NRC FORM 464 Part I
(6-1998)

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) / PRIVACY ACT (PA) REQUEST

FOIA/PA	RESPONSE NUMBER
99-377,00-219,00-257	5

RESPONSE TYPE: FINAL [ ] PARTIAL [✓]

REQUESTER: Ms. Kimberly Boggiatto

DATE: JUL 18 2000

PART I. -- INFORMATION RELEASED

- [ ] No additional agency records subject to the request have been located.
- [ ] Requested records are available through another public distribution program. See Comments section.
- [✓] APPENDICES I — Agency records subject to the request that are identified in the listed appendices are already available for public inspection and copying at the NRC Public Document Room.
- [✓] APPENDICES J — Agency records subject to the request that are identified in the listed appendices are being made available for public inspection and copying at the NRC Public Document Room.
- [ ] Enclosed is information on how you may obtain access to and the charges for copying records located at the NRC Public Document Room, 2120 L Street, NW, Washington, DC.
- [✓] APPENDICES J — Agency records subject to the request are enclosed.
- [ ] Records subject to the request that contain information originated by or of interest to another Federal agency have been referred to that agency (see comments section) for a disclosure determination and direct response to you.
- [✓] We are continuing to process your request.
- [✓] See Comments.

PART I.A -- FEES

AMOUNT * $

* See comments for details

- [ ] You will be billed by NRC for the amount listed.
- [ ] You will receive a refund for the amount listed.
- [ ] None. Minimum fee threshold not met.
- [ ] Fees waived.

PART I.B -- INFORMATION NOT LOCATED OR WITHHELD FROM DISCLOSURE

- [ ] No agency records subject to the request have been located.
- [ ] Certain information in the requested records is being withheld from disclosure pursuant to the exemptions described in and for the reasons stated in Part II.
- [ ] This determination may be appealed within 30 days by writing to the FOIA/PA Officer, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Clearly state on the envelope and in the letter that it is a "FOIA/PA Appeal."

PART I.C COMMENTS (Use attached Comments continuation page if required)

The records identified on Appendix I with a ML accession number are publicly available in the NRC's Public Electronic Reading Room at http://www.nrc.gov/NRC/ADAMS/index.html. If you need assistance in obtaining these records, please contact the PDR at (202)634-3273, or 1-800-397-4209, or by e-mail to pdr@nrc.gov.

SIGNATURE - FREEDOM OF INFORMATION ACT AND PRIVACY ACT OFFICER

Carol Ann Reed *Carol Ann Reed*

APPENDIX I
RECORDS ALREADY AVAILABLE IN THE PDR/ADAMS

NO.	DATE	ACCESSION NUMBER	DESCRIPTION/(PAGE COUNT)
Item 6 - Reinitiation of consultation under ESA			
1.	05/16/00	ML003716659	Letter from A. Thompson from T. Essig re: Moab Reclamation Trust (9 pages)
2.	05/18/00	ML003718371	Letter from Earthjustice to T. Essig re: Moab Reclamation Trust (10 pages)
3.	05/25/00	ML003716876	Letter from J. Greeves to R. Morgenweck re: Fish and Wildlife request to reinitiate consultation (5 pages)
4.	06/01/00	ML003719769	Ltr. to Earthjustice from T. Essig re: Reinitiating consultation (4 pages)

APPENDIX J
RECORDS BEING RELEASED IN THEIR ENTIRETY
(If copyrighted identify with *)

NO.	DATE	DESCRIPTION/(PAGE COUNT)

Item 6 - Reinitiation of consultation under ESA

1.	11/30/99	Cleanup of Pipeline Corridor at Atlas Corporation Uranium Mill Site (36 pages) Presently in ADAMS under ML993350158 (CF ONLY)

Cleanup of Pipeline Corridor at Atlas Corporation Uranium Mill Site

License SUA-917

Docket No. 40-3453

November 1999

Prepared for:

J//

Cleanup of Pipeline Corridor at Atlas Corporation Uranium Mill Site

License SUA-917

Docket No. 40-3453

November 1999

Prepared for:

Atlas Corporation

370 Seventeenth Street, Suite 3140

Denver, CO 80202

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Cleanup of Pipeline Corridor at Atlas Corporation Uranium Mill Site

1. Introduction

From July through September of 1999, the Mid-America Pipeline Company (MAPCO) exercised an option of laying a gas pipeline across the northeastern edge of the Atlas Minerals Uranium Mill Site in Moab, Utah, along State Highway 190. Environmental Restoration Group, Inc. (ERG) was contracted by MAPCO to assist in the removal of all contaminated material, soil verification, monitoring for radioactivity during the digging of the pipe trench and placement of backfill, and site restoration associated with the pipeline corridor through the Atlas Mill site. The corridor is approximately 3500 feet long, extends through the restricted area and non-restricted area, is adjacent to former uranium ore pads, and runs along and through a former ore haul road.

2. Background Ra-226 Concentration in Soil

Seventeen background soil samples were taken near the Atlas Mill site and analyzed for Ra-226 by Energy Laboratories, Inc. (ELI) in Casper, Wyoming. The concentrations are presented in Table 2-1 and the sample locations are shown in Figure 2-1. Four additional samples with Sample ID's beginning with "BKG" are reported for samples taken in 1986 by Atlas and analyzed by EDA. Samples Moab-B14 and Moab-B15 were taken side by side. The mean Ra-226 concentration for all 21 samples is 1.9 pCi/g. The standard deviation is 2.4 pCi/g. A sample number BKG-4 was taken by Atlas north of the mill site. However, the Nuclear Regulatory Commission advised Atlas that the sample was unsuitable as a background sample since it was within the windblown area just north of the site. Therefore it was not considered in this analysis. If only the samples with sample numbers beginning with "Moab-B" are considered, the mean is 1.1 pCi/g with a standard deviation of 1.7 pCi/g.

During the gas-line trench excavation, the trench extended to depths of 8-15 feet. The excavated material was very fine red sand, representative of alluvial material in the area. The only evidence of outcrops or talus slope debris of the nearby cliffs appeared at the far western edge of the Atlas property where gravel material was found at a depth of approximately six feet from the surface. This suggests that all surface soil in the pipeline corridor is alluvial material, much of which was probably deposited from river silt. It does not, however, rule out surface talus slope debris or outcrops of the nearby cliffs in other portions of the site.

The data suggest that samples taken near the site may have significantly higher Ra-226 concentrations than samples taken farther away from the site. Sample Moab-B10 (2.2 pCi/g) was taken from an area near the site. However, the area was very unlikely to have been influenced by windblown tailings due to the distance and local topography. In an attempt to characterize drainages from abandoned uranium mine sites, Moab-B12 was taken within Courthouse Wash, Moab-B14 and Moab-B15 were taken in Moab Wash,

