organization
2. Sect. 14.1, Procurement of Services and Equipment
3. Sect. 14.2, Administration of Subcontracts
4. Sect. 15.11, Control of Deficient Items, Equipment, Processes
5. ORNL/CF-79/53 Guidelines for Subcontracting at ORNL
6. D-2-16 Standard Practice Procedure UCC-ND, Quality Assurance Program
7. D-2-16S ORNL Supplement, Standard Practice Procedure UCC-ND, Quality Assurance Program
8. D-2-8 Standard Practice Procedure UCC-ND, Consultant and Special Services
9. D-2-8S ORNL Supplement Standard Practice Procedure UCC-ND, Consultant and Special Services
10. D-2-1 Standard Practice Procedure, Part 1, Procurement of Material
11. UCC-ND Purchasing Division Manual

15.4.4 Definitions and Abbreviations

15.4.4.1 Definitions

PROCUREMENT DOCUMENT. Purchase requisitions, purchase orders, drawings, contracts, specifications, or instructions used to define requirements for purchase.

Also see Sect. 1.5 of this manual, Terminology.

15.4.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.4.5 Responsibilities

15.4.5.1 RASA Program Manager

The RASA Program Manager or his designee, the RASA/UMTRA Project Manager is responsible for ensuring that all items and services are procured according to the guidelines and standards established in the reference section of this procedure. He is also responsible for approving requests for the procurement of all items and services.

15.4.5.2 QA Coordinator

The QA Coordinator is responsible for reviewing nonconformance reports which document any nonconformance upon visual inspection by a responsible RASA/UMTRA technical staff member.

15.4.5.3 Technical Staff Member

The technical staff member assigned to a particular procurement is responsible for identifying the requirements for purchased items and services, preparing requests for purchase, obtaining necessary approvals from the RASA/UMTRA Project Manager, and ensuring the acceptability of items and services received in accordance with procurement documents for his project.

15.4.6 Procedure

15.4.6.1 Martin Marietta Energy Systems Quality Assurance Program

The RASA/UMTRA project follows the Martin Marietta Energy Systems Quality Assurance Program which is described in Standard Practice Procedures D-2-16 and D-2-16S. These procedures include provisions for the control of procurement documents and purchased items and services. The requirements contained in the UCC-ND QA Program will ensure that proposals are properly reviewed, minimum QA Program criteria are imposed on suppliers and subcontractors, and that suppliers of items and services are properly qualified.

15.4.6.2 Evaluation of Conformance to Procurement Documents

Where vicinity property survey work requires purchased items and services, the RASA/UMTRA Project Manager will remain cognizant of the requirements established in procurement documents. Any deviation or departure from these requirements will be reported to the RASA Program Manager for determination of further action in accordance with internal Martin Marietta Energy Systems guidelines. The QA Coordinator may assist the RASA Project Manager in this determination.

Upon arrival of any item to ORNL Procurement, identification and inspection will be performed in accordance with Sect. 15.5, Identification and Control of Material and Equipment, before shipment to the Grand Junction office. All items other than routine office supplies will be visually inspected by the responsible RASA/UMTRA technical staff member. Any nonconformance will be reported and documented as specified in Sect. 15.11, Control of Deficient Items, Equipment, and Processes.

15.4.7 Exhibits

None.

15.4.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

15.5 IDENTIFICATION AND CONTROL OF MATERIAL AND EQUIPMENT

15.5.1 Purpose

The purpose of this procedure is to describe the requirements for ensuring the proper identification and control of material and equipment used in the RASA/UMTRA program.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.5.2 Applicability

This procedure applies to equipment, instrumentation and supplies such as detectors, computers, peripherals, analyzer components and their support systems; measuring and test equipment; and sources used for calibration or comparison.

15.5.3 References

1. Sect. 11, Equipment Inventory Control and Maintenance
2. Sect. 12, Calibration of Measurement and Test Equipment

15.5.4 Definitions and Abbreviations

HIGH QUALITY. Equipment and materials that may have a significant effect on the quality of the ISC's work, or that have a value greater than $1,000.

Also, see Sect. 1.5 of this manual, Terminology.

15.5.5 Responsibilities

15.5.5.1 RASA Program Manager

The RASA Program Manager is responsible for ensuring that adequate equipment and supplies are available for implementation of the RASA/UMTRA project.

15.5.5.2 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for ensuring that only equipment and supplies authorized for use on the RASA/UMTRA program are used in the performance of radiological surveys and associated Laboratory activities.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.5.5.3 QA Coordinator

The QA Coordinator is responsible for ensuring that the use and maintenance of equipment and supplies are properly documented in accordance with this and referenced procedures. All high quality items received at the Grand Junction office shall be identified as such and documentation of the equipment shall be kept on file by the QA Coordinator. Any items improperly identified or defective in workmanship are identifed with "hold tags" and handled in accordance with Sect. 15.11, Control of Deficient Items, Equipment, and Processes.

