DPST-87-820

SUMMARY OF I-129 MEASUREMENTS IN GROUND AND SURFACE WATERS (U)

by

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To: R.W.Taylor

From: M.V. Kantelo MVK

Reference: DOE-SR ltr to J.A. Porter, dated 11-4-87

SUMMARY OF I-129 MEASUREMENTS IN GROUND AND SURFACE WATERS

INTRODUCTION AND SUMMARY

The iodine-129 content of groundwater and surface water at on-plant and off-plant locations (Figure 1) has been determined at irregular intervals since 1970 using neutron activation analysis. I-129 was detected in groundwater near the Burial Ground and near the seepage basins of the Separations Areas. For reference, I-129 concentrations in the groundwater can be compared to the EPA drinking water standard. At a few locations the concentrations exceeded both the existing and pending EPA drinking water standard. In surface water, Four Mile Creek was the only SRP stream found to transport significant I-129 to the Savannah River. Dilution by C-Reactor discharge and the Savannah River reduced the off-plant I-129 concentrations in river water to less than 1% of the existing EPA drinking water standard and less than 0.01% of the pending EPA drinking water standard.

Water in the vicinity of known sources of I-129 has been sampled as follows:

- o Burial Ground Wells
- o Separations Areas
  - F-Area effluent feeding Four Mile Creek
  - seepage basins
  - wells between seepage basins and outcrop springs
  - outcrop springs feeding Four Mile Creek
- o SRP Streams Feeding Savannah River
  - Four Mile Creek
  - other streams
- o Savannah River

Results of I-129 measurements for each of the above categories are summarized in this memo. Observed concentrations of I-129 in the groundwater of the SRP site primarily reflect mobile forms of iodine buried in the Burial Ground and discharged to the seepage basins in the Separations Areas. Groundwater concentrations at some locations significantly exceed the existing EPA drinking water standard. Some even exceed the less restrictive revised EPA standard which is pending final approval.

The groundwater in which I-129 has been detected becomes surface water at Four Mile Creek. Further dilution by mixing with the discharge from C-Reactor and with the Savannah River results in off-plant river water concentrations that are less than 1% of the existing EPA drinking water standard and less than 0.01% of the pending EPA standard. The pending EPA drinking water standard is 100 pCi/L. It will replace the existing EPA standard of 1 pCi/L. The pending standard is based on ICRP 30 dose methodology which DOE has directed to be used at its facilities.

In this summary, concentrations of I-129 are tabulated together with the statistical one standard deviation uncertainties in the measurements. (For some historical results no statistical uncertainty was found.) Corresponding stable iodine measurement results are available but were not requested in the reference letter. Stable iodine values are important in calculating the radiation dose due to I-129.

The only active sampling program for I-129 in ground or surface water is the quarterly sampling of Savannah River water upstream and downstream of SRP. This program was reactivated in 1986 after five years of dormancy. Analysis of samples collected since 1986 is still in progress. Sampling of water at the two water treatment plants near Savannah is plannned for this fiscal year.

DISCUSSION

Burial Ground Wells

Analyses of certain well waters in the Burial Ground System (Figure 2) were provided to S.B. Oblath as part of a comprehensive study of the Burial Ground in the mid-1980s. The results were published by Oblath as DPST-86-278. This study found that I-129 leached from the Burial Ground is mobile. The maximum concentration observed was 12 pCi/L in August 1983. Two earlier measurements of this particular well water revealed lower concentrations. Based on this limited sampling, I-129 concentrations appeared to be increasing with time. Results extracted from DPST-86-278 are presented in Table I.

In 1979 and 1980 water from two wells at the southwest corner of the Burial Ground (Figure 2) was analyzed. Results are presented in Table I. Even though the location of the wells is near the tritium plume from the Burial Ground, the observed I-129 concentrations are low. This is presumably due to the wells not being deep enough to intercept the plume.

Separations Areas

F-Area Effluent Feeding Four Mile Creek

The effluent stream from F-Area that feeds Four Mile Creek was studied in 1979 and 1980. Results are presented in Table II. Concentrations were 0.06 pCi/L or less. At this level, the effluent stream is not a significant source of I-129.

