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HEALTH PHYSICS PROCEDURE

VERIFICATION PROCEDURES FOR VICINITY PROPERTIES
AND TAILINGS SITES

RAC-015

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VERIFICATION PROCEDURES FOR VICINITY PROPERTIES AND TAILINGS SITES
RAC-015

1.0 SCOPE

1.1 Purpose

To define procedures for final verification of excavated areas to show compliance with applicable EPA mill tailings site and vicinity property land clean up standards.

1.2 Applicability

This procedure applies to all UMTRA vicinity properties (VP) and tailings sites. Section 6 of this procedure applies to all UMTRA vicinity properties and mill tailings sites with windblown surface contamination. Currently, only those areas contaminated with windblown tailings may be verified clean to UMTRAP standards using RTRAK. However, RTRAK may be used in other areas for excavation control.

2.0 PREREQUISITES

All instruments used under this procedure must have valid calibration. For VPs, as stated in the VPMIM, a survey grid may be used to approximate the X and Y coordinates used for initial characterization of the excavated area (inclusion or REA surveys).

Back up data (correlations, etc.) must be acquired, and made available for audit, on all methods used for excavation control and verification measurements.

3.0 REQUIREMENTS

In general, UMTRA tailings sites and vicinity properties will be cleaned to the US EPA standards (40 CFR 192).

US EPA standards: 5 pCi/g Ra-226 average concentration above background for surface areas, 15 pCi/g Ra-226 above background for areas to be more than 6 inches below grade after backfill. The area to be verified shall previously have been determined to be clean via delta measurements, immediate opposed crystal system (OCS) analysis or other methods, which may include on-site analyses for Th-230 and Th-232.

3.1 For sites, grid the area to be verified into 100 square meter blocks; for vicinity properties, duplicate the coordinates used for REA surveys. Location of these blocks must be tied to landmarks used in defining the previous survey grid. (Within this procedure, the terms 100 square meter, 10 x 10m, and 30' x 30' grid are used interchangeably, for convenience).

3.2 For sites and VPs, grid coordinates AND depth < or > 15 cm (< or > 6") of final soil samples are required to be recorded in the sample ID/location column (an average depth is acceptable for the area being verified). Verification sample I.D. numbers and analytical results are required to be recorded on a map of the site (construction drawing) and/or VP (as built drawing). Grids shall be marked on the official verification maps as they are verified by the initial OCS count.

3.3 The OCS must be energy calibrated/checked. These checks must be recorded on the OCS Daily Checks Form (Attachment 1). Minimum Detectable Activity (MDA) will be determined on a site-specific basis, as directed by the Instrumentation Manager - Project Office. MDA values shall not be recorded in the sample results column of the OCS record sheets. Actual OCS-generated pCi/gm values, negative and positive, shall be entered in these columns and the MDA entered at the bottom of the record sheet (Attachment 2).

3.4 Site-specific and vicinity property-specific emanation and moisture correction factors must be developed prior to utilizing the OCS to count wet, unequilibrated soil samples. These correction factors shall be updated on a monthly basis during periods of verification work, with documentation placed on file.

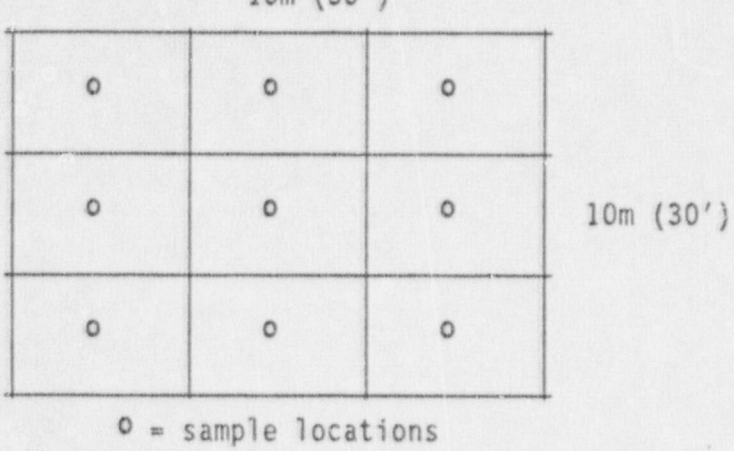
3.5 The operation protocol for the OCS shall be utilized to analyze soil samples with the system(s).

3.6 If a site's OCS lead pig(s) can be vertically mounted for operation and background gamma radiation indicates the pig door(s) can be removed, data shall be collected and documented demonstrating the doors are not required (i.e., MDA requirements can be met).

4.0 PROCEDURE

4.1 Informally, grid each 100 square meter block into approximate 10 x 10 foot squares (see below). This gridding may normally be done visually by the technician performing the verification survey, as the purpose is to provide a random sampling of the area to be verified. For verification, soil sample extraction will be performed at each of the nine 10 x 10 foot squares within the grid. Because the purpose of final verification sampling is to establish the average radium concentration in a 100 m^2 area, biased, non-random sampling (hot spot sampling), should not be performed. Prior excavation control surveying should have resulted in removal of significant hot spots. This applies both to sites and vicinity properties.

Final verification sampling shall be performed at the final excavated elevation. If the area is excavated further for whatever reason, a new verification sample shall be collected (e.g., further excavation for thorium). Exceptions to this requirement must be documented by formal transmittal from Albuquerque RAC/DOE authorities.



o = sample locations

4.2 Seal the sample and count on the OCS immediately. If the OCS pCi/g multiplied by the site specific correction factor indicates that the standards have been met, number and label this sample as the final verification sample. If the sample results indicate the area is clean, it may be backfilled. If not, further remedial action is necessary. If the area being verified is contaminated with Th-230, do not label the sample as the final verification sample until it is confirmed that this nuclide is also below criteria.

