HOMESTAKE MINING COMPANY
P.O. BOX 98
GRANTS, NEW MEXICO 87020
(505) 287-4456

September 15, 1994

UPS NEXT DAY AIR TRACKING NO.: 1078 5568 861

U.S. Nuclear Regulatory Commission
Division of Waste Management, MS5E2
Attn. Mr. Joseph J. Holonich, Chief
High Level Waste and Uranium
Recovery Projects Branch
11555 Rockville Pike
Rockville, MD 20850

Re: Docket No. 40-8903
License No. SUA-1471
Soil Verification License Amendment

Dear Mr. Holonich:

Homestake Mining Company of California requests that license condition 29, soil verification be amended to enclosed Soil Cleanup Verification Survey and Sampling Plan. The new plan provides for greater assurance of compliance than the current license condition 29.

Please review and should there be no comments or changes change Homestake's license condition 29 to reflect the new amendment. We are scheduling to have contaminated soil identified and removed to tailings impoundments by the first week of October 1994. Soil verification will commence immediately after cleanup.

If questions should arise please contact me at (505) 287-4456. Thank you for your timely review.

Sincerely,

HOMESTAKE MINING COMPANY

F. R. Craft
Resident Manager

FRC:jg

Enclosure (1)

xc: S. Collins (Arlington)
H. Barnes
E. Brummett - hand delivered
K. Hooks - hand delivered

9409230302 940915
PDR ADOCK 04008903
P PDR

NL05

Soil Cleanup Verification Survey and Sampling Plan for use at the Grants Uranium Mill Tailings Site

License No. SUA-1471

September 1994

Homestake Mining Company of California
Grants Operations
P. O. Box 98
Grants, New Mexico 87020

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Soil Cleanup Verification Survey and Sampling Plan
for use at the Homestake Mill Tailings Site

1. Introduction

Homestake Mining Company of California, current owner of the Grants Uranium Mill near Grants, New Mexico, is in the final stages of cleanup of the windblown contaminated materials around the mill tailings piles. Areas requiring cleanup have been identified through a combination of soil sampling and analysis and gamma-ray count rates. Studies have been done to develop a correlation between gamma count rate or exposure rate for all instruments currently being used on the site. Scrapers are removing the materials shown to be elevated above the cleanup criteria and the area is resurveyed. This iterative procedure is applied until the area is in compliance with the cleanup concentration limit of 10.5 pCi/g of Ra-226 (5 pCi/g plus the natural background concentration of 5.5 pCi/g).

The Reclamation Plan (HMC, 1993) and the License Conditions 29 specifies that within a certain boundary, the soil samples shall be at 50-meter grid points and gamma surveys documented at 10-meter grid points. Outside the boundary and until the Ra-226 concentrations clearly reach natural background levels, the soil sampling is to be done on a 100-meter grid while the gamma surveys are to be documented at 10 meter intervals.

The License conditions also requires HMC to develop gamma-ray correlations with soil Ra-226 concentrations. These data and action levels derived from these correlations are to be submitted to the NRC for approval. These gamma actions levels are then used to supplement the soil sample results to demonstrate compliance with the standards.

During the early stages of soil cleanup around the pile, a system consisting of a marriage of two existing technologies became available for use in mapping the gamma-ray levels around the site. The ease of developing an accurate high density profile of the gamma levels over the site has lead HMC to propose a slight modification to the verification plan, where a greater reliance on the gamma levels to demonstrate cleanup is proposed. HMC believes that this modification provides greater assurance of compliance with the cleanup standards than that originally proposed.

This report describes the proposed verification method and procedures. An example of the proposed method is presented for clarity. The correlation data and the derived action levels are also included for NRC approval.

All gamma-ray survey data presented in this report and that which will be used in soil verification have been recorded after the Large Tailings Pile had adequate cover to attenuate the gamma emissions from the pile to background levels. Eliminating the "gamma shine" from the pile allowed excavation control decisions to be based on gamma survey data for all off-pile areas.

2. Gamma-Soil Correlations

Correlations were developed between gamma-ray levels and soil Ra-226 concentrations for all detectors used for excavation control or verification measurements using the standard operating procedure included in Appendix A. The procedure specifies that the instrument be placed at the normal height above ground. A one minute integrated count or several instantaneous readings are recorded to assure a good average value. A 5-point composite soil sample is then taken from a circular area of 36 inches diameter and analyzed for Ra-226. A 36-inch diameter is considered representative of the area that is in the detectors "view". A linear regression is done between the Ra-226 concentration and the gamma level, where the Ra-226 values normally range from background to 30 pCi/g.

The linear regression correlation coefficients ranged from 0.83 to 0.89 which indicates a high correlation for all detectors. The data scatter that is typical of all such studies was observed and can be attributed to heterogeneities in the areal and vertical radionuclide profile, the presence of outcroppings of ore, and perhaps local topography. The data along with the linear regressions and plots are included in Appendix A for all detector models to be used in the verification work.

Plots of the correlation data and a least-squares-fit line are shown in Appendix A. Conservatively chosen action levels have been determined based on the desire to have a very low error rate. These action levels are used as levels that indicate that cleanup to 10.5 pCi/g has been achieved. Action levels for the detectors are given in Table 2-1. The Ludlum 44-10 detectors are the primary instruments used to demonstrate compliance with the cleanup criteria. An action level for these detectors of 30 kcpm is proposed. Additional correlations were developed for shielded Ludlum 44-10 detectors and a Ludlum 44-2 detector used for excavation control monitoring throughout the site and verification measurements along the state highway right of way.

In addition to the use of the action levels for defining areas for additional soil removal, HMC proposes to do soil sampling and analysis in areas that are below the action level but have the potential to exceed the cleanup criteria. This plan will provide further assurance of compliance with the cleanup criteria. This plan is described further in Section 4.

Table 2-1. Action Levels for Detectors Used at HMC Mill Site

Meter	Ser. No.	Detector	Ser. No.	Action Level Bare	Action Level Shield
Ludlum 3	93847	Ludlum 44-2	091421		12 uR/h
Ludlum 2221	91925/108853	Ludlum 44-10	PR090262	30 kcpm	10 kcpm
Ludlum 2221	91925/108853	Ludlum 44-10	PRO66863	30 kcpm	10 kcpm

3. Gamma-Ray Mapping Using Global Positioning System

HMC has employed the services of Environmental Restoration Group, Inc. (ERG) to conduct gamma surveys and mapping of the areas around the mill tailings piles. This contractor was chosen because of their use of a new technology that couples radiological survey data to a global positioning system (GPS) land surveyor and computer mapping system. This capability results in bringing the highest quality and spatial density environmental monitoring data to the project within a reasonable budget.

The gamma-mapping system consists of digital gamma-ray monitoring equipment coupled to a Ludlum Model 44-10 2-inch by 2-inch NaI(Tl) detector. The digitized radiological count rate data are recorded once every two seconds by transmission to a GIS Surveyor ESP system which automatically tags the data with the coordinates at the time the data count rate is received. The GIS Surveyor, manufactured by Trimble Navigation, is the state-of-the-art in land surveying equipment, employing the use of satellite global positioning system (GPS) technology. The accuracy of the coordinates is better than one meter while collecting data.

The high accuracy is attained by placing a base receiver at a known surveyed marker within a few miles of the survey. The location of the base station (as determined by the satellites) is recorded each second. The error in this determination is then used to correct the perceived location of the data collection units (Rovers). This differential correction method allows one to attain an accuracy better than one meter in this mode. Measurements to an accuracy of 0.1 ft are possible while operating in the land survey mode where the Rover station is placed at the stationary point to be surveyed for 30 seconds or more.

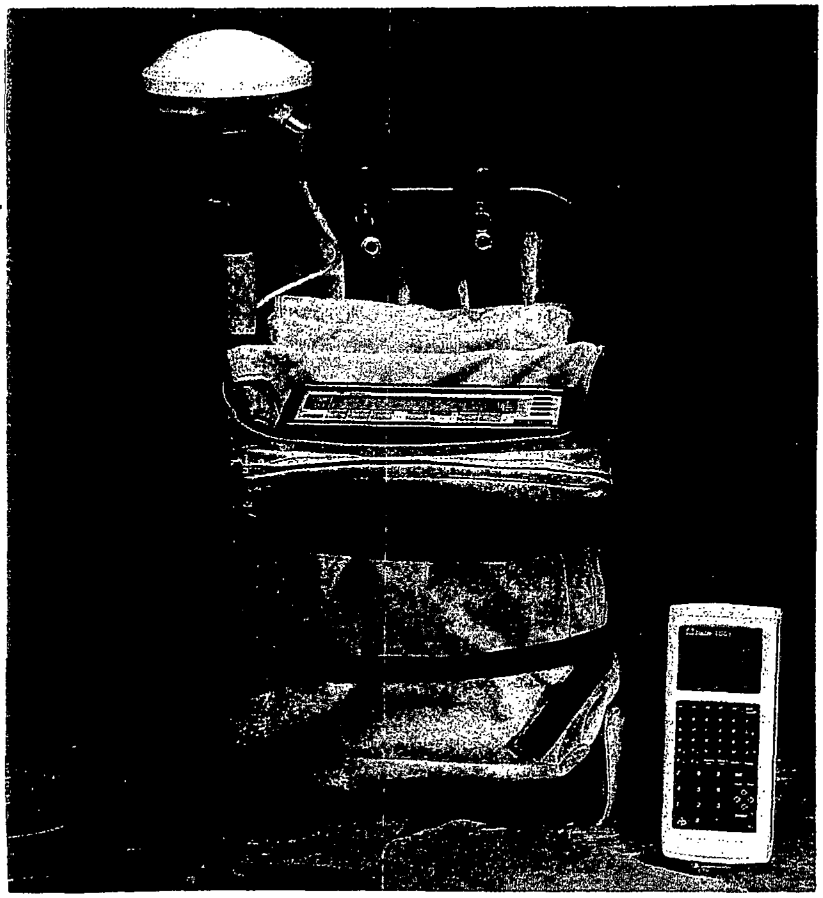
The data are collected in a data logger and later downloaded into a computer equipped with proprietary software. One of the functions of this software is to perform the differential error corrections as determined by the base station data. The data are then loaded into AutoCAD software for mapping and developing isocontours.

A vendor provided photograph of the GPS receiver and backpack (Rover) is shown in Figure 3-1. A base station unit is shown being placed at a known benchmark at the HMC site in Figure 3-2. Field technicians normally walk with the backpack in place while carrying the radiation detector as shown in Figure 3-3. For large sites such as the Homestake Mill Site, portions of the site were surveyed using an all-terrain vehicle (ATV) as shown in Figure 3-4. Pin flags were set for guiding the technicians while walking the traverse lines. In areas where the ATV was used, often the tire tracks were visible and could be used to guide the survey.

Thirty kcpm gamma-ray count rate isocontour lines were used to define where additional excavation was required. After the excavation, the area was remapped and the new data added to the data base.

Function checks for the equipment were performed at the beginning of each work shift using standard operating procedures. In addition, standard operating procedures were used to guide the technicians in operating the Base Station and the Rover unit as well as handling the data. These procedures are included in Appendix B.

Figure 3-1 GIS Surveyor Unit used for GPS Mapping.