Seepage Basins

Monthly grab samples of water in F basin 3 and in H basin 4 were collected in 1977 and 1978. Each of these basins is the terminal basin in a series of progressively larger basins (Figures 3 and 4). Concentrations, which ranged from 15 to 300 pCi/L, are presented in Table III. Generally, the H basin concentrations were lower than those in F basin by a factor of about 5. Within each basin, concentration variations are attributed to rainfall and to varying operational conditions in Separations.

Wells Between Seepage Basins and Outcrop Springs

In August 1977 five H-Area wells were sampled at a depth of 35 feet, and four F-Area wells were sampled at depths from 45 to 60 feet (Figures 3 and 4). Results for I-129 are presented in

Table IV. Concentrations ranged from 0.1 pCi/L to 300 pCi/L and correlated with tritium concentrations. This indicated that a mobile aqueous form of iodine was present.

In 1980 water from one H-Area well (designated BG-10) inside the fence at H basin 4 was analyzed. The value of 63 pCi/L was the greatest concentration observed in H basin wells.

Outcrop Springs Feeding Four Mile Creek

A grab sample of one of the groundwater outcrop springs in the vicinity of F-Area seepage basins was collected on a one-time basis in August 1977. The I-129 concentration of 294 ± 6 pCi/L is consistent with the maximum concentrations observed in basin water and well water.

SRP Streams Feeding the Savannah River

Four Mile Creek

Grab samples of creek water have been intermittently sampled since 1973. In Table V, results are presented by location upstream and downstream of the groundwater outcrops from F-Area seepage basins. Upstream concentrations of 1 pCi/L or less were measured at various locations between Road 4 and the F-Area outcrops. At these locations, the only likely significant source of I-129 is the outcrop springs from H-Area seepage basins.

Further downstream, below the outcrops from F-Area, concentrations ranged from 33 to 2 pCi/L. The greatest concentration was detected at Road A7. Here the stream has not yet been diluted with the discharge water from C-Reactor. The lower concentrations observed at Highway 125 compared to Road A7 reflect the dilution by C-Reactor discharge.

Other Streams

Grab samples from streams (other than Four Mile Creek) feeding the Savannah River were collected in August 1977 and June 1978 at the Highway 125 crossing (Figure 1). Results are presented in Table VI. These concentrations did not exceed 0.002 pCi/L. Thus, the major stream for transport of I-129 to the Savannah River is Four Mile Creek. The I-129 content of any plant stream is strongly diluted by the Savannah River.

Savannah River

Grab samples at upriver and downriver locations have been intermittently collected since 1970. Results are shown in Figures 5 and 6. The typical concentration at Shell Bluff, 5 miles upriver of the plant boundary, was less than the usual detection limit of 0.0003 pCi/L. At Highway 301 Bridge, about 20 miles downriver, the typical concentration was a factor of 10 greater, namely 0.003 pCi/L.

Anomalous results at Shell Bluff occurred in monthly samples from May through September 1978. During this time I-129 concentrations at Shell Bluff were greater than 0.001 pCi/L. Furthermore, in May and June the concentration at Shell Bluff was essentially equal to the concentration at Highway 301 Bridge.

The typical downriver I-129 concentration of 0.003 pCi/L represents 0.3% of the existing EPA drinking water standard (1 pCi/L) and 0.003% of the pending EPA standard (100 pCi/L). There are two downriver water treatment plants which process Savannah River water, namely, the Beaufort-Jasper Water Treatment Plant and the Port Wentworth Water Treatment Plant. Concentrations at these plants have not yet been determined (scheduled for this fiscal year), but they are estimated to be less than or equal to the river concentrations at Highway 301 Bridge.

Table I. I-129 Concentrations in Burial Ground Well Water

Well	Approximate Depth (ft)	Date	pCi/L
Results extracted from DPST-86-278			
I-13		1983	0.006
BGC-3C		1983	0.92
BGC-2C		1983	0.033
BG-109		1983	0.01
PDQ5		Aug '83	12
PDQ5		Dec '82	1.5
PDQ5		Apr '82	0.25
Other studies			
BG-57	45	1979	0.0053 ±.0008
BG-56	47	1980	0.0074 ±.0008

Table II. I-129 Concentrations in F-Area Effluent Stream

Location	Date	pCi/L
F Eff 30	1980	0.062 ±.008
Eff 14	1980	0.024 ±.005
Eff 16	1980	0.016 ±.002
F Eff 3800' from Road E	1979	0.0086 ±.0005
F Eff 2800' from Road E	1979	0.0066 ±.0005
F Eff 1800' from Road E	1979	0.0038 ±.0003
F Eff 100' from Road E	1979	0.0039 ±.0003

