#2569

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ORNL
CENTRAL FILES NUMBER

ORNL/CF-85/435

DATE: September 25, 1985

SUBJECT: RADIOACTIVE LIQUID AND GASEOUS WASTE DISPOSAL OPERATIONS AND EFFLUENT MONITORING REPORT FOR THE MONTH OF JULY 1985

TO: Distribution

FROM: C. B. Scott

Sponsor: J. H. Swanks

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SUMMARY

A total of 104 mCi of ^{90}Sr was discharged to White Oak Lake from ORNL sources; drainage from the burial grounds, contaminated floodplains, and the dormant pit disposal area accounted for 80% of this total. The Environmental and Occupational Safety Division measured a 100-mCi release of ^{90}Sr at the White Oak Dam sample station during the period. The activity emitted with the gaseous wastes from the ORNL stacks remained low. The bulk of this contamination was identified as short-lived mixed fission products; the total ^{131}I release was less than 10 mCi.

RADIOACTIVE EFFLUENTS

LIQUID WASTE

Release to Clinch River

The resultant dose to the body of an individual drinking water at the confluence of White Oak Creek and the Clinch River is shown in Fig. 1. This calculation is based on measurements of radioactivity at this location, and it represents the maximum possible dose that a member of the general public could receive from the ingestion of water released from the ORNL reservation.

The calculated dose resulting from the ingestion of Clinch River water downstream from the White Oak Creek confluence (Fig. 2) is based on the measurement of radioactivity released from White Oak Dam, and it assumes that complete mixing with the river water has occurred.

For all dose calculations based on the ingestion of water, an individual was assumed to drink 2.2 liters per day for the full month covered by this report. The dose calculations are based on assumptions given in ICRP 26/30 and using EPA weighting factors.

A total of 100 mCi of ^{90}Sr was released from White Oak Lake during the period. The ^{3}H released over the dam amounted to 130 Ci, and the TRU assay was 0.4 mCi at this station. The mean weekly discharges of ^{90}Sr, ^{3}H, TRU, and gross beta activities are shown in Figs. 3, 4, 5, and 6.

White Oak Creek Monitoring

The strontium and gross beta activity measurements made at the sampling stations in the tributaries to White Oak Lake are listed in Table 1. A monthly comparison of the strontium released into White Oak Lake is shown in Fig. 7. The total flows for White Oak Creek and Melton Branch, as measured at Stations 3 and 4, were 83.3×10^4 and 6.4×10^4 m^3, respectively. Fig. 8 shows the stream flow (Station 3 plus Station 4) and radioactivity releases from Burial Grounds 4 and 5 for recent months.

The White Oak Creek and Melton Branch watersheds discharged a total of 103 mCi of ^{90}Sr into White Oak Lake.

The Process Waste Treatment Plant and the 190 pond system released 0.12 and 0.21 mCi of ^{90}Sr into White Oak Creek during the period. A total of 6.5 mCi of ^{90}Sr was released from the sanitary waste system.

The following tabulation lists the measured amounts of ^{90}Sr discharged into the White Oak Creek and Melton Branch watersheds and the discharge into White Oak Lake from the LLW pit disposal area. Contributions from Burial Grounds 1, 3, and 4 (White Oak Creek) and Burial Ground 5 (Melton Branch) are calculated as the differences between the sums of the listed branch streams and the measurements at Stations 3 and 4 (see Fig. 9).

	^{90}Sr Discharge (mCi)	
	By Measurement	By Difference
WHITE OAK CREEK		
Flume	10.0	
190 Ponds	0.21	
Process Waste Treatment Plant	0.12	
Sewage Treatment Plant	6.5	
	16.83	
7500 Sampling Station	86.1[a]	
Burial Grounds 1 and 3 and Floodplains		69.3
Station 3	93.5	
Burial Ground 4		7.4
MELTON BRANCH		
7900 Area (HFIR and TRU)	0.29	
7500 Area (NSPP and MSRE)	3.70	
	3.99	
Station 4	9.6	
Burial Ground 5		5.6
LIQUID LLW PIT DISPOSAL AREA		
East Weir	<0.01	
West Weir	0.73	
	0.73	
Total ^{90}Sr to White Oak Lake (Stations 3 and 4 plus Ground Disposal Area)	103.8	
Total ^{90}Sr from Burial Grounds, Ground Disposal Area, and Floodplains		83.0
Percent ^{90}Sr from Burial Grounds, Ground Disposal Area, and Floodplains		80.0

[a]The flow at this station was adjusted on the basis of the other watershed measurements.

PROCESS WASTE

A total of 2.32×10^4 m^3 of process waste was treated by ion exchange. Of this amount, 2.24×10^4 m^3 were released to White Oak Creek; the remainder was used for process operations such as backwashing of filters.

The strontium activity released from the process waste system to White Oak Creek, compared to previous months, is shown in Fig. 10; the waste volume processed, compared to previous months, is shown in Fig. 11. The main contributors to the system are listed in Table 2. A total of 38 ion exchange column runs was made. The following is a summary of the column operation experienced:

	Maximum	Minimum	Average
Run time (h)	43.0	27.5	34.5
Bed Volume (1 BV = 1.3 m^3)	581	366	478

LIQUID LOW-LEVEL WASTE

Both evaporator systems operated normally during the month. The average boil-down rate was 0.24 m^3/h.

A summary of storage operations is given below:

	m^3
Volume Transferred to Service Tanks W-21 or W-22	339.3
Volume of LLW Feed Transferred to Evaporators	347.0
Volume of Evaporator Concentrate Transferred to W-23	41.4
Service Tank Inventory:	
W-21, Beginning of Month	64.4
W-21, End of Month	82.9
W-22, Beginning of Month	107.5
W-22, End of Month	81.3
W-23, Beginning of Month	94.5
W-23, End of Month	135.9

	m^3
South Tank Farm Inventory:	
Beginning of Month	261.0
End of Month	261.0
Melton Valley Waste Storage Facility Inventory:	
Total Volume at Beginning of Month	1095.0
Total Volume at End of Month	1095.0

NOTE: Liquid low-level waste is pumped from the area collection tanks into W-21 and W-22, which act as feed tanks for the evaporators. Evaporator concentrate is stored in W-23 prior to transfer to Melton Valley Storage Tanks.

A list of major contributors of low-level waste is given below. Figure 12 compares the volumes of LLW generated each month.

	m^3
Transuranium Processing Area	8.6
Building 3019	18.9
Building 3525	24.0
Radioisotopes Processing Area	54.3
ORR and BSR	16.6
High Flux Isotope Reactor	32.7
Fission Products Development Laboratory	28.9[a]
4500 Complex	1.7
Building 3544	100.9

GASEOUS WASTE

The ORNL stacks discharged approximately 9.9 mCi of gaseous ^{131}I this month. The total amount of active particulates released during the period was 224 μCi. Inert gases released from the 3039 and 7911 Stacks averaged less than 4.5% and 0.6% respectively, of the calculated maximum permissible operating levels for these stacks. Individual stack releases are listed in Table 3; the total releases are compared on a monthly basis in Fig. 13.