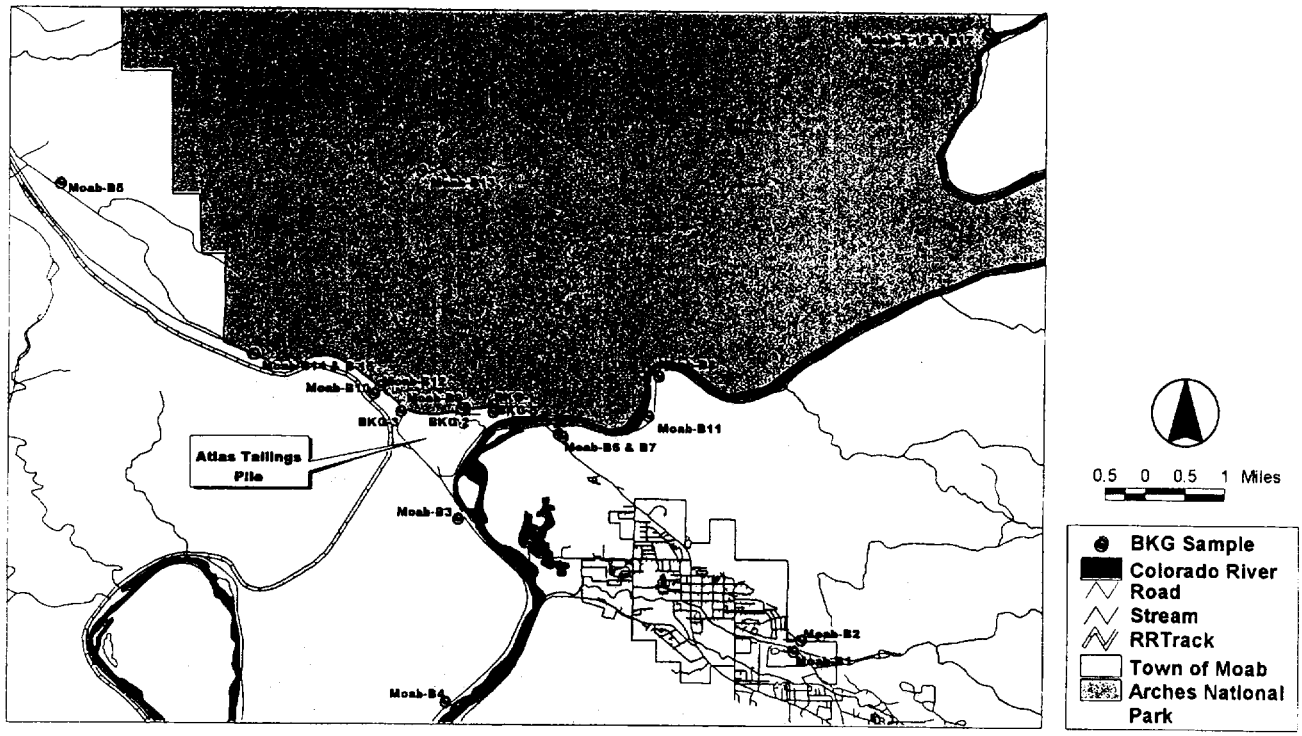


Figure 2-1 Background Soil Sample Locations

Table 2-1 Background Soil Sample Data

Sample ID	ELI Ra-226 Conc. (pCi/g)	Gamma Readings (μR/hr)	Comments
BKG-1	4.0	-	Taken by Atlas in 1986
BKG-2	8.5	-	Taken by Atlas in 1986
BKG-3	4.4	-	Taken by Atlas in 1986
BKG-5	5.0	-	Taken by Atlas in 1986
Moab-B1	0.5	8	
Moab-B2	0.5	9	
Moab-B3	1.2	13	
Moab-B4	0.4	12	
Moab-B5	0.9	10	
Moab-B6	0.5	15	
Moab-B7	0.5	12	
Moab-B8	0.5	10	
Moab-B9	7.4	15	
Moab-B10	2.2	13	
Moab-B11	1.3	13	
Moab-B12	0.3	12	
Moab-B13	0.3	7	
Moab-B14	1.3	12	
Moab-B15	0.2	12	Taken next to Moab-B14
Moab-B16	0.2	13	
Moab-B17	0.4	13	

Mean	1.9
Std. Dev.	2.4

and Moab-B16 and Moab-B17 were taken in Salt Wash. Drainage from uranium mine sites should have affected these washes. As can be seen by the data, all values were less than 1 pCi/g Ra-226. A sample (Moab-B11) of Colorado Riverbed sediment taken upstream of the site but below the confluence with Salt Wash consisted of 1.3 pCi/g Ra-226. The sample locations Moab-B1 and Moab-B2 were taken east of Moab. It should be noted that the drainage from this area currently enters the Colorado River downstream of the site and therefore this area probably did not contribute to the alluvium on which the mill site was placed.

Since most samples collected by ERG personnel were taken from drainages above the alluvial fill area on which the tailings pile and mill were placed, this range should represent the alluvial material. There are, however, small mines very near the pile that might indicate the presence of mine waste or uranium ore outcrop, especially on the western edge of the mill site. We believe that this influence on the alluvium is minimal but do not rule out that some portions of the site may reflect these higher concentrations as natural background radionuclides. Background values for areas contiguous to the site may be significantly higher than for the alluvium.

Windblown ore and/or tailings are evident on the hillside across Potash Road (State Highway 279) that runs along the west side of the tailings pile. However, it does not appear that windblown material should have influenced the Ra-226 results at the reported background locations. The higher levels near the site may be the result of localized ore deposits. The possibility that these higher levels are due in part to windblown ore or tailings was not, however, eliminated.

Laboratory data from 33 cleanup verification samples taken after the cleanup of the gas-line corridor along the northern portion of the site (ore handling area) had a mean concentration of 1.2 pCi/g and a standard deviation of 1.6 pCi/g. The median concentration is 1.1 pCi/g. While the data appear to have a lognormal distribution, the data suggest that the mean confirmation sample concentration is similar to the mean

background concentration of the Moab-B1-Moab-B-17 set of samples. The distributions of the two data sets are also similar.

Prior to the cleanup, surface soil samples were taken near and within the corridor to develop the correlation between the Ra-226 concentrations in surface soil and gamma-ray levels. Biased samples taken in areas of the site where the gamma-ray levels were minimal resulted in Ra-226 values of 2.7, 2.0, 2.1, 3.2, 2.5, and 4.1 pCi/g (average = 2.8 pCi/g). This would suggest a maximum upper range of approximately 2.8 pCi/g for background for the corridor since there may have been a slight influence from windblown in these areas.

Considering the above arguments, the background data show that 2.5 pCi/g represents the upper range of the variability in natural background levels for material in the watershed with the exception of small areas near the site. Since this value is supported by pre- and post- remediation samples from the pipeline corridor, a background Ra-226 concentration of 2.5 pCi/g was used to determine whether the cleanup standards were met.

3. Plan for Decontaminating Surface Soils in Pipe Corridor

The Plan, " Installation of New Gas Pipeline within Restricted Area of the Atlas Mill Tailings Site", was submitted to the NRC on April 20, 1999 with response to staff comments being transmitted on May 14, 1999. (Blubaugh, 1999). On June 24, the plan was approved by the NRC (Surmeier, 1999), resulting in License Amendment No. 31 to Atlas's radioactive materials license. The NRC authorized the cleanup of a corridor up to 150 feet wide and 1400 feet long in the restricted area using the procedures presented in the plan. Specific conditions of the License Amendment are:

A. The NRC shall oversee and /or direct work in accordance with licensee radiation control procedures to ensure ALARA and radiation safety to individuals in the restricted area.

B. All contaminated material will be consolidated in the old ore storage area as a low profile pile, compacted, and stabilized with a cover of at least one foot of clean soil.

C. Only clean fill material (5 pCi/g Ra-226 above background or less) will be used to backfill the pipeline trench. Prior to placement of the clean trench material as backfill, a gamma survey of the pile of fill material (i.e., the clean soil) will be conducted.

The plan requires the use of a 2-inch by 2-inch NaI detector coupled with a ratemeter/scaler to survey the pipeline corridor. A preliminary radiological survey is required with gamma-ray levels documented at a density sufficient to delineate areas exhibiting tailings or ore concentrations above background. A gamma-ray action level for the radiological survey equipment is to be developed using a correlation between soil sample Ra-226 results and the corresponding gamma-ray count rates. Procedures for developing the action level are in the plan. The plan also has provisions for using detector collimators to reduce gamma shine from nearby sources.

Soils are to be removed from areas exceeding the action levels and another radiological survey performed. This iterative process is to be repeated until all areas are below the action levels. The plan requires a final high-density survey to be documented.

The verification-sampling plan specifies that the corridor be divided into grid blocks of approximately 100 m^2. From the final survey data, an average gamma-ray count rate is developed for each grid block. A minimum of ten percent of the grid blocks are to be sampled, including the grid blocks with the highest average gamma-ray count rates.

During the digging of the pipe trench, the plan calls for the operator to be instructed to advise management of any soil that has properties of fill material so that it may be sampled. Contaminated soil is to be removed until near background levels are reached. A final radiological survey of the backfill soil is required to assure that the soil is not contaminated above 5 pCi/g.

The plan requires that contaminated material be consolidated in a low profile pile and stabilized with a minimum of one foot of soil cover. The decontaminated corridor is to be graded so that it is free draining with no water collection points within the area. The area is to be seeded.

