

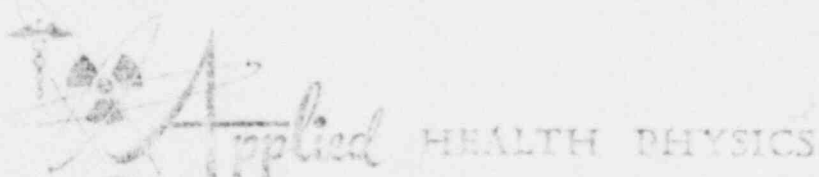
HEALTH PHYSICS REPORT #1  
of  
RADIOLOGICAL SURVEYS  
of the  
AMERICIUM-241 CONTAMINATION  
at  
DRILLING SITES NEAR JOLLYTOWN, PA

for the

Consolidation Coal Company  
Consol Plaza  
Pittsburgh, PA 15241

Attn: Mr. Donald M. Self  
Mgr., Exploration (Eastern Group)

September 30, 1982



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TABLE OF CONTENTS

	Pages
Introduction .....	1 - 3
Description of Sites .....	4 - 5
Survey Techniques and Instrumentation .....	6 - 8
Survey Results .....	9 - 10
Discussion of Survey Results .....	11 - 17
Conclusion and Recommendation .....	18
Tables .....	19 - 23
Figures .....	24 - 35
Appendix .....	36 - 59
References .....	60

## INTRODUCTION

This report has been prepared to present the current status of the radioactive contamination at two drilling sites near Jollytown in Gilmore Township, Greene County, PA. Figures 1A & B show the locations of the drilling sites in the southwestern corner of Pennsylvania, about 15 miles south of Waynesburg, PA. Radioactive contamination of these drilling sites occurred accidentally on or about August 27, 1982 when coal exploration workers from Consolidation Coal Company (Consol) were attempting to retrieve two sealed sources of Americium-241 that had been used to log a 3-inch diameter hole that had been drilled 950 feet into the ground, at the location designated as "Site 1." Please see Figure 2.

Officials of the U.S. Nuclear Regulatory Commission (US-NRC) and the Pennsylvania Bureau of Radiological Health (PA-BRH) were immediately notified of unusually high radiation levels at Drilling Site 1 by Consol personnel on August 27, 1982 in accordance with applicable federal and state regulations. The company is licensed to use the Am-241 sources by the US-NRC under NRC license #37-16998-01. Inspectors from both agencies (US-NRC and PA-BRH) came as quickly as possible and have made several radiological surveys of the site where the incident occurred (Site 1) and of a second drilling location identified as Site 2 (Fig. 2B). Mr. James A. Yusko, a certified health physicist (CHP) from the Pennsylvania Bureau of Radiological Health (PA-BRH), arrived at the site on Wednesday, September 1 and performed initial radiation surveys and on Thursday, he

was joined by Mr. James Nicolosi, a health physicist and compliance inspector from Region I of the US-NRC. Both Mr. Nicolosi and Mr. Yusko have reviewed and witnessed the practices and procedures used to perform the radiological surveys described in this report. Figures 3 and 4 are photographs showing these officials collecting water and silt samples at Site 1 on September 7, 1982.

Applied Health Physics, Inc., (AHP) was requested to provide radiological assistance on Friday, September 3, 1982, by Mr. Donald M. Self, Manager of Consol's Eastern Exploration Group. Consol dispatched one of their corporation's aircraft to pick up Robert G. Gallagher, one of AHP's certified health physicists, at Utica, NY and fly him and his instrumentation to Pittsburgh on Friday afternoon. Mr. Gallagher began AHP's initial phases of the radiation accident evaluation and control program that evening and has been directing health physics and decontamination since then.

Our primary objective during this initial phase was to identify, locate and survey all individuals, vehicles, homes, motels, tools and equipment that might have been involved in or around the logging operation on or after August 27, 1982. Consol's top management spared no time nor cost in facilitating our surveys and in instituting effective radiological control measures including prompt medical evaluations (whole body counting, bioassay, etc.) and isolation of all known sources of radioactive contamination. A detailed chronological report of the initial health physics surveys of personnel and the off-site residences, contractor shops, vehicles, tools, etc. will be summarized in a subsequent report.

All contaminated vehicles, tools, equipment and personal items that were found during our initial off-site surveys were packaged, sealed and labeled in accordance with federal regulations (Ref. 1) and placed within the restricted zones on Sites 1 and 2. The locations of these restricted zones on Site 1 are shown in Figures 5 & 6 while the restricted and placarded "Radiation Area" on Site 2 is shown in Figure 7. These restricted zones were initially established on Labor Day by B. J. Williams and Mark Farnsworth who were called in from Concco's radiochemical operations at Ponca City, Oklahoma to assist in the contamination control operations. They were assisted in the construction of the barricades by Consol's radiological safety officer (RSO), Mr. Dennis Deusenberry. Site 1 and 2 were placed under 24-hour surveillance on September 2 and 4 respectively by Consol, who employed a private security service to prevent unauthorized entrance into these areas.

A heavy downpour of rain struck both sites a few days after the Am-241 source rupture was discovered. In anticipation of the potential for additional dissemination of the contamination, we covered the contaminated ground surface, with large sheets of plastic. To prevent further run off from highly contaminated regions of the small brook that adjoins the drill rig at Site 1, Consol constructed a dam above the drill rig and installed a large diesel pump to divert the water that collects at Dam #1 and discharges it at the point below Dam #4. Unfortunately, we have not been able to prevent some seepage of Am-241 through Dams #2 and #3, even though the main flow of the brook has been diverted. Small pockets of Am-241 are continuing to reappear as contaminated water seeps from Dams #2 and #3.

SITE DESCRIPTION

## Site 1

Site 1 is subdivided into two zones, Zone A and B.

Zone A:

This zone covers an area of about 40 square yards. See Figure 5.

Vehicles and equipment located here include:

- a) Red Ford PickUp Truck (Ohio license #5B2264)
- b) Consolidation Coal Co. Instrument Ford Van (PA license #CR 35862)
- c) contaminated personnel clothing and shoes
- d) miscellaneous tools and equipment

The instrument van provides storage for three sealed sources; one 3.4 mCi Radium-226 and two 250 mCi Americium-241 sources. External exposure due to these sources is about 0.2 mr/hr on contact with the van's gas tank cover.

In addition to the above-mentioned contaminated equipment, several isolated patches of soil were also found to be contaminated and were covered with plastic sheets. Core samples were taken of some of these contaminated patches. Wood stakes were driven into the sample core holes to facilitate relocation and evaluation of decontamination techniques to be used.

Zone B:

This is the primary site of the Americium-241 contamination. Figure 6 provides a sketch of the area, and its contents. The contaminated equipment at this site include:

- a) A Crane Carrier Co. rotary drill (KY U 65900)
- b) Ford rod truck (PA license #CN-29463)
- c) Bulldozer (Caterpillar Tractor)

In addition, more than 600 feet of brook bed is contaminated to varying degrees, dependent on proximity to the rotary drill position.

The last 75 feet of this 600 ft stretch was discovered on September 14, 1982 as AHP personnel were conducting the most comprehensive contamination survey of the area.

The entire 600 ft length of the brook bank (facing the air rotary drill) is also contaminated. The small ponds (identified as W1 and W2) are also contaminated, with W1 having the higher degree of radioactive content. Several large expanses and discrete patches of soil are contaminated as well.

Zone A to Zone B:

This area is shown in Figure 5 and consists of isolated patches of contaminated soil.

Site 2

Figure 7 shows Site 2 and its contents. The Ford 700 mobile drill (WV License #B-83642), the Chevy blazer (PA License #AWP-217), the Ford 750 water tank truck (WV License #B83650), and the Ford F-250 flat bed truck (WV License #NL-6881) are located here. There are several drill pipes lying on both sides of the drill and on the grout tank as well. Several tools (wrenches, screwdrivers, etc) found on this location are contaminated.

In addition to contaminated patches of soil, there is a 513 ft deep drill hole here.

## SURVEY TECHNIQUES AND INSTRUMENTATION

Americium-241 emits alpha particles; 85% have an energy of 5.49 Mev, the balance have a slightly lower energy of 5.44 Mev. Its daughter, neptunium-237, is also an alpha emitter and generates 0.060 Mev x-rays which facilitate our detection of americium contamination. However, as Appendix 4 shows the principal decay scheme of the Americium series is predominately a series of alpha emitters. While the existence of some x-ray (36%) may help us locate contamination, we must also use alpha measurement techniques wherever possible to evaluate fixed and removable contamination of surfaces and Am-241 concentrations in soil and water.

Criteria and Standards used throughout our surveys are based upon those described in a draft<sup>(2)</sup> entitled, "Control of Radioactive Surface Contamination on Materials, Equipment and Facilities to be Released for Uncontrolled Use." This document was prepared and released by the American National Standards Institute, Inc., (ANSI-N13.12)

## SURVEY TECHNIQUES

All equipment and tools were surveyed individually for alpha and x-radiation. Then self-adhesive, serially numbered smears were taken by a health physicist or technician. In the soil contamination survey, the partially shielded FIDLER was primarily used for locating contaminated patches of soil. Each area was apportioned into strips of one meter width and the surveyor went through each strip up to a reasonable distance from the active areas. The surveyor's helper staked each identified



contamination sample location. A second crew followed up with other instruments, to determine the expanse of contamination and cover the patches with plastic sheets, if possible. The second survey with a FIDLER ensured that the covered areas actually included all of the contaminated patch of soil. Finally, a Scintillometer with a shielded probe was used to locate the epicenter of the exposure. Then exposure readings were taken in counts per minute. A Health Physics Instrument, Model 1010 was also used to obtain measurements in mrad/hr. Soil samples were taken with a 6-inch soil plugger. Each soil sample was divided into two parts; the first 3-inch layer and the remaining portion of the core. Every attempt was made to get the soil sample from the epicenter of the exposure. Sample locations were decided by a health physicist.

The two primary standing pools of water (W1 & W2), were covered with large plastic sheets to avoid any increase in volume from rain. Samples were taken from every standing pool of water. Where possible, silt was also collected for analysis.

#### SAMPLE ANALYSIS

Smear samples were counted in a Nuclear Measurements Corporation proportional counter. The counter has alpha and beta/gamma efficiencies of not less than 50% and 45% respectively on any given day. Each smear was counted for at least two minutes.

The water and soil samples were counted in the Nuclear Data MCA. This MCA was calibrated with a 1.13 uCi, Am-241 standard source that was obtained from the US-NRC (Region 1), and it has a better than 30 pCi/gm minimum detectable activity capability.

Five cubic centimeter water samples were put in planchets and evaporated to dryness. In one case, where the liquid was too thick to pass through a pipet, a 10 cc sample was measured out by other means and then evaporated to dryness. Two grams were taken from every soil sample using an OHAUS Dial-O-Gram balance.

The evaporated water samples and the soil samples were then counted in the MCA which had been calibrated for the 60 kev Spectrum of Am-241. Counting time ranged from 5 to 33.3 minutes, depending on the projected radioactive content in the sample.

#### CONTAMINATION SURVEY INSTRUMENTATION

For locating contaminated surfaces, the following instruments were used:

- 1) Eberline PRM-5 with a FIDLER Detector (5" x 1/16" NaI crystal).
- 2) Ludlum ratemeter, Model 2200
- 3) Ludlum ratemeter, Model 2, to which a scintillometer had been attached.
- 4) Victoreen Model 493 with a G-M probe
- 5) Victoreen 491 with an end-window G-M probe
- 6) Three Eberline alpha gas proportional counters (Model PAC-3G)
- 7) Eberline E-520 converted gamma scintillometer
- 8) HP Instruments tissue equivalent Ion Chamber (Model 1010)
- 9) Victoreen 440 Ion Chamber

A Nuclear Measurements Corporation proportional counter (Model PC-55) was used to count the smear samples. A low background Nuclear Data, Inc., (ND 100) multi-channel gamma analyzer was used to analyze the soil and water samples. Except for the FIDLER, all the above-mentioned instrumentation were calibrated at the AHP facilities in Bethel Park, PA. The FIDLER was calibrated at the Lawrence Livermore Laboratory.

## SURVEY RESULTS

The survey results of the direct exposure measurements, smear swipes, soil and water samples are provided in the attached tables. Where possible or necessary, figures or pictures have been included.

### Site 1

The results of the water and soil samples are provided in Tables 1 and 2. Figures 8 and 9 show the locations where the samples were obtained. The smear survey results are provided in Appendix 1 and 2.

#### Zone A:

Appendix 1 shows the results of the smear survey on equipment in Zone A.

#### Zone B:

The results of smear surveys are given in Appendix 2. Figure 9 shows the direct exposure profile of the area.

#### Trail leading from Zone A to Zone B:

Contamination survey was conducted on this trail. Water samples were taken and so were direct exposure measurements. The results are included in Table 10 and Figure 8.

### Site 2

Appendix 3 provides the results of the smear surveys on equipment. The exposure profile is shown in Figure 10. Soil and water sample locations are included in the figure. Tables 1C and 2C provide the results of their analysis.