Table III. I-129 Concentrations in Separations Seepage Basins

Date	I-129 Concentration (pCi/L)	
	F basin 3	H basin 4
8-77	140 ± 4	74 ± 3
12-77	152 ± 6	71 ± 4
1-78	54 ± 3	50 ± 4
3-78	198 ± 6	44 ± 2
4-78	143 ± 5	18 ± 2
5-78	228 ±10	35 ± 2
6-78	188 ± 9	54 ± 3
7-78	153 ± 8	24 ± 2
8-78	208 ±10	62 ± 4
9-78	100 ±13	83 ±11
10-78	77 ± 3	15 ± 1
11-78	145 ± 7	28 ± 1
12-78	299 ±10	39 ± 2

Table IV. I-129 Concentrations in Well Water Near Seepage Basins

Well	Depth (ft)	I-129 pCi/L	H-3 μCi/L
1977 Sampling			
H-Area			
H-13	35	4.4	1.2
H-14	35	16	4.0
H-15	35	0.083	0.056
H-18	35	0.14	0.062
H-19	35	0.61	1.8
F-Area			
F-15	55	0.21	0.13
F-16	60	297	22
F-17	45	0.091	0.021
F-25	55	0.87	0.75
1980 Sampling			
H-Area			
BG-10	20	63 ± 1	--

Table V. I-129 Concentrations in Four Mile Creek

Location	Date	pCi/L
Upstream of Outcrops from F-Area Seepage Basins		
Between Road 4 and F basin outcrops	1980	1.06 ±.22
"	1980	0.46 ±.05
"	1980	1.01 ±.11
"	1980	1.19 ±.19
"	1980	0.86 ±.26
"	1979	0.95 ±.02
"	1979	0.44 ±.01
"	1979	0.146 ±.005
"	1977	0.17
Downstream of Outcrop from F-Area Seepage Basins		
Road A7	8/77	1.7
Road A7	6/73	33.3 ±4.5
Hwy 125	6/78	0.091 ±.006
Hwy 125	8/77	0.043 ±.002

Table VI. I-129 Concentrations in SRP Streams
(Other than Four Mile Creek)

Stream Crossing at Hwy 125	I-129 Concentration (pCi/L) August 25, 1977	June 23, 1978
Upper Three Runs	0.0011 ±.0003	0.0023 ±.0003
Pen Branch	<0.0004	<0.0008
Steel Creek	0.0013 ±.0002	0.0015 ±.0005
Lower Three Runs	<0.0005	0.0008 ±.0002

Figure 1. On-Plant and Off-Plant Sampling Locations.
(Indicated by circled areas)