Table 1. Activity Released to White Oak Lake

Description	Monitoring Station Number[a]	Total Sr (Ci)	Gross Beta (Ci)[b]
Discharge from Bethel Valley Operations and Burial Ground 4	3	0.094	
Discharge from Melton Valley Operations and Burial Ground 5	4	0.010	
Discharge from Liquid LLW Pits and Trenches	East Weir	<0.001	
Discharge from Liquid LLW Pits and Burial Ground 6	West Weir	0.001	
Total Discharge from All Sources		0.105	
White Oak Dam to Clinch River (EOS Measurements)		0.100	0.320

[a]Refers to Fig. 9.

[b]Approximation based on an estimated average counting efficiency for a mixture of radionuclides normally present in White Oak Creek discharges to the Clinch River. The method of analysis used in determining gross beta activity is not sensitive to energies below that of ^{90}Sr.

Table 2. Process-Waste Discharges

	^{90}Sr Bq/L	Ci	% of Total	10^3 m^3	% of Total
Radioisotopes Processing Area (MH 234)	1700	0.328	50.7	7.15	31.8
Radioisotopes Processing Area (MH 114 minus MH 112)	1000	0.012[a]	1.9	0.50	2.2
Reactor Operations (MH 112)	15	0.002	0.3	4.33[b]	19.2
Buildings 3503 and 3508 (MH 229)	3.9	<0.001	---	1.88	8.4
Buildings 3025 and 3026 (MH 149)	3.4	<0.001	---	1.30	5.8
Building 3019 (MH 25)	5000	0.017	2.6	0.13	0.6
Waste Evaporator, Bldg. 2531 (MH 243)	480	0.009	1.4	0.70	3.1
Building 3525 (MH 235)	2.0	<0.001	---	0.55	2.4
Building 2026 (MH 240)	34	<0.001	---	1.05	4.7
Tank Farm Drainage	2100	0.279	43.1	4.92	21.8

[a]The activity entered the process-waste system with inleakage of contaminated groundwater under Building 3047. The value given was obtained by difference in measurements in manholes 112 and 114.

[b]Flow estimated from previous data.

Table 3. Activity Released in Gaseous Wastes

Description	Activity[a] (mCi)	Filterable Particulate Activity[b] (μCi)	Inert Gases (Ci)
HRLAL - Stack No. 2026	<0.001	<1	
Central Radioactive Gas Disposal Facilities - Stack No. 3039	≤1.3	195	5078
Radiochemical-Processing Pilot Plant Stack No. 3020	<0.001	<1	
MSRE - Stack No. 7512	<0.001	<1	
HFIR and TRU - Stack No. 7911	≤8.6	28	4377
Activity in Gases Released at X-10 Site	≤9.9	224	

[a]Activity primarily ^{131}I except as noted. Does not include noble gases.

[b]These values were obtained by allowing the filter papers used in the samples to decay for a period of four days and then measuring the activity.

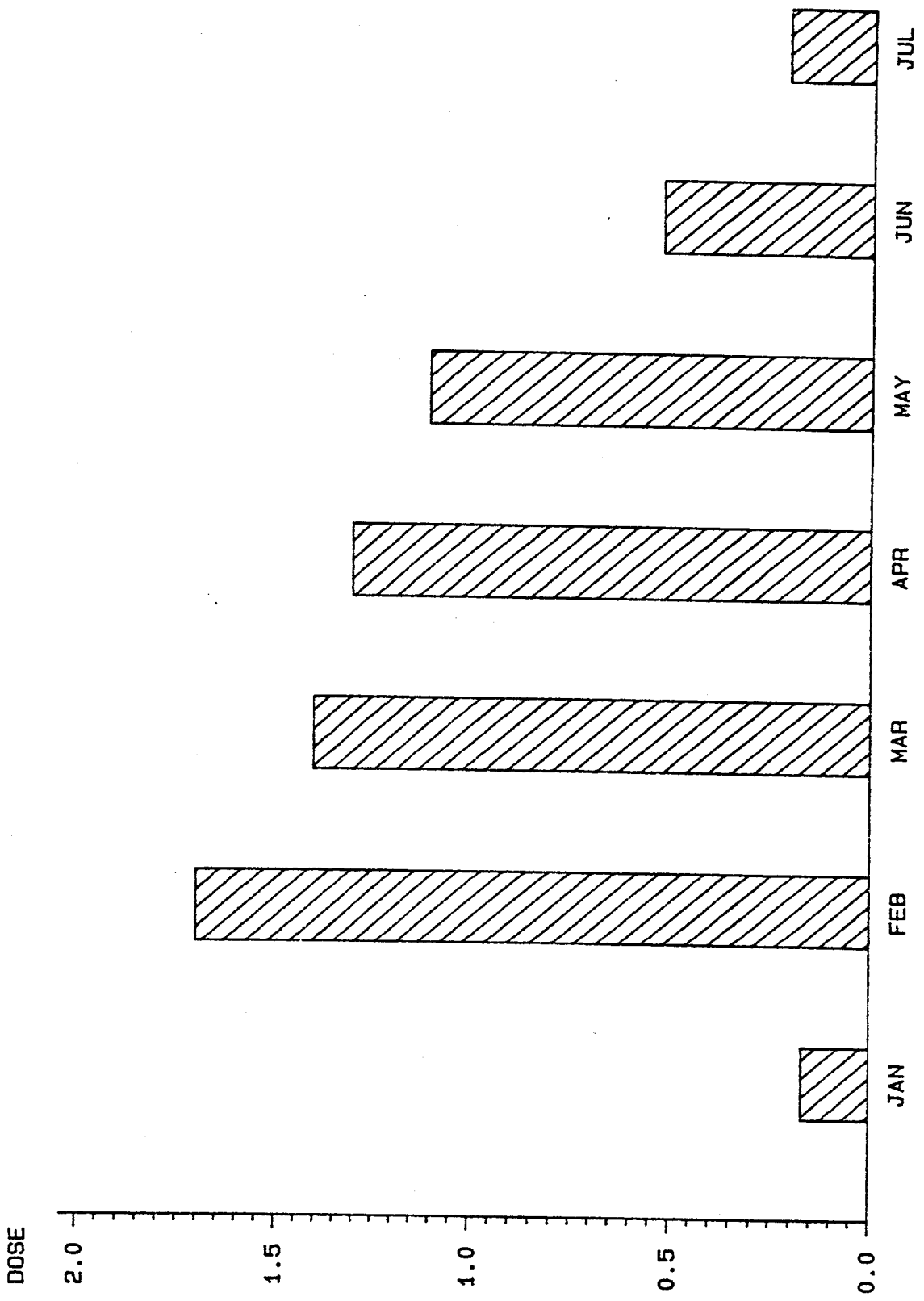

Fig. 1. Body Dose (mrem) Resulting From the Ingestion of Water at the Confluence of White Oak Creek and Clinch River