4. Remediation and Verification of Pipeline Corridor

Minor aspects of the plan were not followed verbatim due to the high gamma shine component in some areas. Because of the varying extent of the shine, the corridor had to be divided into segments and gamma-ray action levels determined for each section. Even while using the half-inch lead collimator, external influences were significant enough to affect the correlation results as will be discussed further in Section 4.3.

In one area, the survey was extended beyond the 150-foot boundary. However, no excavation took place in the extended survey area. The survey was investigative in nature only.

The plan calls for removal of contaminated subsurface soil to a distance of 40 feet from the centerline of the trench. However, this was not possible due to the existing LPG pipeline that was approximately 15 feet from the proposed pipeline and, for safety reasons, material within 5 feet from this existing LPG pipeline could not be removed. Removal of the subsurface soils beyond the work corridor in the other direction was found prohibitively expensive and was not necessary to complete the work.

4.1 Preliminary Radiological Survey

The pipeline corridor is approximately 2300-feet long outside of the restricted area and 1150 feet within the restricted area. While there was no requirement for extending the cleanup outside of the unrestricted area, Atlas and MAPCO decided it was prudent to do so.

An initial global positioning system (GPS) gamma-ray survey of the pipeline corridor was conducted to identify areas having elevated gamma-ray levels. A 2-inch by 2-inch NaI detector was coupled to a ratemeter/scaler and a Trimble ProXR GPS unit and used to log individual gamma count rates and corresponding coordinates every two seconds. The GPS system was placed into a backpack which was worn by field personnel while

they walked the pipeline corridor at a rate of approximately 2.5 feet per second. Transect distances of approximately five feet were used. The data were managed using the ArcView Geographic Information System (GIS) software program, a computer application for managing, displaying, and analyzing data geographically.

4.2 Site Coordinate and Grid Block System

A site coordinate system, based on state plane coordinates, was developed as shown in Figure 4-1. Each 1000-ft by 1000-ft area was divided into four equal grid blocks of 500-ft by 500-ft dimensions. These "major grid blocks", each being 500-ft by 500-ft, were then further divided into 33.33-ft by 33.33-ft grid blocks. Each of these smaller grid blocks is approximately 100 m^2. The grid block nomenclature is best understood by looking at Figure 4-1 where, in the figure, the 1000-ft by 1000-ft grid block is subdivided into four grid blocks. Then the grid block A01B is subdivided into 25 grid blocks, each being 100-ft by 100-ft and numbered from 1 to 25. The Grid Block No. A01B15 is then divided into nine 33.33-ft by 33.33-ft grid blocks. The names of the smallest grid blocks in this example are A01B15A, A01B15B, ...and A01B15J. For ease in managing the soil samples, the composite surface soil samples taken from these grid blocks were given the name of the corresponding grid block. In some cases, a sample was taken from two or three partially surveyed grid blocks with a combined total survey area of 100 m^2. A grid block may have been partially surveyed because it was near the boundary of the survey.

4.3 Correlation Study

By observing data collected from the preliminary radiological survey, locations for developing a correlation between gamma-ray count rate and Ra-226 concentration were chosen. A total of 22 samples were taken. Of these, 21 were used to develop an initial correlation. An additional six samples were added later. After verification sampling had begun, the verification sample results and gamma-ray count rate data were added to the correlation data set. The final correlation data consisted of 60 samples. The correlation data are shown in Table 4-1. From the data, it was found that no single action level could

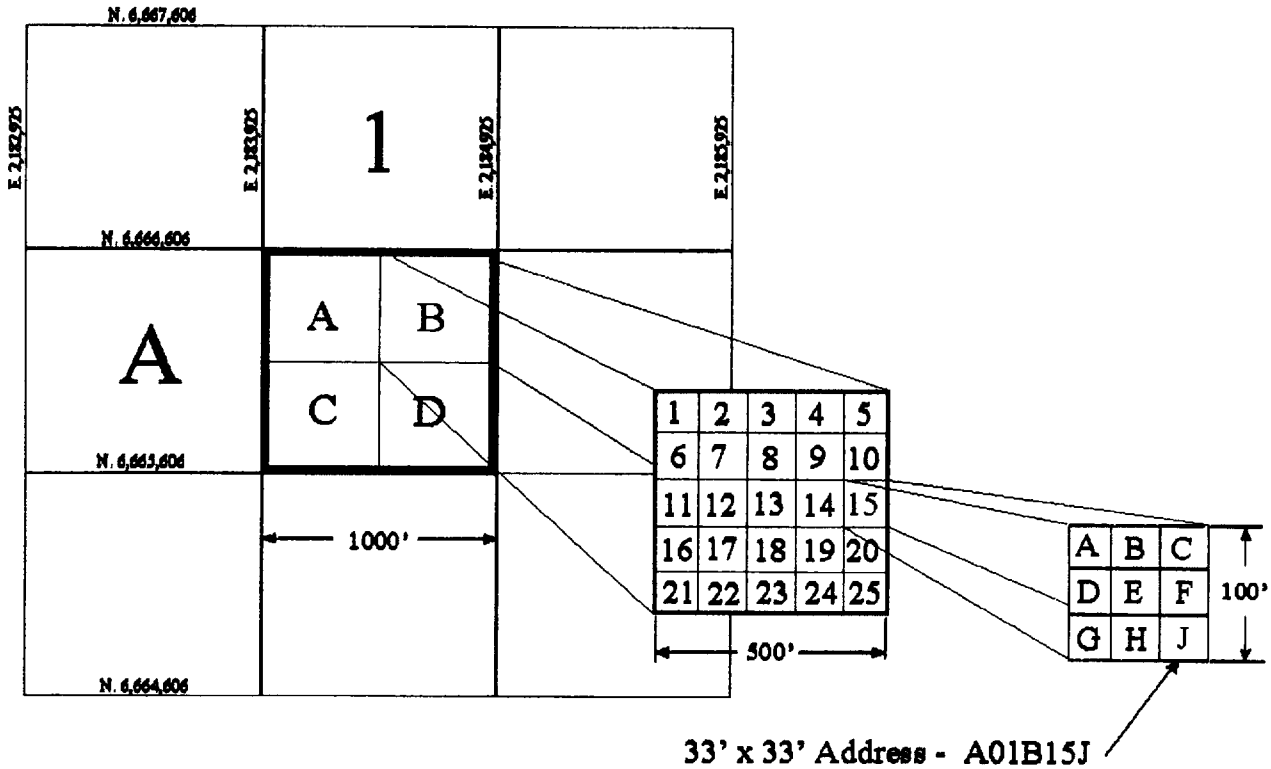


Figure 4-1 Site Coordinate and Grid Block Nomenclature

Table 4-1 Correlation Sample Data

Sample ID	ERG Ra-226 Conc. (pCi/g)	ELI Ra-226 Conc. (pCi/g)	Gamma Count Rate Unshielded (cpm)	Gamma Count Rate Shielded (cpm)
Moab-1	5.8	7.3	41092	7465
Moab-2	17.0	17.2	45558	11202
Moab-3	35.7	35.6	75767	22500
Moab-5	2.5	2.7	51805	8270
Moab-6	2.0	2.0	36820	5887
Moab-7	5.7	7.5	39442	7736
Moab-8	3.5	4.2	48163	8181
Moab-9	6.0	-	67921	12070
Moab-10	16.9	-	81681	17236
Moab-11	6.9	6.8	41523	8028
Moab-12	2.0	2.1	37081	5992
Moab-13	9.5	9.2	53395	11227
Moab-14	2.9	3.2	35944	6950
Moab-15	8.0	7.1	52689	12012
Moab-16	5.6	4.0	40218	8755
Moab-17	33.8	33.9	80165	24846
Moab-18	2.8	2.5	41345	6755
Moab-19	4.0	4.1	36626	6601
Moab-20	17.1	18.4	51975	12198
Moab-21	16.8	19.8	49946	11708
Moab-22	18.4	18.7	51153	13844
A01A13E	4.5	-	35460	-
A01A11I	5.1	-	37152	-
A01A13G	5.2	-	39250	-
A01A11G	9.5	-	41850	-
A01A13I	8.3	-	41616	-
A01A15B	7.1	-	42100	-
A01A15G	2.8	3.1	31252	-
A01A15H/I	4.2	3.6	33491	-
A01A17C/18A	1.1	2.1	34743	-
A01A18B/C	3.9	3.0	34881	-
A01B10I	3.5	3.1	35048	7472
A01B11D/E	5.7	5.9	29678	-
A01B12D	1.6	0.8	33112	5849
A01B12F	0.1	0.5	32344	5878
A01B13C-2	0.1	0.5	35048	6185
A01B14C-2	0.1	1.9	33783	6248
A02A07H	8.8	0.8	33013	6230
A02A08E	2.0	0.8	32736	5511
A02A09E	6.6	2.0	37266	6415
A02A10B	3.0	2.6	37827	-
A02B01H	0.5	0.5	34377	-
A02B04E	0.3	0.5	32197	-
A03A01E	2.1	2.4	33196	-
A03A02H	5.0	6.4	41673	-
A03A02I	3.9	5.7	40366	-