#### The Drill Hole:

The drill hole on this site was surveyed for radioactive contamination on September 17, 1982. This was done by introducing a Gearhart Owens "high resolution" gamma probe into the 513-foot deep, 3-inch diameter hole. Exposure readings were electronically plotted. The readings were obtained along every inch of the hole; as the probe was going in and as it was

being retrieved.

An NRC-supplied 1.13  $\mu\text{Ci}$  Am-241 was used to evaluate the efficiency of the detector. The efficiency was found to be less than 1%: This efficiency would tend to negate whatever results were obtained from the hole. However, other more dependable parameters were used to confirm or substantiate the conclusion of the survey.

DISCUSSION OF SURVEY RESULTSSite 1 (Zone A)Soil Contamination:

Table 1A indicates that the soil samples analyzed are contaminated to varying degrees from not detectable up to 113.2 pCi/gm. The migration of the Americium into the ground may actually have exceeded 3 inches, at least in those instances where initial contamination was heavy. However, our core sampling was to a depth of 6 inches.

Water Samples:

The water samples were collected from the two pools of water lying between Zone A and B. Analysis (Table 2A) indicates residual activity in the pool, along the right of the way leading to Zone B. Although the concentration is well below general release limit of 30 pCi/gm, a second sample has been taken to confirm this finding.

Smear Swipes:

The Ohio licensed red truck (5B2264) and the Consol Van (PA license CR35862) were originally contaminated as seen in Appendix 1. These have been decontaminated but not released to general use yet.

Direct Radiation Exposure:

The highest exposure here is 0.2 mrad/hr on contact and it is due to the sealed sources stored in the Consol van. The measurement was taken at the gas tank cover. The heap of contaminated clothing and shoes gave a reading close to 0.1 mrad/hr. Please see Figure 8 for exposure profile. The measurements were taken with a Health Physics Instrument, Model 1010 ion chamber which is tissue equivalent; thus, results can be expressed as mRads/hr.

Site 1 (Zone B)Soil Contamination:

As Table 1B indicates, the area around the rotary drill, the area from there into the brook bed, and the area down to Dam #2, have the highest radioactive contamination. Sample #4 indicates a soil contamination of approximately  $1.39 \times 10^4$  pCi per gram in the top 3-inch layer of soil. Furthermore, it indicates that the Americium has not seeped into the soil in any significant concentrations beyond the 3-inch depth at this site. However, it is not quite the same in the brook bed. Some samples indicate considerable migration inward, even to the extent of leaching through the first 4 inches of soil. Others show a slower migration rate. Samples #1 and #4 present rather unexpected results. Fresh samples have been taken from these locations to either reaffirm or negate the analytical findings. We suspected that some of the higher concentrate might be due to soil plugger contamination since samples were not sequentially obtained. This suspicion was confirmed when duplicate samples were taken and analyzed on September 29, 1982. Appropriate measures have been taken to prevent cross contamination of soil samples.

Water Samples:

The results of the analyzed water samples indicate a minute contamination in ponds W1 and W2. As time has passed, the concentration reduced due to sedimentation of the insoluble Americium oxide to the bottom of the containment ditches.

The sediment or sludge is highly contaminated but it is not known yet what thickness of the sludge would be contaminated or how far into the ground the isotope may have migrated. We are making plans to

resolve this question and obtain the necessary samples.

As of September 28, 1982, the water situation has changed drastically. After the flow of the stream was diverted, the brook bed was initially dry or at the worst, wet. The rains of September 25, 1982 weekend, filled up the brook. Even the dams, particularly Dam #2, are not holding their ground against the water surge. Currently W2 is almost filled to the brink, and pockets of water have accumulated along the entire length between Dam #1 and #4.

In view of this, the water sample results from W2 may be considered invalid. Data from W1 remains as it is because there was little or no change in the volume of water in the ditch. In any case, the entire water sampling will need to be repeated for this zone.

#### Smear Swipes:

Appendix 2 provides the results of the smear swipes taken on the rotary drill and the rod truck. The bulldozer was discretely contaminated but has been cleaned. It is awaiting the final survey by a health physicist before release to general use.

Smears taken on the accessible surfaces of the air rotary drill and the rod truck indicate that they are not heavily contaminated. This condition may change when access to their under carriage is possible or in the case of the rotary drill, when it is put to use in cleaning the bore hole itself. No measurements have been obtained from the hole itself due to its present inaccessibility. Some of the pipes on the rod truck are contaminated as Appendix 2 indicates.

#### Direct Radiation Exposure:

As a result of the rains of September 25 weekend, previous direct exposure measurements which were as high as 15 mR/hr, particularly in the brook bed, are invalid. The runoff into the brook bed and along the bed itself,

has reduced the direct radiation exposure profile.

Exposure measurements considered here were obtained on September 28 with the HP Model 1010 at areas where the FIDLER and/or scintillometers gave the highest readings. As Figure indicates, the highest exposure (0.5 mRad/hr.) was obtained close to the W2 ditch. This ditch, as explained earlier, is close to being filled to the brink as a result of the runoff. The runoff between Dams #1 and #2, along with the eroded soil, is ending up in this ditch along with their additional radioactive contents. The exposure, at about 25 feet from W2, is 0.2 mRad/hr. at one meter and 0.5 mRad/hr. at about 3 cm above the ground. The rest of the exposure profile is shown in Figure 9.

It should be pointed out that these exposure levels may change as the water carries the Am-241 into the ground or sieves, causes it to leach through Dam #2. Therefore, these measurements will necessarily be repeated periodically.



Site 2Soil Contamination:

The soil sample collection and analysis are being repeated. Samples collected earlier were not divided into the top 3-inch layer and the last 3-inch portion. Consequently, analysis was performed on the whole 9-inch plug and the extent of migration into the ground could not be obtained. However, samples already analyzed (Table 1C) show contamination in the soil, particularly at the location where the drill platform was positioned which ranged from not detectable to  $1.08 \times 10^3$  pCi/g.

Water Samples:

As Table 2C indicates, the water in the horse trough shows insignificant concentration of Am-241. This result does not preclude the sediment in the trough from being contaminated. The sediment will remain inaccessible until the water is siphoned off which will be done at a later date as part of our decontamination operations at Site 1.

A water sample was taken from the pond across the road. Analysis indicated 1.5 pCi/ml of Am-241. Additional samples from this pond and other ponds in the area were taken on 10/1/82. We can comment on the initial analysis after the new samples have been processed and analyzed.

Smear Swipes:

Appendix 3 provides the results of the swipe surveys taken on the equipment located at Site 2 on September 14, 1982.

The mobile drill is fairly contaminated. The removable contamination is not high but it appears to involve a major portion of easily accessible surfaces and it is mostly in the grease used to lubricate the drill rods and pipes.

Every tool (wrenches, screwdrivers, etc.) used on site is contaminated to a certain extent. The same is applicable to all pipes lying on both sides of the rig; however, these pipes are mainly contaminated at the treaded ends. The surface of the horse trough is contaminated

probably to the highest degree relative to any other equipment on site. The Chevy blazer and the Ford pipe truck are contaminated. The results do not show any contamination on the flat bed "Grout truck" (WV license #NL-688). The threaded ends of the drill pipes and the planks on the water truck are slightly contaminated.

Direct Exposure:

The highest exposure occurs at the position of the drill platform. This exposure, 0.2 mrad/hr, is from both the raised platform and the contaminated soil below it. Other measurements made are as shown in Figure 10.

The Drill Hole (BL-82-7):

The pipes had been retrieved from the drill hole and on September 17, a contamination survey of the hole was carried out.

This was done by introducing a Gearhart Owens "high resolution" gamma probe into the 513-foot deep within the 3-inch diameter hole. Exposure measurements in gamma counts per second were plotted on a strip chart recorder. These measurements were obtained along every inch of the depth, as the probe was going in and coming out.

Following this, an NRC-supplied 1.13  $\mu$ Ci Am-241 was used to evaluate the efficiency of the detector. The efficiency was found to be less than 1%. This capability would seem to negate whatever results had been obtained in the hole, however, other more dependable parameters were used to confirm or substantiate the findings of the survey.

The exposure profile as plotted, Figure 11, indicates no contamination along the walls of the hole. This is substantiated by the following;

- a) The second plot in Figure 11 is that of another drill hole about 5000 ft. away which was never involved in the Am-241 incident. A comparison of this plot with that of drill hole

#BL-82-7 indicates that the other drill hole (BL-82-5) has even higher radiation exposure emanating from the rock beds than the drill hole involved in the Am-241 incident.

- b) Practically all of the tape used in wrapping the probe cable was not contaminated. This tape was manually removed and personnel hands were continuously monitored with a scintillometer for contamination, but none was ever found.
- c) The core samples had been surveyed with the FIDLER but a significant reading above background was not found.

However, the portion of the tape which covered the head of the probe, i.e. the part of the wrapping that really touched the bottom of the hole and dragged some soil with it, showed some Am-241 contamination on the scintillometer. This portion was taken to the laboratory and analyzed with a multi-channel analyzer. The result, as shown in Table 1C, indicates the floor of the hole to be contaminated. The activity on the tape and soil obtained on September 17, 1982 was 177 pCi.

#### CONCLUSION AND RECOMMENDATION

It is obvious that the area of primary concern is Zone B of Site 1. More than 90% of the released Americium is in the ditches and along the brook bed. With deteriorating weather conditions, immediate effort should be made to stabilize or adequately contain and prevent any further migration of the Am-241 into the ground or along less contaminated areas.

For this reason, it is recommended that the entire brook bed which is contaminated be drained immediately and its water filtered and transferred to another ditch. The water will be used later as drilling fluid when work on decontaminating the drill hole at this site (Site 1) begins.

The segment of plastic tape that was used to cover the bottom of the probe is the only portion with soil and contamination on it. This means that the debris at the bottom of the hole could not be more than 4 inches thick. It is impossible to estimate the amount of radioactivity at the bottom, but if that which came out with the tape is any indication, the radioactive content could not be sizable. This 4 inches of debris is located in an impermeable shaly claystone and therefore, cannot migrate from its position. Its position is 75 feet below the potentially mineable Waynesburg coal bed and over 100 feet above the Sewickley coal. It is 85 feet below the last potential source of potable ground water, the Waynesburg Sandstone.

TABLES

Table 1a: Results of Soil Samples from Zone A of Site 1

Table 1b: Results of Soil Samples from Zone B of Site 1

Table 1c: Results of Soil Samples from Site 2

Table 2a: Water Samples from Zone A (Site 1)

Table 2b: Water Samples from Zone B (Site 1)

Table 2c: Water Samples from Site 2

TABLE 1aResults of Soil Samples from Zone A of Site 1

<u>Sample Number</u>	<u>Am-241 concentrations (pCi/gm)</u>
1A	17.8
1B	0
2A	13.5
2B	0
3A	113.2
3B	42.7
Soil Bkg 1	4.6
Soil Bkg 3	5.9

Counting Instrument efficiency =  $118 \frac{\text{cpm}}{\text{nCi}}$

TABLE 1b

Results of Soil Samples from Zone B of Site 1

<u>Sample Number</u>	<u>Am-241 concentration (pCi/gm)</u>
1A	41.5
1B	13.7
2A	17.5
2B	25.7
3A	29.4
3B	31.6
4A	13900
4B	22.7
5A	0.0
5B	0.0
6A	104.9
6B	31.0
7A	17.5
7B	0.0
8A	0.0
8B	35.1
9A	0.0
9B	0.0
10A	29.3
10B	0.0
11A	3.0
11B	7.5
22A	25.0
22B	19.4
24A	0.0
24B	15.0
27A	4014
27B	536
29A	183.3
29B	0.0
32A	1520
32B	0.0
33A	29.0
33B	10.9
34A	0.0
34B	0.0
35A	0.0
35B	0.0
37A	150.9
37B	27.8
41A	24.7
41B	52.9
Soil on bulldozer	43.4
Soil in bulldozer	51.9
Soil on bulldozer(right)	8.0
Soil on bulldozer(left)	13.5
Repeat samples: A	11.5
B	0.0
41A	0.0
41B	0.0

TABLE 1cResults of Soil Samples from Site 2

<u>Sample Number</u>	<u>Am-241 concentration (pCi/gm)</u>
1	38.1
4	0.0
6	17.5
Spot near core hold	43.3
Spot under drill platform	1080
Bkg (1)	0.0

Instrument efficiency =  $118 \frac{\text{cpm}}{\text{nCi}}$



TABLE 2a

Water Samples from Zone A (Site 1)

<u>Sample Identification</u>	<u>Am-241 concentration (pCi/ml)</u>
Pond water (between Zone A&B to left of way)	0.60
Pond sediment " " " " "	5.3
Pond water (between Zone A&B to right of way)	14.4

TABLE 2b

Water Samples from Zone B (Site 1)

WI (9/14/82 water sample)	13.6
WI (9/14/82 sediment sample)	4625
WI (9/17/82 water sample)	9.4
WII(9/17/82 water sample)	18.6

TABLE 2c

Water Samples from Site 2

Water in horse trough	7.6
MSC: Pond across from Site 2	1.4
Pittsburgh tap water	0.0
*Tape used in Site 2 core survey	177 pCi

\*mass of tape or soil on it was not assessed.