15.5.6 Procedure

15.5.6.1 Equipment Identification

Identification of equipment is accomplished internally within I&C Division and is dependent upon accountability and inventory controls established by that division. Equipment received directly from the vendor for use by RASA/UMTRA will have an identification number assigned by the Electronics Technician.

15.2.6.2 Equipment Inventory

Accountability of high quality equipment assigned to the RASA/UMTRA project will be accomplished through the use of inventory records identifying the location of the equipment. These records will be kept by the person utilizing the equipment and the QA Coordinator.

15.5.6.3 Radioactive Sources

Identification of radioactive sources will be as described in appropriate calibration procedures identified in Sect. 12 of this manual, Calibration of Measuring and Test Equipment.

15.5.6.4 Supplies

Supplies used for radiological surveys need not be specifically identified or authorized for use on the RASA/UMTRA program.

15.5.6.5 Use of Unauthorized Equipment

Improperly identified or unidentified equipment, instrumentation and/or radioactive sources should not be used during the performance of activities associated with the RASA/UMTRA program (see Sect. 11, Equipment Inventory Control and Maintenance, for identification requirements). Any deviation or departure from this requirement will be reported to the RASA/UMTRA Project Manager for determination of appropriate action.

15.5.7 Exhibits

None.

15.5.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.6 INSPECTION, TEST AND OPERATING STATUS

15.6.1 Purpose

The purpose of this procedure is to provide requirements for the checking of equipment status and providing an overview of the documentation of activities associated with site surveys.

15.6.2 Applicability

This procedure applies to all RASA/UMTRA radiological survey activities.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.6.3 References

1. Sect. 9.1, Equipment Usage
2. Sect. 9.2, Data Recording
3. Sect. 15.11, Control of Deficient Items, Equipment, and Processes

15.6.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.6.5 Responsibilities

15.6.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for accumulating all information relative to the UMTRA project and periodically reporting the status of such activity to the RASA Program Manager. He or his appointed designee is also responsible for the accuracy and completeness of all information recorded in appropriate logs and other data used to provide status of completed activities.

15.6.5.2 QA Coordinator

The QA Coordinator is responsible for periodically reviewing the status of vicinity property surveys to evaluate whether or not records and logs are adequately prepared and contain sufficient information to provide actual status of survey activity. He is responsible for reporting to the RASA/UMTRA Project Manager any discrepancy with respect to the continuous recordkeeping of vicinity property survey activities.

15.6.5.3 Electronics Technician

The inspection, test, and operating status on all equipment is maintained by the Electronics Technician.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.6.5.4 Team Leader

The Survey Team Leader is responsible for checking the condition and operability of field equipment prior to each day's use (see Sect. 9.1, Equipment Use, and Sect. 15.11, Control of Deficient Items, Equipment, and Processes.

15.6.6 Procedures

15.6.6.1 Equipment Status

Prior to each use, the Team Leader will inspect the condition of equipment to be used during survey activities. This inspection will include verification that equipment has been calibrated and the due date for recalibration has not passed. After the inspection, he will record any indications of damage, wear, or malfunction and calibration date status in the appropriate equipment log book. Any nonconforming equipment will be delivered to the Electronics Technician, who will physically relocate the item where it cannot be accessible for use and maintain records of such equipment.

15.6.6.2 Status Reporting

At the beginning of each week, the Survey Team Leaders will prepare and submit reports to the Process Coordinator that describe the status of completed and anticipated vicinity property survey activities (see Sect. 9.2, Data Recording). This information should contain, as a minimum:

1. Identification of those vicinity properties that have been surveyed since the last reporting period;
2. A description or accounting of the reports prepared and issued during the reporting period;
3. Statements regarding reports waiting for results of laboratory analyses;
4. A schedule of activities planned during the subsequent reporting period;

5. A description of unusual or unexpected problems encountered during the performance of survey activities such as problems with subcontractors, the need for special equipment or modifications to existing equipment, etc.
6. The status of the vicinity property survey activities, as reflected in logs and on the networked database, will be monitored by the Process Coordinator and reported to the Survey Manager.
7. In addition, the Team Leader will also provide the Public Relations Coordinator with a weekly list of the properties surveyed, by data and property number.

15.6.7 Exhibits

None.

15.6.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.7 SAMPLE COLLECTION, CONTROL, AND DOCUMENTATION

15.7.1 Purpose

The purpose of this procedure is to establish methods and general criteria to ensure that samples obtained from RASA survey sites are obtained in the specified manner, that the radiological characteristics of these samples are not altered before they are analyzed as a result of handling practices or storage environment, and that samples are properly identified and analyzed with documented results.