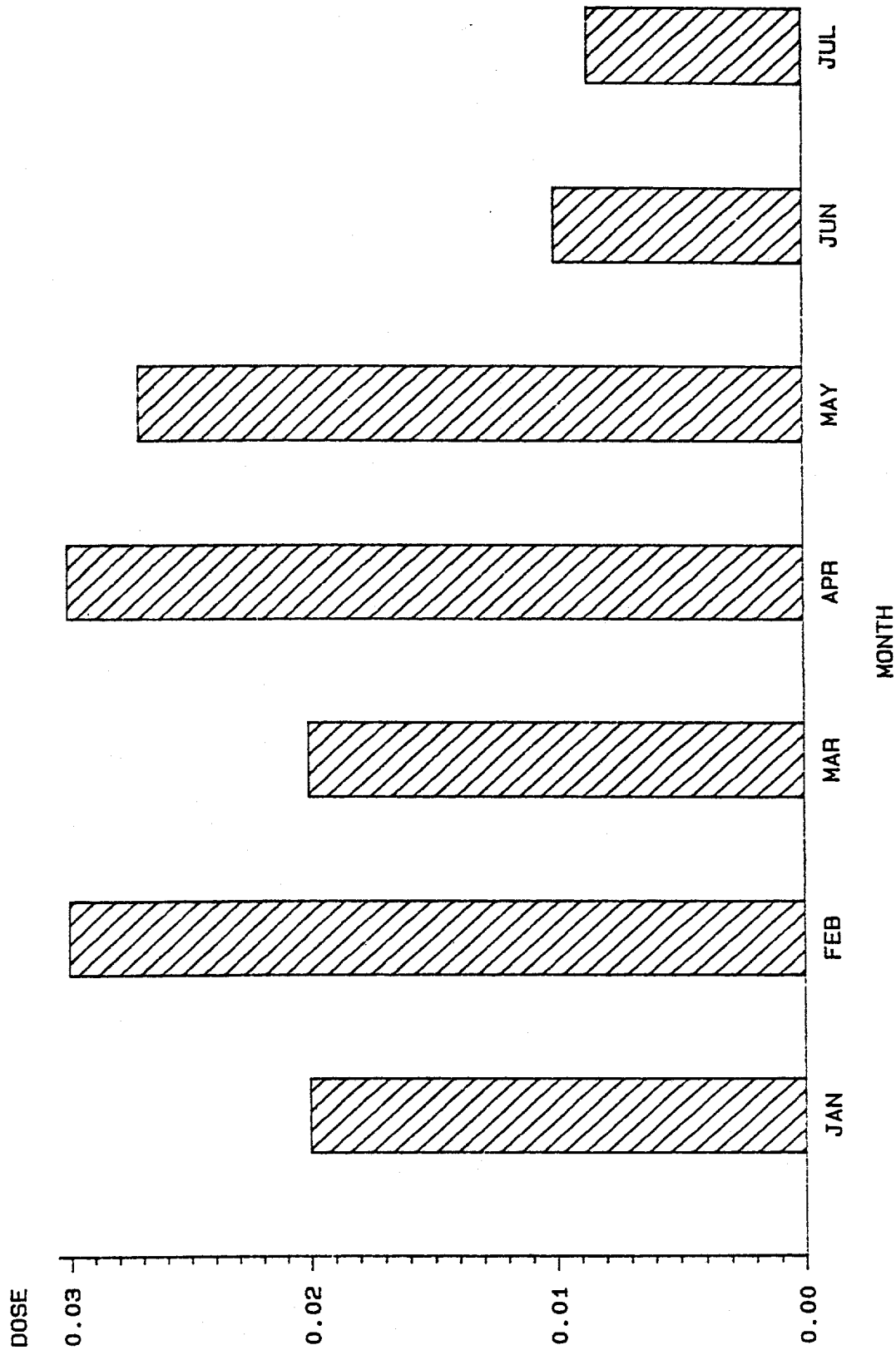

Fig. 2. Calculated Body Dose (mrem) Resulting From the Ingestion of Clinch River Water Below the Discharge of White Oak Dam