FIGURES

- 1A Regional map of southwestern Pennsylvania.
- 1B Local topographic map showing locations of Consol drilling sites #1 and #2.
- 2A Composite aerial photographs of Site 1 taken 9/4/82.
- 2B Composite aerial photographs of Site 2 taken 9/8/82.
- 3-4 Photographs of state and US-NRC regulatory compliance inspectors obtaining samples from the Am-241 contaminated pond above Dam #2 on 9/7/82 at Site 1.
- 5 Sketch of Site 1 showing Zone A.
- 6 Sketch of Site 1 showing Zone B.
- 7 Sketch of Site 2 showing the restricted area.
- 8 X-radiation profile, soil and water sample locations from Zone A (Site 1).
- 9 X-radiation profile, soil and water sample locations from Zone B (Site 1).
- 10 X-radiation profile, soil and water sample locations from Site 2.
- 11 Gamma exposure profiles of Drill hole BL-82-7 and BL-82-5

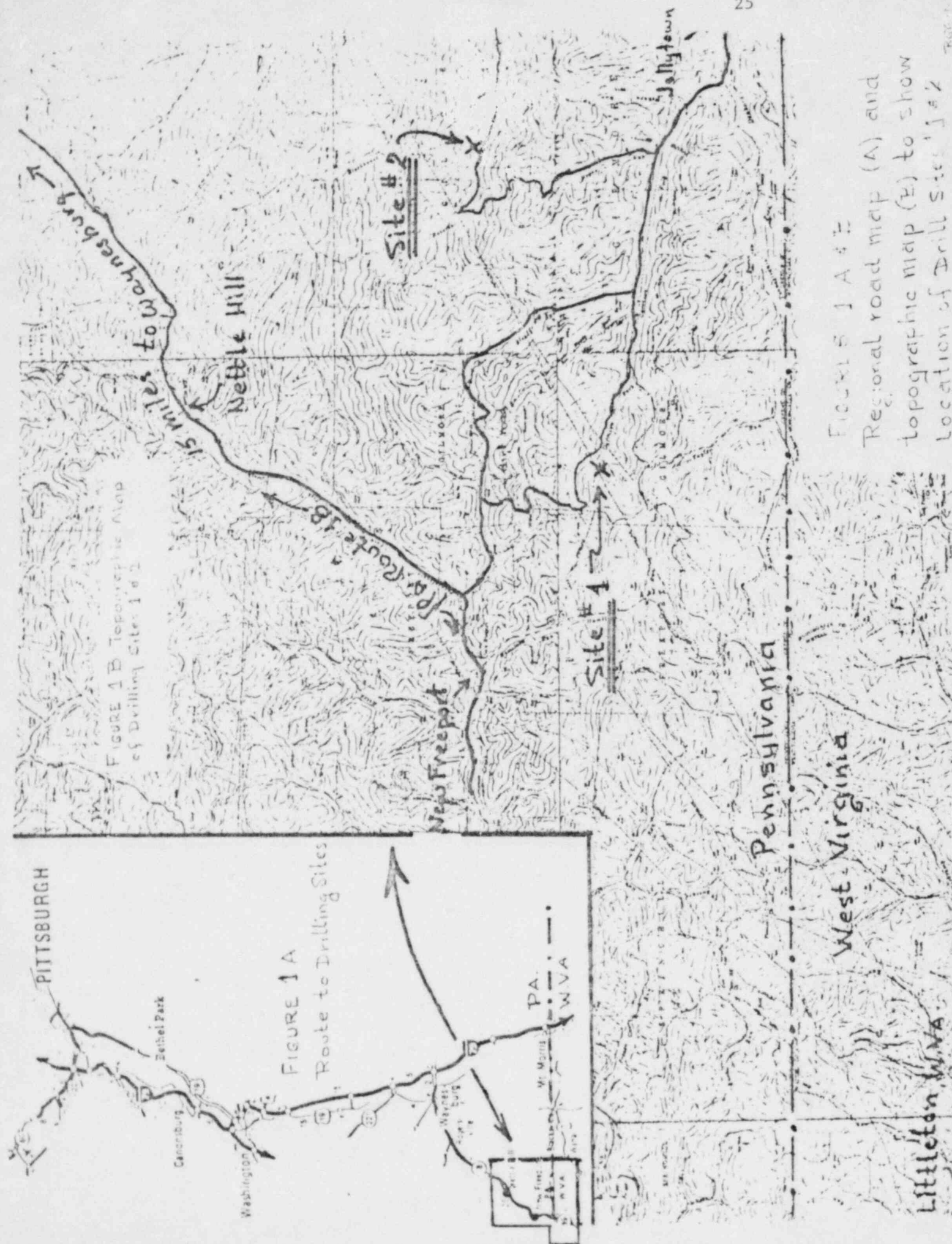
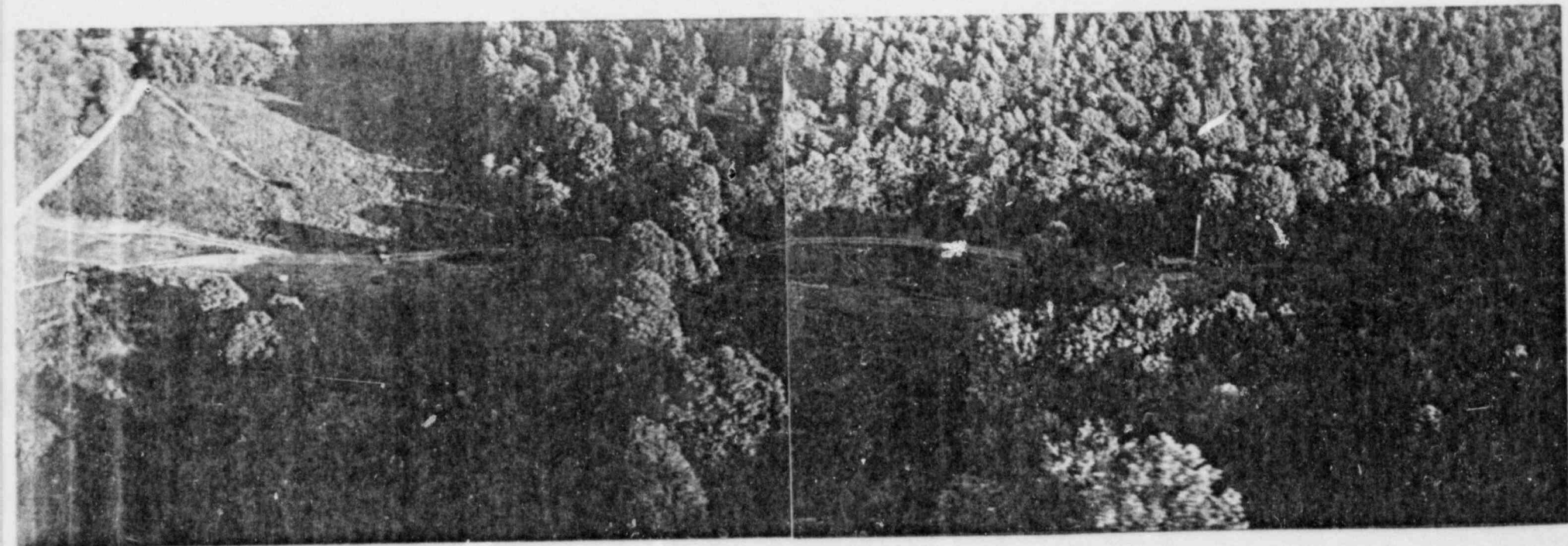


FIGURE 1B Topographic Map of Drilling Sites 1 & 2

FIGURE 1A Route to Drilling Sites

FIGURES 1A & B  
Regional road map (A) and topographic map (B) to show location of Drill Sites 1 & 2



AERIAL VIEW OF ZONE A

&

ZONE B AT CONSOL SITE #1

FIGURE 2A Composite aerial color photographs of Site #1 showing the location of the air rotary drill rig and pipe truck within Zone B. (Right half of picture) Zone A is shown in the left half of the aerial view where the red pick up truck blocks the entrance road into the drilling area.

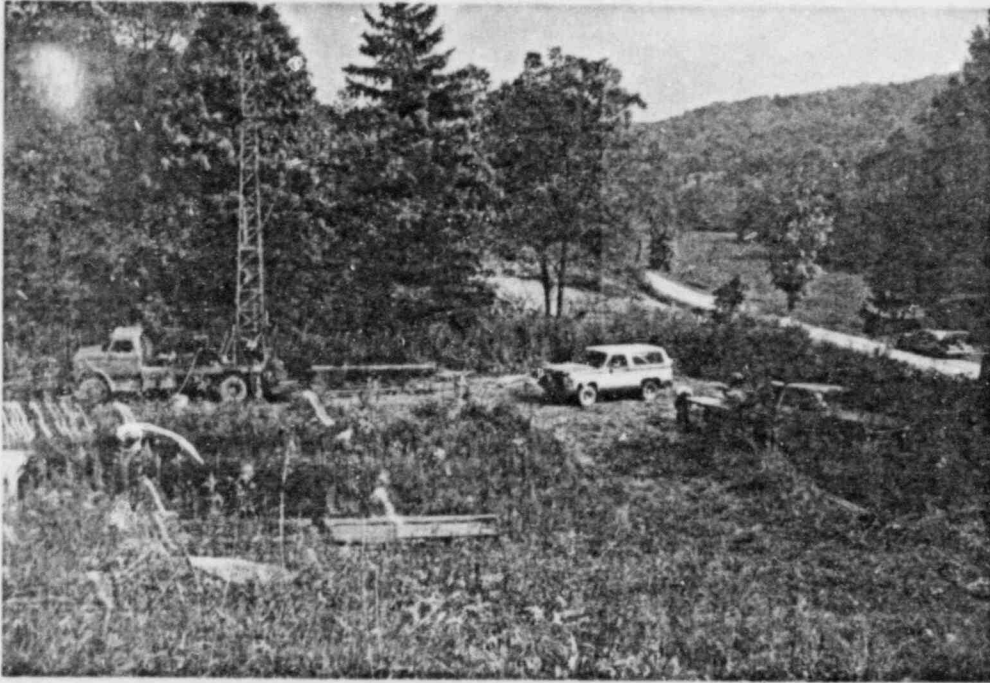


FIGURE 2B Photographs taken  
September 8, 1982  
of Site 2.

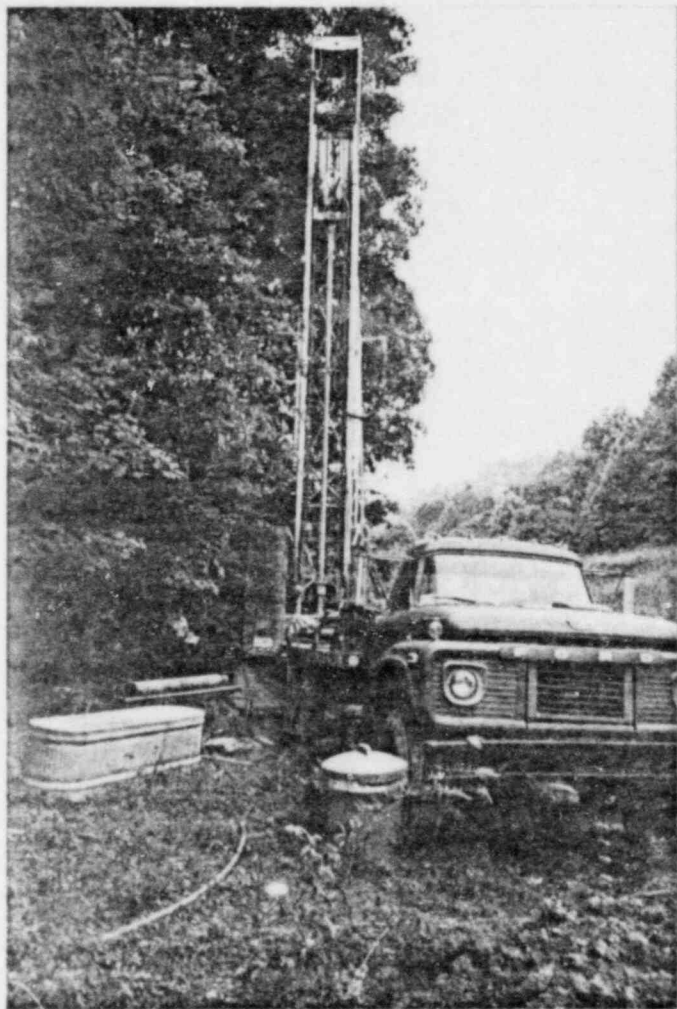




FIGURE 3

Photograph of state and US-NRC inspectors collecting water and silt samples of the contaminated pond above Dam #2 at Consol drill Site #1 on September 8, 1982. Mr. James Yusko, CHP, from PA, Bureau of Radiological Health is in the foreground. Mr. James Nicolosi, Region 1, US-NRC is taking field notes.