4.2.1 As soon as feasible, dry the verification composite sample.

Seal, weigh, and subtract an average value for the weight of the empty can and lid. Record the (dry) weight of the soil, and count at least 20 days later on the OCS system using standard procedures. Record the Ra-226 concentration on the verification log sheet. Leak tests of a sealed sample shall be performed on every 50th sample counted to assure that the sealing system is working properly. Leak tests shall be accomplished by submerging the sealed sample can in hot water and watching for the formation of bubbles from pressure buildup in the can. Results of the leak tests shall be recorded in the "remarks " section of the OCS record sheets.

4.2.2 If the final 20 day results exceed the standards for the specific property or grid, notify the Radiological Programs Manager immediately for guidance.

4.2.3 At least every 25th verification sample (4%) is to be sent to an offsite laboratory for Ra-226 and Th-230 analysis on a routine basis. These QA samples are to be sent out as soon as possible after the 20-day count. Results from vendor analysis shall be recorded on the OCS record sheet, when received, and the vendor results form shall also be retained. All vendor-provided Ra-226 analytical results shall be compared with OCS results on a routine basis.

4.2.4 Permanently store all verification samples at the site. Storage should be arranged and organized for easy sample retrieval, as described in Attachment 3. Do not store any samples or sources near the OCS. The DOE requires that all final verification samples taken at tailings sites and vicinity properties be stored by the RAC prior to archiving.

4.2.5 QA samples sent to an offsite laboratory shall be returned to the originating site after analysis, for archiving. Instruction for return shipments shall be provided to the vendor on the Laboratory Services Authorization Form(s).

4.2.6 Verification samples that are released to other parties for analysis, other than vendor QC samples, shall be documented on a Sample Release Form (Attachment 4).

5.0 POINT SOURCE VERIFICATION (for vicinity properties only)

5.1 The following guidance shall be used to verify clean-up of identified point sources:

5.1.1 A point source is defined to be a small area, one cubic foot or less in volume, that exceeds EPA standards, 5 and or 15 pCi/g of Ra-226 in soil, or has gamma radiation levels in excess of background +50%.

5.1.2 Locate the point source using the same grid system established during the REA.

5.1.3 Record the location and pre-cleanup gamma reading of the point source on an appropriate form.

5.1.4 Excavate the point source and transport the material to the disposal site.

5.1.5 Resurvey the area of the point source and record the gamma reading on the form used above.

5.1.6 Gamma levels < background +30% indicate successful decontamination. The area of the point source is considered "clean" and verified to meet EPA standards.

5.1.7 Gamma levels > background +30% at excavated point sources indicate the need for additional radiological investigation and/or decontamination. The area may no longer be considered a point source and must be included in a soil sample verification grid for final verification.

5.1.8 Attachment 8 of this procedure shall be used to record point source verification data.

6.0 PROCEDURE FOR THE FIELD ANALYSIS SYSTEM FOR THORIUM-230 (F.A.S.T.)

6.1 Discussion

Th-230 in disequilibrium with Ra-226 presents a unique analytical problem for UMTRA site laboratories. Since Th-230 is essentially a pure alpha emitter, a method of providing excavation control on site without elaborate chemical processing is desired. Direct gross alpha counting of soil has been used for many years by various organizations for screening purposes, but the accuracy of the procedure is highly dependent upon the soil and radionuclide matrix as well as the preparation/counting method. Care must be taken to ensure that the soil preparation and counting methods used are consistent so that the other variables of soil type and radionuclide mixture can be quantified and accounted for in the data reduction process. Where Th-232 soil concentrations may produce interferences for F.A.S.T., the set up for counting Th-232 on the OCS shall be utilized (Attachment 5) and a Th-232 correction applied.

6.2 Preparation of Petri Dishes

6.2.1 Cover the work area with paper or plastic. Work with only five petri dishes at a time. Remove the top covers and set out the bottoms on the work area.

6.2.2 Spray the interior of the petri dishes with the Photo Mount adhesive, applying the adhesive in an even coat. Spray in two mutually perpendicular directions.

6.2.3 Place a small amount of zinc sulfide in each dish and agitate to cover all the adhesive. Let stand for five minutes and then dump out the excess (save it for future use). Invert the petri dish and tap lightly to remove any excess. Only a thin, transparent coating is required. Discard any dishes with visible nonuniformity in coating.

6.2.4 Cover and store prepared dishes in a dry, dark area until needed.

6.3 Guide - Soil Preparation

6.3.1 Analytical results from several soil samples collected at Lakeview indicate that at Ra-226 concentrations of 1.5 pCi/g and greater, Th-230 concentrations will appear to be greater than the 35 pCi/g guideline, due to radium-related alpha particle interference. In areas where Th-230 disequilibrium with Ra-226 is suspected, and the FAST system is to be used, excavation should be continued to background, uniform Ra-226 levels using standard gamma scanning excavation control techniques, and OCS checks.

6.3.2 Collect a composite soil sample as described in Section 4.0 of this procedure. In the lab, transfer the soil sample to a shallow, aluminum baking pan. Make sure that the sample number is written on the pan. Save the sample can for future use. Place the soil sample in the oven to dry. Dry at 110° (± 5°) C until dry, approximately four hours.

6.3.3 Pass the sample through a 3 1/2 mesh sieve to remove gravel and rocks. Save the greater than 3 1/2 mesh fraction in the original sample can. Transfer the portion of the sample which passed through the sieve to the grinder hopper. Adjust the tension on the grinder plates by backing off the butterfly nut, tightening the thumb screw until just snug, then back off the thumb screw slightly and tighten the butterfly nut. Place a 100 mesh sieve and bottom pan assembly under the grinder and grind the sample into it.