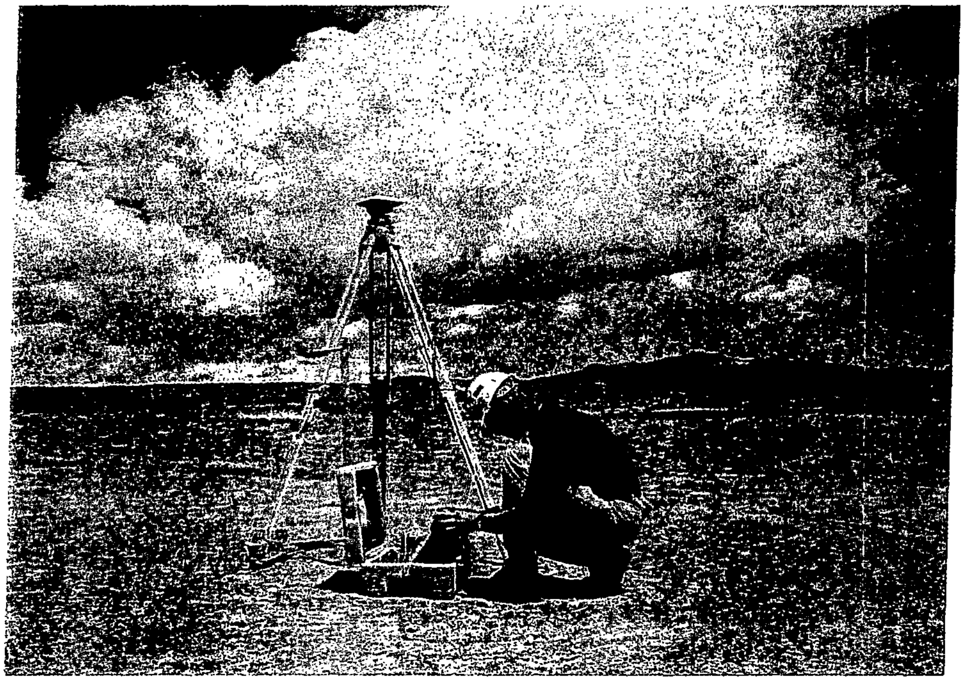


Figure 3-2 Technician Establishing GPS Base Station

Figure 3-3 Technician Conducting GPS Radiological Survey (Walking)

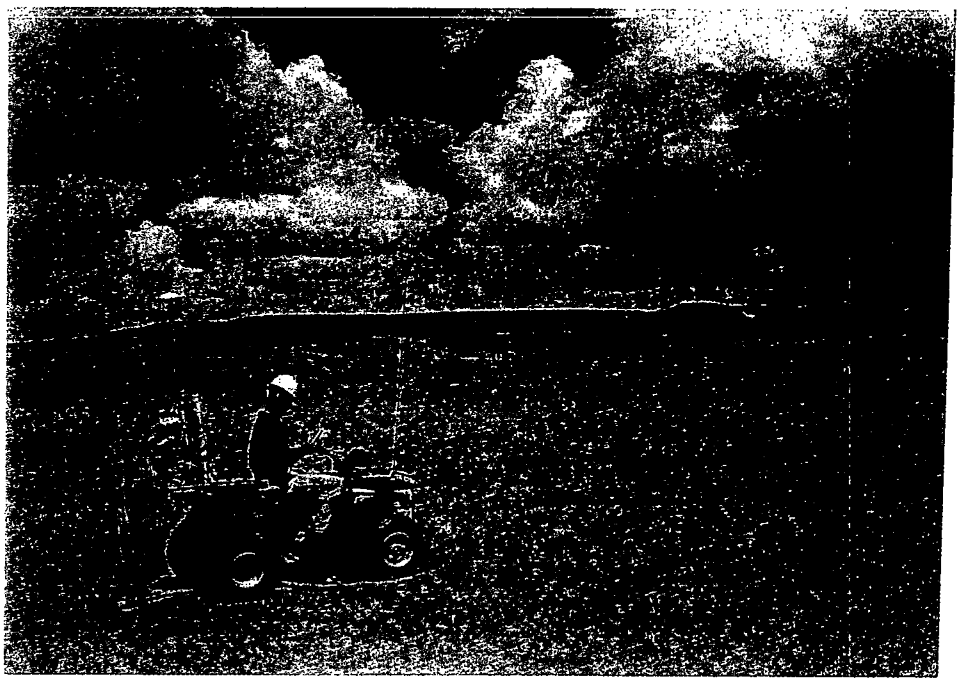


Figure 3-4 GPS Radiological Survey Using and ATV

4. Soil Cleanup Verification Survey and Sampling Plan

4.1 Cleanup of the Windblown Areas

This verification survey and sampling plan takes advantage of the high density gamma-ray survey data. An example of a gamma-ray map of an area is presented as Figure 4-1. Since a count rate was recorded automatically every two seconds, the density of the gamma-ray survey data is determined by the speed at which the surveys were conducted and the distance between traverse lines. As can be seen in Figure 4-1, both the speed and the traverse line distance varied according to site conditions. Normally, the average distance between data points along the traverse was less than twenty feet.

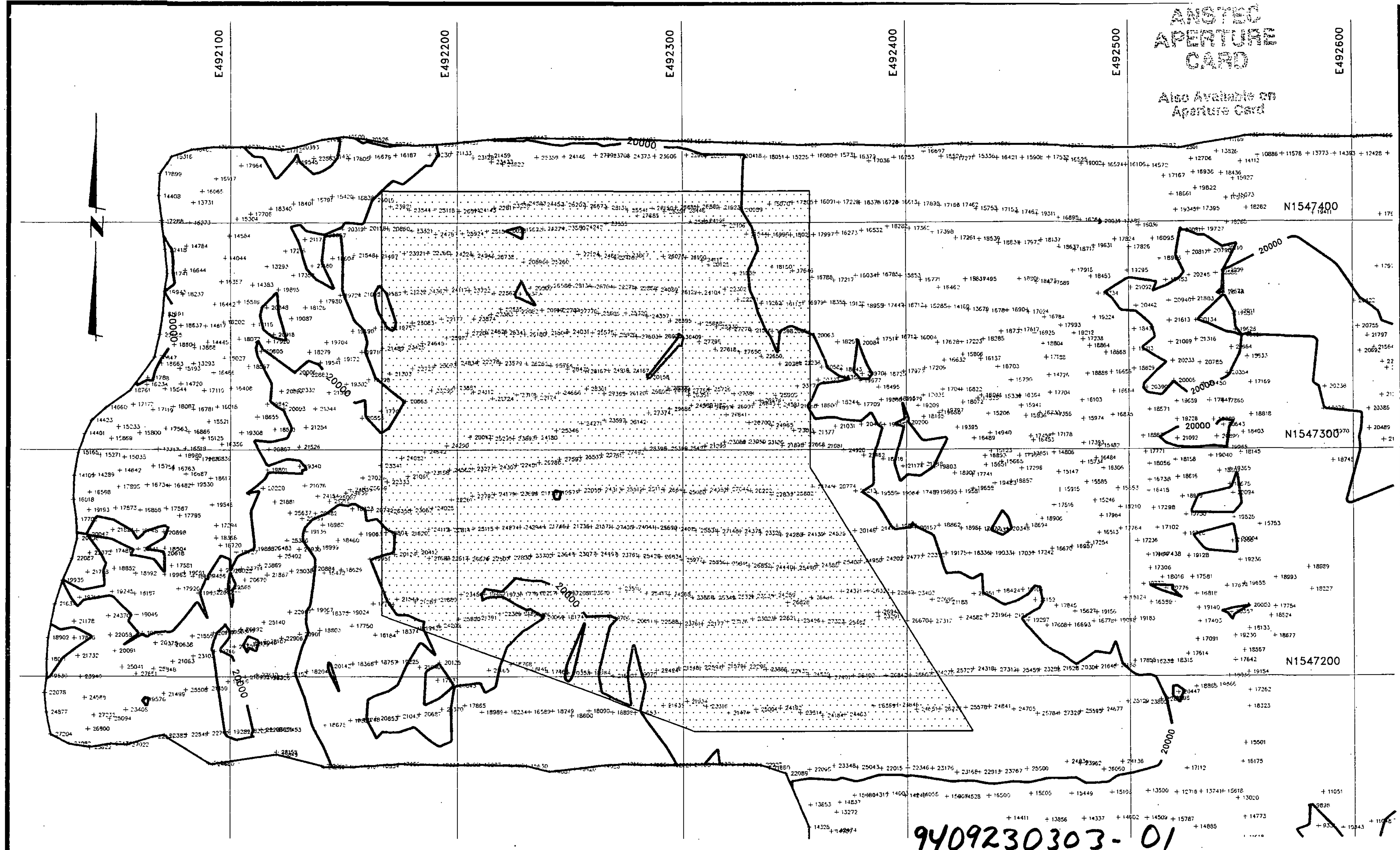
The detector calibration data presented in Section 3 indicate that a gamma-ray action level of 30 kcpm is appropriate for cleanup when using the bare NaI(Tl) probes. The 30 kcpm isocontour gamma-ray maps were used to identify areas requiring additional cleanup. The areas were cleaned and resurveyed using the GPS-based survey technique. These new data were substituted for the old data in these areas and a final verification gamma-ray map prepared.

In order to assure that the 30 kcpm action level is appropriate for all areas of the site, an investigation of areas where the levels average between 25 kcpm and 30 kcpm will be done as part of the verification. A review of the gamma maps will be done and for any area exceeding the dimensions equivalent to a 200 ft by 200 ft area (approximately 1 acre), a composite soil sample will be prepared from 6-inch deep samples taken on 100-ft centers over the area. The Ra-226 analysis of the sample will be compared to the cleanup criterion. If the result exceeds 10.5 pCi/g Ra-226 concentration, the area will be excavated and a new gamma-ray survey and map prepared.

An example has been prepared to illustrate the investigation of these marginal areas. Figure 4-1 shows an area of slightly elevated gamma count rates where the slightly elevated area exceeds 1 acre in size. The count rate within the approximately 200-ft by 600-ft area ranges from 15 to almost 30 kcpm but averages approximately 26 kcpm. The land surveyors will be directed to establish the area by setting stakes at 100-ft intervals. Six-inch deep soil samples will be taken at each of the grid intersections and a composite sample preparded. A Ra-226 analysis of the sample will be made and the surface of the area excavated if the limit of 10.5 pCi/g is exceeded. A new survey will be documented when the cleanup criterion is achieved.

After an area has been shown to be below the gamma-ray action level and marginally high areas investigated (areas of 1 acre size that average between 25 kcpm and 30 kcpm), the final

Figure 4-1 Area Further Evaluated because Average Gamma Count Rate was 25-30 kcpm.



DATE	REVISION	NO.	DATE	REVISION	NO.

ANDERSON ENGINEERING CO., INC.
Long Beach California | Salt Lake City Utah | Grants New Mexico
Telephone (801) 972-6222 Fax (801) 972-6235
CIVIL ENGINEERS CONSTRUCTION MANAGERS

FIGURE 4-1
HOMESTAKE MINING COMPANY
RADIOLOGICAL SURVEY

ERG Environmental Restoration Group, Inc.
12809 Arroyo de Vista NE
Albuquerque, New Mexico 87111
(505) 298-4224

DRAWN BY:	CFS
ENGINEER:	SDA
APPROVED	KRB
DATE	JUNE 23, 1994
HORIZ. SCALE:	1" = 40'
VERT. SCALE:	N/A
REFERENCE	HMC SHEET 1