15.7.2 Applicability

This procedure applies to all sample collection, analysis, and documentation performed as part of the RASA program.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.7.3 References

1. Sect. 9.6, Sample Collection
2. Sect. 10.2, Soil Sample Preparation
3. Sect. 10.3, Soil Radium Content Analysis
4. Sect. 10.4, Soil Sample Storage
5. Sect. 15.1, Interface Control

15.7.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.7.5 Responsibilities

15.7.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for ensuring that all collection, identification, handling, shipping, analysis, and documentation of samples is performed by qualified personnel in accordance with established and approved procedures. He is also responsible for ensuring, through delegated responsibilities, that interface organizations (see Sect. 15.1, Interface Control) performing services related to the above elements are providing those services in accordance with good practices sufficient to ensure the integrity and quality of sample results.

15.7.5.2 QA Coordinator

The QA Coordinator is responsible for periodically reviewing the sample collection practices and the data generated as a result of sample analysis for determination of adherence to established practices and procedures.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.7.5.3 Sample Coordinator

The Sample Coordinator will manage the sample analysis facilities, perform quality control of sample analysis, and coordinate the activities of the teams' Sample Technicians with respect to use of the sample analysis facilities.

15.7.6 Procedure

15.7.6.1 Sample Collection

Sample collection performed during radiological surveys will be performed in accordance with Sect. 9.6, Sample Collection. All samples collected at survey sites will be identified with a unique identification code for traceability in accordance with the procedure of Sect. 9.6.6.1, Sample Identification.

15.7.6.2 Shipping, Handling, and Receiving

All samples will be packaged, shipped, and received in accordance with the procedure of Sect. 9.6, Packaging and Shipment of Samples, to maintain the integrity and traceability of the sample from time of collection to time of analysis.

15.7.6.3 Soil Sample Preparation

All collected soil samples will be prepared in accordance with Sect. 10.2, Soil Sample Preparation.

15.7.6.4 Sample Analysis

All sample analyses performed as part of the RASA/UMTRA radiological surveys will be performed in accordance with Sect. 10.3, Soil Radium Content Analysis.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.7.6.5 Cross-Checks and Inter-Laboratory Analyses

To provide independent tests of the ability to measure radium content, a random sampling of 5% of all samples analyzed will be sent for cross-check analysis to the Analytical Chemistry Laboratory in Oak Ridge or in the Bendix Field Engineering Corporation's Environmental Measurements Laboratory in Grand Junction. The cross-check documentation will be maintained by the Sample Coordinator. Please refer to Sect. 10.3, Soil Radium Content Analysis, for more detail.

15.7.6.6 Sample Retention Periods and Storage

Sample storage at the Laboratory after analysis is complete will be performed in accordance with the procedure of Sect. 10.4, Soil Sample Storage. Samples will remain archived until the RASA Program Manager orders sample retrieval or until DOE issues instructions to discard the samples. Documentation of sample storage locations is maintained by the Sample Coordinator according to the procedure of Sect. 10.4, Soil Sample Storage.

15.7.7 Exhibits

None.

15.7.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.8 RESERVED

15.9 RESERVED

15.10 PROJECT DOCUMENT CONTROL

15.10.1 Purpose

The purpose of this procedure is to describe measures to control the issuance and revision of documents, such as instructions, procedures, and drawings, that describe activities affecting the RASA program, as well as the final issued documents to the DOE.

15.10.2 Applicability

This procedure applies to field input data, procedures, equipment operating and maintenance manuals, and final issued documents used during the various stages of RASA radiological surveys.

15.10.3 References

1. Sect. 7.1, Identification of Properties to be Surveyed
2. Sect. 7.2, Consent for Access to Survey Property
3. Sect. 7.3, Property Base Map Development
4. Sect. 9.2, Data Recording
5. Sect. 10.1, Team Leader Pre-Report Activities
6. Sect. 10.7, Report Review
7. Sect. 10.8, File Transmittal
8. Sect. 12, Calibration of Measurement and Test Equipment
9. Sect. 15.3, Procedure Preparation
10. Sect. 15.6, Inspection, Test, and Operating Status

15.10.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.10.5 Responsibilities

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.10.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Program Manager is responsible for approving all RASA/UMTRA issued documents.

15.10.5.2 Team Leader

The Team Leader is responsible for organizing and reviewing the input data necessary for establishing the basis of a vicinity property survey as well as the subsequent inclusion/exclusion recommendation. He is also responsible for ensuring the availability of RASA/UMTRA procedures and forms to personnel performing vicinity property survey activities (see Sect. 9.2, Data Recording and Sect. 10.1, Team Leader Pre-Report Activities.

15.10.5.3 QA Coordinator

The QA Coordinator is responsible for monitoring the maintenance and control of project records and data. The QA Coordinator is also responsible for maintaining a system of controlled issuance of all RASA/UMTRA project documentation to ensure that outdated revisions of procedures and policies are not in use.

15.10.5.4 Graphics Coordinator

The Graphics Coordinator is responsible for obtaining accurate and current vicinity property legal description, conducting a walk-on survey, and preparing a scale drawing for the radiological survey team (see Sect. 7.3, Property Base Map Development).