Table 4-1 Correlation Sample Data (continued)

Sample ID	ERG Ra-226 Conc. (pCi/g)	ELI Ra-226 Conc. (pCi/g)	Gamma Count Rate (cpm)	
			Unshielded	Shielded
A03A05H	4.5	3.7	42309	-
A03A10C	5.5	3.1	43499	-
A03B01I	1.5	2.1	46158	-
A03B02D	1.2	2.4	43156	-
A03B02G	2.5	2.4	53818	-
A03B02I/7C	0.3	1.4	-	7303
A03B04G/9A	1.9	0.5	-	8967
A03B04H/9B	6.1	0.4	-	9378
A03B06A	1.1	1.7	43633	-
A03B06C	2.7	1.3	49594	-
A03B07A	3.5	2.2	61451	-
A03B10A	6.3	0.9	-	9230
A04A07H/I	1.5	0.4	32970	7575
A04A13I/18C	4.2	4.5	28662	6737

be applied to the entire pipeline corridor. Because of this, the corridor was divided into four sections and an action level for each section was determined.

There are two probable reasons that no single action level could be determined. The first is that portions of the corridor within the restricted area were near a former ore haul road that was probably constructed with ore waste rock, and a former uranium ore pad. This created an intense gamma shine that affected the gamma-ray readings. The second was the variability in topography in some sections either masked or enhanced the gamma shine from the former ore pad and contaminated road.

The four sections of the corridor are shown in Figure 4-2. Section 1 could be described as the unrestricted portion of the pipeline corridor. The action level for Section 1 was determined from 10 samples taken from the correlation study and found to be 32,000 cpm. The ten data points along with the results from 16 verification samples are shown in Figure 4-3. While excessive gamma shine affected some data points, the data support an action level of 32,000 cpm at 7.5 pCi/g (5 pCi/g plus background). The data for the shielded detector support an action level of 7,000 cpm.

Section 2 was very problematic in that the area exhibits high gamma count rates but the seven soil samples taken from the area during the correlation study showed little or no contamination above background. The area is located just over a small hill from the former ore storage pad and adjacent to the former ore haulage road. Because of the varying shine contribution to the gamma count rate from point to point, the action level could not be determined with a high level of confidence. Verification samples were taken in seven 100 m^2 grid blocks in Section 2 having the highest average gamma-ray count rates. All soil samples showed that the concentrations were below 7.5 pCi/g Ra-226. The data are shown in Figure 4-4. While the data for the unshielded detector shows that the gamma shine is the predominant gamma source, the shielded detector correlation is less influenced by the shine and support an action level of 7,000 cpm. No excavation was required in Section 2.