6.3.4 After grinding, stack a 3 1/2 mesh sieve on the 100 mesh sieve. Cover the assembly for shaking. Shake until the majority of the sample (either type) passes through the 100 mesh sieve or for a minimum of five minutes. Transfer the material which does not pass through the 100 mesh sieve back to the original sample can. Aliquot at least 5 grams of the less than 100 mesh fraction into a previously prepared petri dish, seal with black vinyl tape, label, and store in a dark location until counted. Transfer the remaining material to the sample can. Seal the sample can and allow ingrowth for Ra-226 determination. This can now contains all but 5g of the original sample, and becomes the final Ra-226 verification sample, if no further excavation is needed.

6.4 Sample Counting

6.4.1 Quarterly, plateau the SAC-R5 and scaler, using an electroplated Th-230 source in a zinc sulfide coated petri dish. At the chosen high voltage setting, count a 50-minute background without a petri dish. If the empty background exceeds 0.2 cpm, recount. If it still exceeds 0.2 cpm, the high voltage may be too high. Readjust the voltage and recount. An empty SAC-R5's background should not exceed 0.2 cpm.

6.4.2 Daily, count a 10-minute background with an empty zinc sulfide coated petri dish. Check the instrument's response using a Th-230 electroplated source in the petri dish. The response must fall within ± 2 sigma of the average of the previous source checks.

6.4.3 Count the prepared soil samples for 10 minutes each. Calculate the Th-230 activity using the linear regression equation (Section 6.5) for the SAC-R5 used and record on a Thorium-230 Verification Log (Attachment 6).

6.5 Th-230 Gross Alpha QA Program

6.5.1 100% of the first 100 samples shall be sent to the vendor lab for Th-230 analysis.

6.5.2 20% of the next 500 samples shall be sent to the vendor lab for Th-230 analysis.

6.5.3 10% of the remaining samples shall be sent to the vendor lab for Th-230 analysis.

5.5.4 Average background data shall be used for each SAC-R5 in sample calculations.

6.5.5 Vendor-provided Th-230 results shall be compared to the F.A.S.T. analyses and correlations updated on a monthly basis.

Samples with lab results between 10 and 50 pCi/g Th-230 should be used to develop the FAST correlation. The results shall be plotted as an x-y graph with vendor lab results as the ordinate and net FAST counts as the abscissa. A linear regression of the plotted data shall be performed.

6.5.6 Daily source checks shall be performed and checked against the running average for each SAC-R5 and must fall within 2 sigma of that value.

6.5.7 All samples sent to an outside vendor for analysis shall be analyzed for Ra-226 and Th-230.

6.5.8 Petri dish preparation is a critical part of this procedure. On a routine basis, the Site H.P. Manager shall review this process.

7.0 WINDBLOWN SURFACE CONTAMINATION - VERIFICATION USING THE RTRAK MOBILE SCANNER

7.1 Windblown Areas

Final verification of areas contaminated with windblown uranium mill tailings can be accomplished using the RTRAK radiation scanning system. Final verification is intended to show compliance with U.S. EPA mill tailings site or large vicinity property standards.

7.2 Constraints

This procedure applies only to UMTRA vicinity property and mill tailings site windblown surface contamination. RTRAK may be used in other areas for excavation control.

7.3 Calibration - RTRAK

To be used for final verification on any UMTRA Site, the RTRAK must be properly calibrated for that site. Because the calibration procedure at each site will vary, it should be coordinated with the Albuquerque Project Office Instruments Manager. In general, calibration at a site will consist of the following:

7.3.1 Defining, through initial RTRAK scans, a strip of contamination moving radially away from the tailings pile in the direction of the windblown contamination, such that contamination decreases from about 30 pCi/g radium in soil to background.

7.3.2 Scanning that strip, with the RTRAK properly set up, to record gamma levels in the two Bi214 regions of interest. During the scanning, markers will be set either using the built-in paint sprayers, or by other means including stakes, and numbered such that it will be possible to later take soil samples at known locations along that contamination strip.

7.3.3 Once the scanning is completed by RTRAK, a set of soil samples will be taken along the strip at the marked points. Each sample is composited from four 6" deep samples each taken directly under the "Track" of each RTRAK detector, in the center of the QC strip marked per 7.3.2, above. The soil samples will be canned and counted either in twenty days on a calibrated opposed crystal system, or via urgent or priority turn-around analysis by a vendor lab, as schedule requirements dictate, such that a correlation can be developed for that specific site between measured soil radium concentrations and RTRAK region of interest count rates.

7.3.4 Avoid performing this calibration process early in the morning, when local radon daughters may increase RTRAK background, or during or immediately after rainstorms, when the radon emanation rate may be influenced by environmental conditions. Generally, RTRAK site-specific calibrations should be performed during late morning and afternoon on clear, sunny days.

7.4 Measurements - RTRAK

In general, mill sites and vicinity properties will be cleaned to 5 pCi/g average concentration above background, for surface areas, and 15 pCi/g above background for areas to be more than 15 cm below grade after backfill. The EPA standards specifically define areas to be cleaned up as 100 square meters, generally 30' x 30' on the UMTRA Project. RTRAK is capable of resolving and verifying much smaller areas, but because the standards are specific in this regard, RTRAK data will not be officially reported for areas less than 100 square meters. This reported data will be an average of all measurements taken over each 100 square meter grid element. All raw data taken by RTRAK, however, will be retained and plotted for review by DOE, NRC, State and Tribal Officials, as requested.

7.4.1 For site verification, the RTRAK microwave autolocation grid system must be set up such that final RTRAK plots can be superimposed on the MK-Engineering site verification grid maps. This means that the RTRAK operator must request and receive the appropriate final MK-Engineering site grid maps prior to beginning verification at a particular site. These grid maps may be obtained with the assistance of the Albuquerque Chem-Nuclear Manager of Environment, Dosimetry and Verification (EDV), if not already available on site. The EDV manager is responsible to make certain that the grid maps have been prepared in advance of operations at each UMTRA Site. The RTRAK operator at a specific site should make certain that the local MK-Ferguson Site Manager and the local ChemNuclear Health Physics Manager agree that the maps being used to set up RTRAK verification are in fact correct and current.