15.10.5.5 Consent Form Coordinator

The Consent Form Coordinator will obtain accurate and current vicinity property ownership data and attempt to obtain a consent for access for the purposes of the walk-on radiological survey (see Sect. 7.2, Consent for Access to Survey Property).

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.10.5.6 Process Coordinator

The Process Coordinator will assign vicinity property files to specific survey teams for surveying, monitor survey team and property file progress, and supervise the review completed reports before submittal to the Report Typist for final editing and typing of the recommendation letter (see Sect. 15.6, Inspection, Test, and Operating Status, and Sect. 10.7, Report Review).

15.10.5.7 Reports Coordinator

The Reports Coordinator will review all completed reports before submittal for final typing to ensure technical correctness and clerical accuracy.

15.10.5.8 Computer System Manager

The Computer System Manager is responsible for developing, maintaining, and controlling all data processing services; the primary database functions are storing, retrieving, and transmitting vicinity property survey data.

15.10.5.9 Electronics Technician

The Electronics Technician is responsible for maintaining updated equipment maintenance manuals and maintenance and calibration logs for all equipment (see Sect. 12).

15.10.5.10 Report Typist

The Report Typist will perform final revisions on survey reports, prepare the letter of recommendation, copy all appropriate vicinity property file data, and mail the completed "Official Location Folder" to DOE (see Sect. 10.8, File Transmittal).

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.10.6 Procedure

15.10.6.1 General

To the extent possible, all records, data, maintenance manuals, and forms used or referenced in vicinity property survey related activities will be identifiable by revision level and date.

15.10.6.2 Survey Planning

In the process of survey planning, the Team Leader will verify that input data and records used are the latest available sources of information. He may elect to compare this data with historical site information to determine physical changes.

15.10.6.3 RASA/UMTRA Procedures Manual

Distribution of the RASA/UMTRA Procedures Manual will be accomplished by cover letter to assigned individuals who will be accountable for the assigned manual. Manuals are to be distributed in total to ensure that personnel using specific procedures also have available those procedures or sections that may be referenced.

To accommodate the usage of procedures during field activities, a manual will be assigned to each field and mobile scan van. The Team Leader will be accountable for the manual.

The QA Coordinator will ensure that he or she receives a file copy of all cover letters used to issue RASA/UMTRA Procedures Manuals. When procedures are revised and approved for issue, they will be distributed to all manual holders. The cover letter will contain instructions concerning the disposition of obsolete procedures or sections. A file copy of all revisions of RASA/UMTRA Procedures Manual sections and procedures will be retained by the QA Coordinator to provide a historical record of revisions in accordance with the procedure of Sect. 15.3, Procedure Preparation.

15.10.6.4 Equipment Operating and Maintenance Manuals

Equipment operating and maintenance manuals will accompany the associated equipment at all times. Where this policy is not practical, the appropriate operating and maintenance procedures will be provided in the RASA/UMTRA Procedures Manual, which will always accompany a survey team. As a precaution, a copy of these manuals will also be maintained in the corresponding records files kept by the Electronics Technician. In addition, sufficient data will be recorded to ensure the ability to reorder appropriate information in the event a manual is misplaced or lost.

When changes to operating parameters or maintenance procedures are made for a piece of equipment, changes to the corresponding equipment operating and maintenance manuals will be made. These changes will be identified by revision level and date as in Sect. 6.1 of this procedure.

15.10.6.5 Data Collection and Reporting Forms

The use of up-to-date forms and report formats will be controlled through periodic surveillances of this activity. The Reports Coordinator will maintain a separate file of all forms used to report RASA/UMTRA activities and ensure that when forms are revised, all outdated copies are removed from use or destroyed.

15.10.6.6 Protection of Vicinity Property File Data

The original scale drawing of the surveyed vicinity property shall be maintained in a central file kept by the Graphics Coordinator.

All original field data and photographs of surveyed properties located outside of Mesa County shall be archived by the respective Team Leader.

All original vicinity property file data shall be returned by the Report Typist and archived in the appropriate file.

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.10.7 Exhibits

None.

15.10.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

15.11 CONTROL OF DEFICIENT ITEMS

15.11.1 Purpose

The purpose of this procedure is to describe the methods for identifying and segregating deficient items and obtaining corrective action.

15.11.2 Applicability

This procedure applies to equipment and instrumentation improperly identified, in disrepair, or in need of calibration. It also applies to processes or services necessary to complete project goals in an accurate and timely manner.

15.11.3 References

1. Sect. 12, Measuring and Test Equipment Calibration
2. Sect. 14.1, Procurement of Services and Equipment
3. Sect. 14.2, Identification of Subcontractor Requirements
4. Sect. 15.3, Procedure Preparation
5. Sect. 15.4, Control of Purchased Items and Services
6. D-2-8 Std. Practice Procedure, Consultant and Special Services
7. D-2-8S ORNL Supplement Std. Practice Procedure, Consultant and Special Services.
8. D-2-1 Standard Practice Procedure, Part 1, Procurement of Materials
9. Martin Marietta Energy Systems Purchasing Division Manual
10. Procedures QA-L-6-100-103, ORNL Quality Assurance Manual

15.11.4 Definitions and Abbreviations

15.11.4.1 Definitions

DEFICIENCY. A nonconformance or departure of a characteristic from specified requirements. For purposes of this procedure, deficiencies apply to equipment and instrumentation that may be damaged, in need of modification, improperly identified, or past the due date for calibration such that the quality of associated tests, analyses, or measurements would be in question. Deficiencies also apply to processes or contracted services which are not performed in a timely and/or accurate manner.