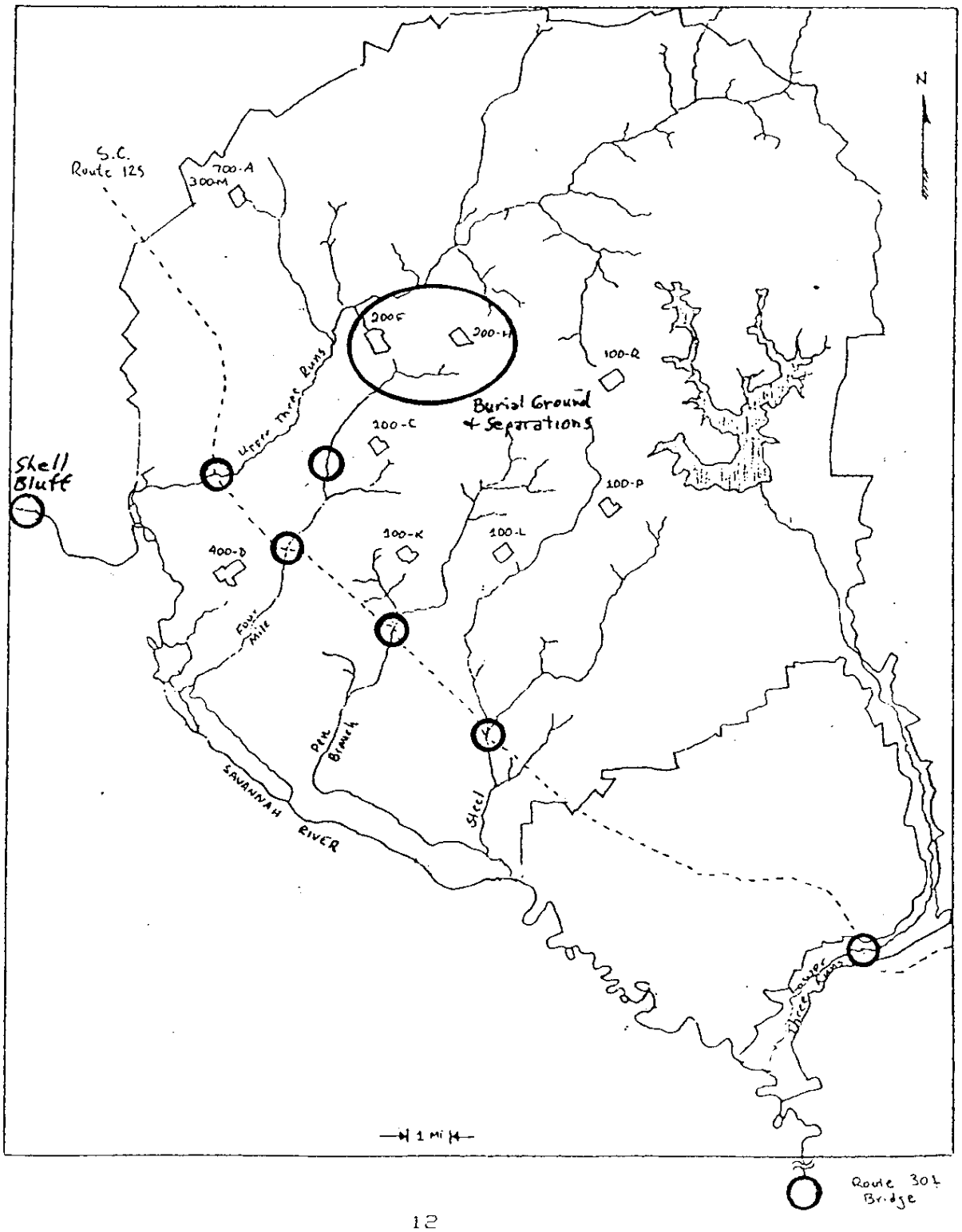


Figure 2. Location of Burial Ground Wells.

