START

39

0013349

DUN-3155

AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

BEST AVAILABLE COPY

[redacted]

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

SEPTEMBER 1967

MASTER

[redacted]

1417

TABLE OF CONTENTS

	PAGE NO.
LIST OF TABLES	i
LIST OF ILLUSTRATIONS	ii
SECTION	1-33
I. INTRODUCTION	1
II. SUMMARY	2-3
III. AUTHORITATIVE STANDARDS	3-5
IV. EFFLUENT SOURCE IDENTIFICATION	5-13
V. CONFORMANCE WITH EFFLUENT CONTROL STANDARDS	14-32
VI. RECORDS AND REPORTING	33
VII. ACKNOWLEDGEMENTS	33
LIST OF REFERENCES	34
APPENDICES	35-65
APPENDIX I — EXECUTIVE ORDER 11288, PREVENTION, CONTROL, AND ABATEMENT OF WATER POLLUTION BY FEDERAL FACILITIES	35-38
APPENDIX II — PROPOSED WATER QUALITY STANDARDS FOR INTER-STATE AND COASTAL WATERS FOR THE STATE OF WASHINGTON AND A PLAN FOR IMPLEMENTATION AND ENFORCEMENT OF SUCH STANDARDS	39-47
APPENDIX III — SUMMARY - BACTERIOLOGICAL, PHYSICAL, CHEMICAL AND RADIOACTIVITY LIMITS OF THE DRINKING WATER STANDARDS, 1962	48-52
APPENDIX IV — DESCRIPTION - 300 AREA PROCESS POND EFFLUENT SAMPLER	53
APPENDIX V — EXECUTIVE ORDER 11282, PREVENTION, CONTROL, AND ABATEMENT OF AIR POLLUTION BY FEDERAL ACTIVITIES	54-59
APPENDIX VI — TENTATIVE HANFORD AIR QUALITY GUIDE	60
APPENDIX VII — OCCUPATIONAL THRESHOLD LIMIT VALUES OF COMMONLY USED CHEMICALS IN THE PRODUCTION FUELS SECTION	61
APPENDIX VIII — SCHEMATIC DIAGRAMS - 313 and 306 BUILDING GASEOUS SCRUBBER SYSTEMS	62-65

UNCLASSIFIED
(CLASSIFICATION)

DOUGLAS UNITED NUCLEAR, INC.
RICHLAND, WASHINGTON

DOCUMENT NO.
DUN-[illegible]55

DATE 9/26/67

COPY NO.

BUILDING FILE

CIRCULATING COPY
RECEIVED 700 AREA
JAN 26 1968
RETURN TO
DOUGLAS UNITED NUCLEAR, INC.
DOCUMENT CONTROL CENTER

AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

J. W. Loe, Engineer
Production Fuels Section

DISTRIBUTION

	NAME	BUILDING	AREA
DUN			
1.	GO Amy	313	300
2.	RC Bell	313	300
3.	AE Brown	305	300
4.	CD Corbit	1760	100-H
5.	JA Cowan	3720	300
6.	RG Geier	1760	100-D
7.	WO Goslin	3703	300
8.	FW Grubb	3717	300
9.	LD Gustafson	3703	300
10.	GB Hansen	3720	300
11.	DC Harland	313	300
12.	GA Huff	3703	300
13.	RL Huff	313	300
14.	F Hunter	3703	300
15.	OB Isaacs	313	300
16.	WR Kirk	333	300
17.	HP Kraemer	Federal	700
18.	JW Loe	313	300
19.	JL Lorenzen	3707D	300
20.	WM Mathis	3703	300
21.	HC Money	3703	300
22.	JW Nickolaus	333	300
23.	EV Padgett	313	300
24.	PR Praetorius	306	300
25.	RJ Pyzel	313	300
26.	JE Ruffin	303J	300
27.	CH Shaw	3707A	300
28.	JS Shipp	313	300
29.	JH Soehnlein	1760	100-H
30.	HL Sterling	333	300
31.	JT Stringer	3703	300
32.	FL Van Wyck	313	300
33.	GW Wells	1704	100-H
34.	JC Williamson	3706	300
35.	DUN File	703	700
36.	DUN Record	703	700
37.-46.	Extras		
AEC-RL			
47.-48.	W Devine	Federal	700
49.-50.	CN Zangar	Federal	700
ARHCO			
51.	GE Bachman	222T	200
B-HW			
52.	JP Corley	3706	300
53.	RB Hall	3706	300
54.	WC Horton	329	300
AEHF			
55.	FE Adley	747	700
56.	DE Anderson	747	700

ROUTE TO	PAYROLL NO.	LOCATION	FILES ROUTE DATE	SIGNATURE AND DATE
File Record				

OFFSITE DISTRIBUTION
Approved By:

16-5100-184 (10-55)
GEO. BLOD RICHLAND, WASH.

UNCLASSIFIED
(CLASSIFICATION)

TO BE USED ON UNCLASSIFIED AND OFFICIAL USE ONLY DOCUMENTS.