Also see Sect. 1.5 of this manual, Terminology.

15.11.4.2 Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.11.5 Responsibilities

15.11.5.1 RASA Program Manager

The RASA Program Manager or the RASA/UMTRA Project Manager is responsible for ensuring that all items and services satisfy the guidelines and standards established in the reference section of this procedure.

15.11.5.2 QA Coordinator

Upon notification of an unusual or unplanned event, the QA Coordinator will determine how it should be reported. It should be reported as one of the following: (1) Nonconformance Report (NCR); (2) Quality Investigation Report (QIR); or (3) Unusual Occurrence Report (UOR). The QA Coordinator is also responsible for performing follow-up on the identified deficiencies to obtain corrective action.

15.11.5.3 Team Leader and Sample Coordinator

The Team Leader and Sample Coordinator are responsible for ensuring the early detection of deficiencies in all equipment and instrumentation utilized in the performance of radiological surveys and/or soil sample analysis. They are also responsible for instructing all Survey Team Members or Sample Technicians in the use of this procedure. In addition, they are also responsible for informing the Electronics Technician of equipment or instrumentation identified as deficient and in need of calibration in accordance with Sect. 12, Measuring and Test Equipment Calibration.

15.11.5.4 Electronics Technician

The Electronics Technician is responsible for maintaining appropriate documentation demonstrating the status of identified deficiencies.

15.11.5.5 Process Coordinator

The Process Coordinator shall alert the Survey Manager to any lag in RASA/UMTRA activities (drawings, consent forms, surveys, or written reports) which may serve as a potential deterrent to realizing RASA/UMTRA project goals. In addition, the Process Coordinator shall supervise the documentation and monitoring of the revision process of any survey reports returned from DOE.

15.11.5.6 Reports Coordinator

The Reports Coordinator will document and monitor the revision process of any survey reports returned from DOE. This documentation will serve as a monthly report which will be sent to the RASA/UMTRA Project Manager and QA Coordinator.

15.11.6 Procedure

15.11.6.1 General

For more specific QA procedures in relation to identification, control, and investigative/corrective action for nonconforming items, services, or processes, please refer to Procedures QA-L-6-100-103 of the ORNL QA Manual.

15.11.6.2 Identification of Deficiencies

Deficiencies in equipment and instrumentation may be identified by any member of the RASA/UMTRA staff. Once a deficiency is identified and a description of the deficiency is noted in the appropriate log book, the Electronics Technician will be informed so that he may make a recommendation of whether or not continued use of the equipment or instrumentation is justified. The RASA/UMTRA Project Manager will determine whether to continue using the item. The QA Coordinator will determine how the deficiency should be documented.

15.11.6.3 Temporary Disposition of Deficiency

If it cannot be immediately determined that a deficiency will cause the quality of associated tests, analyses, or measurements to be in question, the RASA/UMTRA Project Manager may elect to allow the continued use of the equipment or instrumentation. However, after repair or calibration, an evaluation should be made to determine if any retesting must be performed.

15.11.6.4 Repair or Modification of Damaged Equipment and Instrumentation

The Electronics Technician will determine the best method of repair. The available alternatives are to perform the work in-house by sending the item to the ORNL I&C Laboratory or the BFEC Environmental Sciences Laboratory, or through use of an outside repair service. If outside repair services are elected, the requirements of the procedures of Sects. 14.1, Procurement of Services and Equipment, and 15.4, Control of Purchased Items and Services, will apply. If repair of the item involves modification of the equipment or instrumentation, an evaluation should be made to determine whether or not any changes to instructions contained in applicable procedures are necessary. See Sect. 15.3, Procedure Preparation, for guidance on procedure changes.

15.11.6.5 Lack of Identification

If equipment or instrumentation is not properly identified, the ORNL department responsible for its issue will be consulted to obtain the necessary information.

15.11.6.6 Deficiencies Suspected in Calibration

The requirements contained in applicable Sect. 12 procedures will be followed when equipment or instrumentation is suspected to be out-of-calibration or when the established due date for calibration has passed.

15.11.6.7 Records

Exhibits 15.11.6-1, 2, and 3 provide the appropriate forms used to document a Nonconformance Report (NCR), a Quality Investigation Report (QIR), and an Unusual Occurrence Report (UOR). Associated logs and records will be annotated with appropriate notations to describe the actions taken to correct deficiencies and to clear any questions concerning the validity of tests, analyses, and measurements. Records will be available for review by the QA Coordinator to determine that deficiencies are properly identified and corrective action has been taken. If any adverse trends are noted during this review, a written report will be made by the QA Coordinator to the RASA Project Manager along with recommendations to prevent recurrence.

