

INITIAL DRUM RETRIEVAL FINAL REPORT

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August 1978



EG&G Idaho, Inc.



IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1570

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FINAL REPORT

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by:

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PREPARED FOR
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IDAHO OPERATIONS OFFICE
UNDER CONTRACT NO. EY-76-C-07-1570

ABSTRACT

The Initial Drum Retrieval (IDR) program was initiated in FY-1974 to retrieve drums buried between 1968 and 1970. Retrieval operations began in July 1974, and concluded in June 1978. During this period, a total of 20,262 drums with a TRU waste volume of 4391 m³ and 1 m³ of contaminated soil were retrieved. Of this total, 18,029 drums plus the contaminated soil were repackaged and stored on 20-year interim storage pads. One drum containing ⁶⁰Co and ¹³⁷Cs sources was disposed into Pit 15. Evaporated salts, contained in 2232 drums, were disposed in the Transuranic Disposal Area.

The condition of the buried drums limited IDR retrieval operations to Pits 11 and 12. The retrieval operations in Pits 11 and 12 were conducted under an Air Support Weather Shield (ASWS) for weather protection. A Drott excavator was used for returning the drums. After retrieval techniques were optimized, an average of 750 drums per month were retrieved. The retrieval operations were completed without serious injury or spread of contamination into the environment.

The cost to retrieve 20,262 drums was \$1,614,820 or about \$80 per drum. The average cost per drum to retrieve during the last 2 years of operation was about \$60.

CONTENTS

ABSTRACT	ii
I. INTRODUCTION.	1
II. DISCUSSION.	2
1. OPERATIONS.	2
1.1 Working Environment.	2
1.2 Instrumentation and Sampling	2
1.3 Operating Procedures	3
2. ACCOMPLISHMENTS	6
2.1 Program Results.	6
2.2 Observation and Findings	8
2.3 Associated Studies	12
III. COST SUMMARY.	17
IV. CONCLUSIONS AND RECOMMENDATIONS	21

FIGURES

1. IDR retrieval operations.	5
2. IDR monthly drum retrieval summary.	9
3. IDR retrieval drum disposition summary.	11
4. IDR retrieval drum integrity summary.	14
5. Overview of Pit 6 probe area.	16
6. Overview of Pit 9 probe area.	17
7. IDR monthly cost summary.	21
8. Comparison cost per retrieved drum.	22

TABLES

1. Summary of Drum Retrieval for FY-1977	7
2. Summary of Drum Retrieval for FY-1978	8
3. Retrieval Drum Disposition Summary.	10
4. Drum Retrieval Comparisons by Fiscal Year	12
5. Drum Integrity Summary.	13
6. IDR Cost Tabulations for FY-1977 and FY-1978.	20

INITIAL DRUM RETRIEVAL
FINAL REPORT

I. INTRODUCTION

The Radioactive Waste Management Complex (RWMC) was established in 1954 as a solid radioactive waste disposal site. Between 1954 and 1970, about 65 000 m³ of transuranic (TRU) waste were buried below grade at the RWMC. From 1954 through 1968, boxes, cartons, drums, and other assorted waste items were randomly dumped into pits and trenches. In 1969 and 1970, drums containing TRU waste were orderly stacked in Pits 11 and 12.

The Initial Drum Retrieval (IDR) program was established in 1974 for the primary purpose of demonstrating the safe retrieval, repackaging, and placement into interim storage of drums containing TRU waste buried at the RWMC from 1968 through 1970. Initial retrieval operations began in the western half of Pit 11. In FY-1977 and 1978, retrieval operations were performed in the eastern half of Pits 11 and 12. Because of the nature of IDR operations, drum retrieval was limited to Pits 11 and 12, as discussed subsequently in this report. This report covers the accomplishments, observations, and findings of the IDR program--emphasizing efforts in FY-1977 and FY 1978. IDR program efforts conducted before FY-1977 are reported in TREE-1079, Initial Drum Retrieval Interim Report, July 1974 to September 1976, by D. H. Card and D. K. Wang, May 1977.

II. DISCUSSION

1. OPERATIONS

1.1 Working Environment

IDR retrieval operations during FY-1977 and FY-1978 were performed in the western half of Pits 11 and 12. An Air Support Weather Shield (ASWS-1), 52.5 x 360 x 12.2 m in size, was erected over the retrieval areas. The reinforced fabric structure provides all-weather protection for working personnel, retrieval equipment, and instrumentation.

The retrieval and repackaging area inside the ASWS was designated as a controlled access area. This area was enclosed by yellow and magenta radioactive tape with signs noting Health Physics (HP) access requirements. Under normal retrieval conditions, retrieval personnel wore a full set of anti-C equipment, including coveralls, shoe covers, and gloves. In addition, workers wore hard hats and safety shoes. They carried respirators in the advent of an airborne contamination release.

1.2 Instrumentation and Sampling

The instrumentation used in IDR operations for measuring contamination and radiation included alpha and beta-gamma portable surveying instruments, a portable gas-proportional counter, a Stabilized Assay Meter (SAM-II), Constant Air Monitors (CAMs), a nuclear accident dosimeter (NAD), and a radiation area monitor (RAM). Ruggedized probe faces were provided for the alpha survey meters for use in surveying soils and retrieved waste to avert damage to the probe. The portable gas proportional counter was used for counting smears, filters, and soil samples. Using this counter for soil samples merely provided an

indication of activity levels in the samples. The activity level values were verified by analytical chemistry analysis.

Analysis of long-lived alpha and beta-gamma emitters by the Radiation Measurement Laboratory at the Test Reactor Area (TRA) was performed for all air samples taken in and around the IDR work area. During the reporting period, analysis of these air samples did not indicate any atmospheric contamination from IDR operations.

The SAM-II was used to estimate the plutonium (Pu) content in retrieved drums by the detection of low energy gamma-rays characteristic of Pu decay. This instrument is a portable scintillation detector that uses a sodium-iodide crystal. The detector employs a two-channel analyzer that was calibrated to 300 g of Pu in a known matrix inside the waste container. The SAM-II was employed whenever retrieved drums had a surface radiation reading greater than 5 mr/h. The SAM-II is not reliable for Pu determination in retrieved drums for the following two reasons:

- (1) The matrix of Pu in a retrieved drum may not be the same matrix as was used for calibration of the SAM-II.
- (2) Gamma radiation from the retrieved drum or background radiation disguises the effort of the SAM-II to detect low-energy gamma rays from Pu due to compton scattering of the background gamma rays.

However, the use of the SAM-II has shown the need of developing alternative methods for determining Pu content in retrieved drums.