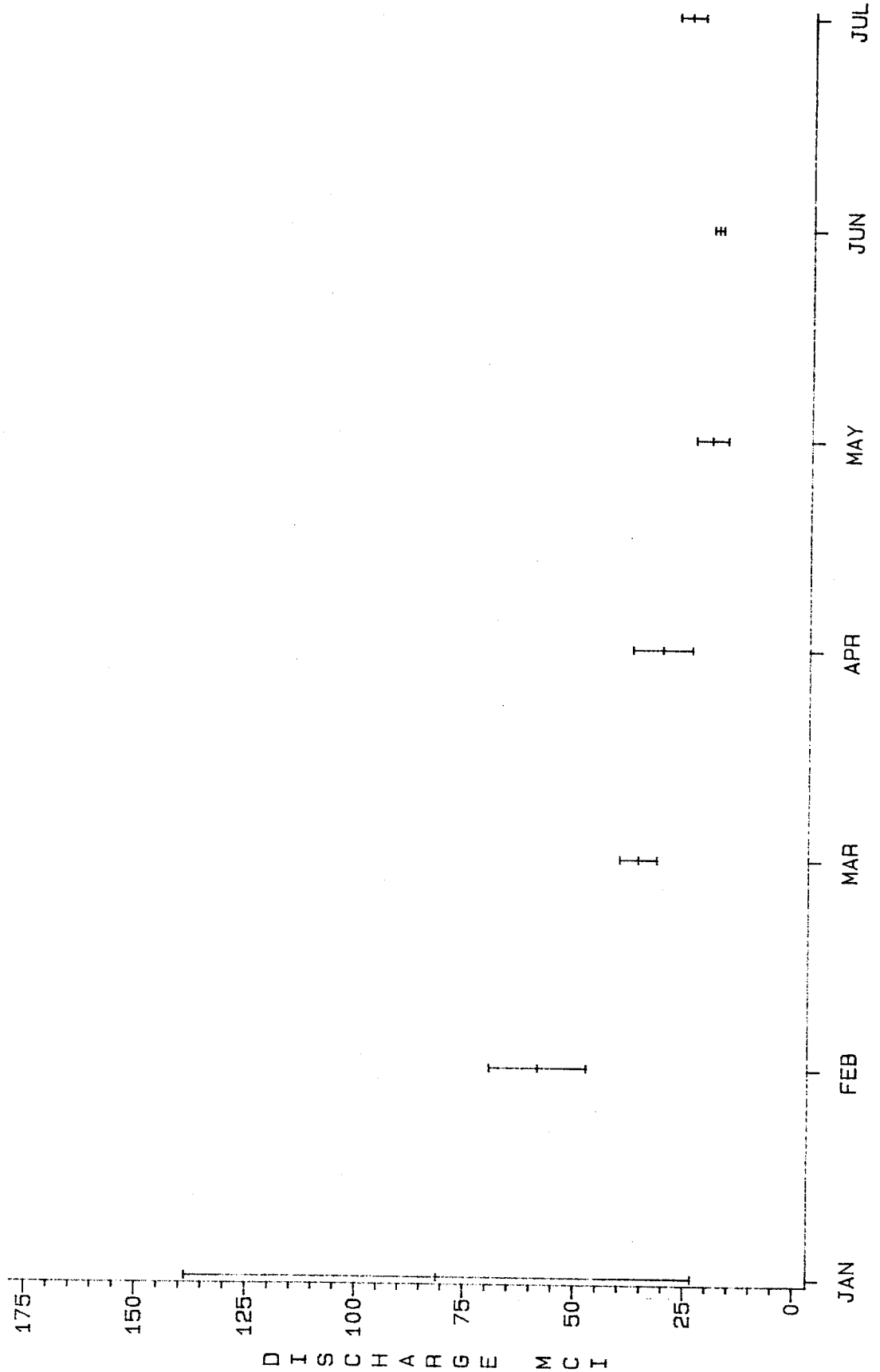

Fig. 3. Mean Weekly Discharges and 95% Confidence Intervals From White Oak Dam During 1985 - SR-90

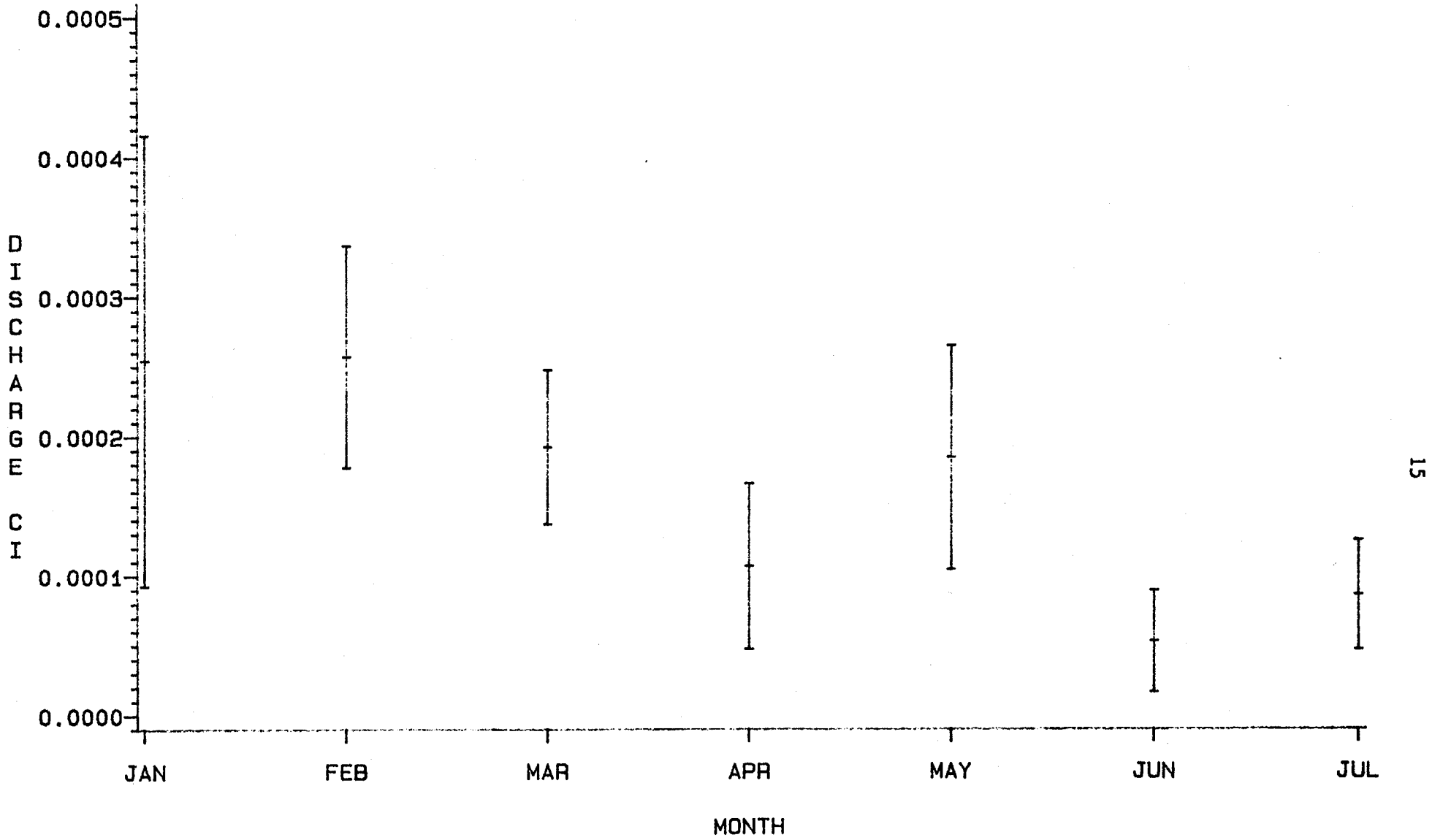

Fig. 4. Mean Weekly Discharges and 95% Confidence Intervals From White Oak Dam During 1985 - TRU