15.11.7 Exhibits

1. 15.11.6-1, Nonconformance Report (NCR)
2. 15.11.6-2, Quality Investigation Report (QIR)
3. 15.11.6-3, Unusual Occurrence Report (UOR)

15.11.8 Revision History

Rev. 1 Date: 03/31/86 First Revision

15.12 SURVEILLANCE/AUDIT PROGRAM

15.12.1 Purpose

The purpose of this procedure is to describe the requirements for surveillance and audits of RASA/UMTRA activities to ensure continued implementation of quality requirements and to determine its effectiveness.

15.12.2 Applicability

This procedure applies to all RASA/UMTRA activities performed at vicinity property survey sites and at the Grand Junction RASA/UMTRA office; subcontractor activities are included.

15.12.3 References

1. Procedure QA-L-8-100, ORNL Quality Assurance Manual

15.12.4 Definitions and Abbreviations

See Sect. 1.5 of this manual, Terminology.

15.12.5 Responsibilities

SUBJECT: QUALITY ASSURANCE PROCEDURES

15.12.5.1 RASA/UMTRA Project Manager

The RASA/UMTRA Project Manager is responsible for conveying to all members of the RASA/UMTRA project the importance of continued surveillance and monitoring of all activities to ensure that applicable procedures are followed and requirements are met in accordance with Sect. 1.3, Scope.

15.12.5.2 QA Coordinator

The QA Coordinator is responsible for (1) conducting internal audits of the RASA/UMTRA organization and subcontractors; (2) assisting the ORNL QA Lead Auditor in performing audits; (3) maintaining audit logs for the RASA/UMTRA organization; and (4) following up on corrective actions resulting from both internal and external audits.

15.12.6 Procedure

15.12.6.1 ORNL Internal Audits

The ORNL QA Lead Auditor performs regular QA audits of ORNL research and development divisions, service divisions supporting the research of ORNL programs, and other service divisions that provide services for ORNL in order to verify that the ORNL QA program is effective and in order to ensure compliance with the ORNL QA program and applicable procedures. Normally, one audit is conducted each month in a division, project, or facility selected by the ORNL QA Director.

15.12.6.2 QA Program Description

Audits are conducted in accordance with an announced audit plan and checklist by the ORNL QA Lead Auditor (Chairperson) with a team composed of ORNL staff members. The audit team members are chosen by the Lead Auditor for their experience and/or knowledge in QA and/or in the activity being audited. Normally, a member of ORNL management is a member of the audit team. Audits are conducted in accordance with ORNL QA Procedure QA-L-8-100.

Audit findings and recommendations of the audit team, as well as agreements and commitments for correction of any deficiencies, are documented by the audit team. The reports are distributed to ORNL and division management, as well as the RASA/UMTRA QA Coordinator.

Audit corrective actions are placed on a computer tracking system for appropriate follow-up by the RASA/UMTRA QA Coordinator.

15.12.6.3 Division Internal Audits

The Division and Program QA Coordinator performs QA audits of activities within the division or program to verify for the Division Director that the QA program is effective and to assure that the staff is complying with appropriate aspects of the division's QA program.

Audits may be formal or informal. During formal audits, the following activities are normally documented: notification of audit, audit plan, audit checklist, audit findings, corrective action recommendations, and final summary report to division management.

Formal audits are normally conducted by an audit team chaired by the Division or Program QA Coordinator. The QA Coordinator reports to division and/or program management and is independent of activities being audited.

Informal audits are conducted more frequently than formal audits. They are normally conducted by the QA Coordinator on an individual basis with the responsible individual(s) in the group being audited. These informal audit activities may or may not be formally documented, but are recorded on the QA Coordinator's audit log.

Audits are conducted when scheduled by the QA Coordinator or when scheduled by responsible division management.

15.12.6.4 DOE UMTRA Project Office Audits

The DOE UMTRA Project Office will conduct formal audits periodically, with the assistance of the Technical Assistance Contractor's QA Manager. The RASA/UMTRA QA Coordinator will assist in these audits and attend the post audit meeting. The QA Coordinator will also follow up on all corrective actions resulting from the audit.

15.12.7 Exhibits

None.

15.12.8 Revision History

Rev. 1	Date: 03/31/86	First Revision

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.3-1. Procedure numbering system*

Section no.	Section and procedures description
	Introduction Section
1	INTRODUCTION
2	INTEGRATED ACTIVITY FUNCTIONAL DESCRIPTION
	Planning Procedures
3	PROGRAM ADMINISTRATION
4	SUBCONTRACT PLANNING
5	QUALITY ASSURANCE PLANNING
6	PROJECT MANAGEMENT
	Implementation Procedures
7	PRE-INCLUSION SURVEY ACTIVITIES
8	MOBILE GAMMA SCANNING VAN
9	INCLUSION SURVEY ACTIVITIES
10	POST-INCLUSION SURVEY ACTIVITIES
11	EQUIPMENT INVENTORY, CONTROL, AND MAINTENANCE
12	CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT
13	DATA MANAGEMENT
14	SUBCONTRACT SERVICES AND ADMINISTRATION
15	QUALITY ASSURANCE PROCEDURES

*Procedures are to be numbered according to the 15 sections of the Procedures Manual.