7.4.2 The microwave transponders used in the RTRAK auto location system shall be placed at locations either surveyed by a licensed land surveyor or locations measured in using the above accurately surveyed positions as a reference.

7.4.3 When it is known in advance that a particular area being verified by RTRAK will be backfilled to a final depth exceeding 15 centimeters, the area to be backfilled should be carefully designated on the site grid map. This is required because backfilled areas are subject to the 15 pCi/g rather than 5 pCi/g verification standard.

7.4.4 The RTRAK operator's log book shall include a record of those environmental conditions that might affect the RTRAK readings. Therefore, the RTRAK operator's daily survey notes shall include the following:

7.4.4.1 Barometric pressure, temperature and relative humidity readings with each detector checkout during any radiological survey work.

7.4.4.2 Written observations made by the RTRAK operator of changing weather conditions such as rainfall or high winds. These observations shall be recorded at the same time as the above readings and should indicate whether or not rainfall is occurring, or occurred during the previous night, whether or not significant winds are occurring during the RTRAK measurement, and any other information that may be useful later to reconstruct the record of the RTRAK measurement process.

7.4.5 During RTRAK verification, RTRAK must be set up and operated in accordance with the current procedures specified by the Albuquerque Instruments Manager. Requirements include multiple daily count rate/energy calibration checks using a canned Uranium ore or tailings source and "background" counts with the source removed. As much as possible, the measurements shall be made at the same location, preferably one known to have no elevated activity due to windblown or deposited material. The results of these counts, along with the appropriate electronics checks shall be recorded on the RTRAK DAILY DETECTOR CHECKS and RTRAK DAILY ELECTRONICS CHECKOUT data sheets (Attachments 9 and 10). Unusual spectral data from the daily checks will be saved to a floppy disk file for review by the Health Physics Instrumentation Manager.

7.4.6 During RTRAK verification operations, any unusual situations encountered, either outside the RTRAK or within the RTRAK's radiation counting, electronics, or autolocation systems, should be immediately logged and reported to the local Site Health Physics Manager and to the Chem-Nuclear Albuquerque Instruments Manager.

7.4.7 Soil samples counted as a result of RTRAK verification operations must be counted as soon as feasible on a calibrated Opposed Crystal System (OCS) either at the local site or in the Albuquerque Project Office.

7.5 Verification Scanning

7.5.1 The need for verification of specific site areas shall be determined through consultation with the local Site Health Physics Manager. During verification, the RTRAK's paint sprayers may be activated to spray areas in excess of the 5 or 15 pCi/g (plus background) standard to aid in defining areas to be further excavated.

RTRAK shall be operated at the standard speed of approximately one mile per hour and the period of integration shall be five seconds. These values are subject to change at a later date by written notification from the Albuquerque Project Office.

7.6 Quality Assurance

7.6.1 Quality Control soil sampling shall be performed on eight (8) percent of the scanned area (2 grids per 25) via the establishment and sampling of normal 30' x 30' grids (4.1).

7.6.2 Quality Control samples from each grid shall be composited on the spot, mixed thoroughly, and an aliquot of the composite sample shall be placed in one of the opposed crystal system aluminum counting cans for OCS analysis.

7.6.3 Quality Control sample cans shall be marked on the spot using indelible ink with a sample number uniquely identifying them as QC samples taken at that specific location on the site. The Chem-Nuclear Systematic Sample Number System shall be used to identify all samples.

7.7 While performing verification measurements, the RTRAK operator shall be responsible for routinely checking operating parameters of the entire RTRAK system. Key parameters are as defined within the RTRAK operating manual. The RTRAK operator shall also be responsible to ensure that all verification data taken on any given day is properly and permanently recorded in at least three separate locations, such that loss of any individual data set will not require re-surveying. The following procedures shall be carried out to ensure data integrity:

7.7.1 Every thirty (30) minutes, data stored in the RTRAK ram disk shall be copied onto a 3 1/2 inch floppy disk.

7.7.2 At least twice daily, the 3 1/2 inch disk shall be copied to a 5 1/4 inch floppy. This should be coordinated in such a manner as to reduce the exposure of the 5 1/4 inch floppy to the RTRAK environment.

7.7.3 A magnetic tape copy of the 3 1/2 inch floppy shall be made when it is full, using the procedure provided in the operator's manual.

7.8 The RTRAK verification quality control samples shall be assayed using the site OCS system. At the site Health Physics Manager's discretion, the soil sample results may be used to recommend further excavation in the areas represented by those samples. Any areas receiving additional excavation shall require reverification. Four percent of these RTRAK quality control samples shall be sent to a vendor laboratory for routine Ra-226 analysis.

7.8.1 At the discretion of the Site Health Physics Manager, plots of RTRAK verification data may also be used to recommend additional excavation. The Site Health Physics Manager shall, particularly during early phases of RTRAK verification at the site, confer with the Albuquerque Project Office during such decision making. This is because experience gained during verification activities by RTRAK at other sites can be more easily correlated and transferred by Albuquerque Project Office staff. To ensure that any additional excavation indicated by RTRAK verification scans results in neither over-excavation (excavation in addition to that necessary to meet the standards), or under-excavation (lack of additional excavation when necessary to meet the standards), the following guideline for use of RTRAK verification data shall be applied:

7.8.1.1 RTRAK data shall be plotted using the same 1200' x 900' grids as the site verification grid map (provided by MK-Engineering; see Section 6.4.1). All RTRAK verification data within each 100 square meter grid element shall be averaged and shall represent the average radium concentration for that 100 square meter grid element.