LIST OF TABLES

TABLE		PAGE NO.
I	FUEL AND CHEMICAL STORAGE	5
II	LIQUID EFFLUENTS DISCHARGED TO THE PROCESS SEWER	7-9
III	GASEOUS EFFLUENTS DISCHARGED TO THE ATMOSPHERE	13
IV	RANGE OF TYPICAL CONTAMINANTS, 300 AREA PROCESS POND INLET AND EAST BANK	15
V	NORTH PROCESS POND ANALYSES	16
VI	BANK SEEPAGE ANALYSES	17
VII	TYPICAL RADIOCHEMICAL ANALYSIS OF ANODIZING CAUSTIC SOLUTION	25
VIII	TYPICAL RADIOCHEMICAL ANALYSIS OF WELL 399-1-1 AND BANK SEEPAGE SAMPLES	25-26
IX	BACTERIOLOGICAL ANALYSIS OF LEACHING TRENCHES, WELLS, AND COLUMBIA RIVER	26

LIST OF ILLUSTRATIONS

FIGURE		PAGE NO.
1.	CHEMICAL STORAGE TANKS AND TRANSFER LINES	6
2.	DUH 300 AREA PROCESS SEWER LINES	10
3.	DNW CONTAMINATED SEWER LINES	11
4.	SANITARY SEWER SYSTEM	12
5.	Cr^{+6} ANALYSES - PROCESS POND INLET	18
6.	Cr^{+6} ANALYSES - EAST BANK AND RIVER BANK SEEPAGE	19
7.	NO_3 ANALYSES - PROCESS POND INLET	20
8.	NO_3 ANALYSES - EAST BANK AND RIVER BANK SEEPAGE	21
9.	URANIUM ANALYSES - POND INLET AND RIVER BANK SEEPAGE	22
10.	URANIUM ANALYSES - EAST BANK AND RIVER BANK SEEPAGE	23

AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

I. INTRODUCTION

In conjunction with the increased emphasis being placed on air and water effluent quality within Federal facilities, it became necessary to investigate the various aspects of effluent control responsibilities applicable to the Production Fuels Section. To add impetus to the study, a recent RL-AEC Waste Disposal Inspection Report of Douglas United Nuclear (Reference 5) recommended that nonradioactive chemical releases to 300 Area lagoons be analyzed to assure compliance with accepted release standards.

The task at hand was to assemble the various authoritative standards, investigate current practices, compare these practices with accepted standards, and establish a responsive effluent control program aimed at continuing compliance with these standards.

Effluent control practices were compared with the following release criteria supplied by the Federal and State Governments:

- Executive Order 11288, "Prevention, Control, and Abatement of Water Pollution by Federal Activities," dated July 7, 1966
- Proposed Washington State Quality Standards for Interstate and Coastal Waters," dated June 6, 1967
- Executive Order 11282, "Prevention, Control, and Abatement of Air Pollution by Federal Activities," dated May 26, 1966
- Tentative Hanford Air Quality Guide (to be issued)
- RL Manual Appendix 0510, Part I, "Radioactive Waste Disposal Guides," dated July 13, 1967

Copies of these standards can be found in the Appendices of this report.

It is trusted that the information contained herein will serve the dual purpose of providing the necessary inputs to those immediately responsible for pollution control and informing others of the current effort being made to assure continuing compliance.

9 2 1 2 5 8 3 0 3 1 4

II. SUMMARY

A. LIQUID EFFLUENT CONTROL

This investigation showed that the chemical and sanitary effluents being released by the 300 Area contractors to the process ponds and septic tanks do not contribute a significant amount of pollution to the environs. This conclusion is based on the results of a comprehensive sampling survey of the north process pond, Columbia River bank seepage, leaching trenches, and the Columbia River.

Current storage facilities for liquid chemicals as presently located would not contribute a significant amount of water pollution in the Columbia River should a rupture or accidental drainage occur.

Operating procedures are available involving the receiving, storing, and distributing of liquid chemicals and their subsequent use in the production process. These procedures provide a comprehensive summary of the methods utilized in controlling the various production process variables.

Future action planned in order to assure continuing compliance includes the gathering of effluent samples by an automatic effluent sampler at the process pond inlet. Chemical and radiochemical analyses will be periodically performed. Grab samples will be taken from the wells in the vicinity of the ponds, along with Columbia River bank seepage samples, to assess the amount of contaminants in the ground water. Samples from the leaching trenches and Columbia River will continue to be taken and analyzed for Biochemical Oxygen Demand (BOD) and coliform content by Battelle-Northwest.

B. GASEOUS EFFLUENT CONTROL

The results of a survey of the Production Fuels Section powerhouse stack by HEHF were inconclusive because of the difficulty in obtaining a representative sample. Additional studies are scheduled to be initiated during the winter months when high steam generation rates are expected.

Smoke density measurements indicate compliance with the standards. The recommendation from HEHF regarding the type of smoke alarms for monitoring the combustion units is pending until a reply to an inquiry to the Department of Health, Education, and Welfare is received by the AEC.

The disposal of refuse that can be burned in open pits does not comply with the 25-pound-per-day limit. Because of the remote location, low population density, and favorable meteorological conditions, it is believed that the standard is unduly restrictive; and an exemption has been requested by the AEC. Special disposal precautions will be used should significant quantities of dark-smoke-producing refuse be accumulated.

HEHF is scheduled to procure air monitoring equipment in October, 1967, and will monitor selected locations in the 300 Area to determine if the Production Fuels Section's gaseous effluents are harmful. Until that time, no change in the current mode of operation is contemplated.