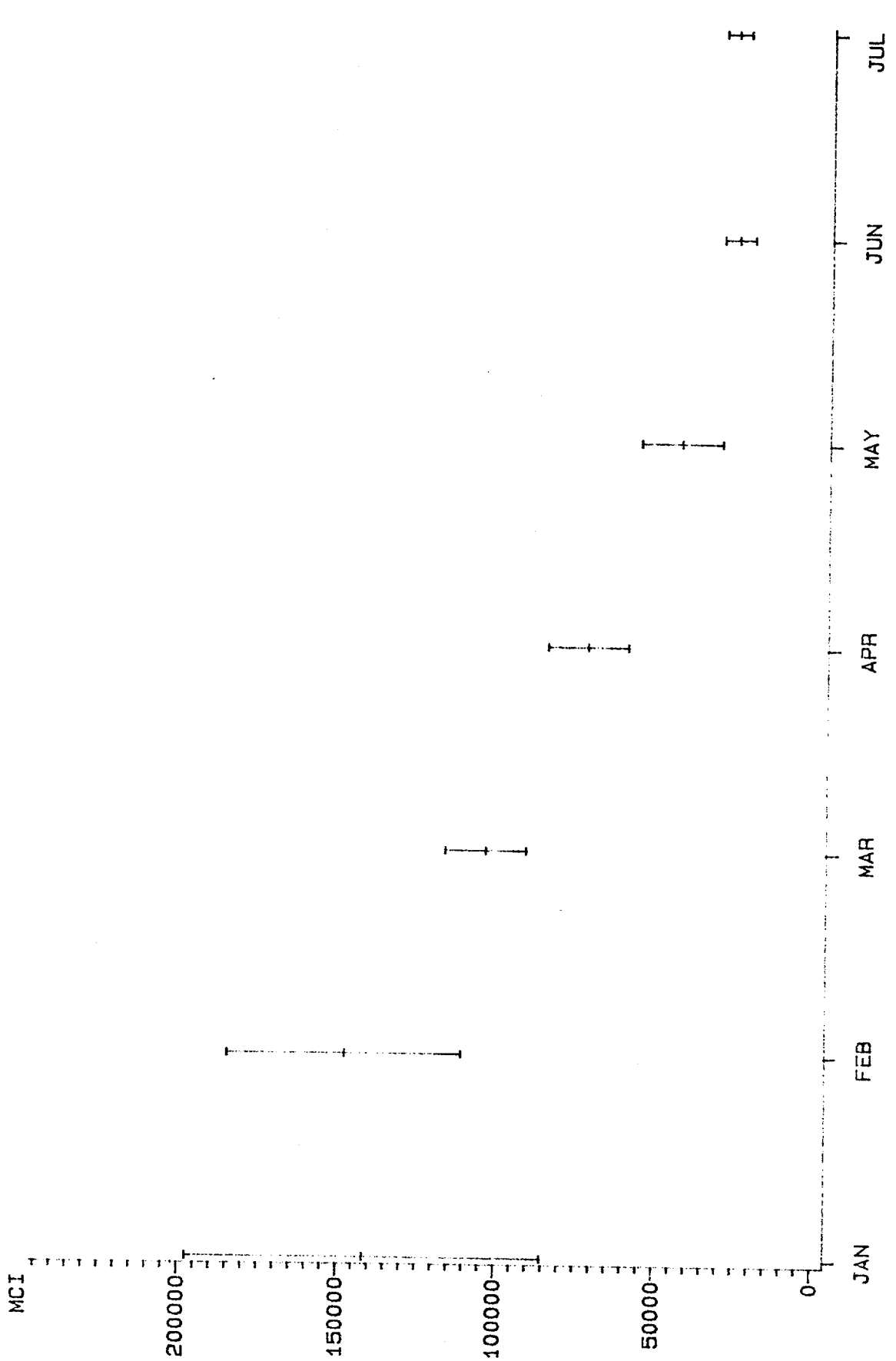

Fig. 5. Mean Weekly Discharges and 95% Confidence Intervals From White Oak Dam During 1985 - H-3

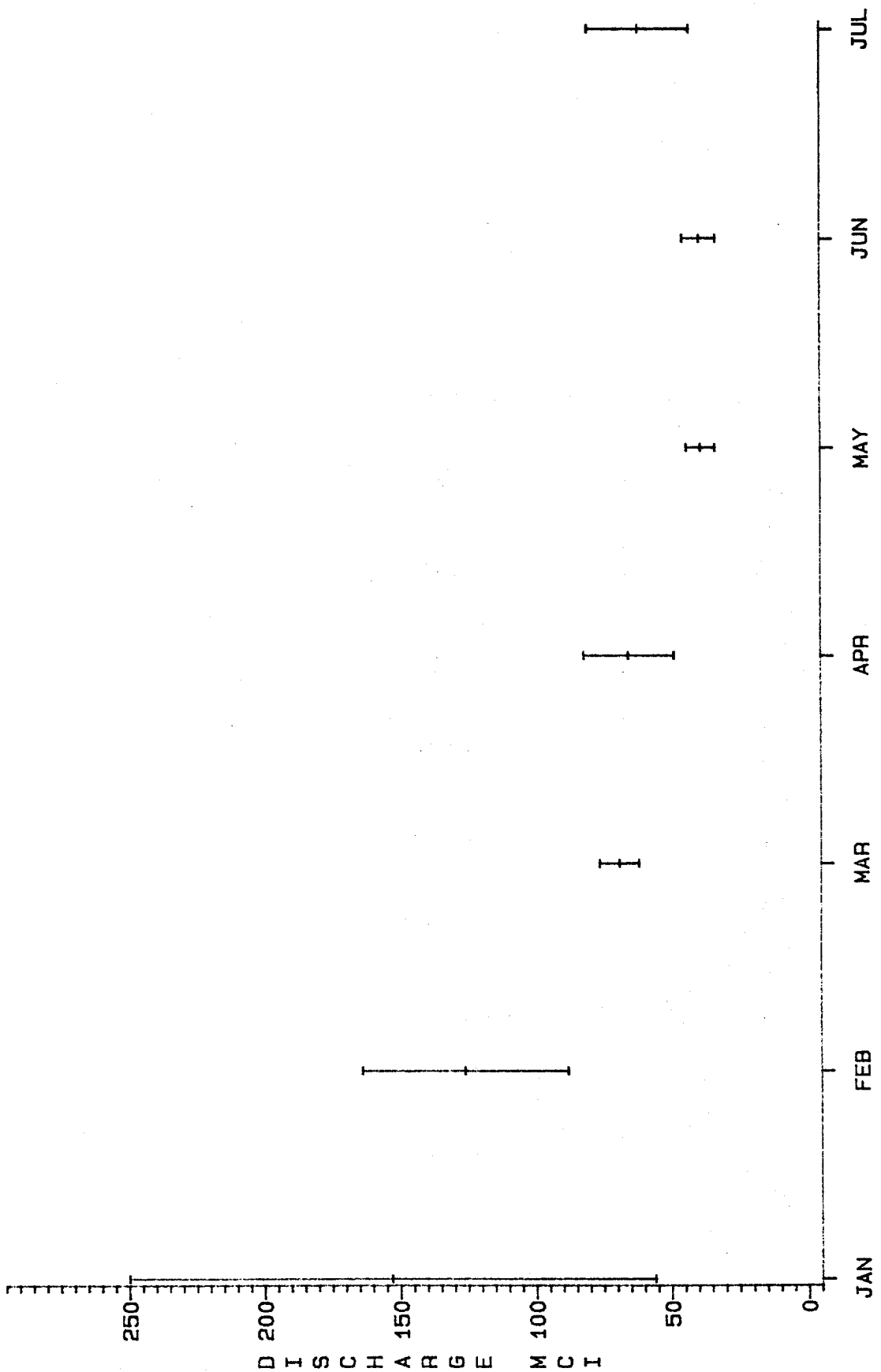

Fig. 6. Mean Weekly Discharges and 95% Confidence Intervals From White Oak Dame During 1985 - Gross Beta