7.8.1.2 The RTRAK calibration data for each specific site, and the record of RTRAK verification data versus the quality control soil samples taken at a particular site, shall be considered in determining the standard error of the RTRAK measurement. This error shall be determined by the Site Health Physics Manager, the Albuquerque Instruments Manager, and the Albuquerque Manager of Environment, Dosimetry and Verification. Given this evaluation, additional

excavation shall be recommended if less than 95% certainty exists that the 100 square meter grid element under consideration meets the appropriate EPA standard, (i.e., 5 pCi/g or 15 pCi/g above background). As twenty day opposed crystal system quality control sample results become available for a specific site, they shall be included in these calculations of current RTRAK accuracy.

7.9 Each day during RTRAK verification activities at a site, a brief meeting shall be held between the RTRAK operator and the RTRAK Site Health Physics Manager or designee, to discuss the day's activities, activities for the next period and any problems with RTRAK system operation. Maps representing RTRAK verification results, produced using the site computer, should be available for this review. On a daily basis, the 5 1/4" backup disks shall be transferred to the Site H.P. Manager. On a weekly basis, the tape data will be transferred to Albuquerque. The RTRAK operator shall record the results of the meeting in his daily log book.

The Site Health Physics Manager shall retain final responsibility and authority with regard to all verification measurements made by the RTRAK system at his site. Any problems or questions regarding RTRAK verification shall be immediately referred to Albuquerque Operations Office Chem-Nuclear staff for resolution. The Site Health Physics Manager is responsible for an adequate understanding of the RTRAK system operation and any problems which may exist during the RTRAK's operation at his site, in order to maintain this responsibility and authority.

To prevent introduction of error, no one other than the RTRAK operator or the CNSI Instrumentation Manager (or designee) shall be allowed to modify the RTRAK's counting equipment, electronics systems, programs, or any other RTRAK systems that could influence the accuracy of the final verification measurements being performed by RTRAK.

Records transferred on a daily basis to the Site Health Physics Manager by the RTRAK operator, shall be stored in a safe place at the site until such time as site verification activities are completed, at which time they will be transferred to the Albuquerque Project Office.

All quality control soil samples taken as part of RTRAK operations and counted on the site opposed crystal system, shall be treated in the same manner as verification soil samples taken for any other purpose. They shall be logged on the OCS and shall be stored and archived in the same manner as any verification sample. Record of these samples and their analysis results shall be stored in the site microcomputer-based data management system, in the same manner as any other verification samples.

The Site Health Physics Manager shall assure himself that an adequate RTRAK verification record is being prepared and maintained. As part of this process, a daily check of all RTRAK activities shall be performed, with progress plotted on the local site verification map. Particularly during early use of RTRAK for verification purposes, every effort must be made by responsible individuals to ensure that no problems affecting accuracy of the RTRAK verification record are evident or developing. If any questions occur, they should be immediately referred to the Albuquerque Project Office.

8.0 RECORDS

All records of soil verification shall be reviewed and approved routinely by the Site H.P. Manager, filed at the site and completed copies sent to the RAC ALB EDV Manager on a routine basis determined by the ED&V Manager.

LIST OF ATTACHMENTS

1. Daily OCS Quality Control Check Form
2. OCS Record Form
3. Soil Sample Storage System
4. Sample Release Form
5. Protocol for OCS Analysis of Th-232
6. Thorium-230 Verification Log Form
7. Systematic Sample Numbering System
8. Point Source Verification Form
9. RTRAK Daily Detector Check Form
10. RTRAK Daily Electronics Checkout Form

ATTACHMENT 1

DAILY OPPOSED CRYSTAL SYSTEM QUALITY CONTROL CHECKS

SITE: _____
DATE: _____
OCS INSTRUMENT: _____
SN: _____

50.2 STANDARD

1. Set the 2506 Co-60 Sum Peak to Channel 512.

2. Determine OCS resolution (1332 KeV Co60 Peak) _____, Channel# _____

3. Daily 10,000 Second Count Data:
(Check applicable count type and enter ROI data.)

Even			Odd		
Ra	_____	ROI 4	Ra	_____	ROI 3
Th	_____	ROI 6	Th	_____	ROI 5
Bkg	_____	ROI 8	Bkg	_____	ROI 7

4. Radium Standard Checks:
(Morning setup and at least one check per day)

(50.2 pCi/gm) GM WT =	_____	_____
Function # =	_____	_____
pCi/gm =	_____	_____

5. Gain Adjustment:

TIME	SUM PEAK SET CHANNEL #	SUM PEAK SET TO CHANNEL #
_____	_____	_____
_____	_____	_____
_____	_____	_____

5.12 STANDARD

(To be checked randomly with no system adjustment.)

SAMPLE NO.	TIME	FUNCTION 3	pCi/gm
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____

5.12 pCi/gm Sample Weight _____

Error Function: $\frac{\text{True Value}}{\text{Calculated Avg.}}$ = $\frac{50.2}{\text{--------}}$ = -------- ; -------- = $\frac{5.12}{\text{--------}}$

Signature of Technician _____ Time _____

Signature of H.P. Supervisor _____ Time _____

ATTACHMENT 2

MK-FERGUSON/CHEM NUCLEAR
OPPOSED CRYSTAL SYSTEM RECORD

SITE NAME _____

SITE AREA _____

OCS SERIAL NO. _____

COUNT DATE					OCS #	FUNCTION NO.	MASS	RA-226		VENDOR LAB RESULT		DEPTH	TECH	REMARKS
INITIAL 20 DAY	SAMPLE NUMBER	SAMPLE LOCATION	DATE SAMPLED	DATE SEALED	INITIAL 20 DAY	INITIAL 20 DAY	WET DRY	INITIAL 20 DAY	QC SAMPLE	Ra-226	Th-230	<15cm >15cm	INITIAL 20 DAY	

NOTE: All soil sample results are in pCi/gm

Site Correction Factor = _____.
Count Time = _____, unless noted otherwise.
MDA = _____ pCi/gm Ra-226

MDA Caluclation

$$4.65 \sqrt{\frac{10{,}000 \text{ sec. background cts.}}{20}}$$

(Ct. Time) (Eff.) (Sample Mass)*

*typically 500 gms

REVIEWED BY: _____
SITE H.P. MANAGER

07878

RECOMMENDED
SOIL SAMPLE STORAGE SYSTEM

The organization of soil samples for the purpose of archiving can be achieved with the systematic numbering system.