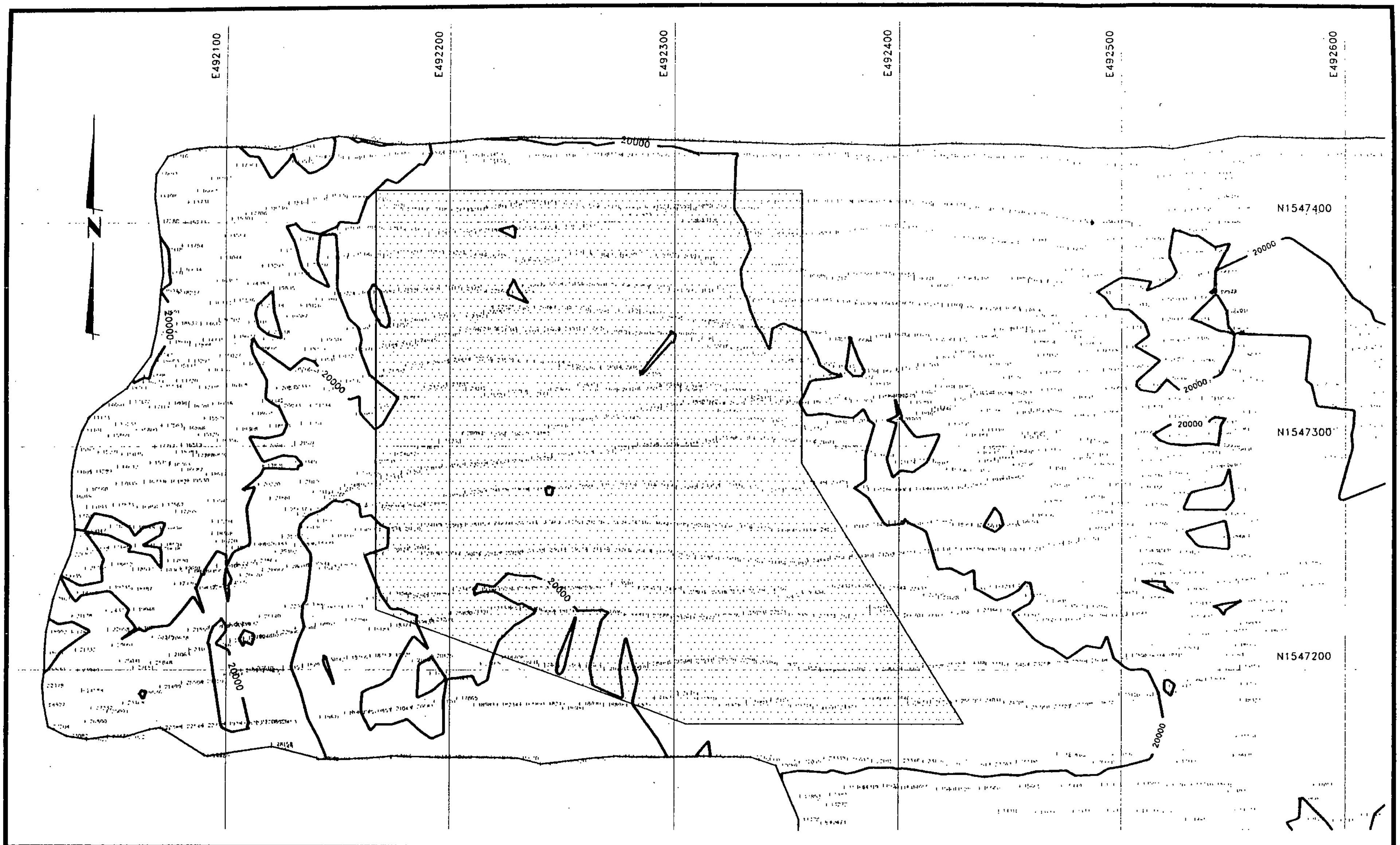


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FIGURE 4-1
HOMESTAKE MINING COMPANY
RADIOLOGICAL SURVEY

EAG Environmental Restoration Group, Inc.
12809 Arroyo de Vista NE
Albuquerque, New Mexico 87111
(505) 298-4224

verification step will be to take soil samples. Soil samples will be taken on 1000-ft grid points and analyzed for Ra-226. Any areas where samples exceed the 10.5 pCi/g limit will be recleaned and resampled.

4.2 Cleanup of the Right-of-Way along State Highway 605

More than a mile of State Highway 605 right-of-way that divides the HMC property was found to contain tailings and uranium ore material. In negotiations with the State of New Mexico, HMC agreed to backfill the excavation as soon as there was reasonable assurance that the area met the cleanup criteria. This was done to protect the safety of the users of the road. Since an excavated segment of the road could be open for only a few hours, the backfill was placed prior to receipt of the Ra-226 analysis of soil samples.

In preparing for this work, gamma correlation studies were done using shielded Ludlum Model 44-10 detectors in windblown tailings contaminated areas of the site. The results of these studies are presented in Table 2-1 with the data and correlations presented in Appendix A. From the data, an action level of 10 kcpm was determined to correspond to the cleanup criterion of 10.5 pCi/g. Since the studies were conducted on relatively flat terrain, the use of this action level is also appropriate on flat areas.

The characterization data predicted that the excavation would be several feet deep along portions of the right-of-way. The shielded Ludlum Model 44-10 was chosen for gamma-ray measurements since the influence from the side walls is less than that for an unshielded detector. However, it was demonstrated during the excavation that the influence of the walls could raise the action level to as high as 15 kcpm. This was determined by taking soil samples and performing a quick Ra-226 analysis (prior to full Bi-214 ingrowth) and also by taking gamma readings at the bottom of the excavation and on the material after it was removed from the excavated area.

A procedure was prepared for verifying cleanup of the highway right of way. A copy of the procedure has been included as Appendix C. Markers were placed at 25-ft intervals along both sides of the highway. After it was determined that the area met the gamma-ray action level, as adjusted for geometry considerations, the area was ready for verification measurements. For each side of the road, 30-second integrated counts were taken while walking within each 25-ft segment of the right-of-way and the count rate recorded. Soil samples were taken at 150-ft intervals along the length of the right of way at a distance of one-half the right-of-way width from the edge of the pavement.

HMC decided that this procedure, while only slightly different from that in the NRC-approved HMC Reclamation Plan, was more appropriate for this task. Therefore a slight modification was made that incorporated the basic requirements of the approved procedure, yet lended itself to verification of a long-narrow strip of land. In order to reduce the chance of not complying with the standards, average gamma-ray count rates over 100 percent of the area were recorded rather that at point locations. In addition, the density of soil samples was increased somewhat since the width of the right of way averaged approximately 50 feet for each side of the road.

As discussed above, HMC believes that this procedure is consistent with the procedure in the NRC-approved HMC Reclamation Plan and where deviations exist, the deviations provide more data and better reflect the average reclaimed area in the road right-of-way.

5. Conclusion

HMC has submitted a plan for verifying that the windblown tailings contaminated areas around the uranium mill tailings piles are cleaned to meet the cleanup criteria in 10 CFR Part 40. HMC's License Condition 29 requires that HMC submit gamma-ray action levels to NRC for approval. Gamma-ray/soil correlation data are presented which provide evidence that 30 kcpm is an appropriate action level for the Ludlum Model 44-10 detectors. HMC proposes to investigate all areas of 1 acre or larger in which the average level is between 25 kcpm and 30 kcpm to assure that the average concentration is less than the 10.5 pCi/g cleanup criterion. This will provide additional assurance that the high density gamma-ray data from the GPS-based gamma survey is in itself, a reliable verification method. HMC requests approval from the NRC for using 30 kcpm as an action level for Ludlum 44-10 gamma-ray detectors.

As a final verification technique, HMC proposes to take soil samples at each 1,000-ft grid intersection out to a distance beyond where cleanup was required and to a distance where local background levels are evident from the gamma-ray survey. This soil sampling density is slightly different than specified in the license Condition 29 and will require a license modification to implement. HMC believes that this proposed plan, considering the increased reliance on the gamma-ray data, provides a higher assurance that the cleanup criteria have been met and therefore respectfully requests approval of the plan.

A slight modification to the NRC-approved cleanup verification procedure was implemented for cleanup of the right-of-way along State Highway 605. Since the excavated areas required immediate backfill because of public health and safety, HMC developed a gamma action level for use with the shielded Ludlum 44-10 for use in this area. For level terrain, an action level of 10 kcpm was established. Note, that for deep excavations, an action level of 15 kcpm was used due to geometry enhanced count rates. An integrated count was taken while walking over the area between 25-ft markers on each side of the road and recorded. A soil sample was taken and analyzed at 150-ft intervals on each side of the road. The results of the soil sample were not available prior to backfilling. HMC believes that this was a reasonable attempt at assuring removal of all radioactive material above the cleanup criteria while also protecting the health and safety of the public that use the highway. Since the modifications to the NRC-approved procedure are minor and result in a higher density of gamma-ray and soil sample data than originally proposed, HMC requests that this procedure be accepted for use along the highway right-of-way.

Appendix A

Gamma-Soil Correlations for Radiation Detectors

Standard Operating Procedure

Homestake Mining Company

Correlation Between Gamma-Ray Measurements and Ra-226 in Soil

1. Purpose

To describe the procedure for developing a correlation between hand-held gamma-ray measurement instruments and the Ra-226 concentration in the top 6-inch layer of soil.

2. Discussion

The cleanup of surface soils contaminated with Ra-226 normally is done using in-situ gamma-ray measurements to guide the cleanup activities. Such factors as emanation fraction, Ra-226 concentration vertical profile, gamma shine from nearby sources, and topography all have an influence on the gamma-ray measurements and the technician has to be aware of these possible influences when interpreting measurements. With these precautions, the use of this technique for most situations has been demonstrated to provide sufficient accuracy to assure that an area has been successfully decontaminated.

The procedure that follows results in a correlation between Ra-226 concentration in the top 6-inches of soil and the gamma-ray count rate from hand-held radiation detectors. It is appropriate for use in areas where there are no strong gamma-ray sources, no buried radioactive material, and where the topography is relatively flat.

3. Procedure

3.1 Field Equipment

_______Radiation detectors and associated rate meters, scalers, and collimators

_______Post-hole digger or other tools used for obtaining 6-inch deep soil samples

_______MicroR meter capable of measuring exposure rates ranging from background levels to 100 microR/h

_______Soil Sample labels and bags

_______Copies of Appendix A (10) and Appendix B (one for each instrument)

_______Ink pen

_______Measuring tape (6 feet minimum)

3.2 Field Data Collection

A. Using the microR meter, locate study areas generally contaminated at levels that provide exposure rate readings taken at 1 meter height of background, 18, 20, 25, 30, 35, 40, and 50 microR/h. Areas should not be in shine areas and should be on relatively flat terrain. Each study area should be large enough that a few steps in any direction should not affect the reading. Record the data for each location on Appendix A data form.

B. At each study area, strike a 36-inch diameter circle on the ground surface. Give each area a unique identifier (e.g. HMC1, HMC2, HMC3, etc). All gamma measurements should be made at the center of the circle and at a height specified on the data sheet. The height should be determined by the height that the detector is placed during actual use (e.g., microR meter @ 1 m, bare NaI probe at 12-18 inches, collimated NaI probe at 6 inches). Assure that this height is maintained during all measurements.

C. Prior to disturbing the surface soils, make all gamma-ray measurements indicated in Appendix B. For rate meters, put the response switch on slow and wait for 10 seconds with the detector in place. Look at the meter 10 times and record the readings. When using a rate meter/scaler, integrate the counts over a one minute counting time. Two to five measurements are sufficient when using the instrument in the scaler mode. Record the data on the Appendix B data form for that study area.

D. After all gamma-ray data are reviewed for completeness, draw perpendicular lines through the center of the circle. Take five soil samples from each circle to a depth of six inches. The first sample should be taken from the center of the circle. The other four samples should be centered at a distance of nine inches from the center and on the perpendicular lines. Label the five samples using the study area unique identifier followed by the sample number (e.g. HMC1-1, HMC1-2, HMC1-3, etc.). Record the sample numbers on Appendix A data form.

E. Repeat the above steps for above for each study area.

3.3 Laboratory

A. Dry each sample using standard operating procedures

B. Make a composite sample using the 5 samples taken from each area (e.g. HMC1-1, HMC1-2, HMC1-3, etc.). Grind and blend the composite sample until a homogeneous mixture has been obtained. Label this sample with a unique identifier that can be traced to the specific area (e.g., HMC1-COM).

C. Select aliquots from the composite samples of appropriate size for analysis and QA checks.

D. Perform the Ra-226 assays using standard operating procedures.

3.4 Data Analysis

A. Enter the Ra-226 concentration-gamma count rate data pairs for each instrument in a spreadsheet (e.g. Lotus 123) having the capability to do a linear regression.

B. Do a least-squares linear regression and plot the results. Evaluate the suitability of the results for use in predicting the Ra-226 concentrations in soils.

C. Develop cut-off gamma count-rates and/or exposure rates that correspond to Ra-226 concentrations of interest, considering errors in predicting the concentrations and desired safety factors.