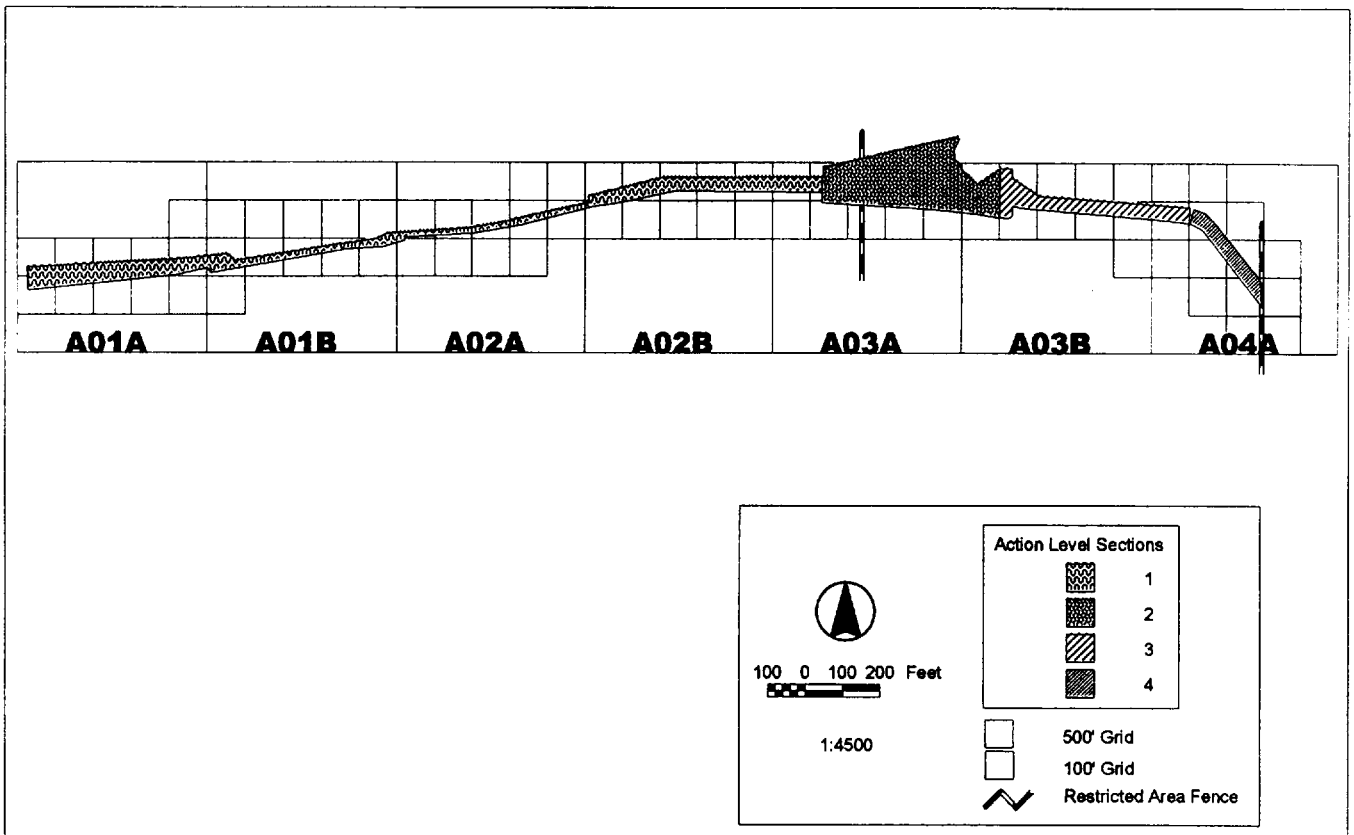


Figure 4-2 Action Level Sections

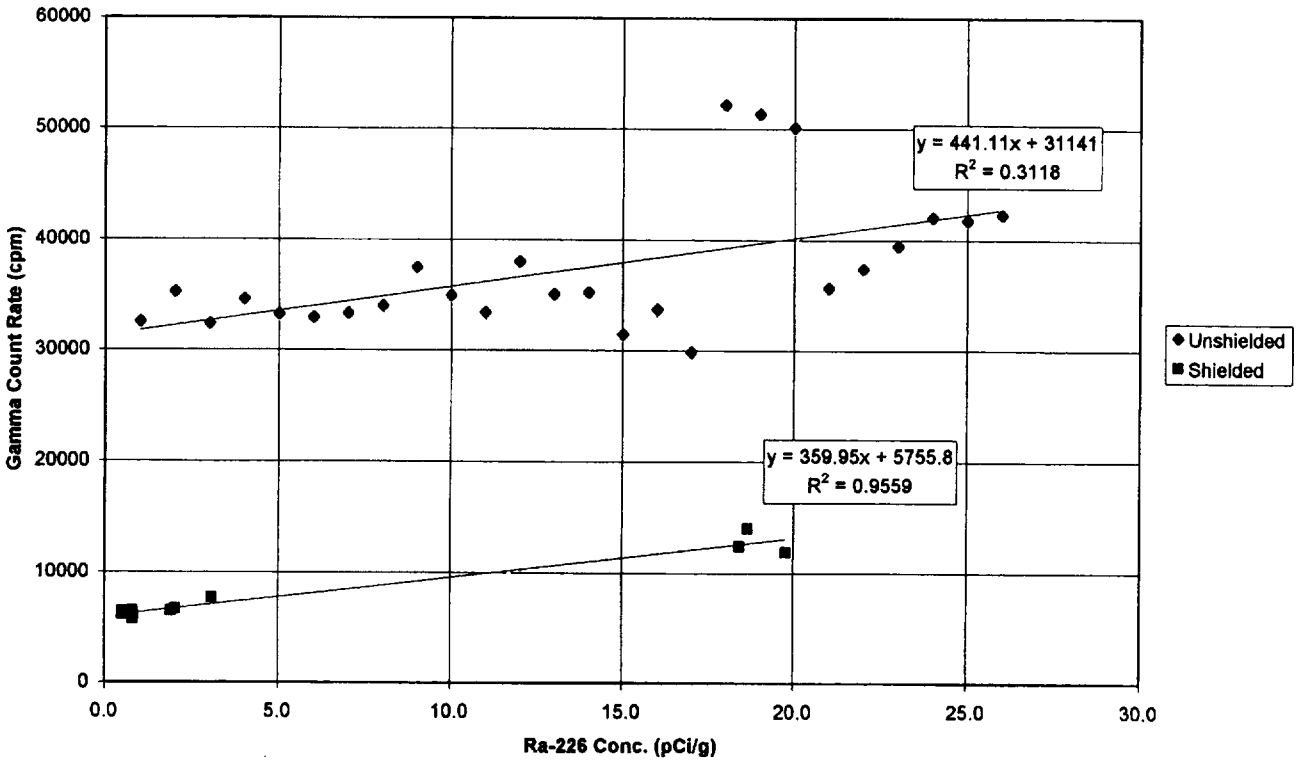


Figure 4-3 Gamma / Ra-226 Concentration Correlation Data for Section 1

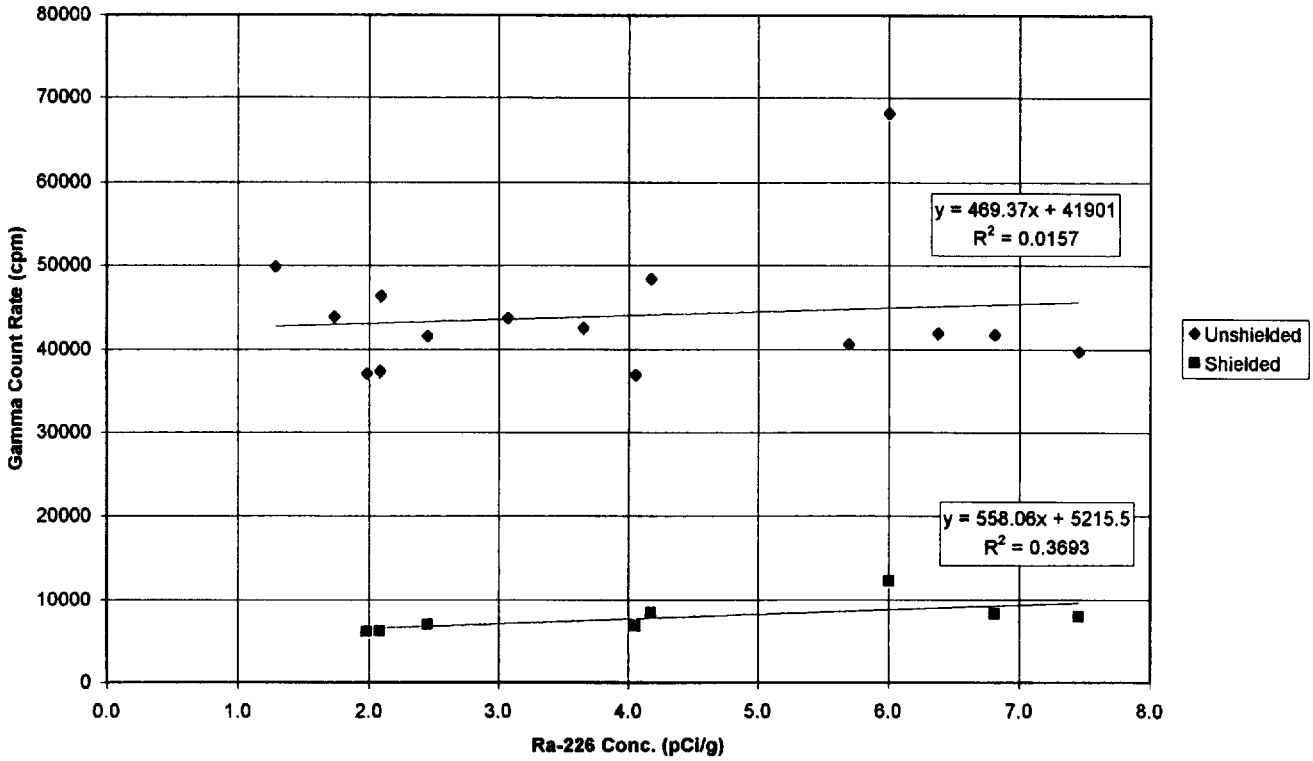


Figure 4-4 Gamma / Ra-226 Concentration Correlation Data for Section 2

Section 3 was located primarily in an ore haul road and adjacent to the former ore storage pad. Because of the high radiation levels and extensive gamma shine, this short section did not produce data favorable for developing a correlation between gamma count rate and Ra-226 concentration as shown in Figure 4-5. Only three correlation study samples were taken in this section. Based on action levels determined from other areas, an action level of 10,000 cpm for the lead collimated detector was used. This was considered conservative since the entire corridor was excavated to a depth of 2 feet or more and backfilled. To provide additional assurance, seven confirmation samples were taken from the grid blocks exhibiting the highest average gamma-ray count rate. All were below the 7.5 pCi/g cleanup criteria for surface soils. Because backfill was applied, one could have justified residual levels up to 17.5 pCi/g.

Section 4 is located just east of the former ore pad and extends to the restricted area fence on the east side of the Atlas property. Correlation data for this low background area agreed with the data from Section 1 supporting a gross count rate action level of 32,000 cpm. An action level of 7,000 cpm was used for the collimated detector. The data are shown in Figure 4-6.

4.4 Contaminated Soil Removal

After the preliminary survey, the data were analyzed using the ArcView GIS application. From the GIS, areas that were above the action limit were identified. These same areas were then navigated to and outlined using the GPS system. Heavy earth moving equipment was then brought in to remove contaminated soil and transport it to a central location to be stabilized with an interim cover. Another gamma-ray survey was then performed over the area and, if needed, additional soil was removed until the area was below the gamma action level.