Each block will contain 25 grids. By organizing the 48 blocks of each area in order by block and grid, the samples and the OCS records can be found.

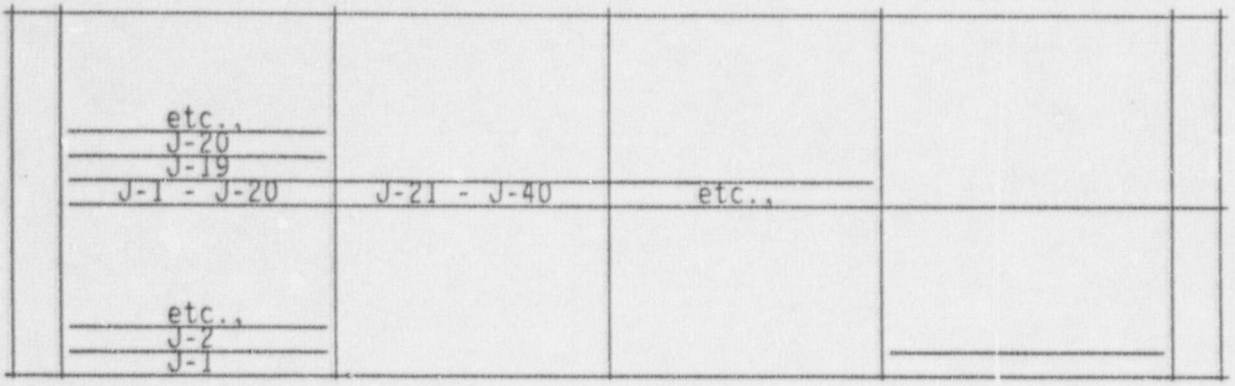
As an example, Area J-1-1 through Area J-1-25 would be the first set of OCS results in the opposed crystal system record for Area J. By assigning a sequential number to each verification sample, the multiples of 25 can be sent for QC. After the soils are counted, they can be filed in a box that will hold 25 cans. This box would hold Area J, Block 1. A box with dimensions of 18" X 18" x 4" works well. (Supply source suggested is American Packaging and Container Corporation.) As the verification proceeds, all of the samples for Area J-1 would be counted and filed. Each box represents a block. A label with each grid that has been sampled can be attached to the box.

In this way, the grids that have been sampled can be seen without opening the box.

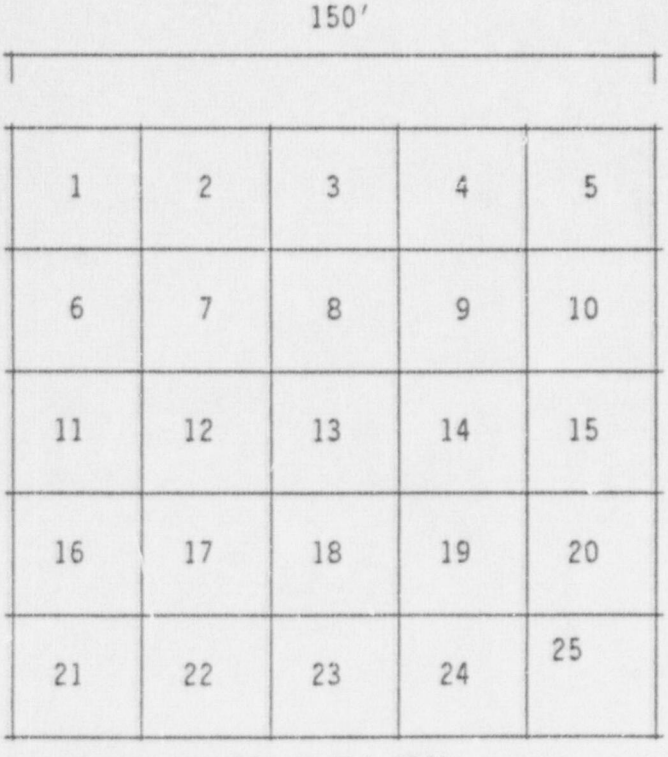
By keeping opposed crystal system records in order by area, block, and grid, one can reference any area, block and grid and find the information for the individual sample. Other kinds of soil samples like SC, BF, and SS can be organized by sequential number as well. Each VP verification would be given a sequential number and filed by VP.

Storage can be organized by area with shelving built to accommodate storage area and box dimensions (see attached sketch).

STORAGE SHELVING WITH LABELS



LABEL FOR BOX



SAMPLE GRID

J-1

ATTACHMENT 4

Date: _____
Site: _____

SAMPLE
RELEASE FORM

I,_____, representing _____, acknowledge receipt from MK-Ferguson Company and Chem-Nuclear Systems, Inc. the following soil sample(s) identified as:

1)_____	5)_____	9)_____
2)_____	6)_____	10)_____
3)_____	7)_____	11)_____
4)_____	8)_____	12)_____

and I further understand that I am to return the sample(s) to MK-F/CNSI in exactly the condition they were received, unless other formal arrangements are made through the M-K Albuquerque Project Office - UMTRA Program.

SIGNED:_____

cc: B. Meyer
J. Turner
HP-10-00-11.C-01
HP-10-00-07-07

ATTACHMENT 5

Procedure for Setting-up OCS for Th^{232} Counting:

1) The following equation will produce Th^{232} pCi/sample; pCi/gm concentrations can be obtained by weighing the sample and dividing by the weight.