III. AUTHORITATIVE STANDARDS

A. LIQUID EFFLUENTS (NONRADIOACTIVE)

Executive Order 11288, dated July 7, 1966, outlines the necessary Federal government policy and requirements that are applicable to Federal agencies and the Atomic Energy Commission and its contractors in regard to the prevention, control, and abatement of water pollution. Detailed copies of this correspondence are included in Appendix I.

In addition to Executive Order 11288, the Production Fuels Section is expected to comply with the water quality standards as established by the state of Washington. Hearings were held in Olympia on June 6, 1967, regarding a proposal before the Pollution Control Commission for the adoption of water quality standards for interstate and coastal waters of the state of Washington, and a plan for implementation and enforcement of such standards.

In the proposed standards, the Columbia River has been categorized in Class A from the mouth to Grand Coulee Dam. Water quality criteria applicable to this classification are listed in Appendix II.

B. GASEOUS EFFLUENTS (NONRADIOACTIVE)

Executive Order 11282, dated May 26, 1966, outlines the necessary Federal government policy and requirements that are applicable to Federal agencies and the Atomic Energy Commission and its contractors in regard to the prevention, control, and abatement of air pollution. Detailed copies of this correspondence are included in Appendix V.

As an initial attempt to satisfy the intent of Executive Order 11282, tentative Air Quality Guides for the Hanford Plant have been established (Appendix VI). These limits, generated by representatives of the Hanford contractors and the Richland Operations Office of the AEC, would apply at the boundaries of the reservation and are based on 1/10 of the Occupational Threshold Limit Values (See Appendix VII). The Threshold Limit Values refer to air-borne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. Selected monitoring of the air within the plant boundaries will be the responsibility of HEHF. After locating the source of the pollutant, it is expected that specific building and process effluent release standards will be developed in the future to reduce the concentration of those pollutants which exceed the standards.

In addition to Executive Order 11282, the AEC in a letter dated April 21, 1967, directed that no rubber, tar, petroleum or other dark-smoke-producing materials be burned in open pits.

C. RADIOACTIVE RELEASE CRITERIA AND PROCEDURES

The release and control of solid, liquid, and gaseous, radioactive wastes is described in Sections D, E, and F of RL Appendix 0510 and will not be covered in detail in this document. Certain limits involving liquid and gaseous releases, however, were extracted and are listed below.

1. Liquid Radioactive Wastes (Open Pond Disposal)

"Liquid wastes discharged to large, open ponds should be essentially free of radioactive materials. Concentrations of 5×10^{-5} μci/ml (low level) should not be routinely exceeded. In the event this concentration is exceeded, control should be established to evaluate the likelihood of its becoming an environmental contamination problem. Liquid wastes failing to meet this criteria should be transported to the 200 Area underground disposal facilities."

2. Gaseous Radioactive Wastes

"The guides for effluent release from each stack in the 300 Area are:

Radionuclides	Release Guide (curie/week) 150-foot Stack	Short Stack or Vent
Sr^{90}	5×10^{-2}	1×10^{-2}
I^{131}	2×10^{-1}	2×10^{-1}
Pu (total)	5×10^{-3}	1×10^{-3}
U (natural)	2×10^{-2}	4×10^{-3}
Total of others except H_3, C_{14}, and Noble gases	10	2

IV. EFFLUENT SOURCE IDENTIFICATION

A. LIQUID EFFLUENTS

1. Chemical Storage

Outside storage tanks that supply the necessary process chemicals for the Production Fuels Section are listed along with the inventory value in Table I. Methanol, trichlorethylene, nitric acid, and sodium hydroxide are distributed by various pumping mechanisms through the 303-F Building. A schematic diagram of the location of the tanks and transfer lines is shown in Figure 1. For safety purposes, the methanol tanks are buried. Batch quantities of nitrated-caustic, deoxidizer, and Altrex are pumped after mixing in 303-F.