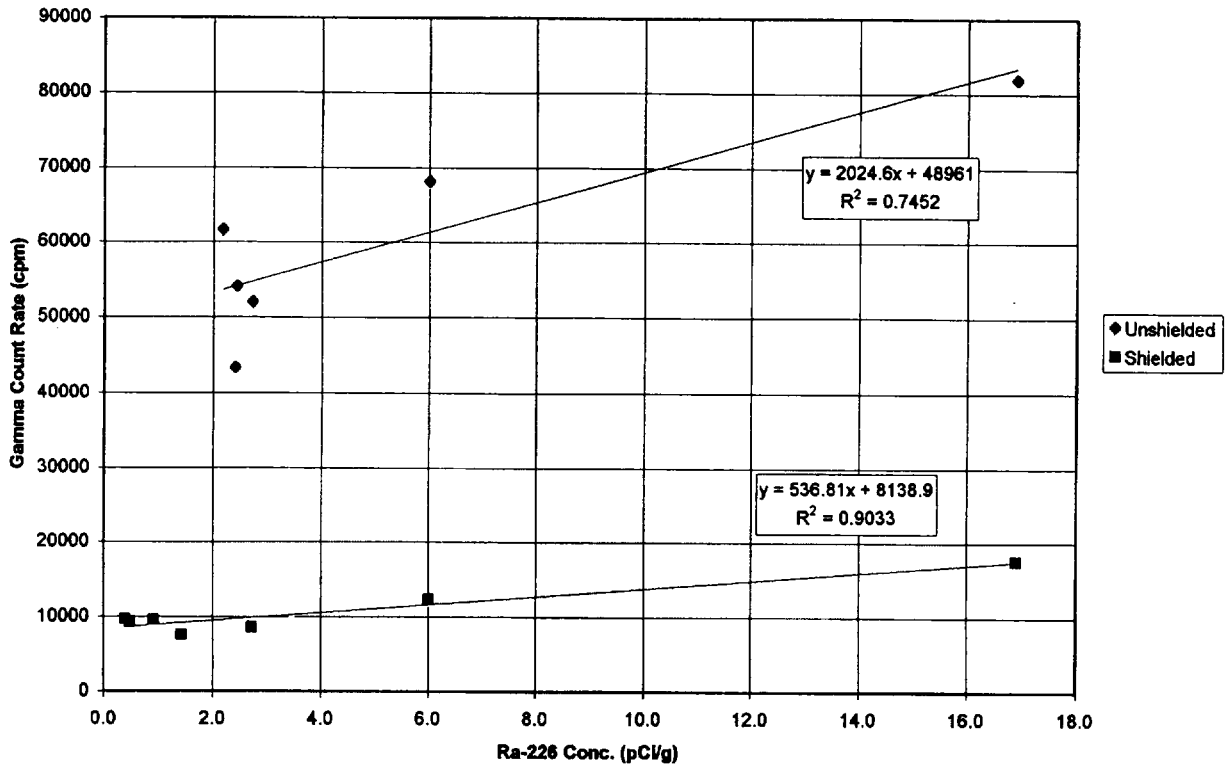


Figure 4-5 Gamma / Ra-226 Concentration Correlation Data for Section 3

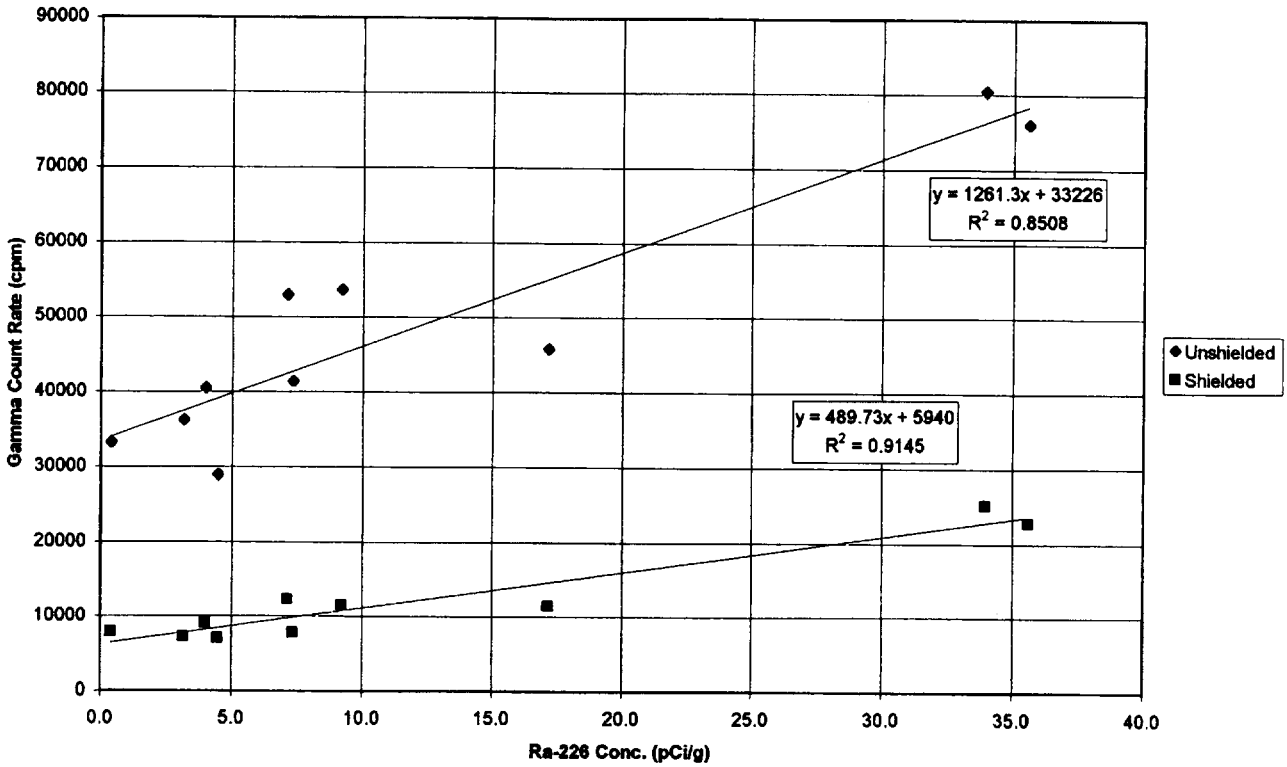


Figure 4-6 Gamma / Ra-226 Concentration Correlation Data for Section 4

4.5 Surface Soil Sampling and Verification

When a section was ready for verification sampling, the average gamma-ray count rate was determined for each grid block. The 100-m^2 grid blocks were not always perfect squares. In some cases the grid blocks were approximately three meters wide and 30 meters long. Sometimes two contiguous grid blocks were sampled as one, if the two grid blocks together contained approximately 100 m^2 of survey area. The grid blocks having the highest average gamma count rate were selected for sampling. Five-point composite samples were taken for each 100-m^2 area. Each sample was then homogenized and placed in a Marinelli beaker and sealed. The sample was counted after 24 hours or more on the on-site NaI gamma spectrometer. The sample was counted again after approximately 48 hours or more. The data from the two counts were entered in a spreadsheet where the final Ra-226 concentration was estimated using known decay equations. If the soil samples did not pass the on-site lab analysis for Ra-226, another attempt at decontaminating the corridor section was made and the corridor surveyed and sampled again. One hundred percent of the verification samples were sent to Energy Laboratories, Inc. (ELI) for outside lab verification. Ra-226 concentrations for all verification samples are reported in Table 4-2.

Figure 4-7 shows the locations of all verification samples taken. Thirty-three verification samples were taken, which is significantly higher than the ten percent of grid blocks required. The extra samples were taken as a precautionary measure due to the variability of gamma shine throughout the site. The final gamma survey of the decontaminated corridor is shown in Figure 4-8.

4.6 Trenching and Backfill

After a section of the pipeline corridor had been verified as decontaminated the trenching operations began. All heavy equipment operators involved in trenching were informed to advise management if any material had suspicious qualities or if it appeared to be backfill

Table 4-2 Verification Soil Sample Data

Sample ID	Number Gamma Readings		Grid Block Average Gamma (cpm)		ELI Ra-226 Conc. ± 2σ error (pCi/g)	
	Unshielded	Shielded	Unshielded	Shielded		
A01A15G	32	-	31252	-	3.12	0.19
A01A15H/I	40	-	33491	-	3.57	0.2
A01A17C/18A	35	-	34743	-	2.12	0.16
A01A18B/C	28	-	34881	-	3.01	0.18
A01B10I	106	105	35048	7472	3.08	0.19
A01B11D/E	32	-	29678	-	5.85	0.29
A01B12D	33	109	33112	5849	0.82	0.1
A01B12F	39	96	32344	5878	0.50	0.08
A01B13C-2	65	68	35048	6185	0.51	0.08
A01B14C-2	68	79	33783	6248	1.90	0.15
A02A07H	143	109	33013	6230	0.79	0.1
A02A08E	56	42	32736	5511	0.81	0.1
A02A09E	42	52	37266	6415	2.02	0.15
A02A10B	78	-	37827	-	2.55	0.17
A02B01H	31	-	34377	-	0.52	0.08
A02B04E	35	-	32197	-	0.51	0.08
A03A01E	35	-	33196	-	2.38	0.2
A03A02H	55	-	41673	-	6.38	0.26
A03A02I	57	-	40366	-	5.69	0.25
A03A05H	51	-	42309	-	3.65	0.2
A03A10C	39	-	43499	-	3.07	0.19
A03B01I	82	-	46158	-	2.09	0.16
A03B02D	69	-	43156	-	2.41	0.2
A03B02G	96	-	53818	-	2.43	0.16
A03B02I/7C	-	47	-	7303	1.43	0.13
A03B04G/9A	-	44	-	8967	0.48	0.08
A03B04H/9B	-	45	-	9378	0.39	0.07
A03B06A	78	-	43633	-	1.73	0.14
A03B06C	61	-	49594	-	1.28	0.17
A03B07A	89	-	61451	-	2.17	0.16
A03B10A	-	39	-	9230	0.92	0.11
A04A07H/I	52	69	32970	7575	0.38	0.09
A04A13I/18C	48	34	28662	6737	4.45	0.24