Equation:

$$\frac{\frac{ROI\ 2}{LT} - \frac{ROI\ 8}{10{,}000} \times \text{Th}^{232}\ \text{pCi/gm concentration of standard} \times \text{weight in grams of the standard}}{\frac{ROI\ 6}{10{,}000} - \frac{ROI\ 8}{10{,}000}} = \text{Th}^{232}\ \text{pCi/sample}$$

Where:

LT = Live time

ROI 6 = average counts in Region of Interest 6 or the average counts in the even Region of Interest after counting the Th^{232} standard several times for 10,000 seconds.

ROI 8 = average counts in Region of Interest 8 or the average counts in the even Region of Interest after counting the background several times for 10,000 seconds.

ROI 2 = The counts from Region of Interest 2 of the unknown sample.

Series 10 - The sequences can be programmed to compute for the Ra^{226} equation and read out, then compute for the Th^{232} equation and read out.

Series 35 - The task function can be programmed to analyze for the Ra^{226} equation and read out, then analyzed for the Th^{232} and read out.

ATTACHMENT 6

MK-FERGUSON/CHEM NUCLEAR
THORIUM-230 VERIFICATION LOG

SITE NAME _____

H.P. SITE MANAGER _____
SIGNATURE

DATE SAMPLED	SAMPLE NUMBER	COUNT DATE	COUNTING INSTRUMENT	COUNTS (10 MIN) GROSS	TH-230 CALCULATED (pCi/gm)	OCS TH-232 (pCi/gm)	QC SAMPLE	LABORATORY RESULT		DEPTH	TECH	REMARKS
								Ra-226	Th-230	<15cm / >15cm		

Backgrounds

Reviewed By _____

SAC #1 pCi/g _____ (Net Counts) + _____ SAC #1 _____

SAC #2 pCi/g = _____ (Net Counts) + _____ SAC #2 _____

SAC #3 pCi/g = _____ (Net Counts) + _____ SAC #3 _____

ATTACHMENT 7

Systematic Sample Numbering System
[ALL SITE DESIGNATIONS SHALL HAVE 3 LETTERS]

UMTRA Site ID's (X)

SLC = Salt Lake City
DUR = Durango
RVT = Riverton
TUB = Tuba City
GRJ = Grand Junction
AMB = Ambrosia Lake
GUN = Gunnison
RFL = Rifle
NAT = Naturita
LKV = Lakeview
HAT = Mexican Hat
MAY = Maybell
SPK = Spook
MON = Monument Valley
FCT = Falls City
BOW = Bowman
EDG = Edgemont
LOW = Lowman
SRK = Slick Rock
GRN = Green River

I. Air Samples

A. Environmental Air Samples

1. X - APE - 0001 - 1*
(HVE)

- 1 — Station
- 0001 — Sample Serial Number
- APE = Continuous Sample
- HVE = Hi-Vol Grab Sample
- X — UMTRA Site ID

* for vicinity property, station = VP #

An example for Lakeview would be:

LKV-APE-0414-6

An example for a Green River VP would be:

GRN-HVE-0850-066

B. Occupational Work Area Air Samples

1. For Sites

X - APO - 0001 - G - WA*
(HVO)

- WA — WA=Work Area
- G — Grid Area (Map)
- 0001 — Sample Serial Number
- APO = Continuous Sample
- HVO = Hi-Vol Grab Sample
- X — UMTRA Site ID

2. For Disposal Sites (cells):

X - APO - 0001 - DS - WA*
(HVO) |_____ Disposal Site

3. For Vicinity Properties:

X - APO - 0001 - VP# - WA*
(HVO) |_____ Vicinity Property Number

*Work Area means as near as safely possible to the workers being monitored but no more than 100 ft. away, and downwind if possible.

Examples:

a) Ambrosia Lake Site Work Area Hi-Vol Sample

AMB-HVO-0512-B-WA

b) Durango Disposal Site Work Area Hi-Vol Sample

DUR-APO-0810-DS-WA

c) Green River VP Work Area Hi-Vol Sample

GRN-HVO-0819-066-WA

C. Occupational Breathing Zone Air Samples (Lapel-type personnel air samplers only)

X - LPO - 0001 - NAME - BZ
- BZ: Breathing Zone
- NAME: Worker's Name, Last, First, Initial
- 0001: Sample Serial Number
- LPO: LPO = Lapel, Occupational
- X: UMTRA Site ID

D. Air Sample Composites

Environmental Air Samples

X - STA. # - APE - QYR
- APE: HVE
- QYR: Quarter/Year
- HVE: Type of Sample
- STA. #: Station Number
- X: UMTRA Site I.D.

Occupational Air Samples

X - WORK AREA - HVO - QYR
(APO)

- Quarter/Year
- Type of Sample
- Work Area
- UMTRA Site I.D.

Examples:

a) Environmental;

TUB-4-APE-288

b) Occupational;

GRN-G-HVO-288

II. Soil Samples

A. Verification

1. For Sites: (Except Ambrosia Lake)

X - SV - F - 8 - 25

- Block Grid Number
- Map Block ID
- Area Map ID
- Verification
- UMTRA Site ID

2. For Vicinity Properties:

X - SV - 066 - 25

- Grid Number
- VP Number
- Verification
- UMTRA Site ID

B. RTRAK Verification Quality Control

X - RQC - A - XXXX - X,Y, - X_2, Y_2

- Diagonally opposite corners of the grid
- Sample Serial Number
- Site Area from Verification Grid Map
- RTRAK Quality Control
- UMTRA Site I.D.

C. Excavation Control

X - SE* - 0001 - 008
(A)

- Site Area or VP#
- Sample Log Number
- Soil Excavation
- UMTRA Site ID

Note: When an SE sample requires outside vendor analyses, add code XXX to end of sample ID. Codes are shown in Section F "Other Soil Samples".