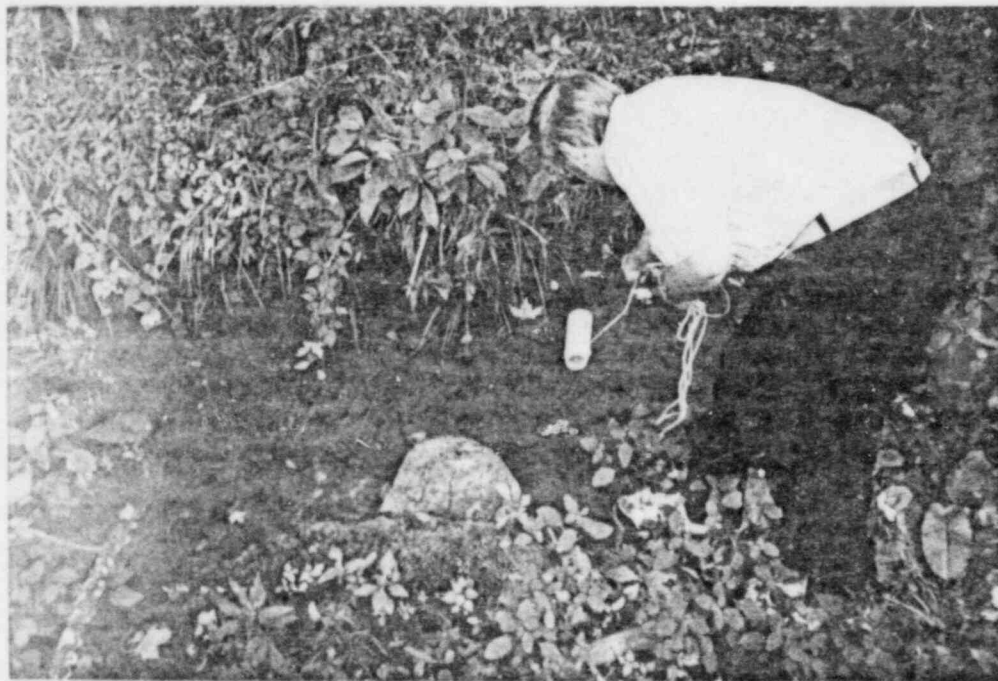


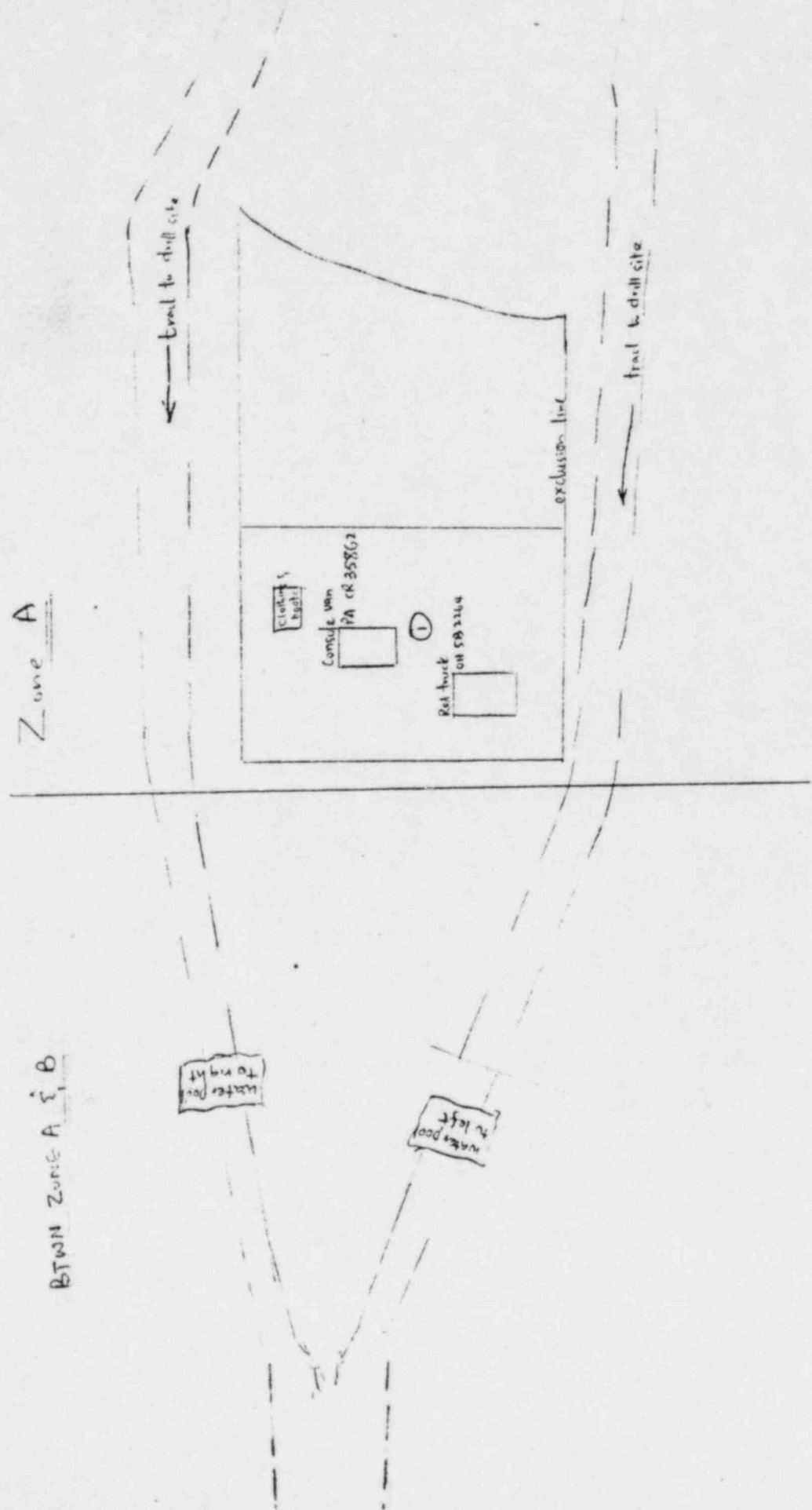
FIGURE 4

Photograph of Mr. Yusko obtaining water and silt samples at the same time and location as shown in Figure 5