1.3 Operating Procedures

The working crew for IDR operations consisted of an HP technician, a project foreman, an equipment operator, a heavy equipment operator, and a laborer.

The first task in the sequence of drum retrieval was to remove, with a scraper or dozer, the soil overburden to within 45 cm of the buried waste.

The remainder of the soil overburden was removed with a Drott excavator which was also used to remove drums and soil from the pit until a working face was formed. (See Figure 1.) The drums were removed from the stack and rigged out of the pit. Subsequently, the drums were removed to an area for a contamination and radiation survey.

If the retrieved drums were breached or had external contamination, the drums were wrapped in plastic and placed in M-III bins (DOT 7A metal box). Drums leaking free liquid were placed over a drip pan containing absorbent materials. After all the liquid had been drained from the drum, the drum was wrapped in plastic and placed in an M-III bin.

Retrieved drums showing surface gamma radiation greater than 5 mr/h were surveyed with the SAM-II for Pu content. Drums which contained more than 100 g of Pu, as measured by SAM-II, were subjected to a more vigorous analysis. Drums that contained salts (745-XXX drums) with TRU activity levels less than 10 nCi/g were taken directly to the Transuranic Disposal Area (TDA). These drums were not placed in overpack containers. All other retrieved drums were placed in cargo containers. The cargo containers and M-III bins were transferred to the Transuranic Storage Area - Retrieved (TSA-R) for storage. The storage containers were transferred to the storage area on a 10-wheel flatbed truck.

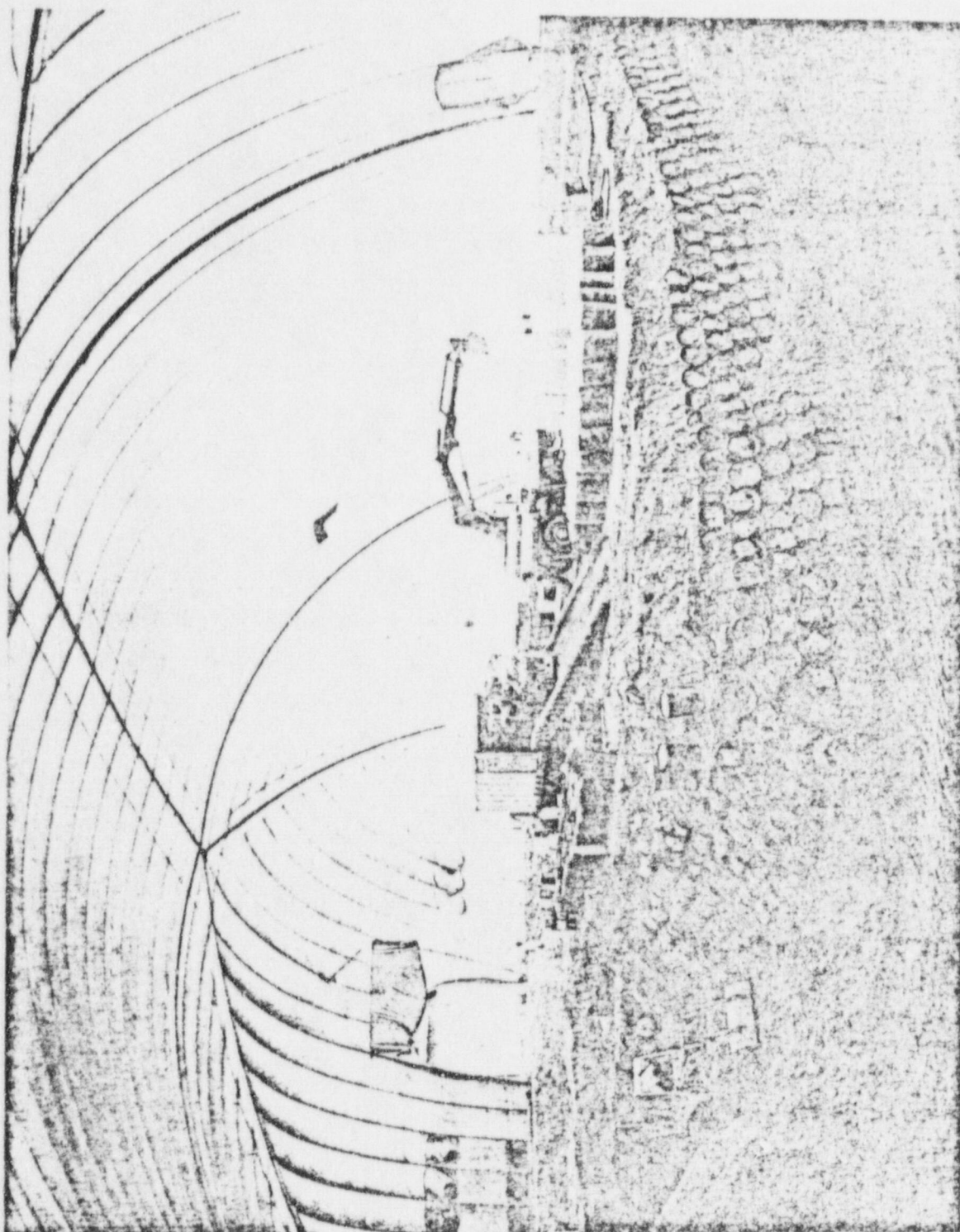


Fig. 1 IDR retrieval operations.

2. ACCOMPLISHMENTS

2.1 Program Results

During FY-1977 and FY-1978, 8919 drums were retrieved from Pit 11, and 6795 drums were retrieved from Pit 12. The total number of drums retrieved in the IDR program was 20,262 with a waste volume of 4397 m³. Only 1 m³ of contaminated soil was retrieved. Monthly summaries of drum retrievals in FY-1977 and 1978 are shown in Tables 1 and 2, respectively. Retrieval operations were completed in Pits 11 and 12 on June 20, 1977, and June 12, 1978, respectively. A total monthly summary of drum retrieval for the IDR project is shown in Figure 2.

During FY-1977, a total of 9141 drums were repackaged and stored, or disposed. During FY-1978, 6690 drums were repackaged and stored, or disposed. One drum that contained ⁶⁰Co and ¹³⁷Cs sources was disposed into a beta-gamma disposal pit (Pit 15). During the entire program, a total of 20,262 drums were repackaged and stored, or disposed. The disposition of the retrieved drums is given in Table 3 and shown graphically on Figure 3 for the entire program.

During the first 2-1/4 years of drum retrieval, an average of 168 drums were retrieved per month. During the last 2 years of retrieval, an average of 748 drums per month were retrieved.