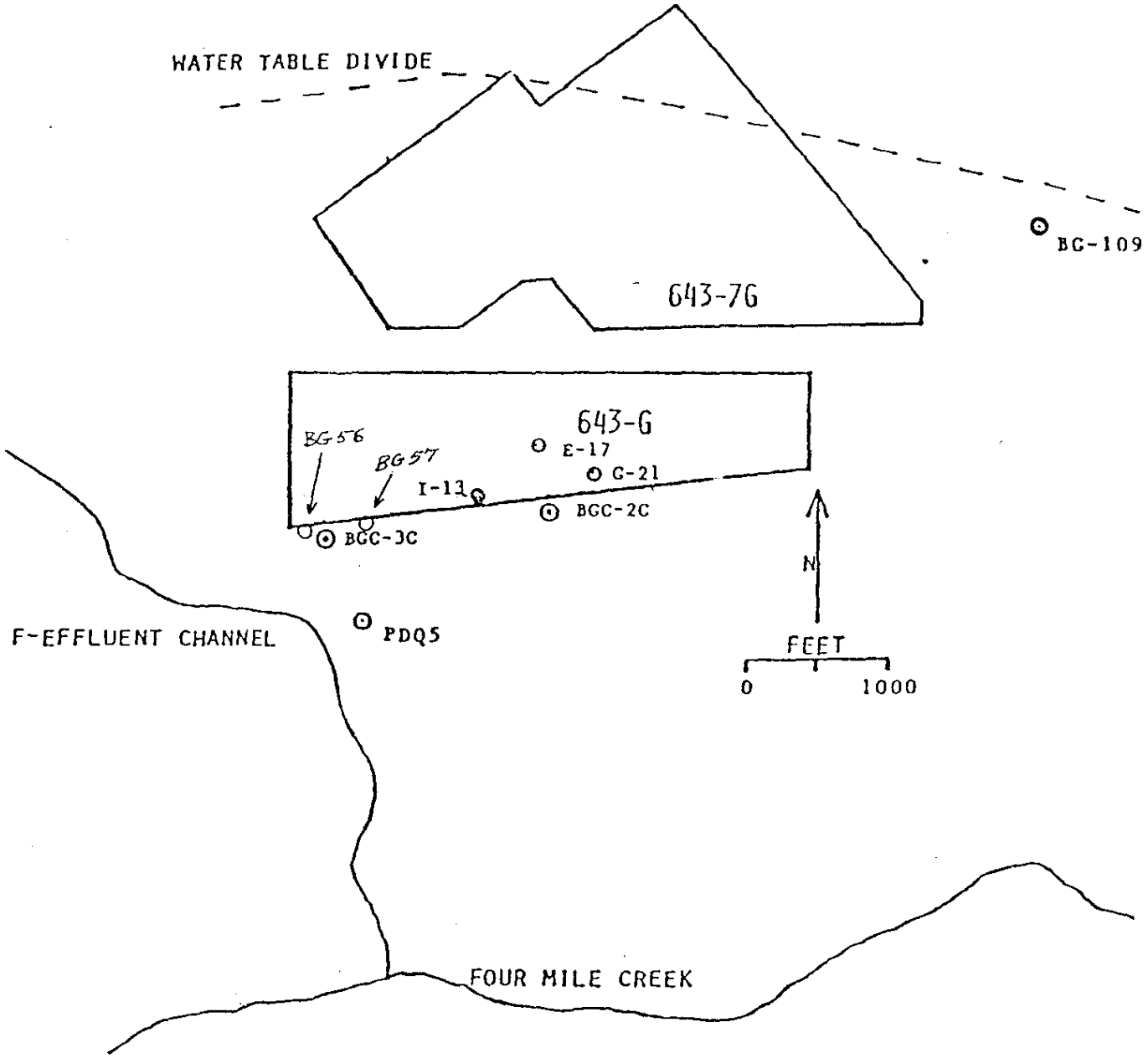


Figure 3. Location of H-Area Seepage Basins and Wells.