TABLE I

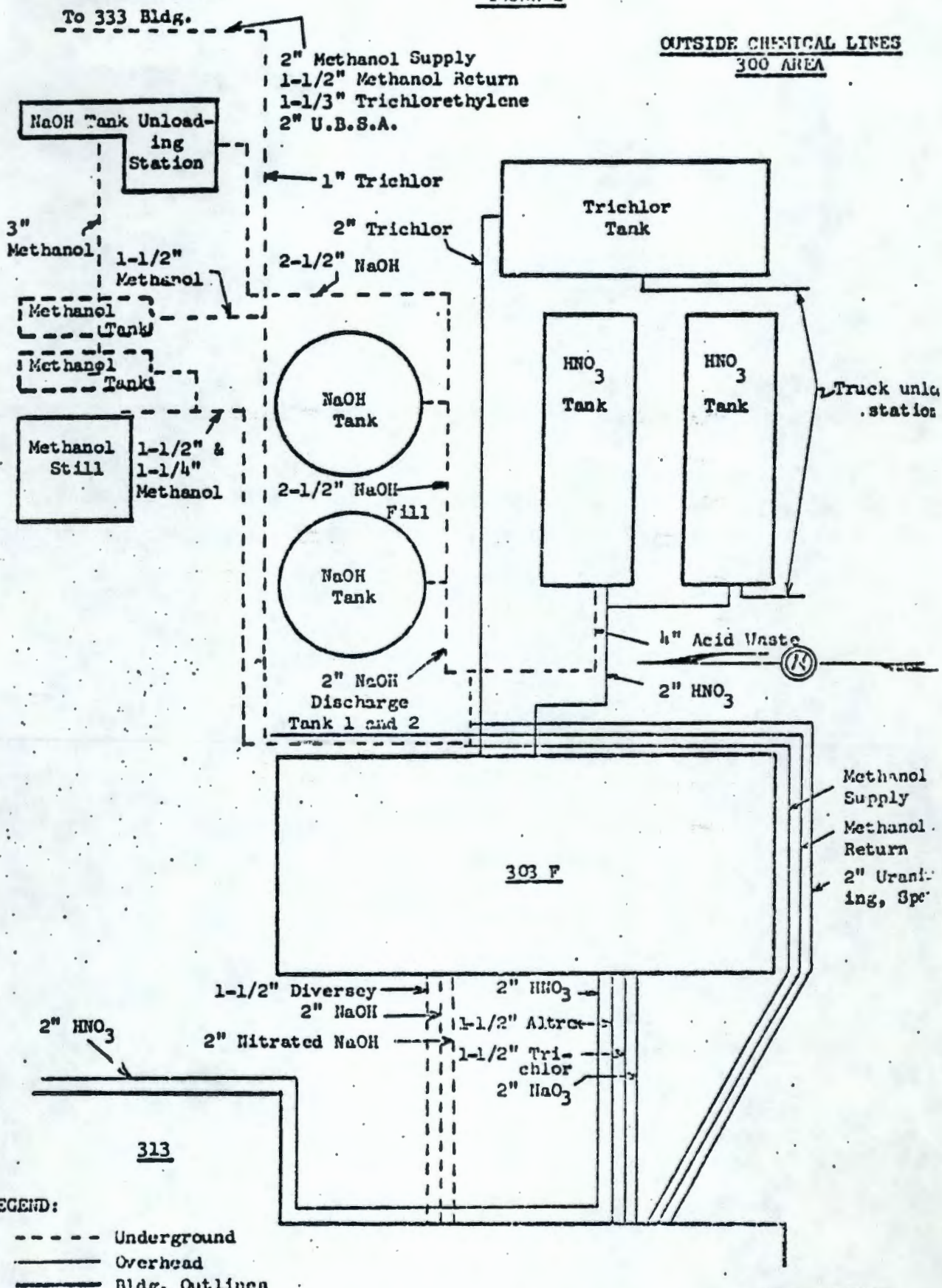
Fuel and Chemical Storage

Chemical	Storage Capacity	Inventory Value
HNO_3	2 - 4,000 gal. tanks	$ 1,600
NaOH	2 - 10,000 gal. tanks	4,000
Trichlorethylene	1 - 10,000 gal. tank	10,900
Methanol	1 - 6,000 gal. tank 1 - 4,000 gal. tank	3,000
Fuel Oil	2 - 75,000 gal. tanks 1 - 15,000 gal. tank	10,500 1,050

9 2 1 2 5 8 3 0 3 1 8

UNCLASSIFIED

FIGURE 1



UNCLASSIFIED

2. Process Solutions

Table II lists the chemicals that are routinely discharged in significant quantities from the 313 and 306 buildings. A portion, if not all, of these eventually reach the Columbia River through underground seepage from the process ponds. The drainage of these chemicals flows through process sewer lines to the ponds as shown in Figure 2, with alternate use of the north and south ponds being made. The empty pond is scarified before being reused. Approximately 5.5 million gallons of effluent water is discharged daily from the total 300-Area operation which includes DUN and Battelle contributions. Pond operation and maintenance is the landlord responsibility of DUN.

TABLE II

Liquid Effluents Routinely Discharged to the Process Sewer

313 Building - Component Preparation

Location	Chemical	Quantity (gal)	Concentration (lbs/gal)	Dumping Frequency
Sleeve Machine	NaOH	800	2.2 - 3.3	2 Weeks
Sleeve Machine	Ivory Soap	50	0.1	Twice Daily
Sleeve Machine	$NaAlO_2$	100	0.03 - 0.07	Daily
Cap & Can Machine	Cleaner	1080	0.19 - 0.34	36 Line-days
Cap & Can Machine	Deoxidizer-2	710	1.25 - 2.5	72 Line-days
Spire Etch	(NaOH	300	0.26 - 0.55	Twice Weekly
	($NaNO_3$	300	0.20 - 0.60	Twice Weekly
	(Chelating Agent-3	300	0.035 - 0.120	Twice Weekly
or	Aluminux-4	300	0.26 - 0.55 (NaOH content)	Twice Weekly
Spire Etch	HNO_3	150	0.4 - 1.4	Weekly
Special Products	Aluminux-4	100	0.26 - 0.55 (NaOH content)	As Necessary