This substantial monthly drum retrieval average increase resulted from:

- (1) Use of cargo containers in lieu of 314-litre overpack containers for good integrity drums
- (2) Standardization of retrieval procedures and techniques
- (3) Learning curve increase of the retrieval personnel

TABLE 1

SUMMARY OF DRUM RETRIEVAL FOR FY-1977

<u>Month</u>	<u>Number of Retrieved Drums</u>
Oct ^(a)	158
Nov	1423
Dec ^(b)	278
Jan	1046
Feb ^(c)	668
Mar	1996
Apr ^(d)	1044
May	1519
Jun ^(e)	787
Jul ^{(f), (g)}	0
Aug ^{(f), (g)}	0
Sep ^(f)	0
TOTAL/FY	8919
Average/month	743

- (a) Lost three working weeks due to strike.
(b) Spent 3 weeks installing new cargo doors on airlock.
(c) Seven working days lost because of malfunction of heating system in subzero weather.
(d) Five working days spent installing new safety electrical panel.
(e) Retrieval of Pit 11 completed on June 20, 1977.
(f) Relocation of ASWS over Pit 12.
(g) Test three working weeks in July and August due to breakdown of sheeps foot compactor.

(4) Less downtime of retrieval operations because of reduced problems with the retrieval equipment and the ASWS

(5) Use of the Drott excavator for retrieval operations.

TABLE 2
SUMMARY OF DRUM RETRIEVAL FOR FY-1978

<u>Month</u>	<u>Number of Retrieved Drums</u>
Oct(a)	0
Nov(b)	137
Dec	338
Jan	1293
Feb	927
Mar	1701
Apr(c)	88
May	1653
Jun(d)	<u>658</u>
TOTAL	6795
Average/Month	755

-
- (a) Relocated ASWS over Pit 12.
 - (b) Resumed retrieval operation on November 11 in Pit 12.
 - (c) Mounted drum labeled "Cyanimide - cyanide poisoning."
One month delay resulted while the drums' history and the
Detailed Operating Procedures (DOPs) for handling the drum
were completed.
 - (d) Retrieval of drums in Pit 12 was completed June 12.
-

The monthly retrieved averages for each fiscal year of operation are shown in Table 4.

2.2 Observations and Findings

During the entire program, 91.5% of the total drums (208-litre, 114-litre, and 745-XXXX evaporated salt drums) had good integrity. About 6.1% of the drums had external alpha contamination to 120,000 cpm. All of these drums were retrieved from Pit 11. None of the drums retrieved from Pit 12 had external contamination. Pit 12

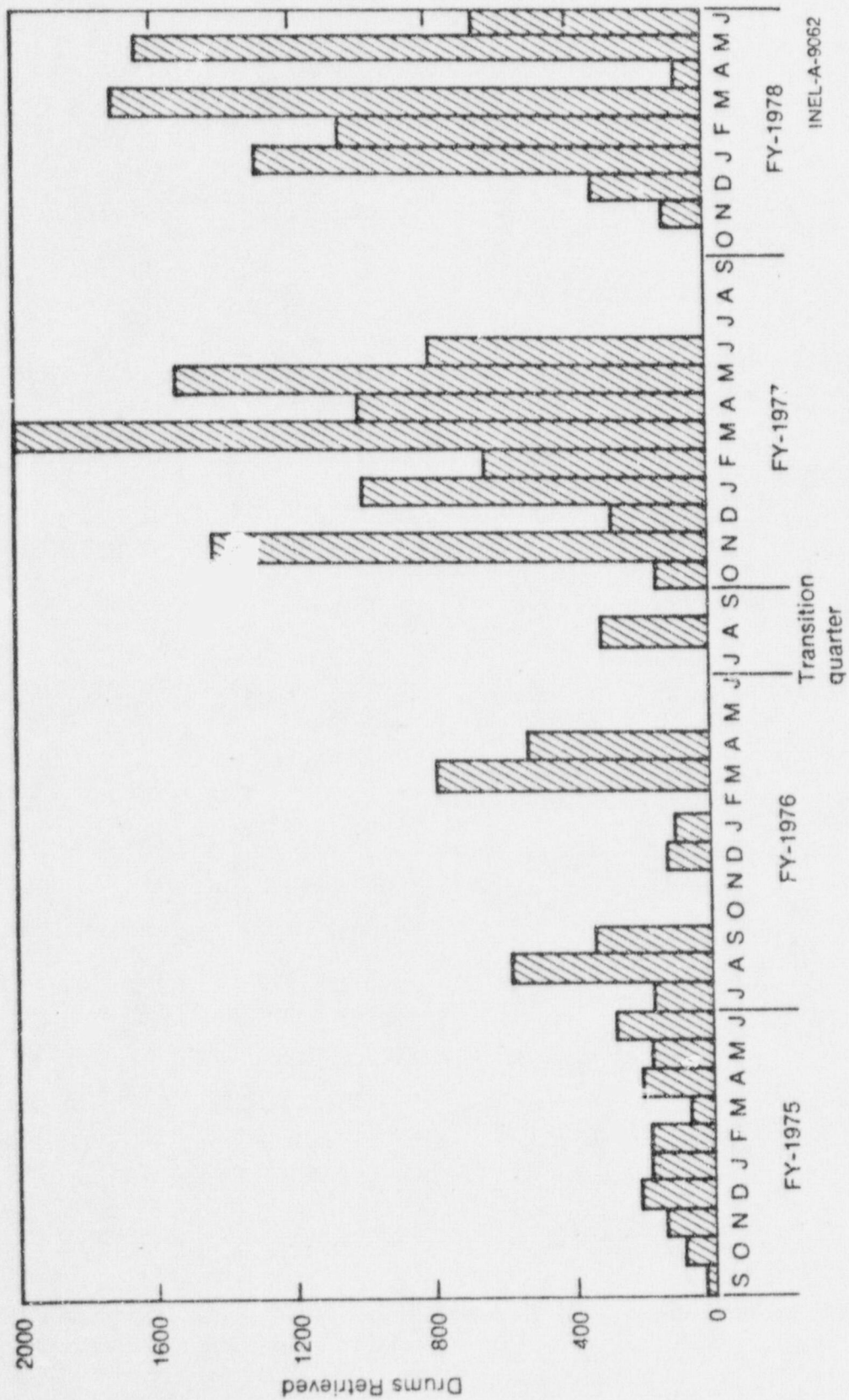


Fig. 2 IDR monthly drum retrieval summary.