SITE I, FIGURE 5

Zone A

BETWEEN ZONE A & B



trailers park

Sketch not drawn to scale  
FAS 9/12

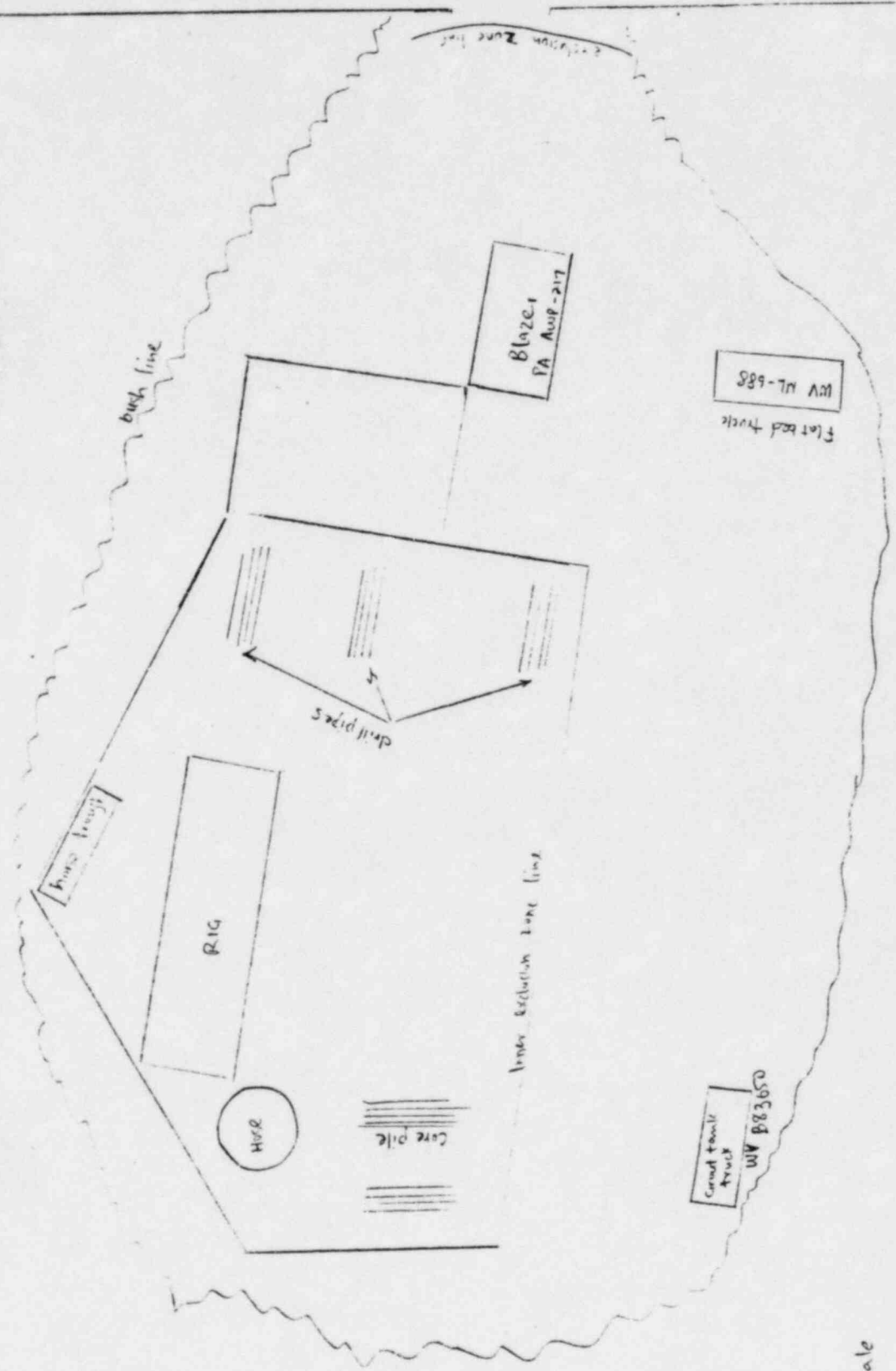
SITE I [ZONE B] Figure 6



Sketch not drawn to scale  
EN 9/82



SITE II FIGURE 7

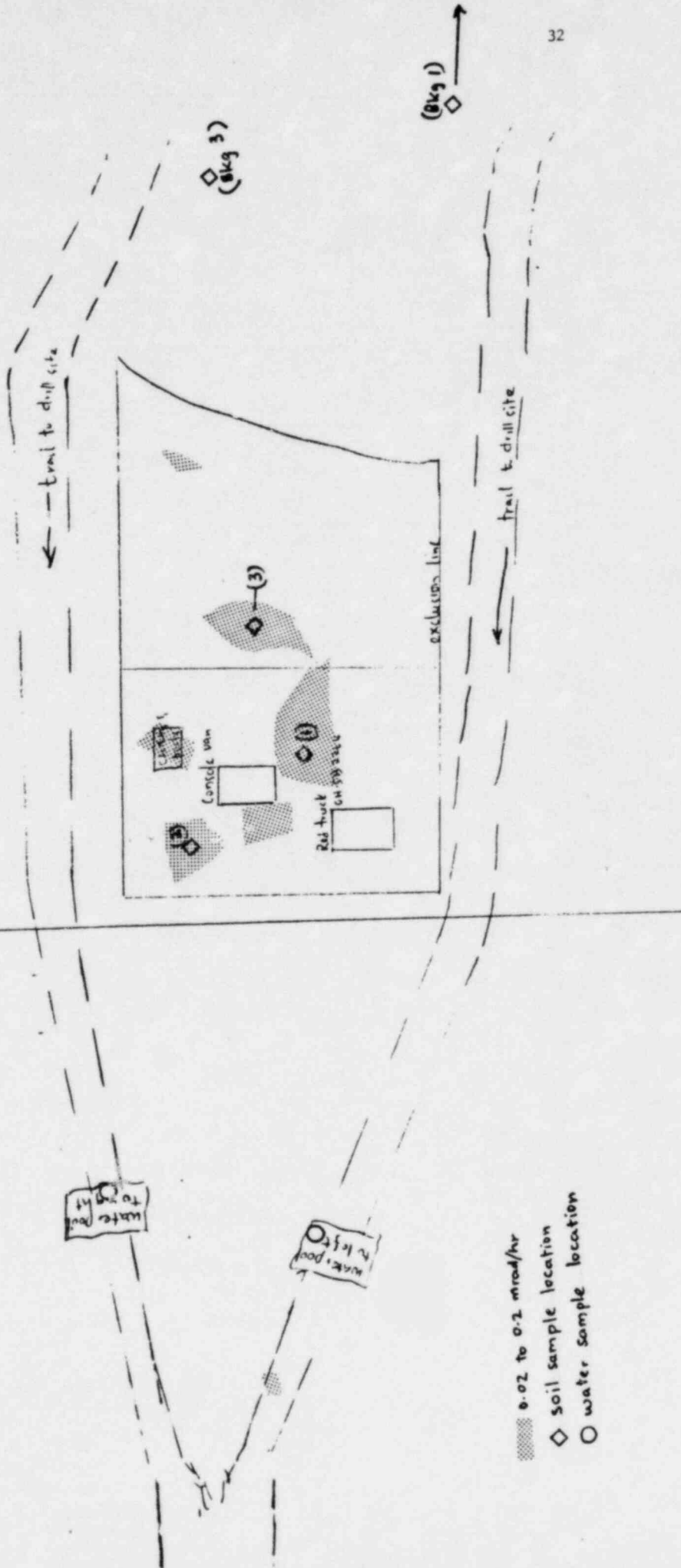


sketch not drawn scale  
ENI 9163

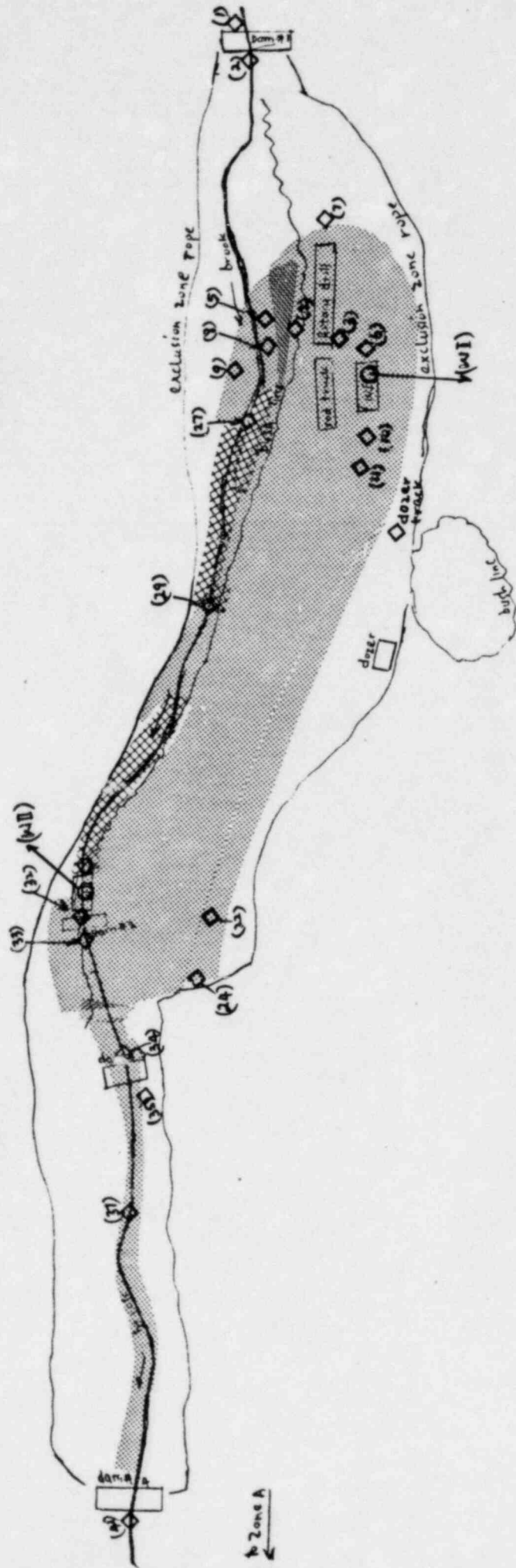
SITE I Figure B

Zone A

BETWN ZONE A & B



SITE I [ZONE B] FIGURE 9



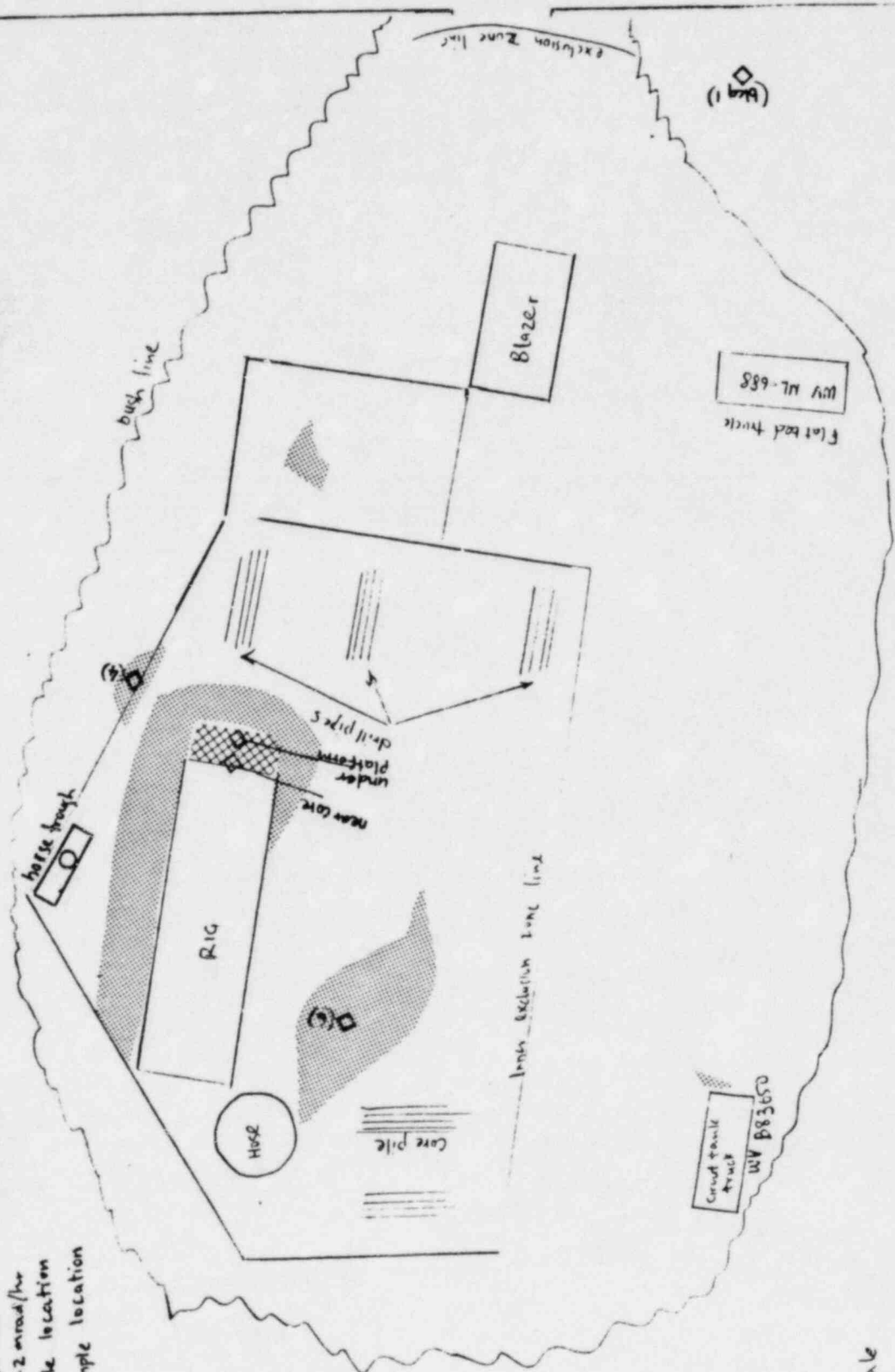
- XXX 0.2 to 0.5 mrad/hr
- XXXX 0.02 to 0.2 "
- ◇ soil sample location
- water sample location

Sketch not drawn to scale  
FN 9/82

Lead area

SITE II FIGURE 10

- XX 0.1 to 0.5 area/hr
- ▨ 0.01 to 0.2 area/hr
- ◇ soil sample location
- water sample location



Sketch not drawn scale

APPENDIX

Appendix 1: Smear Survey Results from Zone A (Site 1)

Appendix 2: Smear Survey Results from Zone B (Site 1)

Appendix 3: Smear Survey Results from Site 2

Appendix 4: Americium series decay scheme

APPENDIX 1

Smear Surveys in Zone A (Site 1)

APPLIED HEALTH PHYSICS Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/10/82 Page # (1)

Description of Survey: SMEARS ON RED TRUCK Lic. No. OH 5B 2264 (Zone A Site 1)

Surveyed by: EDWIN Date: 9/10/82 Suspected Activity Am 241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a .5 B 48

Background of detector after counting: a .6 B 44.8

Efficiency of detector: a 54.3% B 58.8% Counted by: J. DOUGLAS

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	Gross	c/m	NET d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>
B 2923 #3	Time	Location	2 min	6	3	4.6	.05	2 min	82	41	—	—
B 2924 #4		REAR TIRE (PASSENGER SIDE)	"	1	.5	—	—	"	90	45	—	—
B 2922 #2		FRONT TIRE (DRIVER'S SIDE)	"	6	3	4.6	.05	"	88	44	—	—
B 2921 #1		DRIVER'S SIDE FLOOR BEHIND SEAT	"	17	(8.5)	14.7	.15	"	96	48	—	—
B 2925 #5		FRONT TIRE (PASSENGER SIDE)	"	2	1	.92	.009	"	100	50	3.4	.034
B 2926 #6		SEAT (DRIVER)	"	3	1.5	1.84	.018	"	84	42	—	—
B 2927 #7		PASSENGER SEAT	"	10	5	8.3	.08	"	92	46	—	—
B 2928 #8		STEERING WHEEL	"	9	4.5	7.36	.073	"	122	61	21.1	.211
B 2929 #9		PEDALS	"	25	(12.5)	22.1	.22	"	114	57	15.3	.153
B 2930 #10		DOOR KNOB (DRIVER'S)	"	1	.5	—	—	"	88	44	—	—

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consel W.O.# \_\_\_\_\_ Date: 9/12/82 Page # (2)Description of Survey: Smears on Red truck OH 5B 2264Surveyed by: EW Date: 9/11/82 Suspected Activity Am-241Counted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NIMC Model PC-55 S/N 81-271205Background of detector before counting: a 0.2 cpm 43 cpmBackground of detector after counting: a 0.2 42Efficiency of detector: a 54.8% 57.9% Counted by: JJ

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
12571		pedals	2 min	2	1	1.45	0.014	2 min	104	52	15.5	.16
-72		steering wheel	1	2	1	1.45	.014	1	116	55	20.7	.21
-73		floor behind seat (passenger)		17	8.5	15.1	.15		118	59	27.6	.28
-74		fr. infant seat ( " )		5	2.5	4.01	.04		82	41	-	-
-64		door ledge (driver's side)		3	1.5	2.37	.023		100	50	12.0	.12
-65		electric cable		2	1	1.45	.014		120	60	29.3	.29
-66		floor behind seat (drivers)		0	0		0		106	53	17.2	.17
-67		" " "		0					86	43	-	-
-68		Little dent on floor		0					102	51	13.8	.14
-69		rubber molding		0					106	53	17.2	.17
70		rubber floor mat	✓	1	0.5	0.59	.005	✓	94	47	6.9	0.069



## APPLIED HEALTH PHYSICS, Inc.

## Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/14/82 Page # ③  
 Description of Survey: SMears (Red TRUCK) OH 5B2264  
 Surveyed by: Edwin Date: 9/14 Suspected ACTIVITY α

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a .8 B 51

Background of detector after counting: a 1 B 48.9

Efficiency of detector: a 54.0% B 58.7% Counted by: J. Douglas

2nd survey after decon

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma				
			Ctg. Time	Gross	c/m	d/m	d/m <sup>2</sup>	Ctg. Time	Gross	c/m	d/m
3141	pedals	2min	2	1	0.37	0.003	2min	160	80	44.9	0.494
3140	floor behind (pass seat)	"	1	0.5	—	—	"	130	65	23.8	0.238
3139	front fender (pass seat)	"	2	1	0.37	0.003	"	92	46	—	—
3138	back bumper	"	3	1.5	1.029	0.012	"	132	66	22.5	0.225
3137	front bumper	"	2	1	0.37	0.003	"	150	75	40.8	0.408
3136	front fender (drv side)	"	3	1.5	1.029	0.012	"	100	50	—	—
3135	floor behind (drv side)	"	2	1	0.37	0.003	"	112	56	28.51	0.085

③

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/13/82 Page # 1

Description of Survey: Surveys of consols van [PA CR 35862]

Surveyed by: Edwin Date: 9/11/82 Suspected Activity Au-241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a 0.1 B 45.3

Background of detector after counting: a 0.1 B 45.5

Efficiency of detector: a 83.6% B 58.5% Counted by: John Danylas

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma				
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m
A12538	handle of side door	2min	1	0.5	0.74	0.007	2min	92	46	1.14	0.11
39	ledge of side door	"	68	34	63.2	0.632	"	88	44	-	-
43	surface tool box	"	0	0	-	-	"	84	42	-	-
44	passenger seat	"	0	0	-	-	"	96	48	4.61	0.46
32	probe end	"	23	11.5	21.0	0.21	"	110	55	16.5	1.65
63	Victor 493	"	3	1.5	2.42	0.24	"	82	41	-	-
62	Surveyor Am counter	"	1	0.5	0.74		"	102	52	11.4	1.14
61	Card-board box (cont. source)	"	0	0	-	-	"	98	49	6.02	0.63
60	lead pig	"	0	0	-	-	"	122	61	28.8	2.88
59	Surface of generator	2min	0	0	-	-	2min	110	55	16.5	1.65
33	pulley handle	"	0	0	-	-	"	122	61	26.8	2.68
34	window to front of van	"	0	0	-	-	"	76	38	-	-
35	Tool box surface	"	1	0.5	0.74	0.007	"	116	58	21.7	2.17
36	Source drive pul on rack	"	2	1	1.66	0.166	"	84	42	-	-
37	Surface of rack	"	1	0.5	0.74	0.007	"	126	63	30.2	3.02
45	door handle (pass. side)	"	2	1	1.66	0.166	"	114	57	20	2.0
46	hand rest "	"	8	4	7.27	0.727	"	120	60	25.1	2.51
47	floor "	"	12	6	11	0.11	"	160	80	54.3	5.43
48	path funder	"	6	3	5.41	0.541	"	105	54	14.8	1.48