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.3-2. Procedure review form (PRF)

PART 1 ( ) NEW ( ) REVISED

Procedure Number:____________________Revision:________

Title:____

Page(s) and Paragraph(s) Affected:

Reason and References

Originator:__________________________ Date:_______

PART 2

Approval:

RASA/UMTRA Project Manager:_________________Date:_____________

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.3-3. Request for procedure deletion (RPD)

Procedure Number:____________ Revision:____________

Title:________________________________

It is requested that the above procedure be deleted.
Reason for deletion:

Originator:____________ Date:__________

Comments:

Concurrence:

RASA/UMTRA Project Manager:________________

Date:__________

Exhibit 15.3-4. Procedure deletion notification (PDN)

Procedure Number:________________________Revision:________________

Title:____

The above procedure has been deleted from the Remedial Action Survey and Certification Activities Procedures Manual.

Discard the copy of the procedure in your possession and replace it with this sheet.

RASA/UMTRA Project Manager:____________________________

Date:_____________________

Exhibit 15.11.6-1. Nonconformance Report (NRC)

QA PROGRAM	NCR NO. DIVISION

TYPE: ☐ MATERIAL ☐ PART ☐ SYSTEM ☐ ASSEMBLY

PROJECT TITLE PROGRAM

ITEM NAME	DWG / SPECIFICATION NO.
VENDOR / SHOP	WORK / PURCHASE ORDER

DESCRIPTION AND CAUSE OF NONCONFORMANCE

NAME TITLE DATE

PROPOSED REMEDY AND JUSTIFICATION

PROPOSED DISPOSITION: ☐ USE UNCORRECTED ☐ REPAIR ☐ REWORK ☐ REJECT

NAME TITLE DATE

DISPOSITION:	☐ USE UNCORRECTED ☐ REPAIR ☐ REWORK ☐ REJECT		QI REPORT REQUIRED	☐ YES ☐ NO	
APPROVED BY:	TASK LEADER	DATE	OTHER	DATE	
	LEAD DESIGNER	DATE	OTHER	DATE	
	ITEM USER	DATE	QAC	DATE	

QA REASSESSMENT REQUIRED ☐ YES ☐ NO

☐ APPROVED DISPOSITION COMPLETED

NAME TITLE DATE

UCN-10077
(23 1-85)

Exhibit 15.11.6-1 (Continued)

INSTRUCTIONS FOR USE

1. On report of a nonconformance the Task Leader or person(s) delegated by the Task Leader shall fill in the initial portion of this form and complete the Description and Cause of Nonconformance portion as soon as possible.

2. If the cause of the nonconformance is not immediately determinable, the Task Leader or his designee(s) shall upon completion of the quality control or quality assurance measures necessary to determine the cause promptly complete this portion. The Task Leader or his designee shall sign and date this portion on completion at the indicated place.

3. Upon evaluation by management of the remedial action necessary to dispose of the item and the justification for such action, the Task Leader or his designee(s) shall complete the portion, Proposed Remedy and Justification, detailing actions to be applied to the item and the reasons the remedy will make the item adequate for the intended use. The recommended disposition shall be indicated in this portion. The Task Leader or his designee shall sign and date this portion on completion.

4. The NCR Continuation Sheet shall be used as necessary to adequately explain Steps 1, 2, and 3.

5. The material review board shall complete the portion, Disposition and Corrective Action Report, by checking the appropriate box indicating the decision of the material review board.

6. The portion, Approved By, requires the signature of the Task Leader or his designee and all personnel substantially participating in the evaluation of the nonconformance, recommending disposition, and/or requiring a quality investigation report, giving date and title.

7. Where the nonconformance results in a violation of design requirements and the disposition recommended is Use Uncorrected or Repaired, the approval of the Lead Designer is required by his signature with date.

8. All NCR's pertaining to items manufactured, fabricated, or assembled at MMES require the signature of the person using the final item or responsible for its performance in service, or the signature of his supervisor; unless such authority is specifically delegated to others.

9. The NCR and each attached NCR Continuation Sheet shall be signed and dated at the appropriate places.

10. The QAC shall, upon satisfactory completion of all required QA actions, sign and date the NCR, and indicate if a QA reassessment is required.

11. A copy of the NCR completed to this stage shall be transmitted to the personnel who are to accomplish the approved disposition, and upon completion, the responsible person shall check the box Approved Disposition Completed, sign, give title, date the copy, and return it to the project.