313 Building - Component Preparation (continued)

Location	Chemical	Quantity (gal)	Concentration (lbs/gal)	Dumping Freq.
Special Products	$NaNO_3$	300	0.33	Every Other Da
Special Products	Deoxidizer-2	300	0.80 - 1.88	As Necessary
Tool Cleaning	NaOH	200	2.5	Weekly
313 Building - Recovery				
Stripper Tank	NaOH $NaNO_3$	300 100 pounds per 225 pieces	1.80	12 Times Month
Filter Press	$NANO_3$ Uranium (Negl)	2241	Unknown 4 lbs/month	Continuous When Running
313 Building - Anodizing				
Plating Tanks	$H_2C_2O_4 \cdot 2H_2O$	2 - 425	0.51 - 0.68	Infrequently
Cleaning Tank	$NaNO_3$ NaOH	125	0.3	2 Weeks
313 Building - Finishing				
Etch Machine	HNO_3	1500	1.4 - 3.0	2-4 Months
313 Building - Slug Pickle				
Pickle Rinse	Uranium	--	About 60 lbs. per month	Continuous
306 Building				
Hand Cleaning Line	Aluminum-4 $NaNO_3$	100	0.26 - 0.55 0.20 - 0.40	6 Per Month
Hand Cleaning Line	Deoxidizer	60	0.80 - 1.20	2 Weeks
Automatic Cleaning	HNO_3 NaOH	80 55	5.0 5.0 - 6.0	2 Weeks Every Other Da
Automatic Cleaning	HNO_3	80	2.5	Twice Monthly

9 2 1 2 5 3 3 0 3 2 1

TABLE II (continued)

Composition consisting mainly of:

-1 Cleaner: Na_2CO_3, Na_2SiO_3, $Na_4P_2O_7$

-2 Deoxidizer: $NaHSO_4$, CrO_3 or Na_2CrO_7, Na_2SiF_6

-3 Chelating Agent: $NaC_6H_{11}O_7$ (Sodium Gluconate)

-4 Aluminux: $NaOH$, $NaC_6H_{11}O_7$

3. Contaminated Effluents

Contaminated wastes from Battelle facilities are routinely discharged to storage tanks at the 340 retention and neutralization building as shown in Figure 3, and are later transported to the 200 Areas for disposal. Waste destined for the process pond is held in storage basins, sampled, and then released. Except for an occasional spillage, Battelle does not contribute a significant quantity of radioactivity to the process ponds.

Normal and enriched uranium are discharged from waste solutions from DUN 300-Area operations. In FY 1967, approximately 245 pounds of enriched and 525 pounds of normal uranium were discharged, according to accountability figures, from the Production Fuels Section while the N-Fuels contribution totaled approximately 1,000 pounds.

The anodizing process contributes certain radioactive activation products from the caustic cleaning solution in 306 Building. Gamma scans have shown the presence of Zn^{65} Zr-Nb, Se^{46}, Fe^{59}, Co^{60}, and Co^{58}.

4. Sanitary Wastes

One common sanitary waste disposal system serves all 300 Area contractors and is the operational responsibility of DUN.

Sewage flows through vitreous tile pipe to septic tanks, and the daily overflow of approximately 300,000 gallons per day drains into one of two 500-foot long leaching trenches. The septic tanks are periodically cleaned and the solids disposed into a sludge pit located near the leaching trenches. A schematic diagram of this disposal facility is shown in Figure 4.

DUN 300 AREA
PROCESS SEWER LINES (Not to Scale)