(2)

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONROL W.O.# — Date: 9/13/82 Page # ⑤Description of Survey: Smears on Consolidated Lead VanSurveyed by: Edwin Date: 9/11/82 Suspected Activity XCounted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a 0.1 B 45.3Background of detector after counting: a 0.1 B 15.5Efficiency of detector: a 53.6 B 58.5 Counted by: J. Douglas

SER. NO.	SAMPLE IDENTIFICATION		Alpha					Beta-Gamma				
			Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>
A 12549	Time	Location	2min	0	0	—	—	2min	130	65	33.6	0.336
A 12550		door outside van	"	0	0	—	—	"	122	61	26.8	0.268
A 12551		door ledge	"	2	1	1.6	0.16	"	106	53	13.1	0.131
A 12558		rear wheel drivers side	"	2	1	1.6	0.16	"	126	63	30.2	0.302
A 12557		console dash board	"	24	12	22.2	0.222	"	110	55	16.5	0.165
A 12556		steering wheel	"	13	6.5	11.9	0.119	"	100	50	8.03	0.08
A 12555		drivers seat	"	16	8	14.7	0.147	"	106	53	13.1	0.131
A 12554		Seats	"	2	1	1.6	0.16	"	110	55	16.5	0.165
A 12553		floor (drivers side) *	"	289	144.5	269.9	0.269	"	214	107	105.4	1.054
A 12552		hand rest (drv side)	"	2	1	1.6	0.16	"	106	53	13.1	0.131
A 12531		floor around Am241 box	"	0	0	—	—	"	84	42	—	—
A 12530		" Ra-226 pig	"	0	0	—	—	"	88	44	—	—
A 12529		bumper	"	2	1	1.6	0.16	"	72	36	—	—
A 12528		Step up	"	1	0.5	0.74	0.074	"	82	41	—	—
A 12527		front tire (drv side)	"	3	1.5	2.42	0.242	"	80	40	—	—
A 12526		" " (pass side)	"	0	0	—	—	"	94	47	2.9	0.29
A 12525		Rear tire (Pass side)	"	0	0	—	—	"	86	43	—	—
A 12524		rear tire (drivers side)	"	98	49	91.2	0.912	"	132	66	35.3	0.353

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/16/82 Page # 3Description of Survey: SMARS (CONSOL Van)Surveyed by: EN + Date: 9/14/82 Suspected Activity XCounted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a 0.8 B 51Background of detector after counting: a 1 B 48.9Efficiency of detector: a 54.0% B 58.7% Counted by: J. Douglas

After 1st decon

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>
3153	Probe	end of cable	2min	3	1.5	1.029	0.012	2min	130	65	23.8	0.238
3151	panel	right side		0	0	—	—	"	122	61	17	0.17
3150	dash	pass. side	"	2	1	0.37	0.003	"	110	55	6.8	0.068
3149	floor	pass. side	"	0	0	—	—	"	118	59	13.6	0.136
3148	dash	drv. side	"	4	2	2.022	0.022	"	132	66	25.5	0.255
3152	step	pass. side	"	2	1	0.37	0.003	"	112	56	8.51	0.085
3142	front tire	(drv.)	"	1	0.5	—	—	"	142	71	34.0	0.34
3143	back tire	(drv.)	"	0	0	—	—	"	118	59	13.6	0.136
3144	front tire	(pass)	"	1	0.5	—	—	"	124	62	18.7	0.187
3145	back tire	(pass)	"	2	1	0.37	0.003	"	132	66	25.5	0.255
3146	floor	drv. side	"	3	1.5	1.029	0.012	"	140	70	32.3	0.323
3147	step	" "	"	3	1.5	1.029	0.012	"	136	68	28.9	0.289
3154	Not used		"	2	1	0.37	0.003	"	96	48	—	—

APPENDIX 2

Smear Surveys in Zone B (Site 1)

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/10/82 Page # 1 Zone BDescription of Survey: Impacts drill rig & truck (Site #)Surveyed by: Edwin Date: 9/11/82 Suspected Activity AM-241Counted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a 02 B 43Background of detector after counting: a 02 B 42Efficiency of detector: a 50.8% B 57.4% Counted by: John Douglas

SER. NO.	SAMPLE IDENTIFICATION Time Location		Alpha					Beta-Gamma				
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
12615	rear tire wheel (2nd)	2min	2	1	1.45	0.14	2min	84	42	—	—	
12614	" " (1st)	"	1	0.5	0.547	0.005	"	92	46	5.18	0.051	
13	rear jack (pass. side)	"	0	0	—	—	"	92	46	5.18	0.051	
12	pipe on truck (rocker)	"	2	1	1.45	0.14	"	106	53	17.2	0.172	
11	rear tire (drv. side)	"	6	3	5.10	0.051	"	116	58	25.4	0.254	
12625	rear tire wheel (on rig)	"	35	17.5	31.5	0.315	"	114	57	24.1	0.241	
24	latter	"	18	9	16.0	0.16	"	106	53	17.2	0.172	
23	front tire wheel 2nd	"	20	10	17.8	0.178	"	86	43	—	—	
22	" " 1st	"	2	1	1.45	0.145	"	106	53	17.2	0.172	
21	drivers door handle	"	0	0	—	—	"	100	50	12.0	0.120	
2000	pipe on rack (small outward sun)	"	21	10.5	18.7	0.187	"	106	53	17.2	0.172	
05	" big 1 surface	"	170	85	154.7	0.54	"	190	95	89.8	0.898	
04	inside big pipe on truck	"	40	20	36.1	0.361	"	142	71	48.3	0.483	
03	pipe on track	"	3	1.5	2.37	0.023	"	90	45	5.63	0.0563	
02	rear tires	"	90	45	81.7	0.817	"	160	80	63.9	0.639	
01	middle tires	"	14	7	12.4	0.124	"	82	41	—	—	
12540		"	88	44	79.9	0.799	"	100	50	12.0	0.12	
12541		"	16	8	14.2	0.142	"	110	55	20.7	0.207	
42		"	3	1.5	2.37	0.0237	"	118	59	27.6	0.276	

(1)

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consel W.O.# \_\_\_\_\_ Date: 9/12/82 Page # 6Description of Survey: Smears of drill & Truck siteSurveyed by: Edwin Date: 9/11/82 Suspected Activity LA Am 241Counted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NAIC Model PC-55 S/N 81-271205Background of detector before counting: a 0.2 B 43Background of detector after counting: a 0.2 B 42Efficiency of detector: a 54.8% B 57.9% Counted by: John Douglas

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
12030	controls	rear drv side	2min	2	1	1.45	0.014	2min	80	40	-	-
24	rear	driver's seat	"	1	0.5	0.54	0.005	"	124	6.2	32.8	0.328
28	platform	to rear drv seat	"	135	67.5	122.8	1.222	"	156	7.8	66.4	0.664
27	rear	jack drv side	"	10	5	8.75	0.087	"	86	4.3	-	-
26	rear	tire wheel 2nd	"	0	0	-	-	"	76	3.8	-	-
20	front	jack stand (drv)	"	2	1	1.45	0.014	"	118	5.9	27.6	0.276
19	"	" (passenger)	"	3	1.5	2.37	0.023	"	122	5.1	13.8	0.138
18	front	wheel 2nd	"	0	0	-	-	"	80	4.0	-	-
17	"	" 1st	"	18	9	16.0	0.160	"	98	4.9	10.3	0.103
16	water	tank	"	1	0.5	0.54	0.005	"	118	5.9	27.6	0.276
1596			"	7	3.5	6.02	0.06	"	160	8.0	12.0	0.120
97	front	bumper	"	0	0	-	-	"	138	6.5	37.9	0.379
98	door	handle (pass side)	2min	21	2	3.28	0.032	2min	116	5.5	25.4	0.254
99	gas	tank	"	29	14.5	26.0	0.260	"	96	4.5	3.45	0.345
12600	front	tire (pass.)	"	22	11	14.7	0.147	"	162	5.1	13.8	0.138
610	middle	" " #drv	"	1	0.5	0.54	0.005	"	112	5.6	22.4	0.224
09	Front	" " #drv	"	4	2	3.28	0.032	"	116	5.3	17.2	0.172
07	gas	tank drv	"	4	2	3.28	0.032	"	92	4.6	5.15	0.515
07	door	handle drv	"	0	0	-	-	"	102	5.1	13.8	0.138

(7)

APPLIED HEALTH PHYSICS, Inc.

<sup>47</sup>  
(Zone B, Site 1)

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# \_\_\_\_\_ Date: 9/12/82 Page # 1

Description of Survey: SMEARS BULLDOZER

Surveyed by: EDWIN Date: \_\_\_\_\_ Suspected Activity α Am-241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a .2 B 43

Background of detector after counting: a .2 B 42

Efficiency of detector: a 54.8% B 57.9% Counted by: JOHN DOUGLAS

SER. NO.	SAMPLE IDENTIFICATION Time Location		Alpha				Beta-Gamma				
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/b Gross	c/m Net	d/m
12593	BACK WINDOW CASE	2 min	1	.5	.518	.005	2 min	118	59	27.6	.276
12594	HYSTER - BACK	"	3	1.5	2.37	.023	"	92	46	5.18	.051
12595	HYDRAULIC HOSE	"	1	.5	.5	.005	"	94	47	6.9	.069
12591	PEDALS	"	1	.5	.5	.005	"	106	53	17.2	.172
12590	DASH	"	11	5.5	9.15	.091	"	106	53	17.2	.172
12589	GEAR HANDLES	"	60	30	51.4	.514	"	170	85	72.5	.725
12588	TOP - OVER SEAT	"	2	1	1.45	.014	"	120	60	29.3	.293
12586	SEAT	"	4	2	3.10	.031	"	108	54	18.9	.189
12585	FLOOR - CAB	"	2	1	1.45	.014	"	106	53	17.2	.172
12584	BACK WHEEL LEFT SIDE	"	0	0	-	-	"	92	46	5.18	.051
12583	FRONT WHEEL LEFT SIDE	"	6	3	4.83	.048	"	122	61	31	.31
12582	LEFT WHEEL TREAD	"	0	0	-	-	"	86	43	-	-
12581	LEFT WHEEL "BACK RIGHT"	"	8	4	6.56	.065	"	80	40	-	-
12580	WHEEL FRONT RIGHT	"	2	1	1.45	.014	"	92	46	5.18	.051
12579	WHEEL TREAD RIGHT	"	0	0	-	-	"	106	53	17.2	.172
12578	ENGINE HOOD	"	0	0	-	-	"	120	60	29.3	.293
12577	RIGHT ARM - DRIVER	"	2	1	1.45	.014	"	112	56	22.4	.224
12576	LEFT ARM - DRIVER	"	0	0	-	-	"	86	43	-	-
12575	BLADE SURFACE	"	4	2	3.10	.031	"	114	57	24.1	.241



APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/12/82 Page # 2

Description of Survey: Dimers on Bulldozer

Surveyed by: EA Date: 9/11/82 Suspected Activity Am-241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a 0.2cpm B 43

Background of detector after counting: a 0.2 B 42

Efficiency of detector: a 54.8% B 57.9% Counted by: JD

SER. NO.	SAMPLE IDENTIFICATION Time Location		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m <sup>2</sup> cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m <sup>2</sup> cm <sup>2</sup>
12631		tow edge	2min	0	0			2min	78	39	-	-
12632		under seat	1	2	1	1.45	0.012	1	84	42	-	-
-33		under seat		0	0				90	45	-	-
-35		right side chain		0	0				80	40	-	-
-36		blade bottom edge		1	0.5	.54	.005		76	38	-	-
-37		engine cover	1	0	0			1	82	41	-	-
—		soil sample	5min	11	2.5	3.93	0.037	5min	447	87.4	80.1	0.8

(4)

APPENDIX 3

Smear Surveys from Site 2

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/14/82 Page # 1

Description of Survey: Smears of underside of drill rig, (site 2)

Surveyed by: R. Altieri/R. Mart Date: 9/14/82 Suspected Activity \_\_\_\_\_

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: NMC Model PC-55 S/N 81-271205