TABLE 3

RETRIEVAL DRUM DISPOSITION SUMMARY

	<u>FY-1977</u>	<u>FY-1978</u>	<u>Total Program</u>
Transferred to TSA-R in cargo containers.	7,128	4,973	13,433
Transferred to TSA-R in M-III bins.	1,606	199	2,351
745-XXXX evaporated salt drums disposed in the TDA.	407	1,517	2,232
Packaged in 314-litre containers and trans- ferred to TSA-1 and TSA-2.	0	0	2,235
Disposed in Pit 15	0	1	1
Packaged in DOT 19A boxes	0	0	10
TOTAL	<u>9,141</u>	<u>6,690</u>	<u>20,262</u>

drums generally were in much better condition than Pit 11 drums, probably because Pit 12 drums were in the ground a shorter period of time.

Approximate 2.4% of the drums were breached (drums that had small holes in them). About one-third of these drums leaked free liquid. The liquid was usually free of contamination. However, alpha contamination levels to 40,000 cpm were found in some of the liquids. The drum integrity summary is given in Table 5 and shown graphically on Figure 4.

The radiation levels at contact with the drums were usually less than 10 mr/h. The highest radiation levels encountered at contact with drum was 120 mr/h.

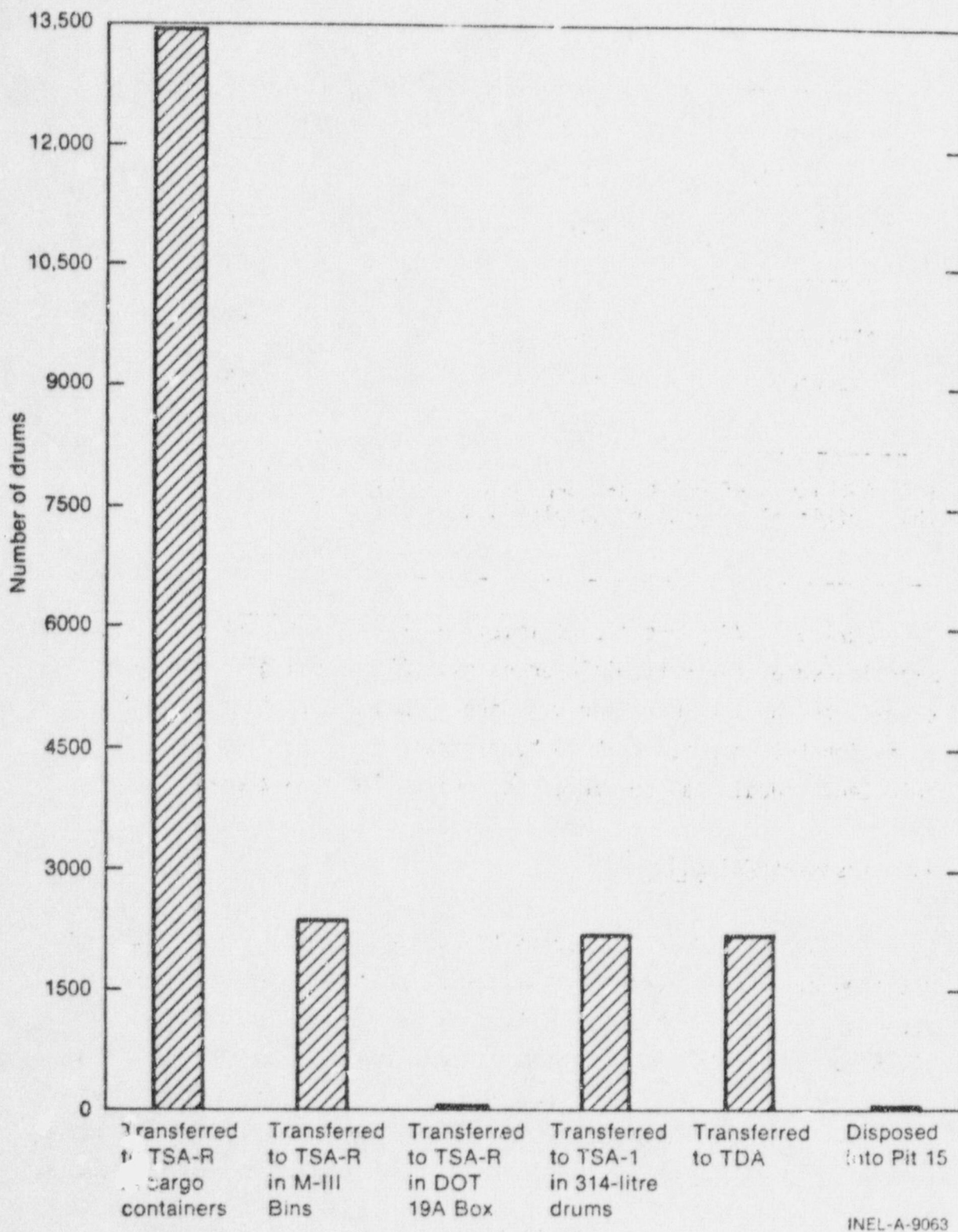


Fig. 3 IDR retrieval drum disposition summary.

TABLE 4
DRUM RETRIEVAL COMPARISONS BY FISCAL YEAR

<u>Fiscal Year</u>	<u>Retrieved Drums</u>	<u>Retrieved Drums Per Month</u>
FY-1975(a)	1540	154
FY-1976	2693	224
Transition Qtr	315	105
FY-1977	8919	743
FY-1978(b)	6795	755

- (a) Retrieval effort began September 23, 1974.
(b) Retrieval operations completed June 12, 1978.

During 3-1/2 years of retrieval operations, no serious injury was experienced by any retrieval personnel. Also, during retrieval operations, no contamination was spread into the environment. No significant increases in whole body burdens of radioisotopes were detected. Fecal analyses were less than 10^{-4} $\mu\text{Ci/sample}$.

2.3 Associated Studies

During FY-1977, the concrete blocks which supported the ASWS were replaced by ground anchors. These anchors were easier to properly position in the soil berm than the concrete blocks had been. The use of the ground anchors saved about 2 weeks during the movement of the ASWS from Pit 11 to Pit 12. Use of the ground anchors also provided better moisture exclusion from the retrieval site. Water occasionally leaked into the retrieval site between and under the concrete blocks; leakage did not occur with the ground anchors.