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.11.6-2. Quality Investigation Report (QIR)

INDEX NO.

REPORT DATE:
☐ Initial
☐ Interim
☐ Final

PART I

1. TITLE (Descriptive) | DATE OF PROBLEM | QIR NO.

2. DESCRIPTION OF PROBLEM AND SIMILAR OCCURRENCES

3. OPERATING CONDITIONS & CONTRIBUTING FACTORS

4. IMMEDIATE ACTION TAKEN (Submit to immediate supervision within 2 working days of problem recognition.)

Originated By | Date | Supervisor | Date

5. PRELIMINARY INVESTIGATION AND EVALUATION (Include any preliminary indications of contributing QA deficiencies.)

APPARENT CAUSE:	☐ Design	☐ Material	☐ Personnel	☐ Procedure	☐ Other
QA ASSESSMENT:	☐ Adequate	☐ Deficient	☐ Nonexistent		☐ QAA No. ______
QA PLAN:	☐ Adequate	☐ Deficient	☐ Nonexistent	☐ Not Required	☐ QAP No. ______
COST IMPACT:	☐ Over $50,000	☐ $25,000 - $50,000	☐ $5,000 - $25,000	☐ Under $5,000	Est./Actual Cost $ ______

6. IS CORRECTIVE ACTION REQUIRED? (Explain in terms of QA or administrative actions required as well as needed "technical fix".)

7. FURTHER INVESTIGATION IS REQUIRED: ☐ Yes ☐ No

INVESTIGATION TEAM: Chairman | QA Representative

APPROVED | DATE | DIVISION QA COORDINATOR | DATE

8. DISTRIBUTION: Dept./Section Head | Plant QA Coordinator | Others (List)
Div. Director/Manager | Division QA Coordinator

UCN-10994
(1235 6-84)

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.11.6-2 (Continued)

PART II Investigation Team Report

9. FINDINGS (Include any specific QA deficiencies noted during the investigation. Attach supplemental information.)

10. CORRECTIVE ACTION(S) RECOMMENDED (Explain in terms of QA or administrative actions required as well as needed "technical fix".)

11. OTHER SITUATIONS WHERE RECOMMENDED ACTIONS MAY BE APPROPRIATE.

SUBMITTED BY:	Chairman	Date

12. FOLLOW-UP ASSIGNED TO:		13. SCHEDULED COMPLETION DATE:	
APPROVED BY: Division/Manager/Director	Date	Division QA Coordinator	Date

SUPPLEMENTAL DISTRIBUTION:

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.11.6-3. Unusual Occurrence Report (UOR)

MARTIN MARIETTA ENERGY SYSTEMS, INC

MARTIN MARIETTA ENERGY SYSTEMS, INC.
OAK RIDGE NATIONAL LABORATORY
UNUSUAL OCCURRENCE REPORT

Page 1 of ____

1. Report No. ____________
2. Report Date
   Initial ____________
   Interim ____________
   Final ____________

3. Division or Project

4. Facility, System, and/or Equipment

5. Date of Unusual Occurrence | 6. Time of Unusual Occurrence

7. Unusual Occurrence Subject

8. Apparent Cause: Design ______ Material ______ Personnel ______ Procedure ______
   Other ______, *Explain in Item 14*

9. Description of Unusual Occurrence

10. Operating Conditions of the Facility at Time of Unusual Occurrence (if applicable)

11. Immediate Evaluation

UCN-11100
(3 5-84)

SUBJECT: QUALITY ASSURANCE PROCEDURES

Exhibit 15.11.6-3 (Continued)

UNUSUAL OCCURRENCE REPORT

Page 2 of ____

Report No. ____________

Report Date ____________

12. Immediate and/or Temporary Corrective Action Taken and Results

13. Is Further Evaluation and/or Corrective Action Necessary? Yes_____ No _____
    If Yes: Before Further Operation

    By Whom? ____________

    When ____________

14. Final Evaluation and/or Corrective Action

    Taken ________ Recommended ________ To be supplied ________

15. Programmatic Impact

16. Impact Upon National Codes and Standards, Including RDT Standards

17. Similar Unusual Occurrence Reports [indicate report no.(s)]

18. Suggested Laboratory-wide Application of Corrective Action Taken for this Unusual Occurrence

19. Signatures:

    Originator ____________ Date ________

    Approved by ____________ Date ________

    Approved by ____________ Date ________

    Approved by ____________ Date ________

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EXTERNAL DISTRIBUTION

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62-88. Office of Scientific and Technical Information, DOE, Oak Ridge, TN 37831

89. B. Beardon, Jacobs Engineering Group, Inc., 5301 Central Avenue, Suite 1700, Albuquerque, NM 87108

90-97. J. G. Themelis, UMTRA Project Office, U.S. Department of Energy, P. O. Box 5400, Albuquerque, NM 87115

98. M. G. White, UMTRA Project Office, U.S. Department of Energy, P. O. Box 5400, Albuquerque, NM 87115