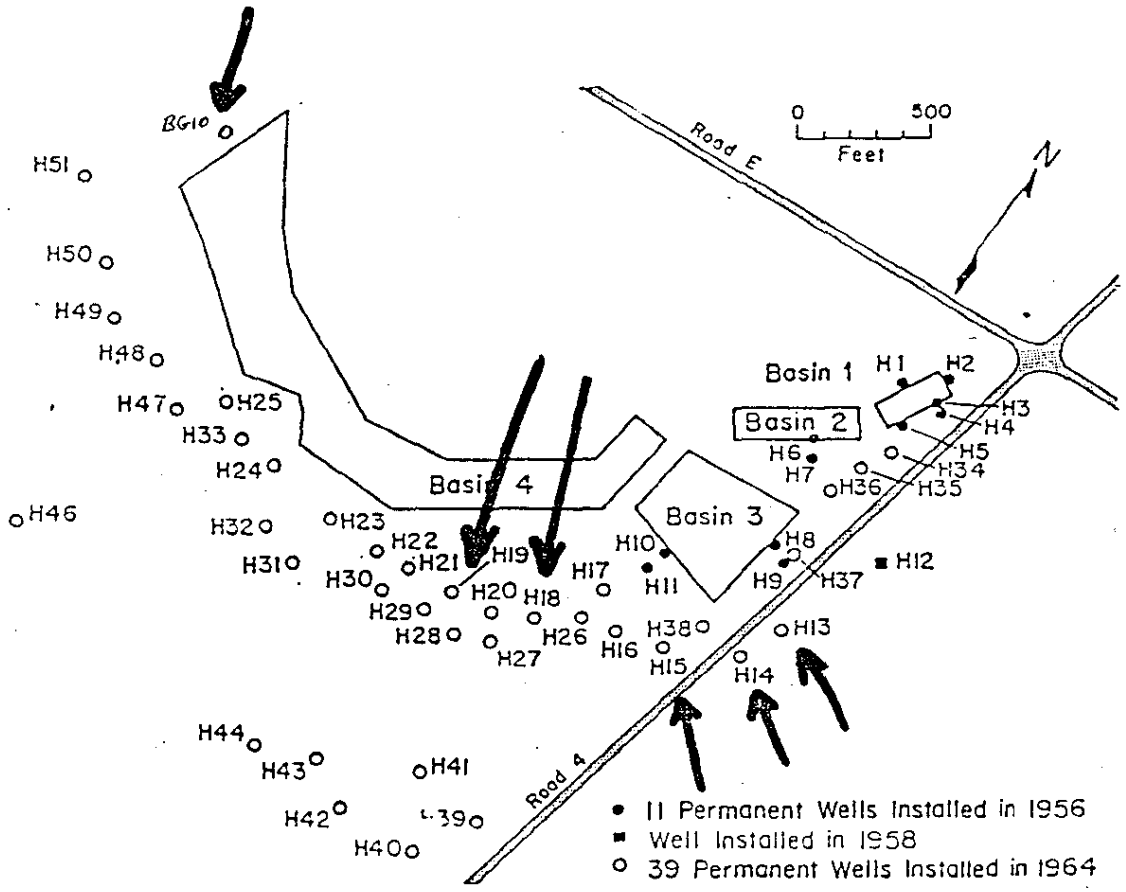


Figure 4. Location of F-Area Seepage Basins and Wells.