TABLE 5
DRUM INTEGRITY SUMMARY

<u>Integrity</u>	<u>Number of Drums</u>			<u>Percent of Total Drum Retrieval</u>		
	<u>FY-1977</u>	<u>FY-1978</u>	<u>Total Program</u>	<u>FY-1977</u>	<u>FY-1978</u>	<u>Total Program</u>
208-litre drums intact	7,171	4,870	15,964	80.4	71.7	78.8
208-litre drums with external contamination	1,002	0	1,229	11.2	0	6.1
Breached 708-litre drums	128	179	352	1.4	2.6	1.6
208-litre drums leaking free liquids	91	19	155	1.0	0.3	0.8
745-XXX evaporated salt drums	407	1,653	2,368	4.6	24.3	11.7
114-litre drums intact	120	74	194	1.4	1.1	1.0

Since 155 drums leaked liquid, the potential for other drums leaking liquid after they were placed in cargo containers was considered possible. Consequently, the cargo containers, floors, and the area extending 30 cm up the sidewalls were waterproofed with a sealant material called Peda-Guard II, as manufactured by Nedgard Corporation Dallas, Texas. Also, about 23 kg of absorbent material were spread on the floor of each cargo container. The sealant and absorbent material precludes the spreading of contaminated water from the cargo container if drums in the cargo container should leak.

During FY-1977, Pits 6, 9, and 10 were probed to determine if the drums in these pits could be retrieved under the IDR program. The results of the probes are as follows:

- (1) Pit 6: Probing in Pit 6 was along the south side of the pit. The drums, plywood boxes, and loose waste were inter-mixed. Drum exteriors were in fair condition. All drums

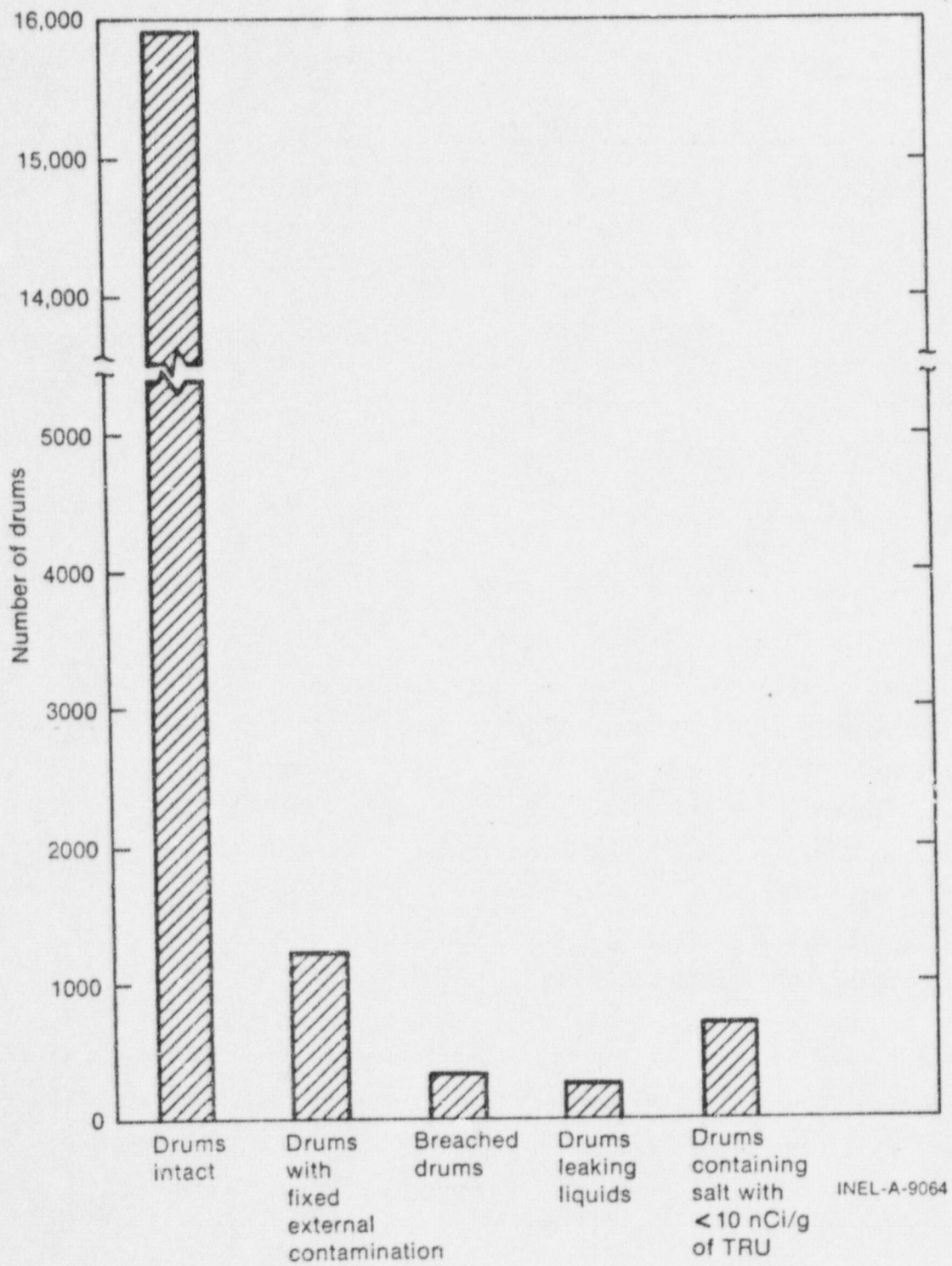


Fig. 4 IDR retrieval drum integrity summary.

and loose waste uncovered were found to have removable alpha contamination up to 1,000,000 cpm. The plywood boxes were in extremely poor condition. The levels of loose contamination encountered are not conducive to IDR type operations. Figure 5 shows the probe sites.

- (2) Pit 9: The waste in the southern portion of the pit appeared to be two-thirds drums and one-third plywood boxes. The drums were randomly dumped and 50% had obvious corrosion holes. The other half of the drums investigated were wrapped in poly bags. The contamination levels around the wrapped drums ranged from 1000 to 100,000 cpm alpha. The plywood on the box containers crumbled when touched. The boxes were apparently placed only one layer thick in this pit. Contamination levels from the loose waste of the boxes ranged up to 6000 cpm alpha. The average depth of soil overburden was 0.6 m. The northern portion appeared to be principally boxes intermixed with randomly dumped drums and assorted loose waste. The condition of the boxes and drums was the same as the southern portion of the pit. The loose waste consisted of piping, metal plates, tubing, plastics, etc. A glove box and a stainless steel vault were also located in this pit.