Appendix A

Location Number ______________________

Approximate Exposure Rate ______________________

Soil Sample Numbers ______________________
____
____
____
____

Approximate Coordinates* ______________________

*If coordinates are unknow, mark approximate location on map or drawing and attach

Appendix B

Location Number	________
Ratemeter/Scaler	
Make	________
Model	________
Ser.No.	________
Probe (if any)	
Make	________
Model	________
Ser.No.	________
Collimator Used (if any)	________
Detector Height above ground (in.)	

Gamma Measurements

		units
Measurement No. 1	________	________
Measurement No. 2	________	________
Measurement No.3	________	________
Measurement No. 4	________	________
Measurement No. 5	________	________
Measurement No. 6	________	________
Measurement No. 7	________	________
Measurement No.8	________	________
Measurement No. 9	________	________
Measurement No. 10	________	________

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44–10
Serial Number	PR066863
Height above ground	6 inches with shield

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC–1	2.0	1.0	7994
HMC–2	7.4	7.4	11031
HMC–3	6.2	10.1	13516
HMC–4	17.6	22.7	20912
HMC–5	38.2	56.4	37869
HMC–6	61.9	70.9	43073
HMC–7	21.8	28.6	27142
HMC–8	1.6	4.2	8505
HMC–9	11.9	11.9	14960
HMC–10*	25.9	30.7	29367
HMC–10	12.8	11.6	6842
HMC–11	2.4	5.0	4362
HMC–12	1.3	3.7	2805
HMC–13	13.6	13.8	12846
HMC–14	2.0	4.4	4030
HMC–15	1.5	3.9	3560
HMC–16	0.8	3.0	3134
HMC–17	1.1	3.5	3694
HMC–18	21.8	21.0	12073
HMC–19	23.3	19.0	10371
HMC–20	9.1	9.3	7332
HMC–21	5.6	7.8	5274
HMC–22	4.2	6.2	6177
HMC–23	9.9	11.6	7833
HMC–24	12.0	14.8	9528
HMC–25	15.9	16.3	12715
HMC–26	11.2	12.7	11174
HMC–27	5.7	6.6	6866
HMC–28	6.4	7.0	8514
HMC–29	21.5	25.0	10870
HMC–30	4.7	7.5	5037

* HMC–10 was inadvertently used for two different studies on different days

Homestake Mining Company
Field Instrument Calibration

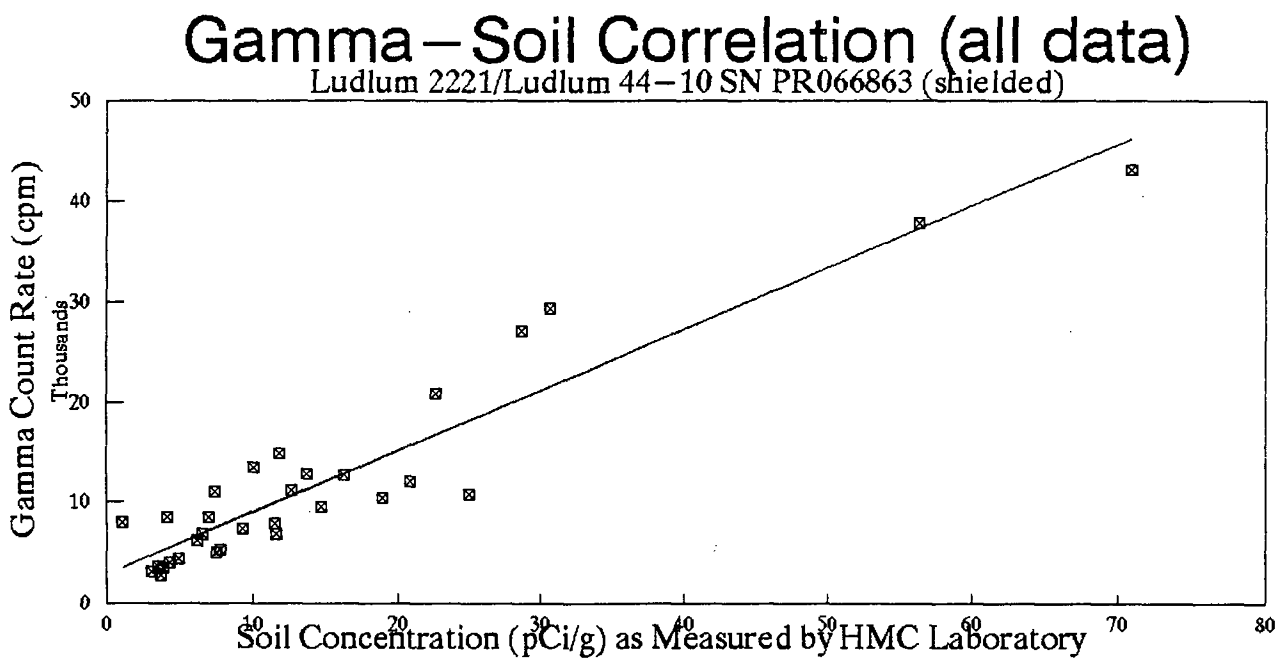
Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44–10
Serial Number	PR066863
Height above ground	6 inches with shield

Regression Output:

Constant		2933.50593456189
Std Err of Y Est		3508.82338788878
R Squared		0.87913999688155
No. of Observations		31
Degrees of Freedom		29
X Coefficient(s)	608.9779	
Std Err of Coef.	41.92903	

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44-10
Serial Number	PR066863
Height above ground	6 inches with shield



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44–10
Serial Number	PR066863
Height above ground	18 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC–1	2.0	1.0	27969
HMC–2	7.4	7.4	33561
HMC–3	6.2	10.1	43414
HMC–4	17.6	22.7	60915
HMC–5	38.2	56.4	99384
HMC–6	61.9	70.9	107306
HMC–7	21.8	28.6	74352
HMC–8	1.6	4.2	29738
HMC–9	11.9	11.9	44273
HMC–10*	25.9	30.7	79724
HMC–10	12.8	11.6	19455
HMC–11	2.4	5.0	13818
HMC–12	1.3	3.7	8278
HMC–13	13.6	13.8	41837
HMC–14	2.0	4.4	15557
HMC–15	1.5	3.9	13824
HMC–16	0.8	3.0	12494
HMC–17	1.1	3.5	15839
HMC–18	21.8	21.0	40043
HMC–19	23.3	19.0	33039
HMC–20	9.1	9.3	24682
HMC–21	5.6	7.8	17956
HMC–22	4.2	6.2	20582
HMC–23	9.9	11.6	26773
HMC–24	12.0	14.8	31676
HMC–25	15.9	16.3	39646
HMC–26	11.2	12.7	35250
HMC–27	5.7	6.6	24295
HMC–28	6.4	7.0	28833
HMC–29	21.5	25.0	34617
HMC–30	4.7	7.5	16544

* HMC–10 was inadvertently used for two different studies on different days

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44-10
Serial Number	PR066863
Height above ground	18 inches

Regression Output:

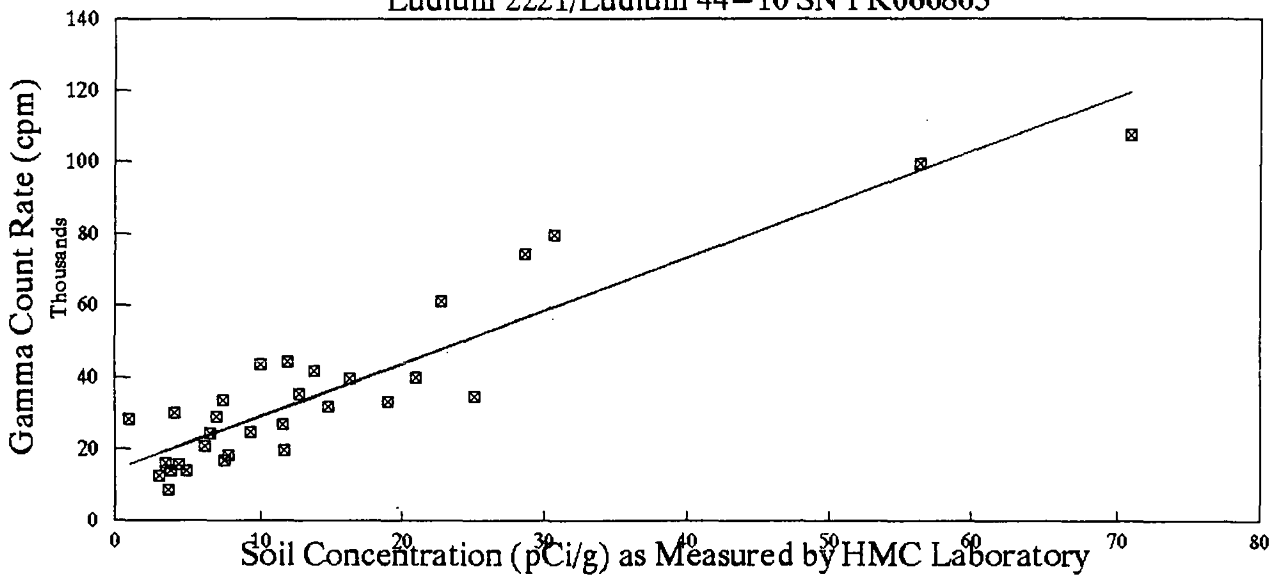
Constant		14137.9193791571
Std Err of Y Est		9843.52994129771
R Squared		0.84542526905741
No. of Observations		31
Degrees of Freedom		29
X Coefficient(s)	1481.397	
Std Err of Coef.	117.6262	

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44-10
Serial Number	PR066863
Height above ground	18 inches

Gamma-Soil Correlation (all data)

Ludlum 2221/Ludlum 44-10 SN PR066863



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44−10
Serial Number	PR066863
Height above ground	18 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC−1	2.0	1.0	27969
HMC−2	7.4	7.4	33561
HMC−3	6.2	10.1	43414
HMC−4	17.6	22.7	60915
HMC−5	38.2	56.4	99384
HMC−6	61.9	70.9	107306
HMC−7	21.8	28.6	74352
HMC−8	1.6	4.2	29738
HMC−9	11.9	11.9	44273
HMC−10*	25.9	30.7	79724
HMC−10	12.8	11.6	19455
HMC−11	2.4	5.0	13818
HMC−12	1.3	3.7	8278
HMC−13	13.6	13.8	41837
HMC−14	2.0	4.4	15557
HMC−15	1.5	3.9	13824
HMC−16	0.8	3.0	12494
HMC−17	1.1	3.5	15839
HMC−18	21.8	21.0	40043
HMC−19	23.3	19.0	33039
HMC−20	9.1	9.3	24682
HMC−21	5.6	7.8	17956
HMC−22	4.2	6.2	20582
HMC−23	9.9	11.6	26773
HMC−24	12.0	14.8	31676
HMC−25	15.9	16.3	39646
HMC−26	11.2	12.7	35250
HMC−27	5.7	6.6	24295
HMC−28	6.4	7.0	28833
HMC−29	21.5	25.0	34617
HMC−30	4.7	7.5	16544