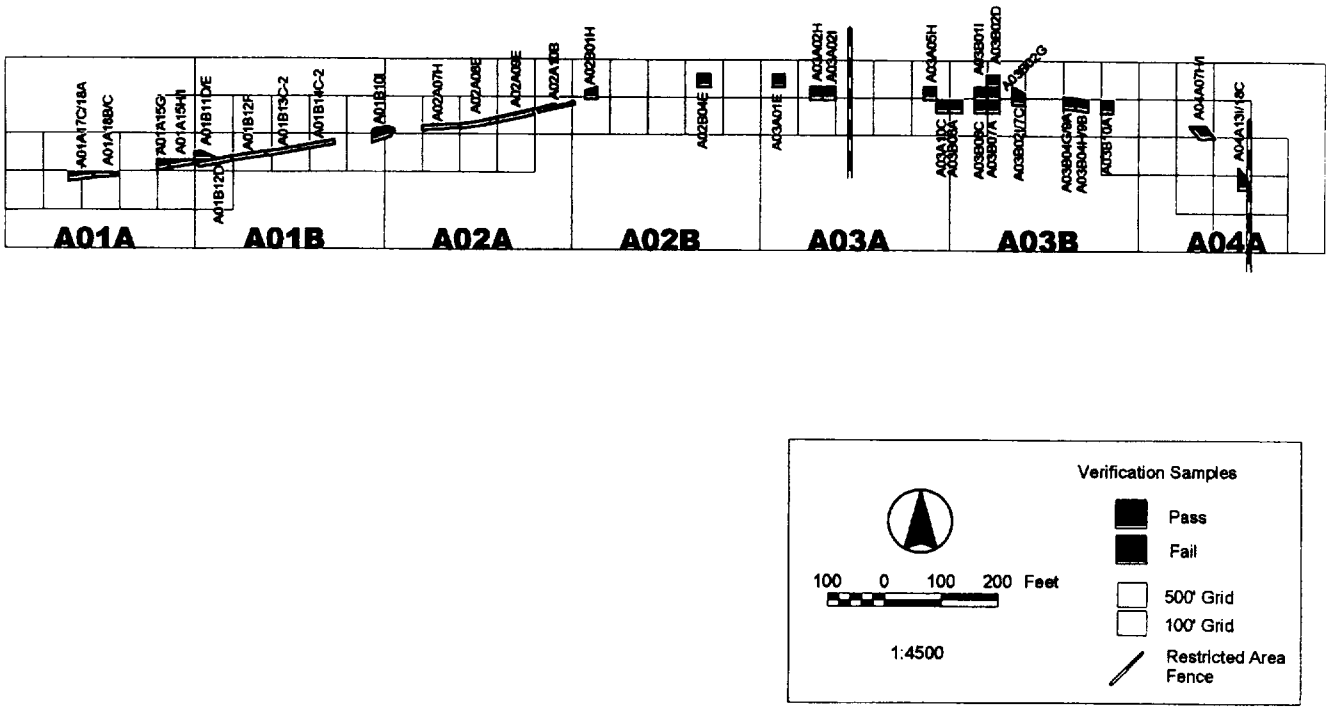
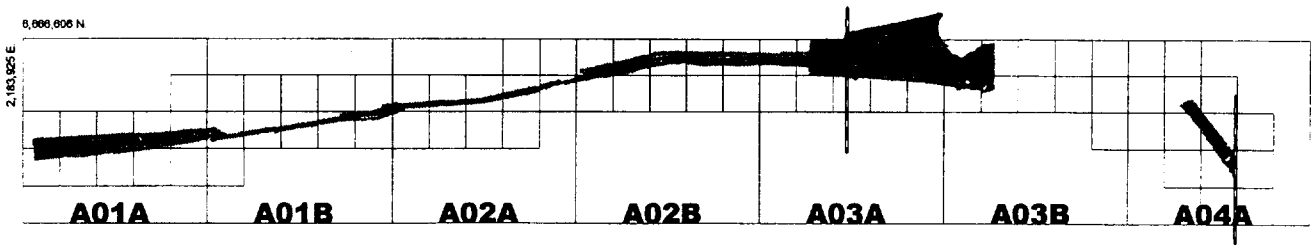
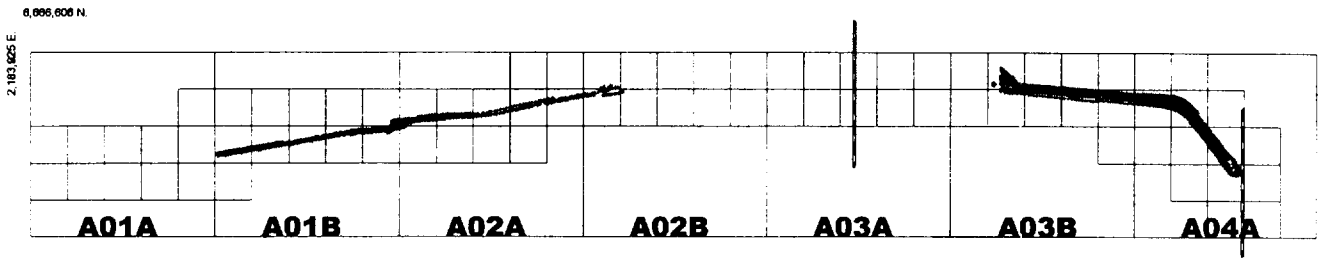


Figure 4-7 Verification Sample Locations



Final Unshielded Gamma Survey



Final Shielded Gamma Survey

100 0 100 200 300 Feet

1:3000

Coordinate System is NAD83 Utah Central

Final Gamma Survey	
UNSHIELDED	SHIELDED
< 32,000 CPM	< 7,00 CPM
32,000 - 39,000 CPM	7,000 - 10,000 CPM
> 39,000 CPM	10,000 - 20,000 CPM

500' Grid
100' Grid
Restricted Area Fence

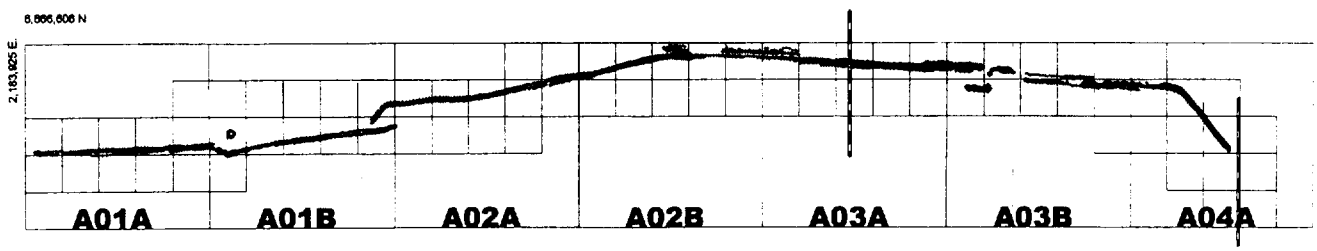
Figure 4-8 Final Gamma Survey

material. After a trench had been dug the trench backfill material was surveyed, sampled, and analyzed on site to confirm that no contamination was present.
No contamination was found in any of the trench backfill material.