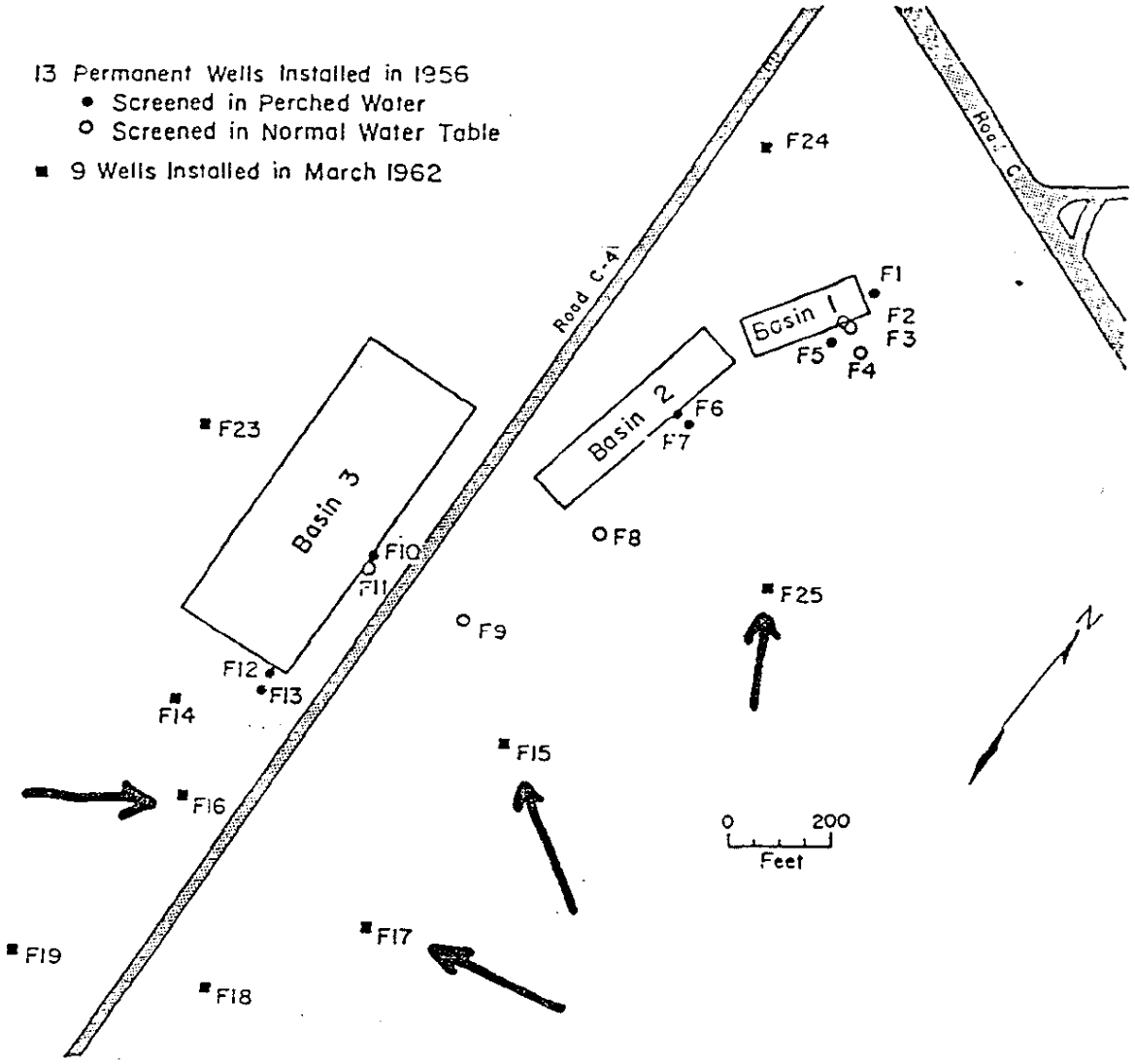
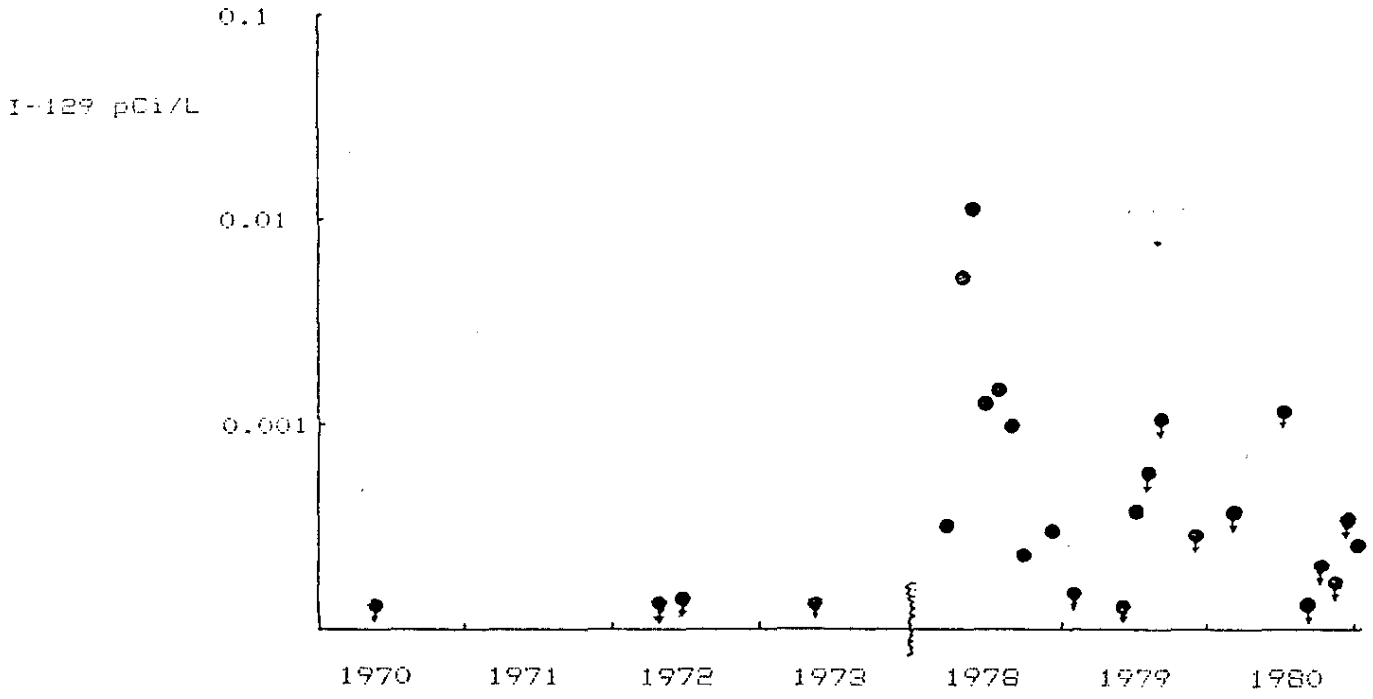


Figure 5. I-129 Concentrations in Savannah River at Shell Bluff.



Note: An arrow on a data point indicates the detection limit. The actual concentration of the sample is less than or equal to the plotted value.

Figure 6. I-129 Concentrations in Savannah River at Highway 301 Bridge.