Background of detector before counting: a 0.8 B 51

Background of detector after counting: a 1 B 48.9

Efficiency of detector: a 54.0% B 58.7% Counted by: John Douglas

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
2940	Rear	left support post	2min	35	17.5	30.6	0.31	2min	154	77	44.2	0.442
2941	Under	left rear wheel	" "	0	0	-	-	" "	104	52	1.70	0.017
42	beam	left center	" "	1	0.5	-	-	" "	120	60	15.3	0.153
43	left	side tool box	" "	3	1.5	1.29	0.112	" "	110	55	6.81	0.068
44	Rear	right support post	" "	254	127	233.3	2.3	" "	200	100	33.9	0.339
45	under	right rear wheel	" "	0	0	-	-	" "	92	46	-	-
46	beam	right center	" "	0	0	-	-	" "	88	44	-	-
47	right	side of tool box	2min	1	0.5	-	-	2min	80	40	-	-
48	middle	beam right side	" "	2	1	0.37	-	" "	90	45	-	-
49	"	" left side	" "	1	0.5	-	-	" "	80	40	-	-
2950	left	side cab step	" "	0	0	-	-	" "	102	51	0	-
51	right	side cab step	" "	0	0	-	-	" "	89	42	-	-
52	left	front wheel	" "	0	0	-	-	" "	116	58	11.9	0.119
53	right	front wheel	" "	1	0.5	-	-	" "	92	46	-	-
54	left	front bumper	" "	1	0.5	-	-	" "	108	54	5.11	0.051
55	right	front bumper	" "	0	0	-	-	" "	102	51	0	-

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/12/82 Page # 2Description of Survey: Smears of drill rig on site 2Surveyed by: R. Altieri Date: 9/12/82 Suspected Activity \_\_\_\_\_Counted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model FC-55 S/N 81-271205Background of detector before counting: a 02 B 43Background of detector after counting: a 02 B 42Efficiency of detector: a 54.8% B 57.9% Counted by: John Douglas

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma				
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m
A 9893	back grill (right)	2min	196	98	178	1.78	2min	206	103	281	2.81
A 9891	rear boom (left)	}	98	49	89	0.89	}	120	60	29.3	0.293
9896			0	0	-	-		106	53	17.2	0.172
9894	back mud flap (right)		19	9.5	16.9	0.169		112	56	22.4	0.224
9895	" " (left)	}	1	0.5	0.547	0.005	}	82	41	-	-
9892	back grill (left)		290	145	264	2.64		190	95	89.8	0.898
9890	rear boom (right)	2min	1160	558	1617.8	10.17	2min	604	302	447	4.47
9889	Top meter	}	248	124	225	2.25	}	208	104	105	1.05
9888	middle boom (right)		414	207	377	3.77		242	121	134	1.34
9887	" " (left)		77	38.5	64.8	0.648		106	53	17.2	0.172
9886	front cable		927	463.5	845	8.45		366	183	241	2.41
9884	boom platform (front)	}	136	63	123	1.23	}	118	59	27.6	0.276
9882	" " right		116	56	101	1.01		122	61	31	0.31
9881	boom cable		2min	906	453	830		8.30	2min	464	232
3088	outside <sup>trough</sup> tank	}	1652	826	1506	15.06	}	756	378	578	5.78
<del>3087</del>	<del>" "</del>		<del>5518</del>	<del>2759</del>	<del>5071</del>	<del>5.071</del>		<del>2508</del>	<del>1254</del>	<del>291</del>	<del>2.91</del>
3086	inside tank	}	8954	4477	8169	81.69	}	3744	1872	3158	31.58
3085			2206	1103	2012	20.12		1194	597	956	9.56
9885	Front boom (right)		88	44	79.9	0.799		134	67	41.4	0.414
9883	boom platform (left)	}	55	27.5	49.8	0.498	}	120	60	29.3	0.293

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/11/82 Page # 3Description of Survey: SMears of drill rig & pipes on Site 2Surveyed by: E. Njoku Date: 9/10/82 Suspected Activity XCounted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a 0.23 B 4605Background of detector after counting: a 0.37 B 44Efficiency of detector: a 54.5% B 59.5% Counted by: J. Douglas

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	Gross	c/m	net d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>
9490	door	threshold (passenger)	2min	38	19	34.3	0.34	2min	116	58	19.3	0.193
9489	door	handle, outside ( " )	"	72	36	155	0.62	"	148	74	48.7	0.48
9488	surface	of battery	"	146	73	133	1.33	"	154	77	53.7	0.537
9487	top	of tool cabinet	"	70	35	63.7	0.637	"	136	68	38.6	0.386
9486	passenger side	(tool cab. lock)	"	31	15.5	28	0.28	"	102	51	10.	0.10
9485	grat	platform (surface)	"	179	89.5	163	1.63	"	170	85	67.2	0.672
9484	latter leg	passenger side	"	61	30.5	55.5	0.555	"	132	66	35.2	0.352
9483	passenger side	back tire	"	5	2.5	4.16	0.041	"	82	41	-	-
9482	left	hydraulic stand	"	338	169	309	3.09	"	210	105	100	1.0
9481	grat	passenger side wall	"	134	67	122	1.22	"	166	83	63.8	0.638
9480	grat	platform (left center)	"	5	2.5	4.16	0.041	"	92	46	1.6	0.016
9491	wound	black hose	"	2	1	1.41	0.014	"	94	47	3.36	0.033
9462	wound	black hose	"	52	26	47.2	0.472	"	122	61	26.8	0.268
9461	water	hose (red)	"	24	12	21.5	0.215	"	114	57	20.1	0.201
9460	jack		"	39	19.5	35.3	0.353	"	104	52	11.7	0.117
9459	water	hose (black)	"	70	35	63.7	0.637	"	116	58	21.8	0.218
9458	long	line pipes (new)	"	113	56.5	103	1.03	"	144	72	45.3	0.453
9457	long	line pipes (new)	"	167	83.5	152	1.52	"	150	75	50.4	0.504
9456	screw	driver	"	5	2.5	4.16	0.041	"	80	40	-	-

(4)

## APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/11/82 Page # (4)Description of Survey: SMARS of rig & pipe cont'dSurveyed by: \_\_\_\_\_ Date: 9/10/82 Suspected Activity αCounted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a 0.23 B 46.5Background of detector after counting: a 0.37 B 44Efficiency of detector: a 54.5% B 59.5% Counted by: J. Douglas

SER. NO.	SAMPLE IDENTIFICATION Time Location		Alpha				Beta-Gamma				
			Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m
9455	Wrench	2min	12	6	10.5	0.105	2min	114	57	20.0	0.200
9454	bent nose pliers	"	30	15	27.1	0.271	"	134	67	36.9	0.369
9453	creasent wrench	"	42	21	38.1	0.381	"	102	51	10.0	0.10
9452	Small pipe wrench	"	38	19	34.4	0.344	"	110	55	16.8	0.168
9451	large pipe wrench	"	178	89	162	1.62	"	196	98	89	0.89
9450	new 10' lang pipes (oh old)	"	74	37	67.4	0.674	"	120	60	25.2	0.252
9449	old line pipes)	"	490	245	449	4.49	"	324	162	196	1.96
9457		"	1	0.5	0.49	0.004	"	92	46	1.68	0.016
9469	leg of latter (drv. side)	"	73	36.5	66.5	0.665	"	146	73	47	0.47
9468	grat deck wall (drv. side)	"	44	22	39.9	0.399	"	130	65	33.6	0.336
9464	hydraulic leg (rear drv. side)	"	117	58.5	106	1.06	"	126	63	30.2	0.302
9465	back side light (drivers side)	"	368	184	337	3.37	"	250	125	134	1.34
9466	control knobs (lower set)	"	196	98	179	1.79	"	154	77	53.7	0.537
9467	" / higher set)	"	330	165	362	3.62	"	264	132	146	1.46
9468	pipe wrench on truck	"	117	58.5	106	1.06	"	130	65	33.6	0.336
9479	out board drv. side	"	33	16.5	36.2	0.362	"	100	50	8.4	0.084
9470	middle of truck (drv. side)	"	71	35.5	119	1.19	"	128	64	31.9	0.319
9472	Top tool cabinet	"	46	23	41.7	0.417	"	104	52	11.7	0.117
9471	tool cabinet locks	"	30	15	27.1	0.271	"	108	54	15.1	0.151



Health Physics Laboratory Report: Analyses of Removable Contamination

Client: CONSOL W.O.# — Date: 9/10/82 Page # (1)Description of Survey: SMEARS AWP-217 CHEVY BLAZERSurveyed by: ALTIERI + MERSKY Date: 9/11/82 Suspected Activity αCounted with:  GM detector  Scintillation detector  Gas Proportional DetectorCounter Mfg.: NMC Model PC-55 S/N 81-271205Background of detector before counting: a .5 B 48Background of detector after counting: a .6 B 44.8Efficiency of detector: a 54.3% B 58.8% Counted by: J. DOUGLAS

SER. NO.	SAMPLE IDENTIFICATION Time Location		Alpha				Beta-Gamma				
			Ctg. Time	Gross	c/m	d/m	d/m cm <sup>2</sup>	Ctg. Time	Gross	c/m	d/m
9402	RT. FRONT SIDE	2 min	0	0			2 min	88	44	—	—
9403	RT. DOOR OUTSIDE HANDLE	"	1	.5	—	—	"	96	48	—	—
9404	RT. SIDE WINDOW	"	1	.5	—	—	"	80	40	—	—
9405	BACK DOOR HANDLE	"	21	(10.5)	18.4	.184	"	82	41	—	—
9406	LT. SIDE BACK PANEL	"	0	0	—	—	"	80	40	—	—
9407	LT. SIDE DOOR HANDLE	"	6	3	4.60	.046	"	98	49	1.7	.017
9408	HOOD	"	6	3	4.60	.046	"	130	65	28.9	.289
9409	PASSENGER FRONT SEAT	"	16	8	13.8	.138	"	90	45	—	—
9410	STICK SHIFT	"	106	(53)	96.6	.966	"	132	66	30.6	.306
9411	PASSENGER FRONT MAT	"	0	0	—	—	"	94	47	—	—
9412	DRIVER'S SEAT	"	12	6	10.1	.101	"	130	65	28.9	.289
9413	STEERING WHEEL	"	15	7.5	12.8	.128	"	120	60	20.4	.204
9414	INSIDE DOOR HANDLE	"	48	(24)	43.2	.432	"	98	49	1.7	.017
9415	FLOOR NEXT TO PEDAL	"	30	15	26.7	.267	"	92	46	—	—
9416	BACK SEAT	"	1	.5	—	—	"	96	48	—	—
9417	BACK SEAT	"	39	(19.5)	34.9	.349	"	100	50	3.4	.034
9418	BACK SEAT FLOOR MAT	"	8	4	6.44	.064	"	88	44	—	—
9419	PASSENGER DOOR HANDLE	"	0	0	—	—	"	80	40	—	—



7

APPLIED HEALTH PHYSICS, Inc.

Site 2

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/22/82 Page # 1

Description of Survey: <sup>(water) tank</sup> Truck W. Virginia B 83650

Surveyed by: ENIAW Date: 9/21/82 Suspected Activity Am - 241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: Nuclear Measurements Model PC-55 S/N \_\_\_\_\_

Background of detector before counting: a 0.6 cpm B 49 cpm

Background of detector after counting: a \_\_\_\_\_ B \_\_\_\_\_

Efficiency of detector: a 54.5% B 55.8% Counted by: JCH

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/100 cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
9532	Time	Location	2min	6.5	5.9	10.9	0.167	2min	62.5	13.5	24.5	0.99
9533		drill pipe on truck (inside)										
9533		drill pipe on truck (outside)		214	213.4	395.1	3.95		196.5	147.5	268.1	2.68
9534		rear tire (drivers side)		1	.4	.74	.007		56.5	7.5	1.8	.018
9535		step on gas tank (drivers)		3.5	2.9	5.37	.053		81.5	32.5	59	.59
9536		Threshold (drivers side)		1	.4	.74	.007		52.5	3.5	6.3	.063
9537		Floor (drivers side)		3	2.4	4.44	.04		56.5	7.5	13.6	.136
9538		podals (3)	2min	1	.4	.74	.007	2min	44	0.5	.9	.009
9539		Steering wheel		22	21.4	39.6	0.396		63	14	25.4	.25
9540		dash board		19	18.4	34	0.34		72.5	23.5	42.7	.42
9541		door handle (drivers) inside		2.5	1.9	3.51	.035		53.5	4.5	8.18	.08
9542		" " outside		1.5	.9	1.6	.01		57	8	14.5	.145
9543		front tire drivers side		.5	.01	.018	.000		60	11	20	0.2
9544		" " passengers side	2min	.5	.01	.018	.000	2min	54	5	9.09	.09
9545		door <del>handle</del> <sup>step</sup> (pass. side)		1	.4	.74	.007		59.5	10.5	19	.19
9546		door handle (pass. side)		4	3.4	6.29	.06		88.5	39.5	71.8	.71
9547		floor (passengers side)		0					53.5	4.5	8.1	.08
9548		Seat " "		14					70	21	37.6	.376
9549		rear tire passenger side		1					45.5	-	-	-
9550		3 1/8 pipe (outside)		169	168.4	311.8	3.11		117	123.6		1.23
9551		" " inside		55	54.4	99.5	1.0		90	41	73.4	.734

APPLIED HEALTH PHYSICS, Inc.