* HMC−10 was inadvertently used for two different studies on different days

Homestake Mining Company
Field Instrument Calibration

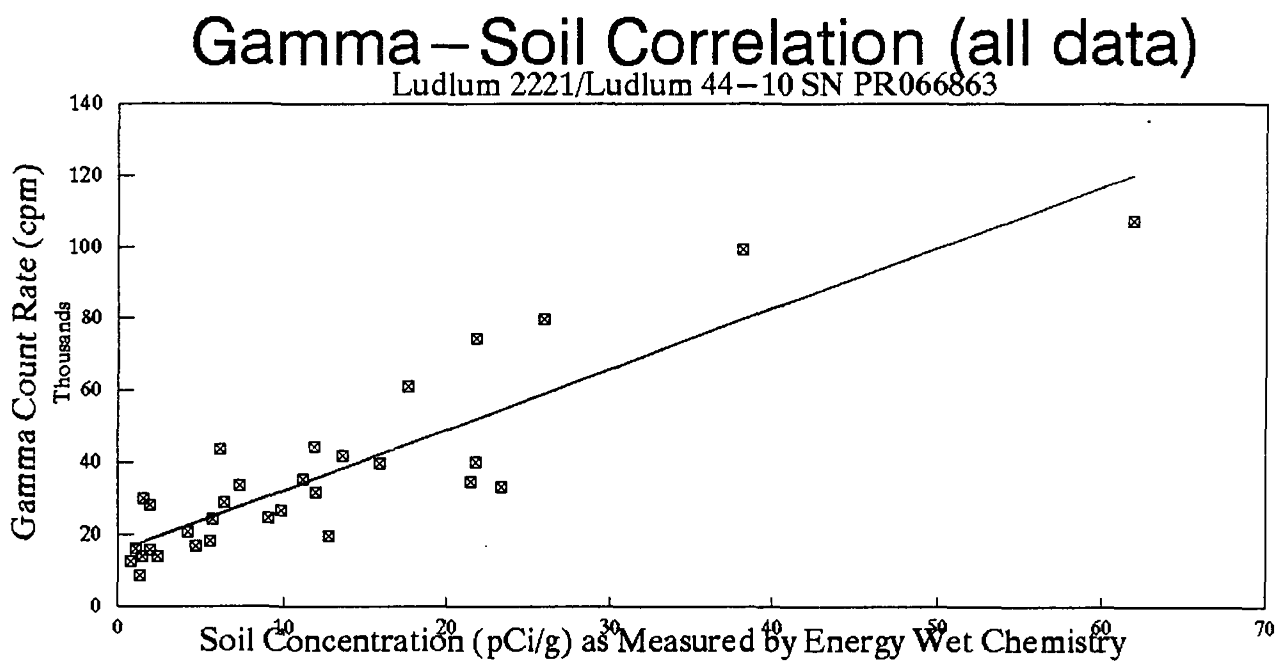
Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44–10
Serial Number	PR066863
Height above ground	18 inches

Regression Output:

Constant		15205.4070551742
Std Err of Y Est		11640.6207588363
R Squared		0.78383317339766
No. of Observations		31
Degrees of Freedom		29
X Coefficient(s)	1689.762	
Std Err of Coef.	164.7818	

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	91925
Instument Model	Ludlum 44-10
Serial Number	PR066863
Height above ground	18 inches



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	18 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC-1	2.0	1.0	24004.0
HMC-2	7.4	7.4	29227.0
HMC-3	6.2	10.1	38239.0
HMC-4	17.6	22.7	53744.0
HMC-5	38.2	56.4	88918.0
HMC-6	61.9	70.9	97353.0
HMC-7	21.8	28.6	66627.0
HMC-8	1.6	4.2	25929.0
HMC-9	11.9	11.9	39836.0
HMC-10*	25.9	30.7	72376.0
HMC-10	12.8	11.6	20961.0
HMC-11	2.4	5.0	16154.0
HMC-12	1.3	3.7	9256.0
HMC-13	13.6	13.8	47416.0
HMC-14	2.0	4.4	18491.0
HMC-15	1.5	3.9	16132.0
HMC-16	0.8	3.0	14993.0
HMC-17	1.1	3.5	17485.0
HMC-18	21.8	21.0	44872.0
HMC-19	23.3	19.0	35348.0
HMC-20	9.1	9.3	28693.0
HMC-21	5.6	7.8	21303.0
HMC-22	4.2	6.2	24297.0
HMC-23	9.9	11.6	31690.0
HMC-24	12.0	14.8	36415.0
HMC-25	15.9	16.3	45114.0
HMC-26	11.2	12.7	39828.0
HMC-27	5.7	6.6	28629.0
HMC-28	6.4	7.0	32960.0
HMC-29	21.5	25.0	38780.0
HMC-30	4.7	7.5	19069.0

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	18 inches

* HMC-10 was inadvertently used for two different studies on different days

Regression Output:

Constant	17267.2420736033
Std Err of Y Est	7761.03156012193
R Squared	0.86925630355885
No. of Observations	31
Degrees of Freedom	29

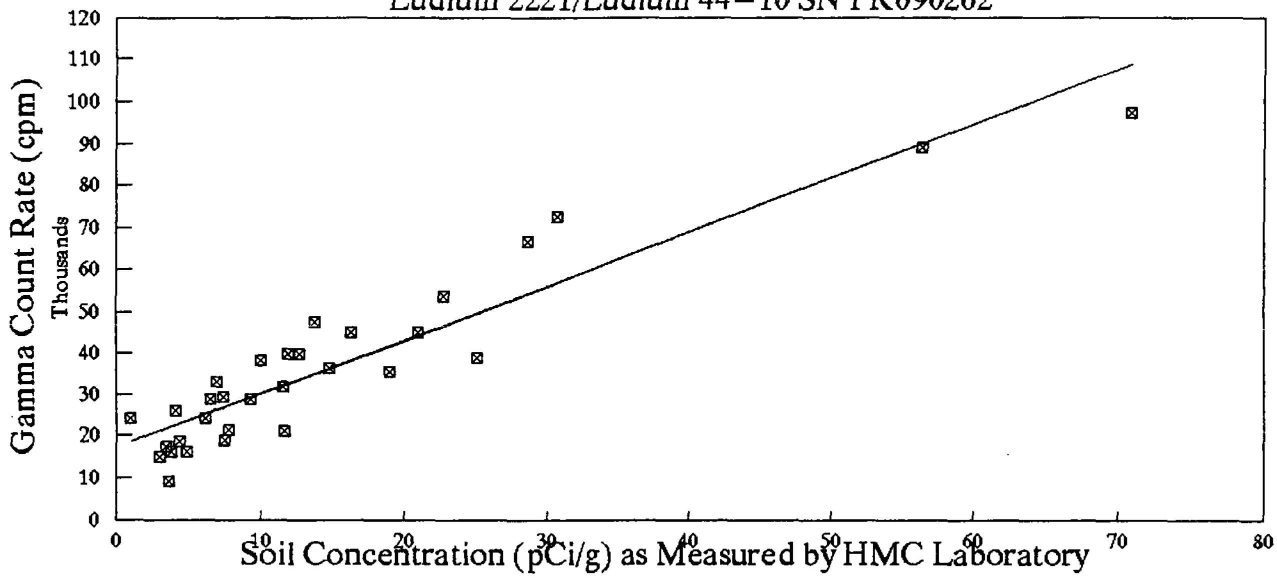
X Coefficient(s)	1287.761
Std Err of Coef.	92.74121

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	18 inches

Gamma-Soil Correlation (all data)

Ludlum 2221/Ludlum 44-10 SN PR090262



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44–10
Serial Number	PR090262
Height above ground	6 inches with shield

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC–1	2.0	1.0	7383
HMC–2	7.4	7.4	10226
HMC–3	6.2	10.1	12503
HMC–4	17.6	22.7	19460
HMC–5	38.2	56.4	35059
HMC–6	61.9	70.9	38801
HMC–7	21.8	28.6	25427
HMC–8	1.6	4.2	7655
HMC–9	11.9	11.9	14161
HMC–10*	25.9	30.7	28980
HMC–10	12.8	11.6	7617
HMC–11	2.4	5.0	5299
HMC–12	1.3	3.7	3217
HMC–13	13.6	13.8	16021
HMC–14	2.0	4.4	5286
HMC–15	1.5	3.9	4641
HMC–16	0.8	3.0	4039
HMC–17	1.1	3.5	4764
HMC–18	21.8	21.0	16586
HMC–19	23.3	19.0	11933
HMC–20	9.1	9.3	9494
HMC–21	5.6	7.8	6680
HMC–22	4.2	6.2	7959
HMC–23	9.9	11.6	10179
HMC–24	12.0	14.8	12150
HMC–25	15.9	16.3	16554
HMC–26	11.2	12.7	14260
HMC–27	5.7	6.6	8975
HMC–28	6.4	7.0	10974
HMC–29	21.5	25.0	13544
HMC–30	4.7	7.5	6010

* HMC–10 was inadvertently used for two different studies on different days

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	6 inches with shield

Regression Output:

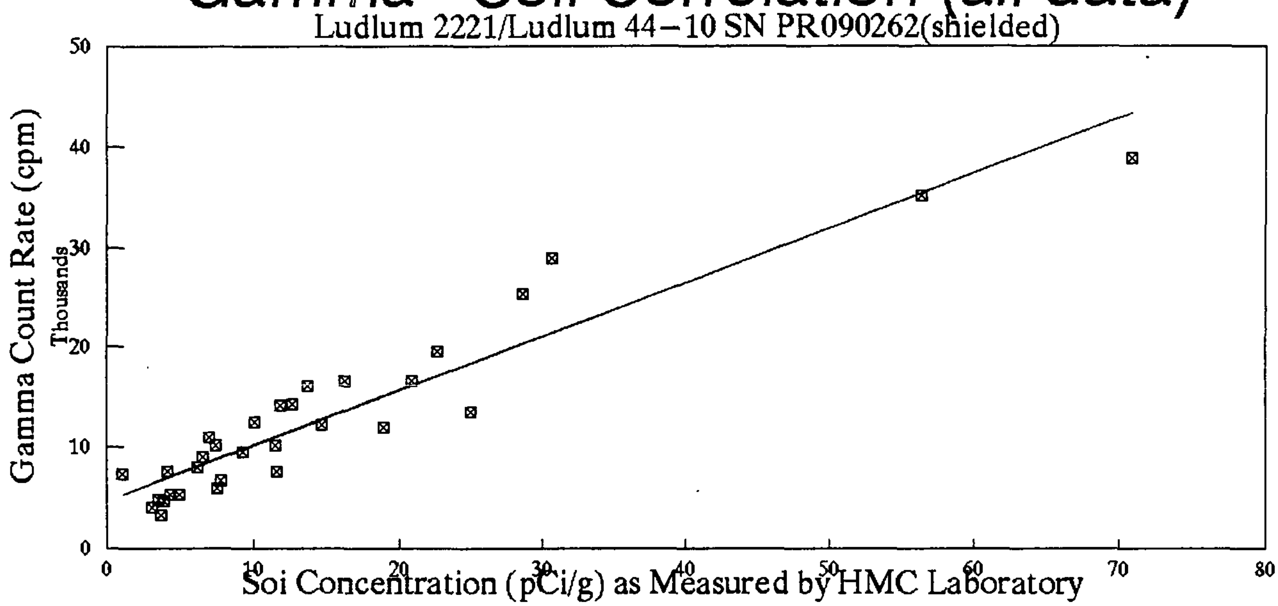
Constant	4756.12291125542
Std Err of Y Est	2992.34453500565
R Squared	0.88837164465619
No. of Observations	31
Degrees of Freedom	29

X Coefficient(s)	543.2178
Std Err of Coef.	35.75731

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44–10
Serial Number	PR090262
Height above ground	6 inches with shield

Gamma–Soil Correlation (all data)



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44–10
Serial Number	PR090262
Height above ground	18 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Count Rate (cpm)
HMC–1	2.0	1.0	24004.0
HMC–2	7.4	7.4	29227.0
HMC–3	6.2	10.1	38239.0
HMC–4	17.6	22.7	53744.0
HMC–5	38.2	56.4	88918.0
HMC–6	61.9	70.9	97353.0
HMC–7	21.8	28.6	66627.0
HMC–8	1.6	4.2	25929.0
HMC–9	11.9	11.9	39836.0
HMC–10*	25.9	30.7	72376.0
HMC–10	12.8	11.6	20961.0
HMC–11	2.4	5.0	16154.0
HMC–12	1.3	3.7	9256.0
HMC–13	13.6	13.8	47416.0
HMC–14	2.0	4.4	18491.0
HMC–15	1.5	3.9	16132.0
HMC–16	0.8	3.0	14993.0
HMC–17	1.1	3.5	17485.0
HMC–18	21.8	21.0	44872.0
HMC–19	23.3	19.0	35348.0
HMC–20	9.1	9.3	28693.0
HMC–21	5.6	7.8	21303.0
HMC–22	4.2	6.2	24297.0
HMC–23	9.9	11.6	31690.0
HMC–24	12.0	14.8	36415.0
HMC–25	15.9	16.3	45114.0
HMC–26	11.2	12.7	39828.0
HMC–27	5.7	6.6	28629.0
HMC–28	6.4	7.0	32960.0
HMC–29	21.5	25.0	38780.0
HMC–30	4.7	7.5	19069.0