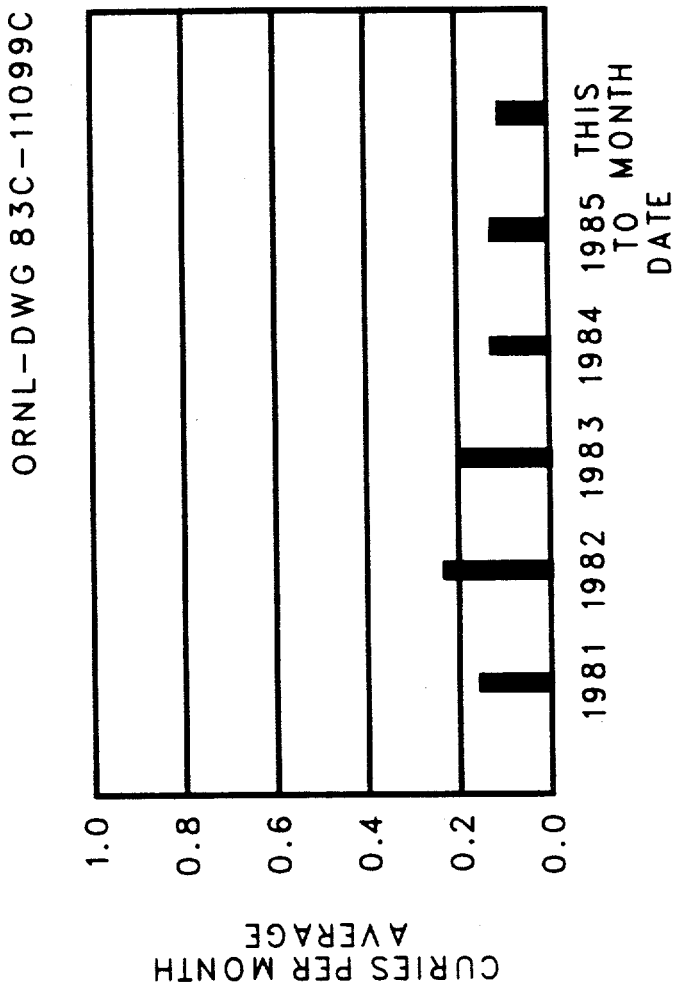

Fig. 7. ^{90}Sr Released to White Oak Lake as Measured at Sampling Stations 3 and 4 (See Fig. 9).

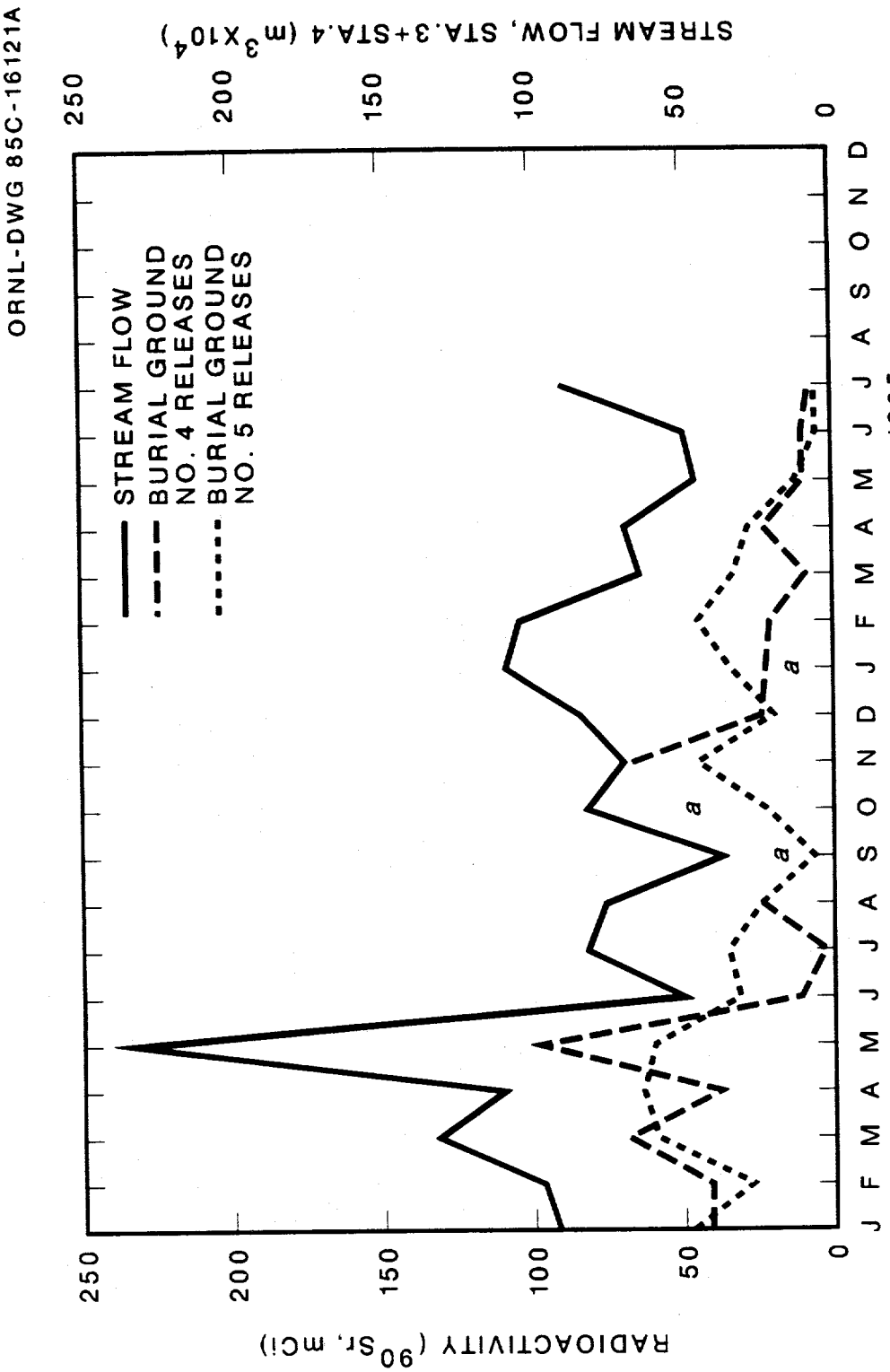

Fig. 8. Stream Flow and Radioactivity Released to White Oak Creek by Burial Grounds 4 and 5.