The contamination levels of the boxes in the northern portion of the pit ranged up to 50,000 cpm alpha. All drums uncovered showed loose alpha contamination up to 8,000 cpm. Figure 6 shows the probe locations in Pit 9. The condition of the intermixed waste in Pit 9 creates a high risk of contamination spread for IDR operations.

- (3) Pit 10: The waste in Pit 10 resembled the condition and type of waste in Pit 9. The drums showed visible signs of corrosion, and the boxes crumbled when disturbed. The random dumping and intermixing of the waste has resulted in loose alpha contamination levels which ranged up to 100,000 cpm.

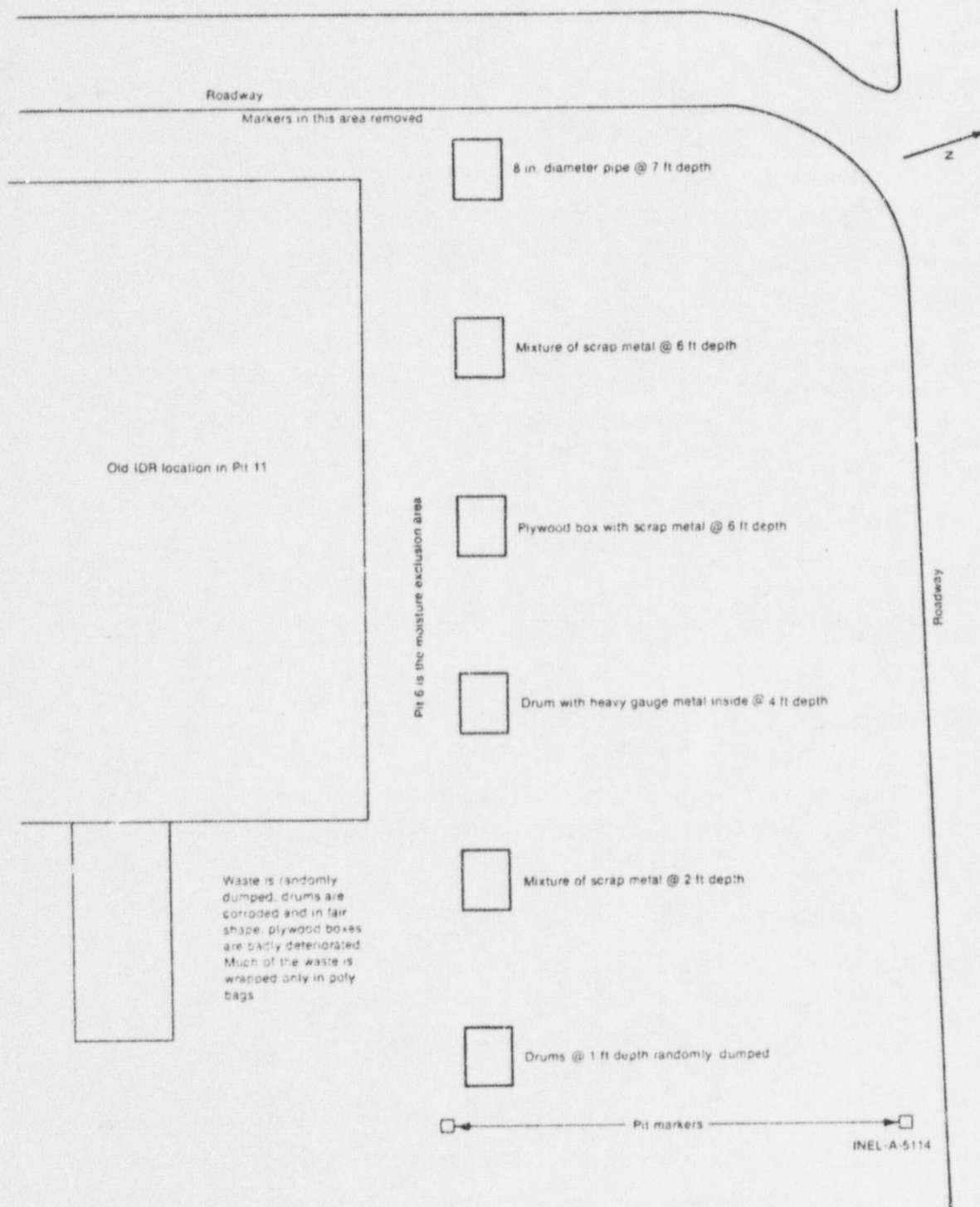


Fig. 3 Overview of Pit 6 probe area.