FIGURE 2

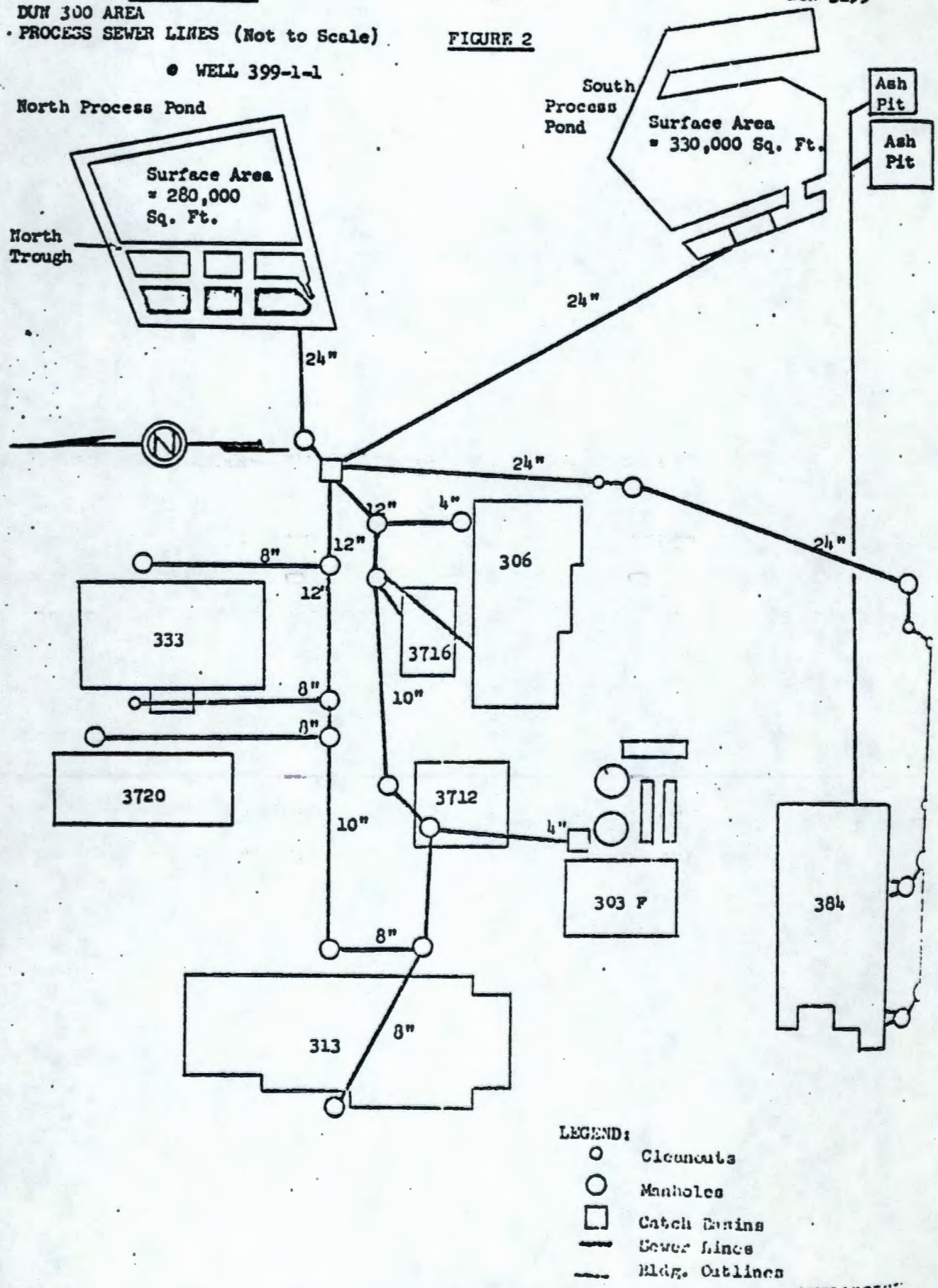


FIGURE 3

300 AREA
ATED SEWER LINES
to Scale)

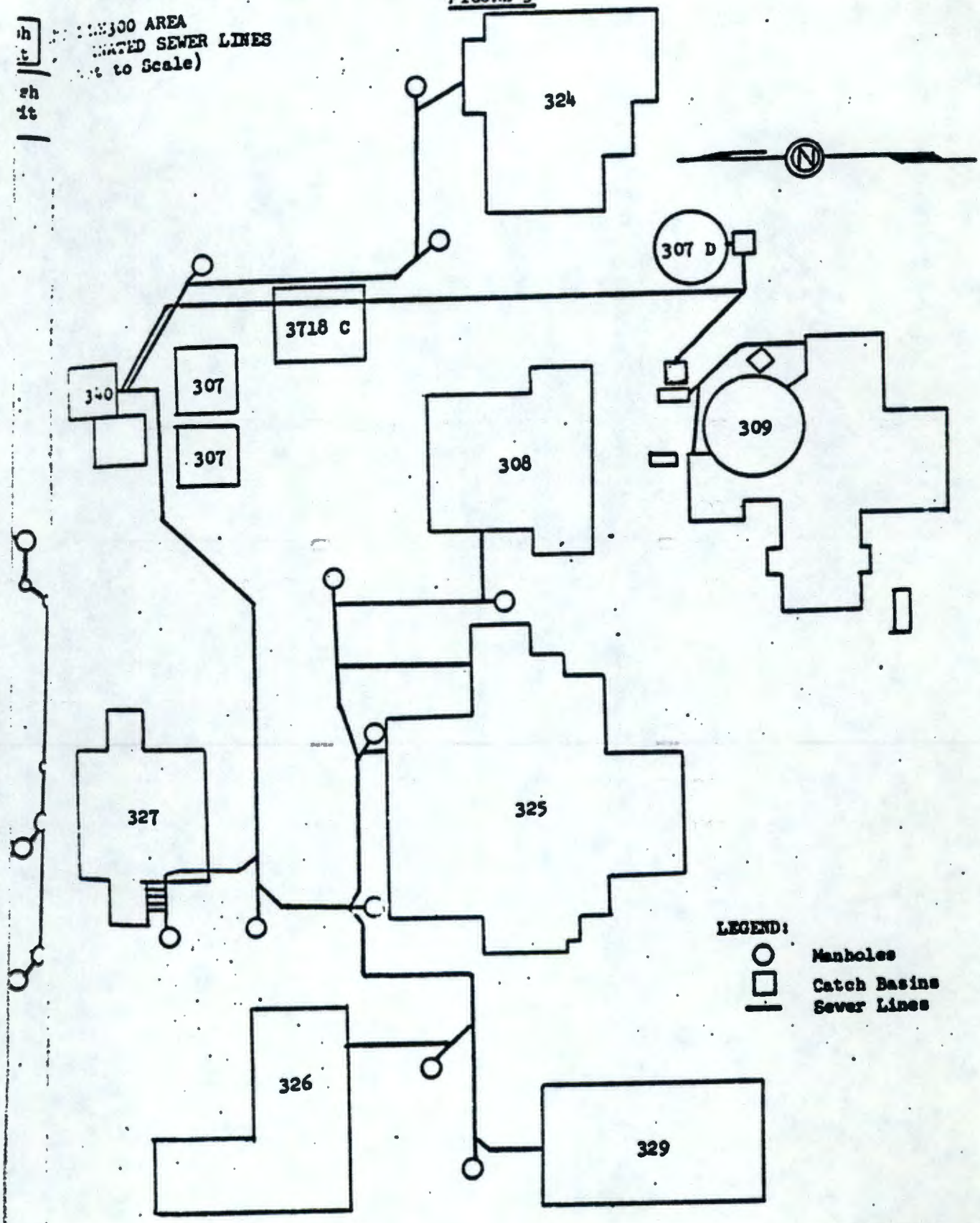
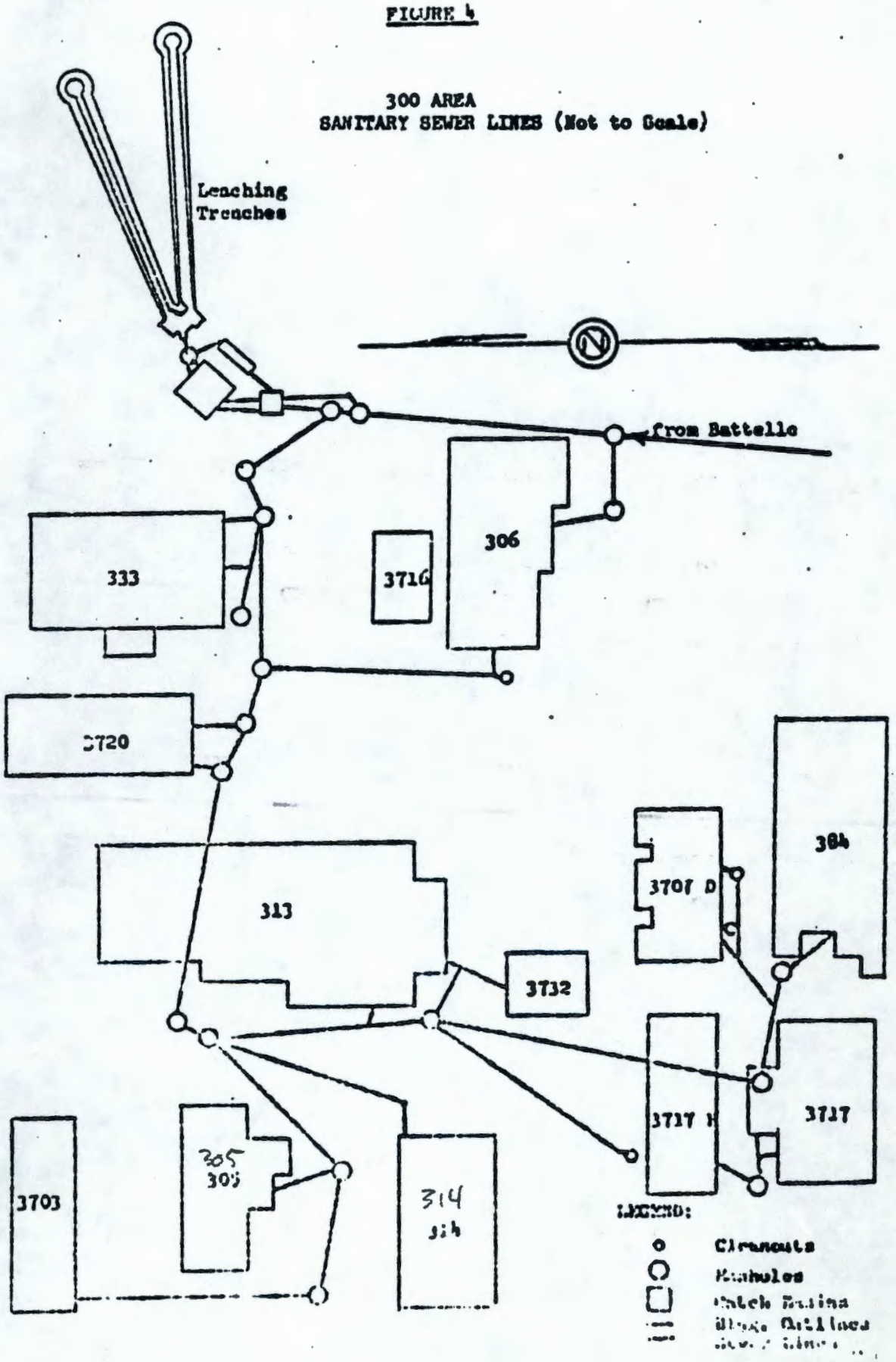


FIGURE 4

300 AREA
SANITARY SEWER LINES (Not to Scale)



9 2 1 2 5 8 3 0 3 2 5

B. GASEOUS EFFLUENTS:

Gaseous effluents that are routinely discharged to the atmosphere from the Production Fuels Section facilities are listed in Table III.

TABLE III

Building	Process	Gaseous Effluent		Type Filter Control
313	Slug Pickle	NO_2, HNO_3		Scrubber
313	Fuel Element Etch Machines	NO_2, HNO_3		Scrubber
313	Sleeve Machines	NaOH, $NaAlO_2$		None
313	Slug Recovery	NaOH Spray		Scrubber
313	Acid Neutralization	NO_2, HNO_3		Scrubber
313	Spire Etch	NaOH, $NaAlO_2$		None
313	Special Products	NaOH Spray, Methanol Trichlorethylene		None
313	Cap and Can Machines	NaOH Spray, Methanol		None
313	Rail Degreaser	Trichlorethylene		None
313	Anodizing	NaOH Spray Oxalic Acid Spray		Scrubber
306	- - -	NO_2, HNO_3		Scrubber
384	- - -	Combustion Products		Regenerative Fly Ash Collector
3716	- - -	NaOH HNO_3 H_3PO_4	HCl $NiSO_4$ $NiCl_2$	Scrubber
3720	- - -	HF KOH NH_4OH HNO_3 HCl	H_2SO_4 Uranium Thoria Be	Particulate Filters
3732	- - -	ThO_2		Particulate Filter

9 2 1 2 5 8 3 0 3 2 6

V. CONFORMANCE WITH EFFLUENT CONTROL STANDARDS

A. LIQUID EFFLUENTS

1. Current practices that satisfy the intent of Executive Order 11288 include:

- SECONDARY TREATMENT

  The existing process ponds, septic tanks, and leaching trenches provide the necessary secondary treatment.