[a]Not reported because of uncertainties with flow data & possible cross-contamination of sample.

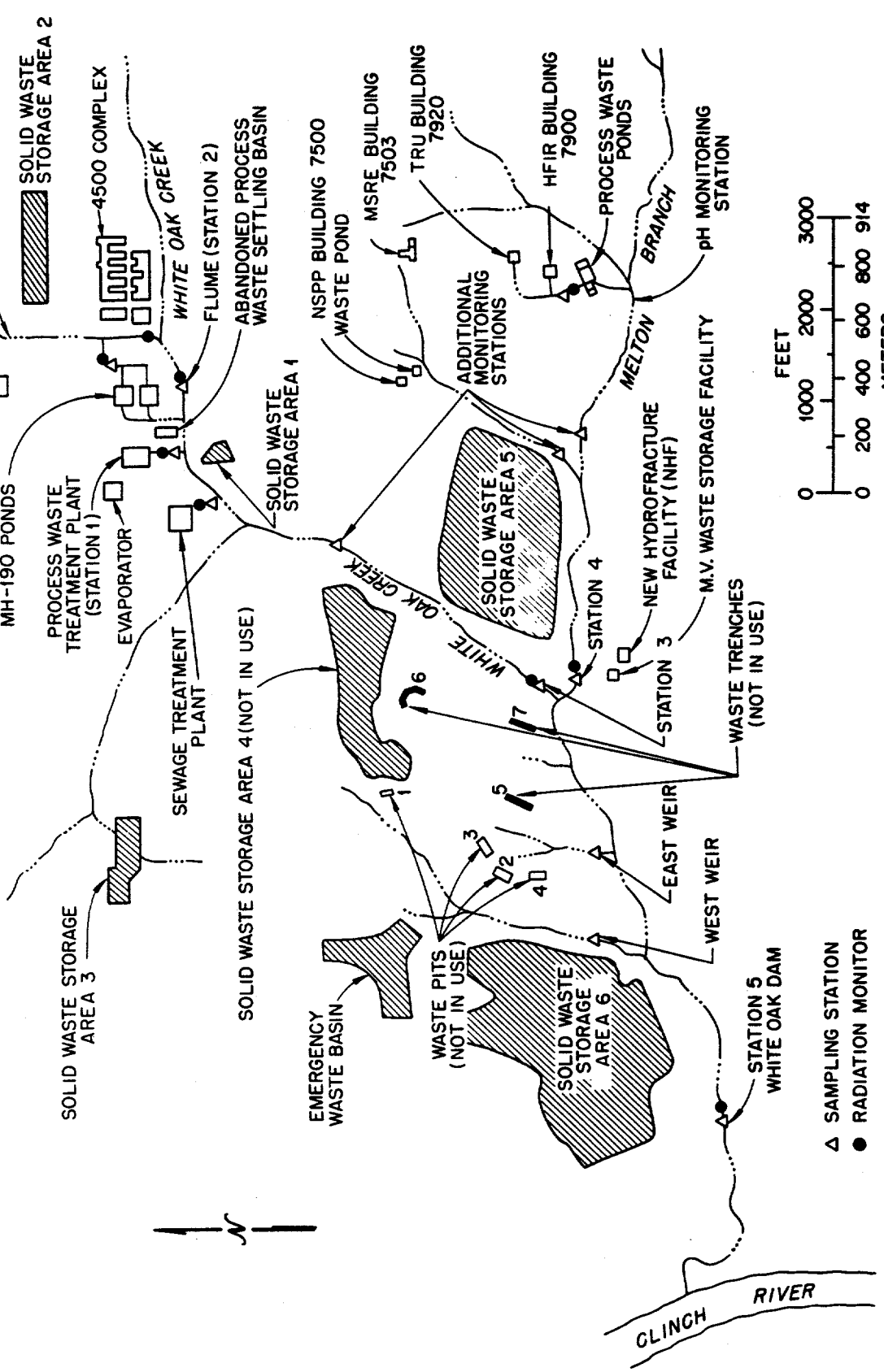

Fig 9. Location Plan for White Oak Creek Sampling Stations and Radiation Monitors.

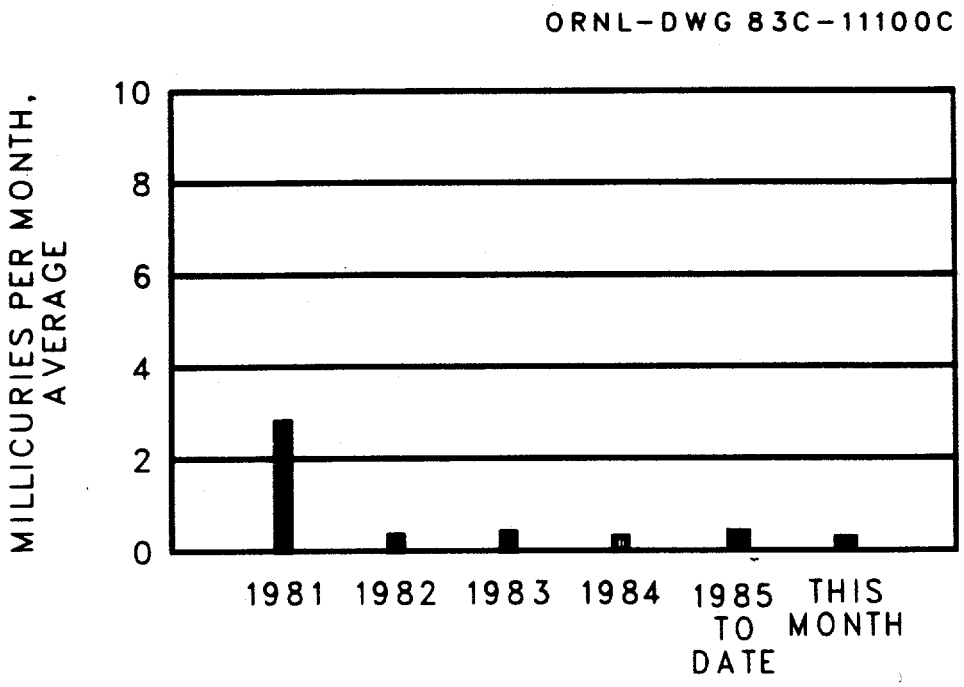

Fig. 10. ^{90}Sr Discharges in Waste From PWTP to White Oak Creek.