Health Physics Laboratory Report: Analyses of Removable Contamination

Client: Consol W.O.# \_\_\_\_\_ Date: 9/24/82 Page # 2

Description of Survey: WV 883650 Grant tank truck bed [smear of planks]

Surveyed by: Bruce Whitney Date: 9/23/82 Suspected Activity Air-241

Counted with:  GM detector  Scintillation detector  Gas Proportional Detector

Counter Mfg.: Nuclear Measurements Model PC-55 S/N \_\_\_\_\_

Background of detector before counting: a 1.04 B 59.1

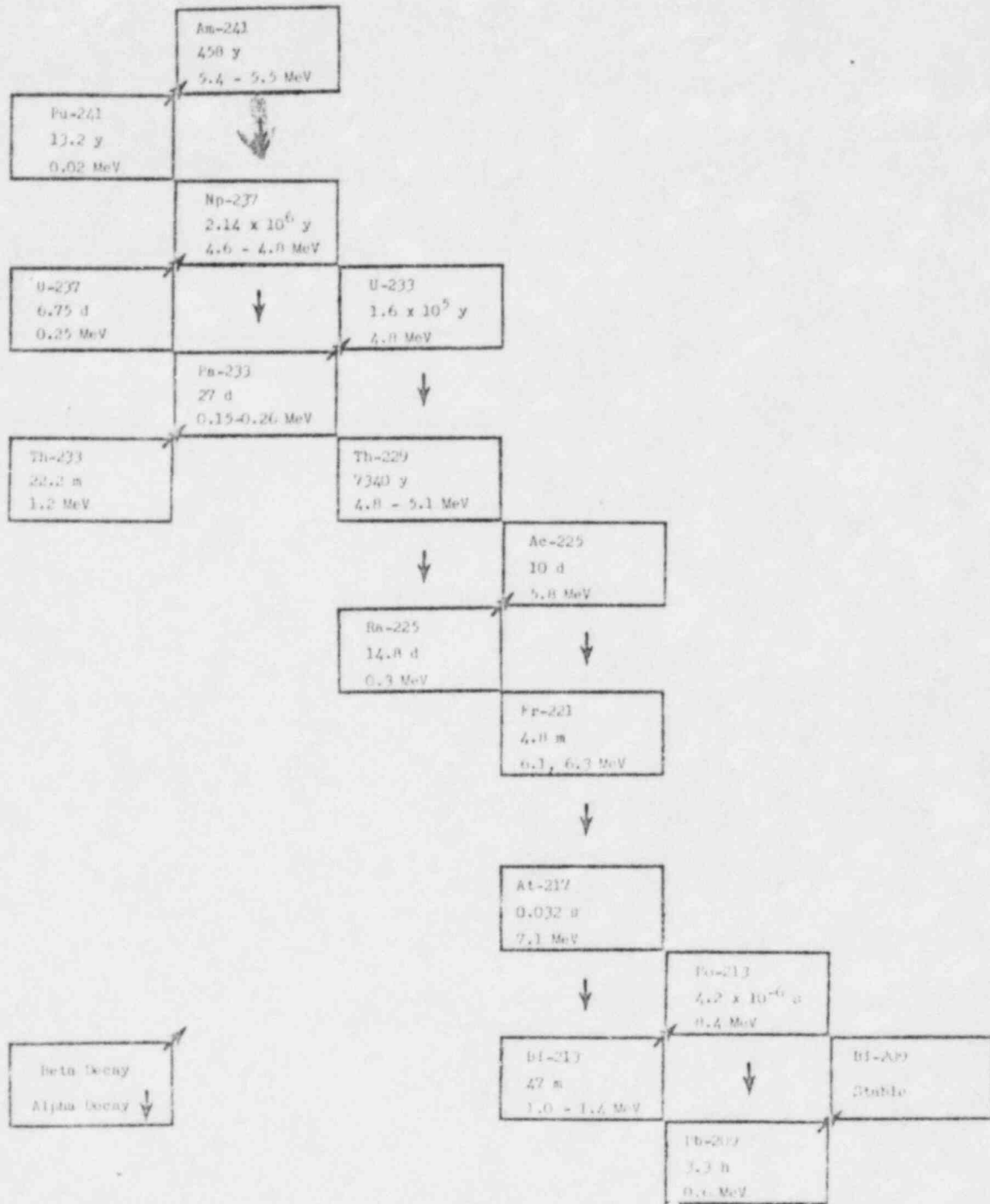
Background of detector after counting: a 1 B 47.01

Efficiency of detector: a 54.1% B 58.1 Counted by: CH

SER. NO.	SAMPLE IDENTIFICATION		Alpha				Beta-Gamma					
			Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>	Ctg. Time	c/m Gross	c/m Net	d/m	d/m cm <sup>2</sup>
9558	From	drivers side (plank 1)	2min	7.5	6.1	11.2	0.112	2min	65.5	6.4	11.0	0.110
59	plank	2	" "	47	45.6	84.2	0.842	" "	57	0	-	-
60	plank	3	" "	55	53.6	99	0.99	" "	60.5	1.04	2.4	0.024
61	plank	4	" "	19.5	18.1	33.4	0.334	" "	52.5	0	-	-
62	plank	5	" "	6.5	5.1	9.42	0.094	" "	79	19.9	34.2	0.342
63	plank	6	" "	10	8.6	15.8	0.158	" "	49	0	-	-
64	plank	7	" "	2.5	1.1	2.03	0.02	" "	54.5	0	-	-
65	plank	8	" "	2	0.6	1.1	0.11	" "	58	0	-	-
66	plank	9	2min	4	2.6	4.8	0.048	2min	48.5	0	-	-



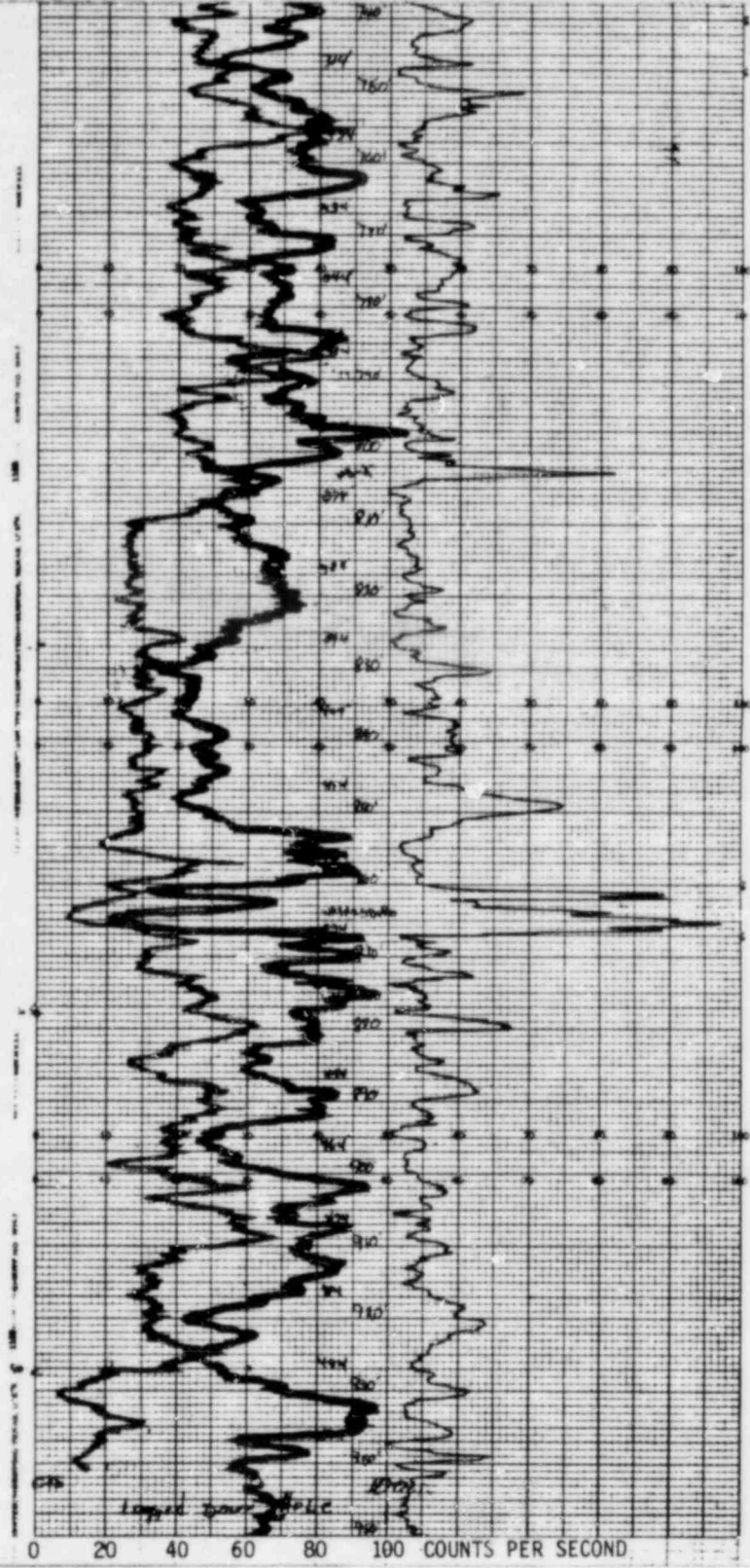
APPENDIX 4



Principal Decay Scheme  
 of the Americium Series

REFERENCESNumber

- 1 Title 10 Code of Federal Regulations Part 20  
"Protection Against Radiation"
- 2 Draft, American National Standard:  
"Control of Radioactive Surface Contamination  
on Materials, Equipment, and Facilities to be  
Released for Uncontrolled Use. ANSI-N13.12  
American National Standards Institute, Inc.,  
August 1978.



19  
76

20  
77

Figure II

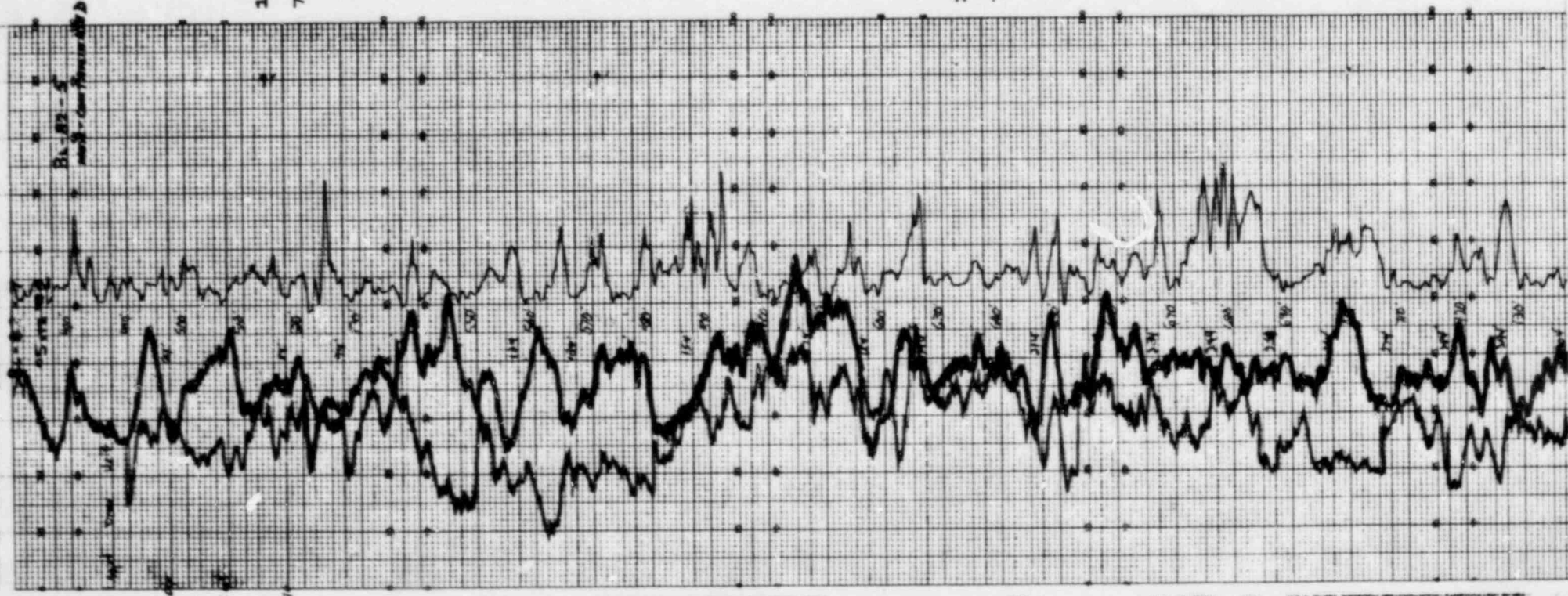
35

COMPARISON OF NATURAL GAMMA LOGS  
BLACKSVILLE III

- DRILL HOLE BL-82-5 (Non-Contaminated)
- - - DRILL HOLE BL-82-7 (Site #2 Contamination)

\*Note: Gamma Count Rates increase from Left to Right

DRILL MILE



Bl. 82 - S  
Bl. 82 - C

17  
74

18  
75