D. Correlation Soil Samples

X - SC - 0001 - 066
(A)

- Site Area or VP#
- Sample Log Number
- Soil Correlation
- UMTRA Site ID

E. Borrow Material Samples

1. X - BF - 0001- PIT ID

- Pit Location/ID
- Sample Log Number
- Backfill
- UMTRA Site ID

2. X - BF - 0001 - 088
(A)

- VP# (VPs) or Map ID (Sites)
- Sample Log Number
- Backfill
- UMTRA Site ID

F. Other Soil Samples

X - SS - 0001 - 008 - XXX*
- (A) — To be used when Sample goes to EDA
- Site Area or VP #
- Sample Log Number
- Soil Sample
- UMTRA Site ID

XXX Codes (For outside vendor only)

REA Rad Assessment
CEL Cell Survey (Radon Emanation Sample for Rn-222 Barrier)
SPO Spillover Property
COM Comingled Waste
STD Supplemental Standards
NAT Suspected Natural Interferences
SLG Slag
SPL Special (these type samples shall be further described in a note to Manager, EDV - Project Office as soon as possible.

G. Routine Smear Samples (for outside vendor only)

1. X - RS - 0001 - CNSI-O
- Grid/Location
- Sample Number
- Routine Smear (type)
- UMTRA Site ID

Location examples:

MKF-O = MKF Office
CNSI-O = CNSI Office
BKHO-B = Back Hoe Bucket/Blade
TK-0152 = Truck License # etc.

H. Water Samples: (two types)

1. Up and Down Stream Surface

X - WSU - 001 - 1 - 84
- (or D)
- Year
- Quarter
- Unique Sample ID
- Water Sample - Upstream WSU or WSD Downsiream
- UMTRA Site ID

2. Special Work Water Samples (Runoff, Construction Water, etc.)

X - WWS - 001 - YR

- YR — Year
- 001 — Sample 001
- WWS — Work Water
- X — UMTRA Site ID

3. Retention/Evaporation Pond Samples

X - PS - RP# - W - ###

- ### — Sample Number
- W — Water
- RP# — Retention Pond No.*
- PS — Processing Site
- X — UMTRA Site I.D.

X - DS - RP# - W - ###

- ### — Sample Number
- W — Water
- RP# — Retention Pond No.*
- DS — Disposal Site
- X — UMTRA Site I.D.

* Replace "RP" with "EP" for Evaporation Pond Samples.

(Send a location abbreviation list update as necessary to Manager, EDV Project Office).

I. Urinalysis Samples

1. Use social security number followed by; "I" for initial samples or "E" for exit samples.

2. For resamples; use social security number followed by:
   R (I) for an initial resample
   R (E) for an exit resample
   R (Q) for a quarterly resample

3. For quarterly samples; use social security number followed by:

Q__ - __

- __ — Year
- Q__ — Quarter of Year

Examples:

Initial Sample = 123-56-7889-I
Resample of an Initial = 123-56-7889-R(I)
Quarterly Sample = 123-56-7889-Q4-86
Resample of a Quarterly = 123-56-7889 R(Q)4-86

J. Radon - Records completed as previously instructed for RGM's). Include location on "Radon Concentrations in Air" RAC-012 procedure form. (see L.2 for Rad Worker Monitoring).

K. Grab Radon Daughters - Results of actual measurements for vicinity property work can be recorded on a WL Data Form. Actual filter samples need not be retained unless recounting is necessary due to suspected longlived particulate activity. Additional operational method may be required later.

L. WL Rn-D results: Type SF Track Etch ID

Use vendor SN and Systematic numbering as follows: (two types):

Verification in Structures

1.

SN	Sample ID/Location
432511	CA-053 - 06/84

SN Issued by Vendor on TE Detector
VP (DOE) #
Date Placed in Structure

2. Personnel Monitoring

Sample/ID	Location/Description	Vendor SN
368-85-6832	3/15/85 - 6/15/85	322515

SSN of Rad Worker
Period of Badge Use
Vendor SN

CALIBRATION CURVE IDENTIFICATION

1) * X - RaO - 001 - 11/20/84

- Date
- Rev #
- Radium in soil OCS immediate counts
- UMTRA Site ID

2) * X - RaD - 001 - 11/20/83

- Date
- Rev #
- Ra in soil Delta
- UMTRA Site ID

3) * X - RaS - 001 - 11/20/83

- Date
- Rev #
- Ra in soil (OCS)
- UMTRA Site ID

ATTACHMENT 8

VICINITY PROPERTY
POINT SOURCE VERIFICATION FORM

SITE _____

LOCAL BKG: _____ INSTR. I.D.: _____

LOCATION	PRE-RA CPTM	POST-RA CPTM	DATE	TECHNICIAN	COMMENTS

REVIEWED BY: _____

RTRAK DAILY DETECTOR CHECKS ATTACHMENT 9

Adjust GAIN and ZERO as required for a ROI #1 Peak Center at 200 +/- 2 and a ROI #2 Peak Center at 588 +/- 4 (Using a tailings or ore source).

TIME _____

DET. #		ROI #1	ROI #2	GAIN	LLD	ZERO	FILE NAME
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____

TIME _____

DET. #		ROI #1	ROI #2	GAIN	LLD	ZERO	FILE NAME
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____
_____	Source	_____	_____	_____	_____	_____	_____
	BKG	_____	_____				_____

Technician _____ Date _____

RTRAK DAILY ELECTRONICS CHECKOUT ATTACHMENT 10

	Time		Time		Time		Time	
H.V. Supply	H.V.	mA.	H.V.	mA.	H.V.	mA.	H.V.	mA.
#1								
#2								

6.0 Volt Supply				
NIM Voltages				

METEOROLOGICAL DATA

Barometric Pressure				
Relative Humidity				
Temperature				

SURVEY NOTES

Technician _____ Date _____