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	18 inches

* HMC-10 was inadvertently used for two different studies on different days

Regression Output:

Constant	17929.8641987183
Std Err of Y Est	8855.70454354668
R Squared	0.82977313636244
No. of Observations	31
Degrees of Freedom	29

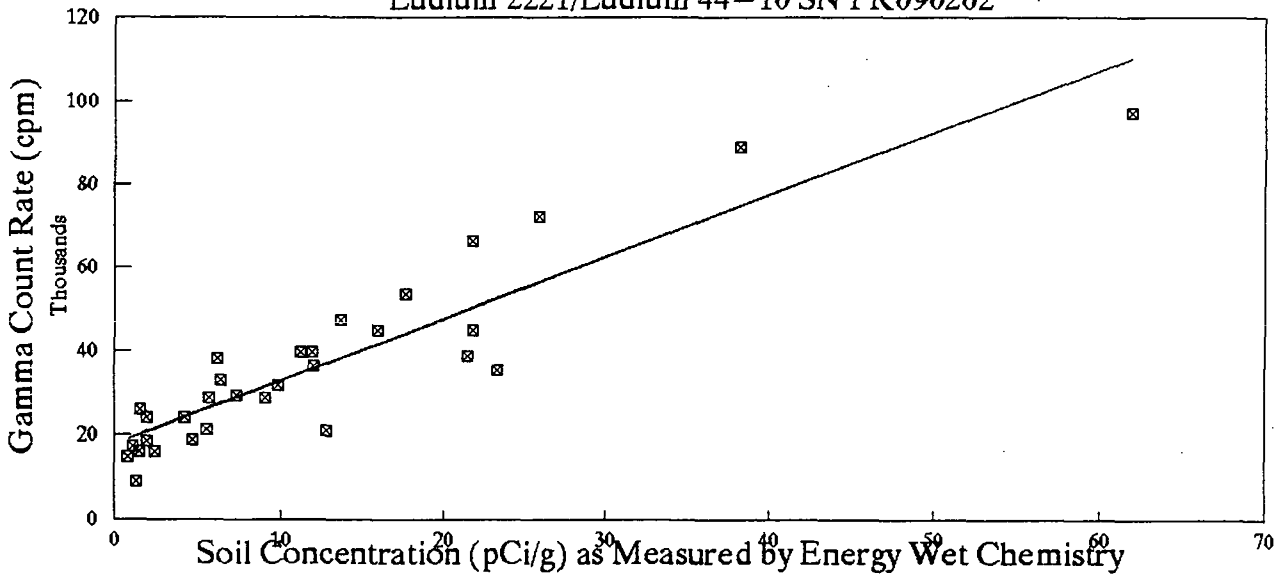
X Coefficient(s)	1490.462
Std Err of Coef.	125.3592

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 2221
Serial Number	108853/91925
Instument Model	Ludlum 44-10
Serial Number	PR090262
Height above ground	18 inches

Gamma-Soil Correlation (all data)

Ludlum 2221/Ludlum 44-10 SN PR090262



Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 3
Serial Number	93847
Instument Model	Ludlum 44-2
Serial Number	091421
Height above ground	6 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Rate(uR/h)
HMC-1	2.0	1.0	10.1
HMC-2	7.4	7.4	11.6
HMC-3	6.2	10.1	13.8
HMC-4	17.6	22.7	19.9
HMC-5	38.2	56.4	46.1
HMC-6	61.9	70.9	49.6
HMC-7	21.8	28.6	32.5
HMC-8	1.6	4.2	10.7
HMC-9	11.9	11.9	14.5
HMC-10*	25.9	30.7	25.7
HMC-10	12.8	11.6	9.5
HMC-11	2.4	5.0	6.6
HMC-12	1.3	3.7	2.2
HMC-13	13.6	13.8	18.0
HMC-14	2.0	4.4	7.9
HMC-15	1.5	3.9	6.8
HMC-16	0.8	3.0	6.6
HMC-17	1.1	3.5	8.9

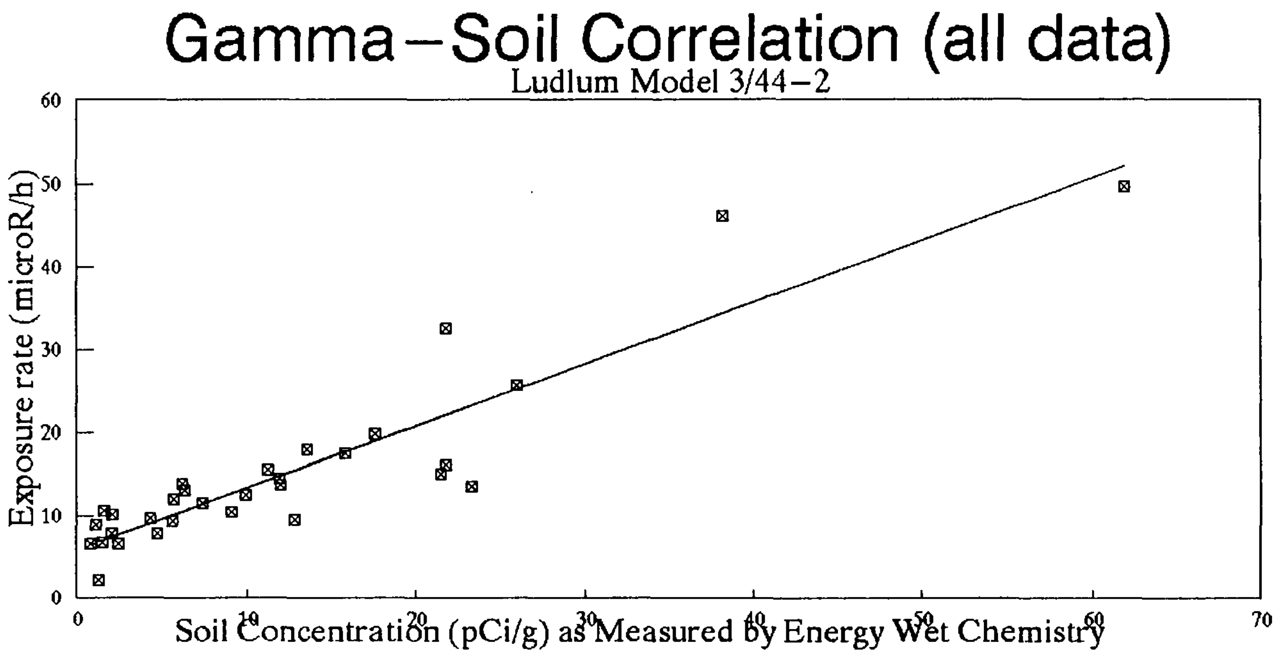
HMC-18	21.8	21.0	16.1
HMC-19	23.3	19.0	13.5
HMC-20	9.1	9.3	10.4
HMC-21	5.6	7.8	9.4
HMC-22	4.2	6.2	9.7
HMC-23	9.9	11.6	12.5
HMC-24	12.0	14.8	13.7
HMC-25	15.9	16.3	17.5
HMC-26	11.2	12.7	15.6
HMC-27	5.7	6.6	12.0
HMC-28	6.4	7.0	13.1
HMC-29	21.5	25.0	15.0
HMC-30	4.7	7.5	7.9

* HMC-10 was inadvertently used for two different studies on different days

Regression Output:

Constant	5.90712430716699
Std Err of Y Est	4.36087317268297
R Squared	0.83415523155465
No. of Observations	31
Degrees of Freedom	29

X Coefficient(s)	0.745552
Std Err of Coef.	0.061731


Gamma−Soil Correlation (all data)
Ludlum Model 3/44−2
Exposure rate (microR/h)
0
10
20
30
40
50
60
0
10
20
30
40
50
60
70
Soil Concentration (pCi/g) as Measured by Energy Wet Chemistry

Homestake Mining Company
Field Instrument Calibration

Instrument Model	Ludlum 3
Serial Number	93847
Instument Model	Ludlum 44–2
Serial Number	091421
Height above ground	6 inches

Location	Energy Lab (pCi/g)	HMC Lab(pCi/g)	Rate(uR/h)
HMC–1	2.0	1.0	10.1
HMC–2	7.4	7.4	11.6
HMC–3	6.2	10.1	13.8
HMC–4	17.6	22.7	19.9
HMC–5	38.2	56.4	46.1
HMC–6	61.9	70.9	49.6
HMC–7	21.8	28.6	32.5
HMC–8	1.6	4.2	10.7
HMC–9	11.9	11.9	14.5
HMC–10*	25.9	30.7	25.7
HMC–10	12.8	11.6	9.5
HMC–11	2.4	5.0	6.6
HMC–12	1.3	3.7	2.2
HMC–13	13.6	13.8	18.0
HMC–14	2.0	4.4	7.9
HMC–15	1.5	3.9	6.8
HMC–16	0.8	3.0	6.6
HMC–17	1.1	3.5	8.9

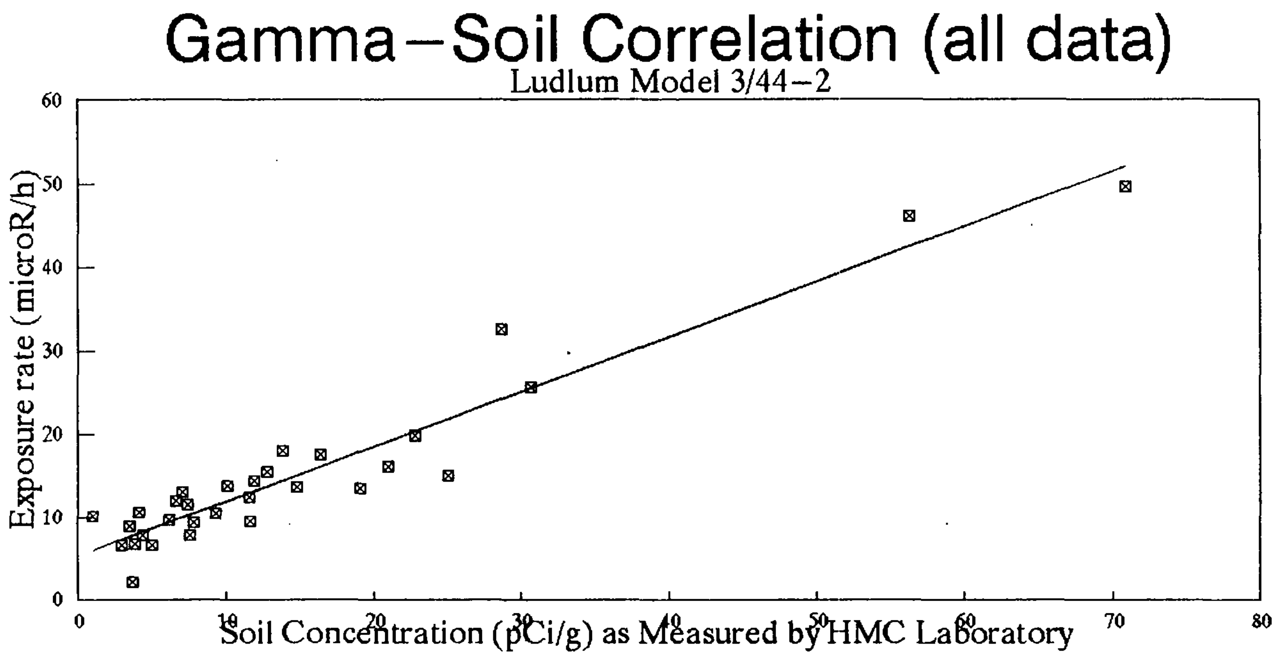
HMC-18	21.8	21.0	16.1
HMC-19	23.3	19.0	13.5
HMC-20	9.1	9.3	10.4
HMC-21	5.6	7.8	9.4
HMC-22	4.2	6.2	9.7
HMC-23	9.9	11.6	12.5
HMC-24	12.0	14.8	13.7
HMC-25	15.9	16.3	17.5
HMC-26	11.2	12.7	15.6
HMC-27	5.7	6.6	12.0
HMC-28	6.4	7.0	13.1
HMC-29	21.5	25.0	15.0
HMC-30	4.7	7.5	7.9

* HMC-10 was inadvertently used for two different studies on different days

Regression Output:

Constant	5.36327844022097
Std Err of Y Est	3.15215691219155
R Squared	0.91334961030116
No. of Observations	31
Degrees of Freedom	29

X Coefficient(s)	0.658557
Std Err of Coef.	0.037667


Gamma-Soil Correlation (all data)
Ludlum Model 3/44-2
Exposure rate (microR/h)
0
10
20
30
40
50
60
0
10
20
30
40
50
60
70
80
Soil Concentration (pCi/g) as Measured by HMC Laboratory

Appendix B

Procedures for Operating Global Positioning System for Radiological Surveys

Standard Operating Procedure ERG/AECI.01

Setting up the Base Station

1.0 Purpose

This procedure is used to establish a base station for land surveys or environmental surveys using a global positioning system (GPS).