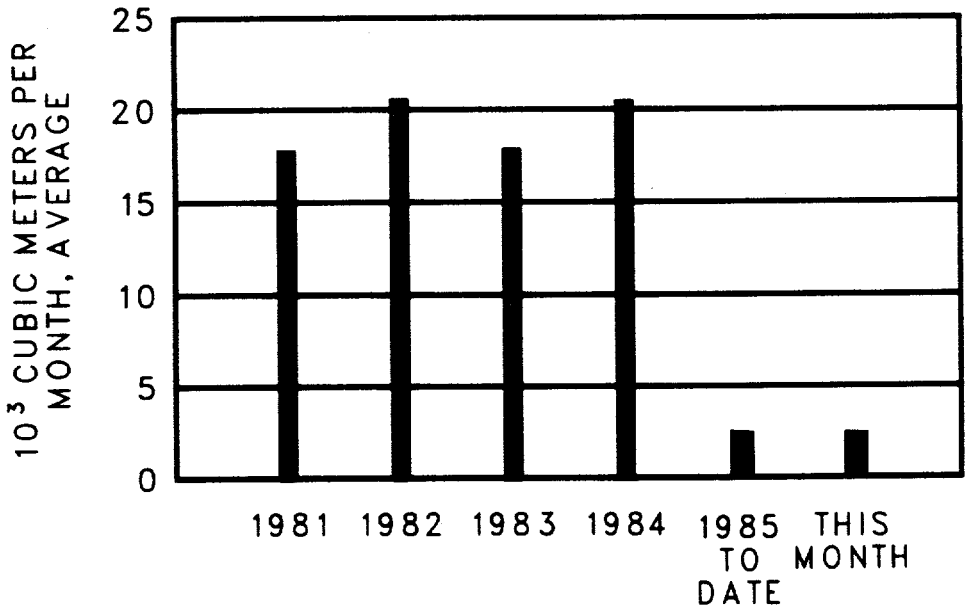

Fig. 11. Process Waste Volumes Treated In The PWTP.

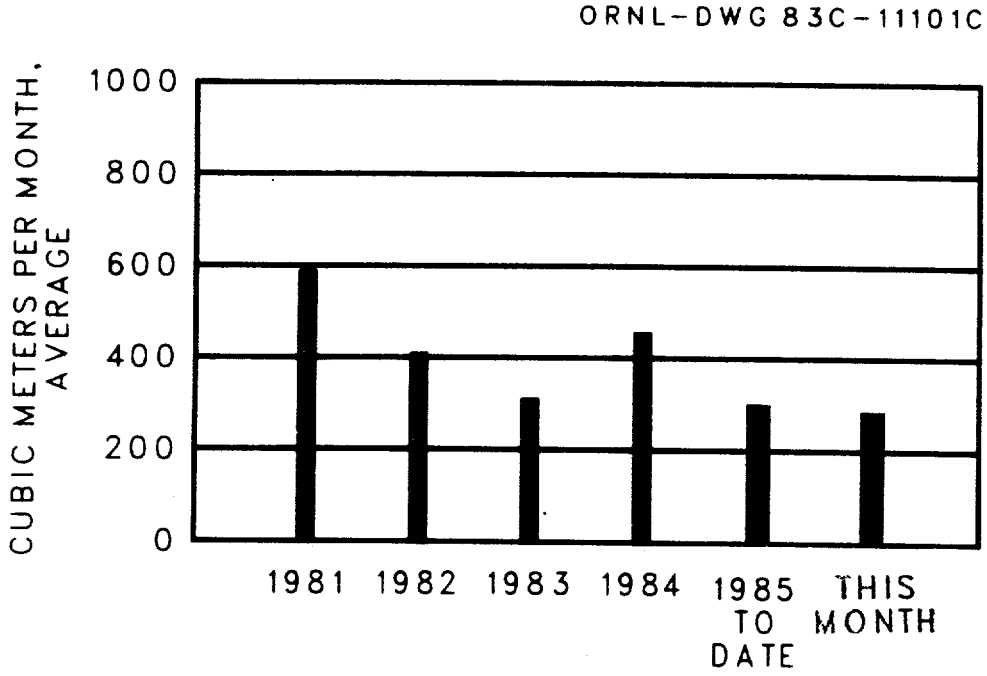

Fig. 12. Low-Level Waste Volume Generated This Month.

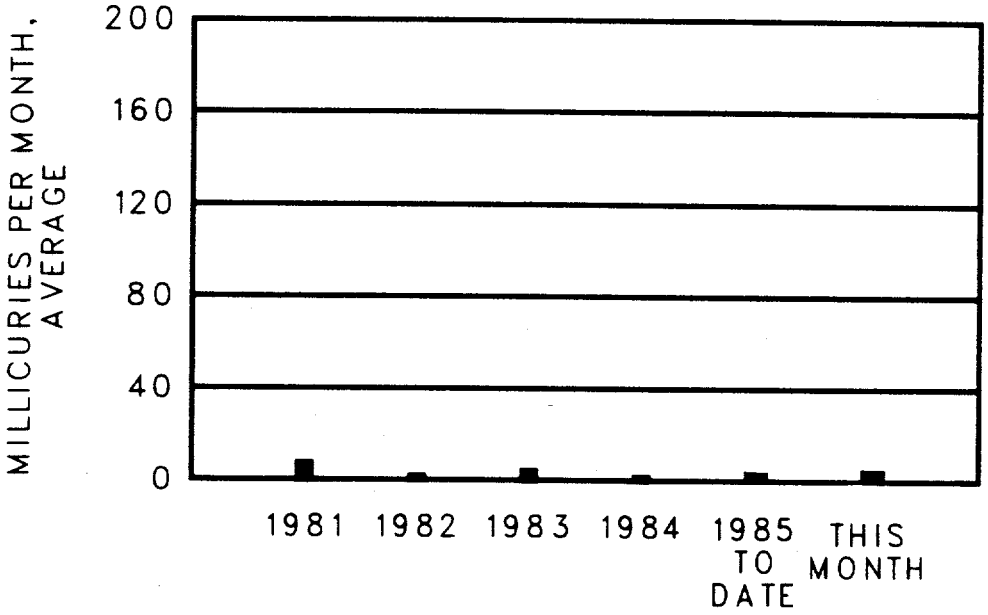

Fig. 13. Total Activity Released in Gaseous Waste (Mainly ^{131}I; Not Including Rare Gases or Other Nonfilterable Species). Maximum Permissible Operating Level is 13 Ci/Quarter.

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