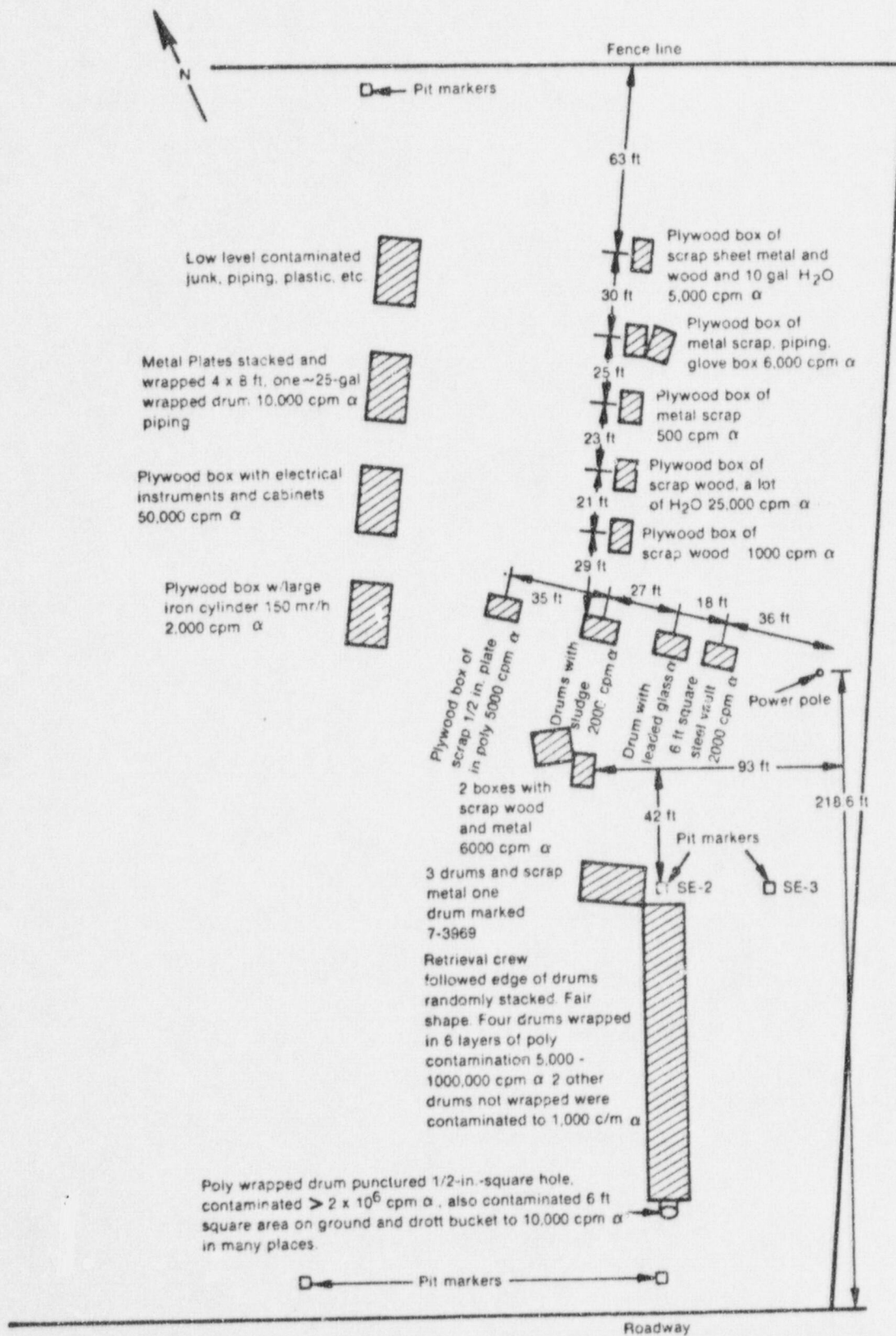


Fig. 6 Overview of Pit 9 probe area.

Because of the intermixing of drums and boxes that have completely deteriorated, thus releasing high levels of loose alpha contaminations, retrieval of the drums under the IDR program in these pits was not recommended.

III. COST SUMMARY

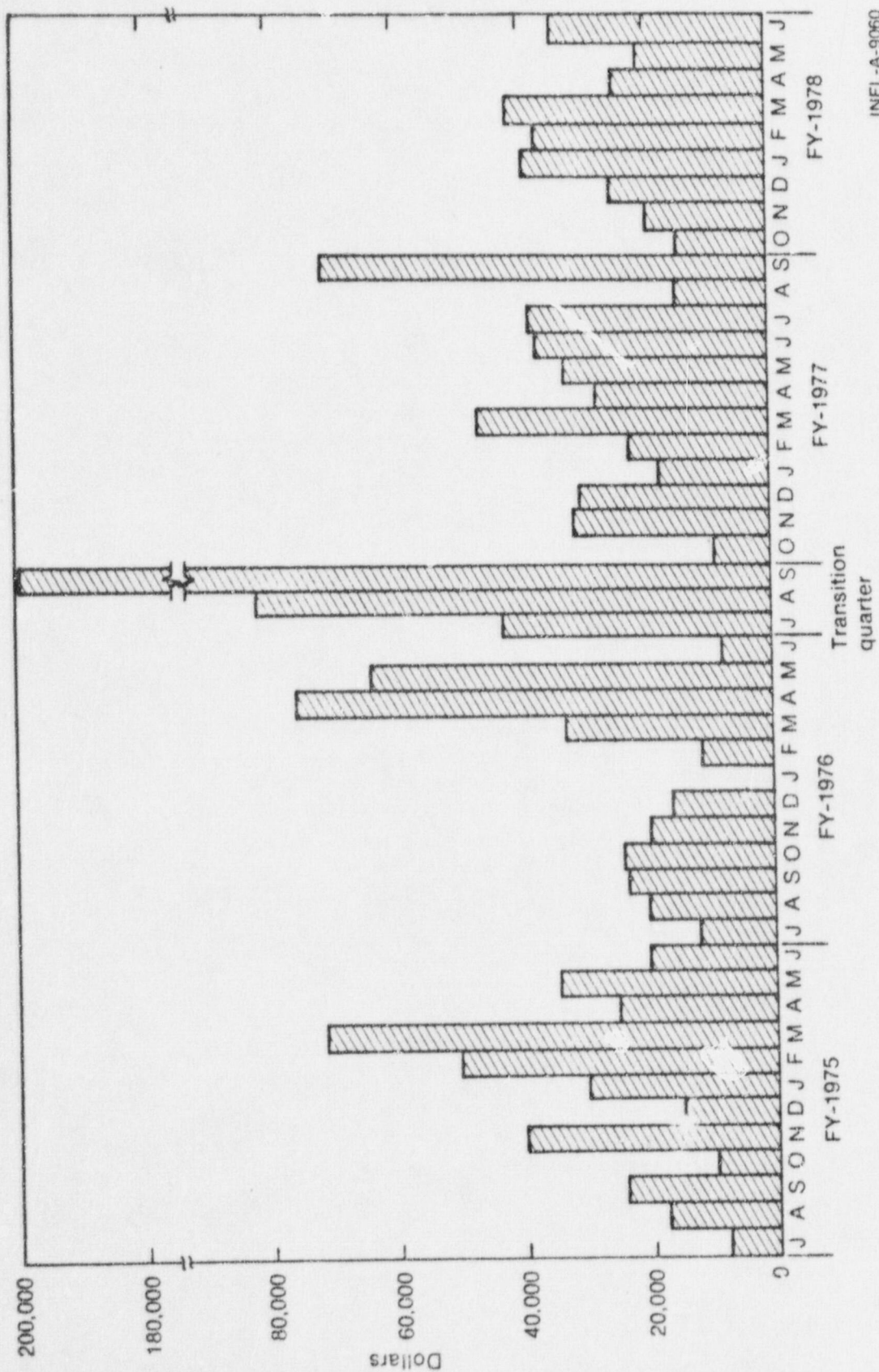
During FY-1977, a total of \$379,922 was spent to retrieve 8919 drums. During FY-1978, \$251,960 was spent to retrieve 6795 drums. A breakdown of these costs is given in Table 6. During the entire program, \$1,614,820 was spent to retrieve 20,262 drums. The monthly costs of the entire program are shown on Figure 7.

The cost to retrieve drums in FY-1975 was about \$700 a drum. During FY-1976, the cost was reduced to \$187 a drum. The cost for retrieving drums during the transition quarter, FY-1977, and FY-1978 was about \$60 a drum (Note: during the transition quarter and FY-1977, 200 cargo containers were bought at a cost of \$356,550. This cost was spread over the transition quarter and the two fiscal years to obtain the true cost per retrieved drum during these periods). The lower costs during the transition quarter and the two fiscal years resulted from the use of cargo containers for retrieved drums, and more efficient retrieval operations, as discussed in Section II.2.1. The cost per retrieved drum for the entire program was \$80. These comparisons are shown on Figure 8.