2.0 Discussion

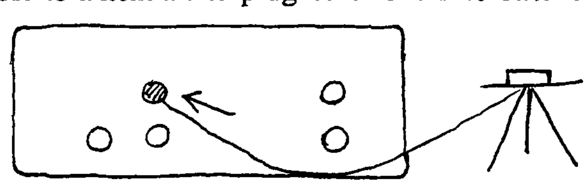
The procedure for establishing a base station must be followed in order to obtain the necessary data to perform the differential correction on the ROVER unit. Without this correction, the accuracy of the position coordinates is greatly impaired.

3.0 Equipment and Supplies Checklist

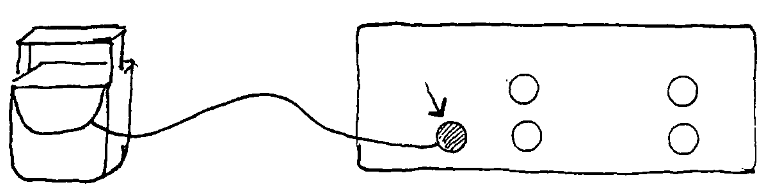
Tripod____
Base Receiver and case____
Cable____
Base Antenna____
Antenna cable____
Charged battery____

4.0 Procedure

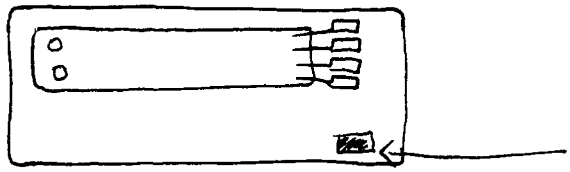
4.1 Set up the Tripod and attach tribrach. Anchor each leg by standing on the foot pad at the bottom of each leg. Loosen knurled, brass thumb screw at the top of the tribrach and remove brass center. Screw brass center into base antenna and hand tighten. Place antenna into tribrach. Point corner of antenna with "N" towards North. Tighten thumb screw. Connect antenna cable to antenna and plug other end into back of base receiver.



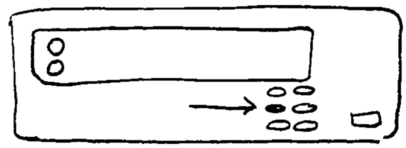
4.2 Remove cable from the pouch on the front of the base battery and plug into the back of the base receiver.



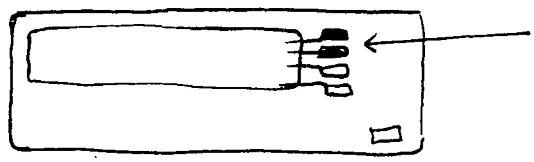
4.3 Turn on the power to the base receiver by pressing and holding down the power button for about 1 second.



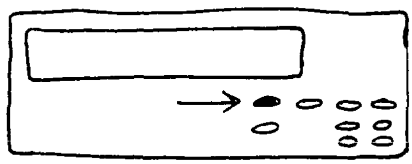
4.4 Press the "SESSIONS" button to enter the station (control point) and session information.



4.5 Select "NEXT STATION" OR "PREV STATION" until the control point occupied by the base station is displayed.



4.6 Press "ENTER" twice to choose currently displayed station.



4.7 Select "MANUAL" to enter latitude and longitude of base station. Select "HERE" to let base receiver determine its own location.

4.8 Select "ACCEPT" to enter session I.D. We will use the date as the session I.D. as follows. For June 06, enter 606. The right arrow must be pushed between each number.

4.9 Push the right arrow once more and enter 1 for the first session of the day, 2 for the second and so on. The session I.D. will look like this when finished. "606-1". Press "ENTER" to accept the currently displayed sessions I.D.

4.10 Select "USE SPECIAL CONTROLS".

4.11 Check, and change if necessary the three settings on this screen to as follows:

Position Logged	{EVERY CYCLE}
Over Determine	{ENABLE}
Log smooth PR	{ENABLE}

4.12 Select "MORE"

4.13 Check, and change if necessary the two settings on this screen to as follows"

Position Type	{3D ONLY}
Height Source	{AUTO}

4.14 Press "ENTER" to accept the settings.

4.15 Select "MANUAL START BY USER".

4.16 Use the number and arrow keys to set the following:

Elevation of Mask $+10^0$
Minimum SV's 03
Meas Sync Time 05.0 sec

4.17 Select "ACCEPT", select "NO" twice to NOT add another session or station.

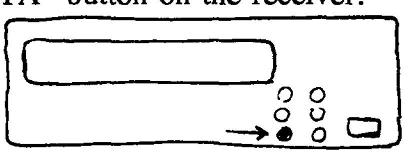
4.18 Select "START PREPLANNED (SINGLE SURVEY)". Verify and accept or change the station and session information. (This is to double check the settings made previously.)

4.19 Enter the approximate height in inches from the station monument to the top of the antenna. (A entry of 0060.00 inches is close enough for this type of survey.) Select "ACCEPT".

4.20 Select "START SURVEY" to begin base receiver collecting position information.

4.21 After a few seconds, the base receiver should display that it is logging data. This completes the base station setup.

4.22 To end the collection of base station data or to end a survey for downloading, Press the "LOG DATA" button on the receiver.



4.23 Select "END SURVEY". You will then be asked to confirm that you want to end the survey. Select "YES".

4.24 Turn off the power and disconnect the battery and antenna at the back of the receiver. Place the receiver in the yellow case to transport.

Standard Operating Procedure ERG/AEIC.02

Setting Up the ROVER

1.0 Purpose

The purpose of the procedure is to instruct the user on how to properly establish the settings on the roving receiver (ROVER) of the global positioning system (GPS). These instructions should be followed after first establishing the Base Station (Standard Operating Procedure ERG/AEIC.01).

2.0 Discussion

The settings on the ROVER receiver are extremely important to assure useable data. Some settings should be made after consultation with the Project Manager.

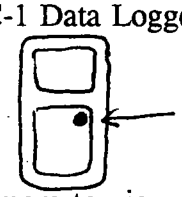
3.0 Equipment and Supplies Checklist

Roving Receiver and antenna____
Ludlum 2221____ (For radiological surveys)
Radiation Detector____ (For radiological surveys)
TDC-1 Data Logger____

4.0 Procedure

4.1 All of the settings that control the roving receiver, are controlled through the TDC-1 Datalogger. You must however manually turn on the power to the receiver.

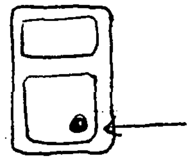
4.2 Turn on the TDC-1 Data Logger by pressing the clear, on/off button.



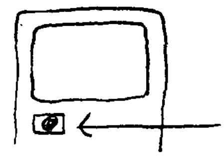
4.3 Press clear once more to view the main menu. This may not be necessary if the main menu is displayed when the power is turned on.

Asset Surveyor
Data Capture
Navigate
Configure
Data Transfer
Utilities

4.4 Press "OK" after selection of "Data Capture."



4.5 Select "CREATE" to create a database (job title).



4.6 Use the alpha keys to enter a job title such as "HMC", followed by the date and session as on the base receiver (see SOP ERG/AEIC.01). For example the second session on June 7th would look like this: "HMC6072". Press "OK".

4.7 Make sure that the current database is highlighted, or use the up or down arrow key to highlight it and press "OK" again.

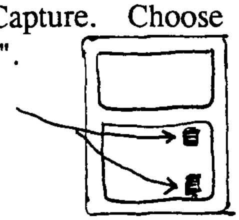
4.8 The Datalogger will display that it is connected to the 4000, and also to the Ludlum 2221. The feature option menu will appear with the current database (job title) at the top.

HMC 6072
Point
Line
Area

4.9 You are now ready to begin the survey. The next selection will begin the collection of position and radiation detector information.

4.10 Make sure you are ready to begin moving, then use the down arrow to select "LINE". Press "OK" and begin moving along the line. It is very important that you are moving while collecting data. Otherwise, several points are collected on top of each other in the same position. This makes processing and mapping extremely difficult. If you need to stop for any reason, just press "OK". The current line definition will be stored. You may press "OK" again while "LINE" is highlighted to begin a new line. It is alright to do this to resume an interrupted line also.

4.11 When you press "OK" to end the last line to be surveyed press "CLEAR" until you are asked if you want to exit Data Capture. Choose "YES" and turn the power off by pressing "FUNC" and then "OFF".



4.12 Turn off the power to the receiver and gamma meter in the backpack.

4.13 Go to the base receiver and end its collection of data ("LOG DATA", "END SURVEY"). Disconnect cables and bring base receiver and data collector into the office for downloading.

Standard Operating Procedure ERG.03

Downloading Procedure - Base Station

1.0 Purpose

The purpose of this procedure is to provide the procedure for downloading the data from the global positioning system (GPS) base station.

2.0 Discussion

The GPS base station collects position data while the survey is being conducted. At the end of the survey or prior to exceeding the memory capacity of the base station, the data must be downloaded into a computer for use in the differential correction of the Roving GPS receiver. **Note that the memory capacity of the base station is limited and in most cases will last only six to eight hours.**

3.0 Equipment and Supplies Checklist

Base Station____
Windows-Based Computer____
TRIM 4000 software____
Data transfer cable____
Battery Charger____

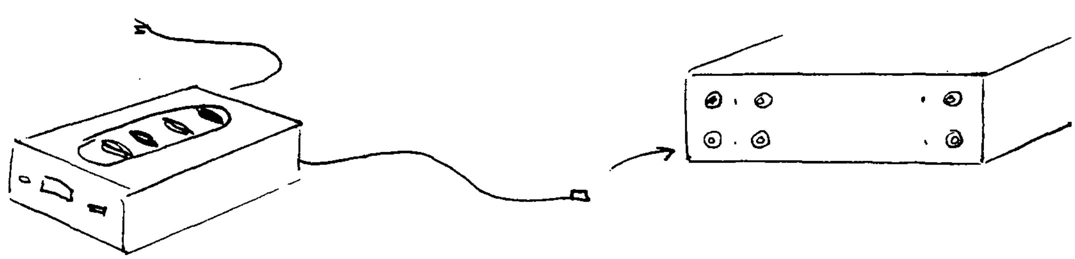
4.0 Procedure

4.1 Get to C:\PROMPT on computer.

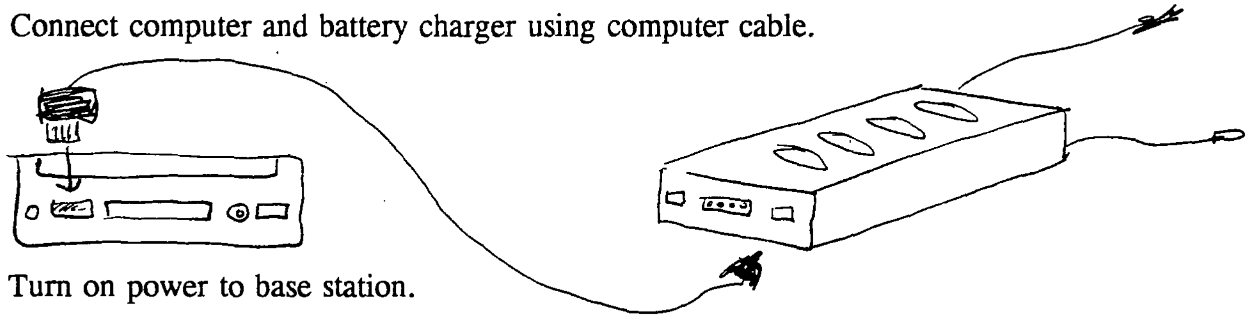
4.2 Type "CD TRIM 4000"