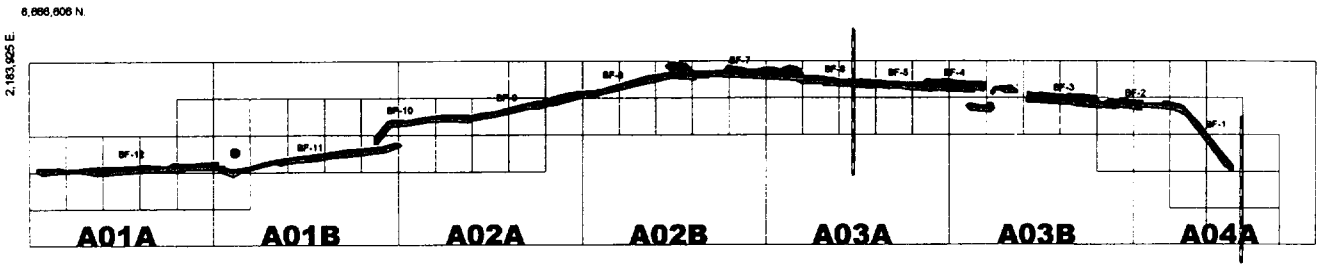
A gamma survey was conducted along the entire length of the soil pile from the trenching which was used for backfill. For each segment of approximately 100-m in length, a five-point composite sample of the trench material was taken and analyzed for Ra-226 on site. Table 4-3 shows the results of the on-site backfill sample analyses. Figure 4-9 shows both the shielded gamma survey of the backfill material and the locations at which the five point composite backfill material samples were taken.

Table 4-3 Backfill Soil Sample Data

Sample ID	Number Gamma Readings	Backfill Average Gamma (cpm)	ERG Ra-226 Conc. (pCi/g)
BF-1	205	5141	1.6
BF-2	273	7283	1.3
BF-3	222	8050	1.2
BF-4	609	5594	1.1
BF-5	294	4354	1.5
BF-6	177	4474	1.2
BF-7	295	4877	2.5
BF-8	412	5005	1.2
BF-9	152	5111	2.9
BF-10	219	5385	0.4
BF-11	405	6255	0.7
BF-12	551	4892	0.3



Backfill Shielded Gamma Survey



Backfill Soil Sample Locations

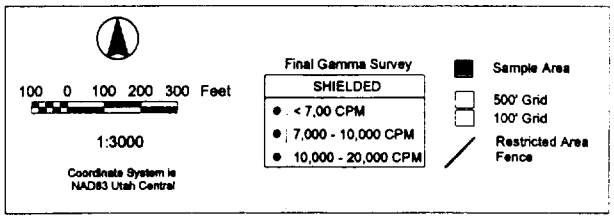


Figure 4-9 Backfill Gamma Survey and Sample Locations

5. Restoration

After the pipeline trench was backfilled, the corridor was graded so that it was free draining with no water collection points within the area and then seeded. All contaminated material was consolidated in a low profile pile in the old ore storage area and stabilized by covering with a minimum of one foot of clean cover material. Atlas personnel verified that the thickness of the cover was a minimum of one foot by digging several test areas and performing measurements. These data are maintained at the site.

6. QA/QC

The quality of the gamma survey data was maintained through daily function checks of the radiological survey equipment. Data management quality problems associated with the gamma surveys are almost nonexistent since data values and associated location coordinates are automatically determined by the GPS units. Computer assisted data presentation also eliminates the possibility of human error.

The plan called for the use of the on-site gamma spectrometer as a screening tool with final verification sample results analyzed by the vendor laboratory. ELI was chosen as the vendor laboratory since they participate in the EPA comparison studies and have analyzed verification samples for several NRC-licensed uranium mill site cleanups. Figure 6-1 compares the soil sample results from ELI and the on-site laboratory. Considering that the samples analyzed on site were not processed prior to counting, the results show excellent agreement with no discernible bias.

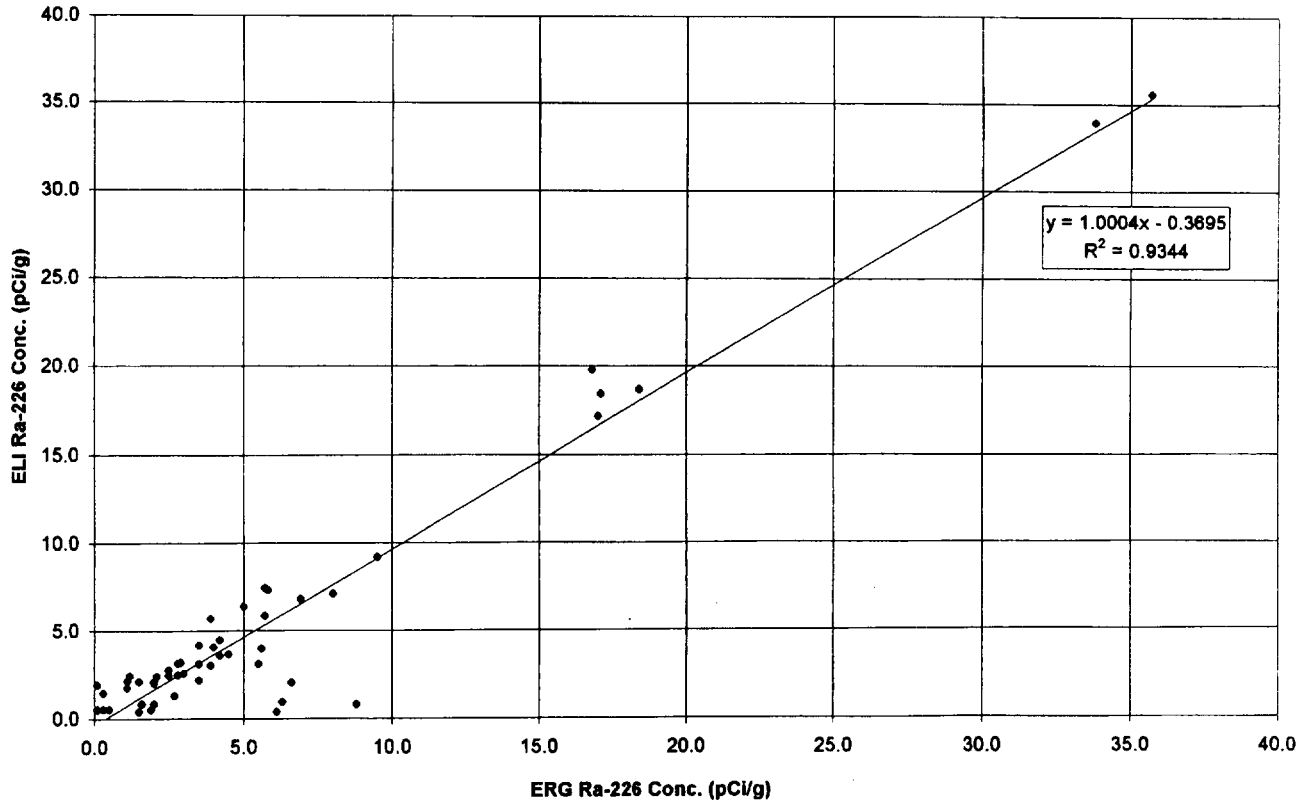


Figure 6-1 Comparison Between ERG Field Lab and Energy Labs Results for Ra-226 Concentration (pCi/g)

7. Conclusion

A background study of the nearby area revealed that the Ra-226 background concentration for the site is 2.5 pCi/g. Contaminated soil was removed from the 3,450-ft long MAPCO pipeline corridor to depths of several feet. The results of verification samples taken prior to digging the trench indicate that the area met the cleanup criteria. Soil samples and gamma surveys of the material removed from the pipe trench indicate that no further subsurface contamination was evident. The material from the trench all appeared to be native soils. After the pipe was placed and the backfill completed, the area was graded and seeded. The contaminated soil was consolidated on site and stabilized according to the requirements. All data indicate that the surface and subsurface soils in the pipeline corridor meet the cleanup criteria for unrestricted use.

8. References

Blubaugh, R.E. 1999. April 20, 1999 letter from Atlas Corporation to U. S. Nuclear Regulatory Commission Requesting a License Amendment for Installation of Pipeline.

NRC, 1999. Letter from John J. Surmeier to Atlas Corporation, July 24, 1999. U. S. Nuclear Regulatory Commission, Washington D. C. 20555-0001