TABLE 6

IDR COST TABULATIONS FOR FY-1977 AND FY-1978

<u>Year</u>	<u>Month</u>	<u>Labor, etc.</u>	<u>Fuel</u>	<u>Materials</u>	<u>Monthly Total</u>
FY-1977	Oct	\$ 7,482	\$ 684	\$ 1,085	\$ 9,249
	Nov	15,687	0	15,463	31,150
	Dec	18,802	3,156	8,047	30,005
	Jan	14,919	1,262	1,327	17,508
	Feb	13,492	5,598	3,238	22,328
	Mar	18,206	2,404	26,241	46,851
	Apr	22,462	1,128	3,715	27,305
	May	16,488	413	16,512	33,413
	Jun	10,653	283	26,973	37,909
	Jul	24,139	0	13,862	38,001
	Aug	10,998	1,225	1,995	14,218
	Sep	20,510	19	51,456	71,985
TOTAL		\$175,036	\$16,172	\$188,714	\$ 379,922
FY-1978	Oct	13,463	0	1,189	14,652
	Nov	17,738	0	1,503	19,241
	Dec	20,340	18	3,921	24,279
	Jan	22,381	10,049	5,457	37,887
	Feb	21,781	3,707	9,159	34,647
	Mar	34,156	2,729	4,667	41,557
	Apr	11,172	961	12,506	24,639
	May	16,714	0	3,909	20,623
	Jun	28,275	0	6,160	34,435
TOTAL		\$189,425	\$11,064	\$ 48,471	\$ 251,960
TOTAL PROGRAM		\$703,588	\$83,848	\$824,984	\$1,614,820



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Fig. 7 IDR monthly cost summary.

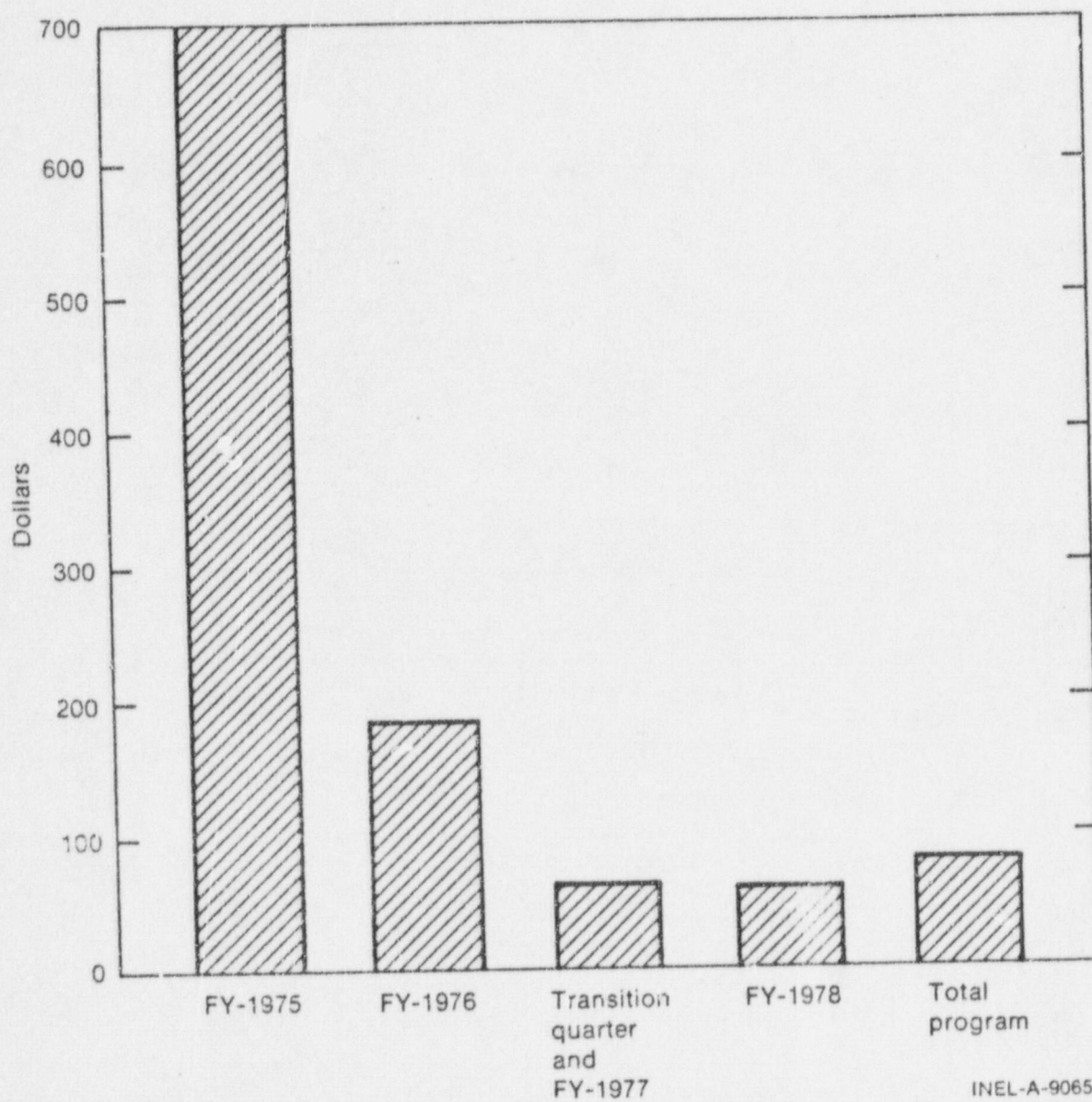


Fig. 8 Comparison cost per retrieved drum.

IV. CONCLUSIONS AND RECOMMENDATIONS

A total of 20,262 drums were retrieved safely without the spread of contamination into the environment. These drums were orderly stacked in Pits 11 and 12. Of the drums that have been buried below grade for an average of 8 years, deterioration is minimal. Consequently any retrieval operations--where drums have been orderly stacked and in the ground for less than 10 years--can be performed in a similar manner as that of the IDR program. The retrieval cost of such a program would be about \$60 per drum. However, the TRU waste drums still buried at the RWMC have been randomly dumped and intermixed with boxes and cartons. Therefore, future drum retrieval operations at the RWMC without additional environmental protection is not recommended.

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