4.3 Type "4000"

4.4 Plug data transfer cable, from battery charger, into back of base station (PWR I/O Port)



4.5 Connect computer and battery charger using computer cable.



4.6 Turn on power to base station.

4.7 Follow directions on computer screen.

Press any key

Hit "ENTER"

Press "F10" key

Press "ENTER" on files desired or "F9" for all files listed

Press "F10" key to transfer files from base unit to computer

Hit any key to begin

4.8 When transfer is done.

"ESCAPE" to menu

"ESCAPE" to C:\PROMPT

Go to Windows by typing "WIN" at C:\PROMPT

Check in file manager or TRIM Directory to see if all files were downloaded into TRIM 4000 Directory

Click on Main

Click on File Manager

Click on TRIM 4000

Standard Operating Procedure ERG.04

Downloading Procedure - TDC-1

1.0 Purpose

The purpose of this procedure is to provide instructions on downloading the data from the TDC-1 data logger to the computer.

2.0 Discussion

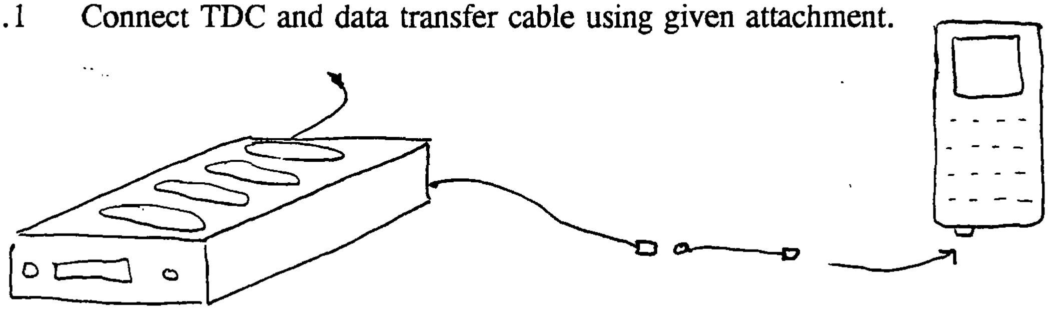
The TDC-1 data logger has an extended memory with a capability of holding one or more days of collected data. However it is prudent to download the data once or more per day.

3.0 Equipment and Supplies Checklist

TDC-1 Data Logger____
Battery Charger____
Data Transfer Cable____
Computer____
PFINDER Software____

4.0 Procedure

4.1 Connect TDC and data transfer cable using given attachment.



4.2 Keep battery charger attached to computer as was in base station downloading (see SOP ERG/AEIC.01).

4.3 On computer, type "LMOUSE" at C:\PROMPT.

4.4 Type "PFINDER".

4.5 On TDC-1

Press "ON"

Hit "OK" to get to ASSET SURVEYOR Menu

Use arrow keys to highlight DATA TRANSFER

Press "OK"

4.6 On Computer

With mouse click on "OK"

Click on "PROJECT" (at top)

Go down and click on "SET CURRENT"

Click on "CURRENT SITE" name

Click on "COMM" (at top)

Click on "DATA FILES TO PC"

When Menu comes up click on desired files to download (A checkmark will then appear by them)

When all files are chosen click on "OK"

Wait for files to download

After files have downloaded click on window "OKAY"

Then click on "QUIT: (at top) and then "YES" in new window

Type "WIN" and check to see if files were downloaded into TRIMBLE/DATA/PFINDER/HOMESTAKE directory

Click on Main

Click on File Manager

Click on TRIMBLE/DATA/PFINDER/HOMESTAKE

Standard Operating Procedure ERG.05

Saving GPS Data On Disk

1.0 Purpose

This procedure provides guidance on saving downloaded GPS generated data to floppy disk.

2.0 Discussion

The amount of GPS generated data that can be stored in the computer is limited and must be saved on floppy disk periodically. This also provides backup in case of hard disk failure or loss of computer. Because of the large quantity of data normally involved, a compression utility is used to decrease the number of floppy disks required. Normally, one 1.14 Mb disk will be required for each day of data aquisition.

3.0 Equipment and Supplies Checklist

Computer____
Floppy Disks____
Norton Desktop Version 3.0____

4.0 Procedure

4.1 In Windows double click mouse on Main Icon

4.2 Double click on Norton Desktop Icon

4.3 Click on Drive option near top of screen

4.4 Select Drive C: and click on "OK"

4.5 All downloaded files will be in two directories

Trim 4000.DAT

Trim 4000.ION

Trim 4000.MES

Trim 4000.EPH

or

TRIMbLE\DATA\PFINDER\HOMESTAKE.SSF

TRIMBLE\DATA\PFINDER\HOMESTAKE.

4.6 Using July 31 session 2 at HMHC as an example, our file names would be:

HM#C 7312.DAT
HM#C 7312.ION
HM#C 7312.MES
HM#C 7312.EPH

AND

HMC 7312.SSF
HMC 7312

4.7 Click on the files wanted, place disk in drive, and click on "file"

4.8 When file menu comes up, click on "compress"

4.9 When asked name to compress to, enter FILENAME.ZIP

EXAMPLE: HM#C 7312.ZIP

4.10 When all 6 files are compressed onto 1 disk, check drive A:\ and verify their presence.

Standard Operating Procedure ERG/AEIC.06

Sending Data by Modem

1.0 Purpose

The purpose of this SOP is to provide guidance on sending GPS generated data by modem to another computer.

2.0 Discussion

Generally, the GPS data are collected in the field and transmitted to the office for data processing at the end of each day. This allows the specialist to begin processing the data for possible feedback to the field crew.

3.0 Equipment and Supplies Checklist

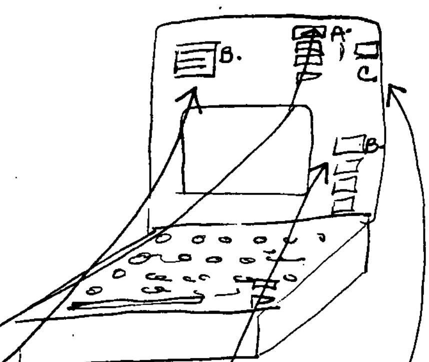
Computer with Windows____
Hayes ACCURA Fax Modem____

4.0 Procedure

4.1 In windows double click on "Main" Icon, then double click on "SMARTCOM FOR WINDOWS" ICON

4.2 With mouse, double click on "desired party to connect" (or click on "desired party to connect" once, then click on "connect")

4.3 After:
Setting up
Waiting for dial tone
Now dialing
Waiting for
Connected at



You will get a new window

A. Click on "SCWINLE", then "send"

B. Click on desired file, then add to list (or double click on Filename)

C. Click on send list

4.4 After each file is sent, a message saying "FILE SENT" will appear. After all files are sent click on the "phone" icon at bottom left of screen, to disconnect

4.5 At top of screen click on" File", then exit. Click on "NO" for rest of questions until you get to main menu

Standard Operating Procedure ERG/AEIC.007

To Delete Files from Computer

1.0 Purpose

To provide guidance on deleting data files from the computer

2.0 Discussion

The field computer will normally require the deletion of data files after a few days of data collection.

3.0 Equipment and Supplies Checklist

Computer____

4.0 Procedure

4.1 Make absolutely certain files have been stored on floppy disks. (5 minutes could save 5 hours)

4.2 From Windows double click on Main Icon

4.3 Double click on File Manager Icon.

4.4 Click on Directory and Subdirectories until file is highlighted

4.5 Press "DELETE" key

4.6 Press "ENTER" or click on "OK"

4.7 Press "ENTER" or click on "OK"

Appendix C

Procedure for Verification of State Highway Right of Way

Standard Operating Procedure
Homestake Mining Company

Verification of Highway Right-of-Way

1. Purpose

To describe the radiological measurements necessary for assuring that the highway right-of-way has been cleaned up to meet the cleanup criteria.

2. Discussion

The highway right-of-way that divides the HMC property is known to be contaminated by windblown tailings. Because of public safety concerns, HMC plans to backfill the excavated areas contiguous to both sides of the pavement prior to obtaining the verification data from soil sample results. Gamma-ray count rate action levels will be developed for detectors that have known correlations between the gamma-ray count rate and Ra-226 concentrations in soil. These action levels will be conservatively chosen in order to minimize the probability for error (estimated 95 % confidence interval).

3. Gamma-Ray Count Rates for Use in Determining Adequacy of Cleanup

Two separate studies were conducted to develop correlations between radiation detector readings and Ra-226 concentrations in soil. The first study focussed on areas south of the Large Tailings Pile where windblown and tailings liquids had contaminated the area. The area is representative of contamination where the uranium content is higher than that that exists in tailings.

A procedure was developed whereby detectors were held at a fixed height and one or more measurements recorded. A five-plug composite sample was taken from the top six-inch soil layer within an area having a radius of approximately 18 inches. Locations where the Ra-226 concentrations ranged from near background to approximately 30 pCi/g were used to develop the correlations shown in the attached figures.

Action Levels were chosen as follows:

Detector	Height	Action Level
Ludlum 3/44-2	6 in	10-12 microR/h*
Ludlum 44-10 (shielded)	6 in	10 kcpm*

* May be higher when geometry conditions increase gamma exposure levels

4. Procedure

4.1 Land survey stakes or other markers will be placed adjacent to the area to be excavated on both sides of the highway at intervals of 25 feet. Each stake will have a unique identifier with at least one stake referenced to the site coordinate system.

4.2 Scrapers will excavate to the prescribed depth, based on prior soil sample results.

4.3 The excavation control technician will the scan the area. Areas exceeding the action level will be marked with pin flags for additional excavation. This will be done until it appears that all contamination above the cleanup criterion has been removed.

4.4 The width of the excavation on each side of the highway will range from 15 to 50 feet. A gamma-ray measurement representing each 25-ft long segment (parallel to the highway) will be recorded on the attached form according to the following procedure.

4.4.1 Follow the HMC procedure for function checking the meter at the beginning of each work shift.

4.4.2 Walk within the excavated area at a fast pace while observing the meter reading, assuring that time is spent in all areas. Record the average reading on the line corresponding to the number on the land survey marker on the northernmost part of the area.

Mark any area that exceeds the action level and immediately advise the field supervisor.

4.5 After areas have been shown to be below the gamma-ray action level, take a 6-inch deep soil sample at approximately one-half the excavation width along each side of the road at 150-ft intervals.

Homestake Mining Company
Gamma-Ray Verification Measuremnts
Cleanup of Highway Right-of-Way

Scaler/Rate Meter Ser. No.________________
Detector Ser. No._______________
Shield Used (Y or N) __________
Action Level __________________microR/h

Stake Number	microR/h	Stake Number	microR/h

Homestake Mining Company
Gamma-Ray Verification Measuremnts
Cleanup of Highway Right-of-Way

Scaler/Rate Meter Ser. No.________________
Detector Ser. No.______________
Shield Used (Y or N) ___________
Action Level __________________(cpm or cphm)

Stake Number	counts/min	Stake Number	counts/min