- STORAGE FACILITIES

  Storage facilities for liquid chemicals as presently located (See Figure 1) would not contribute a significant amount of water pollution in the Columbia River should rupture or accidental drainage occur. Most of the chemicals would be discharged to the ground. The small amount that could be expected to reach the process sewer would not be significantly greater than is currently being routinely dumped to the ponds from the various process operations in the 313 and 306 Buildings.

  REVIEW AND SURVEILLANCE PROGRAMS

  Weekly effluent samples at the north process pond inlet and east bank have been collected since November, 1966, by Battelle Northwest and analyzed by the DUN Analytical Laboratory. The typical range of contaminants is shown in Table IV. Notice that of those contaminants analyzed in the east bank samples only Cr^{+6}, NO_3, and F concentrations exceed the drinking water standards of 0.05, 45, and 0.8 ppm, respectively, as shown in Appendix III.

In order to provide additional information concerning the mobility of liquid effluents, a daily grab sample was collected during April, 1967, at three different locations of the north process pond - the inlet, north trough, and east bank. During periods of low river flow, river bank seepage samples were also collected and analyzed to determine the seepage concentrations of Cr^{+6} and NO_3. Uranium and some fluoride analyses on certain samples were also included in order to compare the results with uranium accountability losses and determine if the HNO_3-HF etch used by N-Fuels on zircaloy was contributing any fluoride to the river. The results of the sampling program are listed in Tables V and VI and are plotted against time in Figures 5 through 10.

TABLE IV

Range of Typical Contaminants

Process Pond Inlet and East Bank

Contaminant	Inlet (ppm)	East (ppm)
Copper	ND - 0.11	0.002 - 0.11
Iron	ND - 5.9	ND - 0.12
Sulfate	8 - 1890	14 - 60
Nitrate	74 - 2484	88 - 286
Chloride	0.6 - 24.0	0.5 - 9.2
Chromium (VI)	0.001 - 200	0.01 - 7.0
Zinc	<0.001 - <0.001	<0.001 - <0.001
Uranium	0.01 - 3.3	0.03 - 1.6
Fluoride	-	3.5 - 26

ND = Not Detectable

A. LIQUID EFFLUENTS (continued)

In reviewing the results of the sampling program, it is important to realize that considerable fluctuation is expected because of the various disposal frequencies of the 300-Area contractors. There is special significance in two of the graphs. Figure 10 illustrates that most of the uranium, as expected, settles out in the vicinity of the inlet, seeps through the soil and enters the river in concentrations significantly higher than those found on the east bank. Since the average inlet uranium concentration of 0.45 ppm is only slightly higher than the average bank seepage concentration of 0.36 ppm, it is believed that very little of discharged uranium is being retained by the soil. These concentrations indicate that approximately seventeen pounds of uranium per day are being discharged to the river from the 300-Area operations. This

TABLE V

North Process Pond Analyses (ppm)

Date	Inlet			Trough			East			
	U	NO_3	Cr^{+6}	U	NO_3	Cr^{+6}	U	NO_3	Cr^{+6}	F
MARCH										
27	.11	345	.17	.09	52	.03	.07	120	.15	
28	.68	83	.22	.13	96	.07	.11	148	.13	
29	.27	87	.25	.16	194	.08	.13	165	.11	
30	.52	119	.68	.16	186	3.20	.04	161	3.00	
31	.17	167	.26	.11	179	.61	.05	140	1.20	
APRIL										
3	.60	201	.28	.11	125	.04	.16	370	.18	
4	.11	116	.25	.13	189	.08	.18	212	.09	
5	.34	92	.25	.11	138	.13	.27	154	.16	
6	.16	109	.30	.21	137	.06	.19	193	.17	
7	.19	157	1.00	.16	315	.15	.13	222	.20	
10	.11	148	.21	.07	116	.03	.14	154	.11	
11	.44	89	.22	.29	149	.07	.05	102	.08	
12	.18	93	.22	.03	316	.08	.07	140	.09	
13	.55	100	.38	.22	165	.05	.05	141	.07	
14	.97	169	45.60	.22	278	.03	.03	195	.03	
17	.31	104	.30	.08	125	.31	.11	91	.60	
18	1.00	160	.22	.52	179	.11	.01	88	.60	
19										
20	1.00	145	.20	.16	248	.40	.22	145	.43	
21	.18	181	.22	.06	298	.22	.04	166	.68	
24	.88	74	.20	.09	86	.06	.60	138	.21	
25	.58	221	.22	.01	153	.23	.08	114	.21	
26	1.80	6228	.02	.02	149	.20	.08	185	.25	
27	.40	293	.20	.07	382	.08	.09	333	.12	
28	.20	257	.18	.04	245	.11	.20	269	.11	
MAY										
1									.20	5.0
2									.34	3.5
3									.11	4.7
4									.16	26.0
5									.17	-

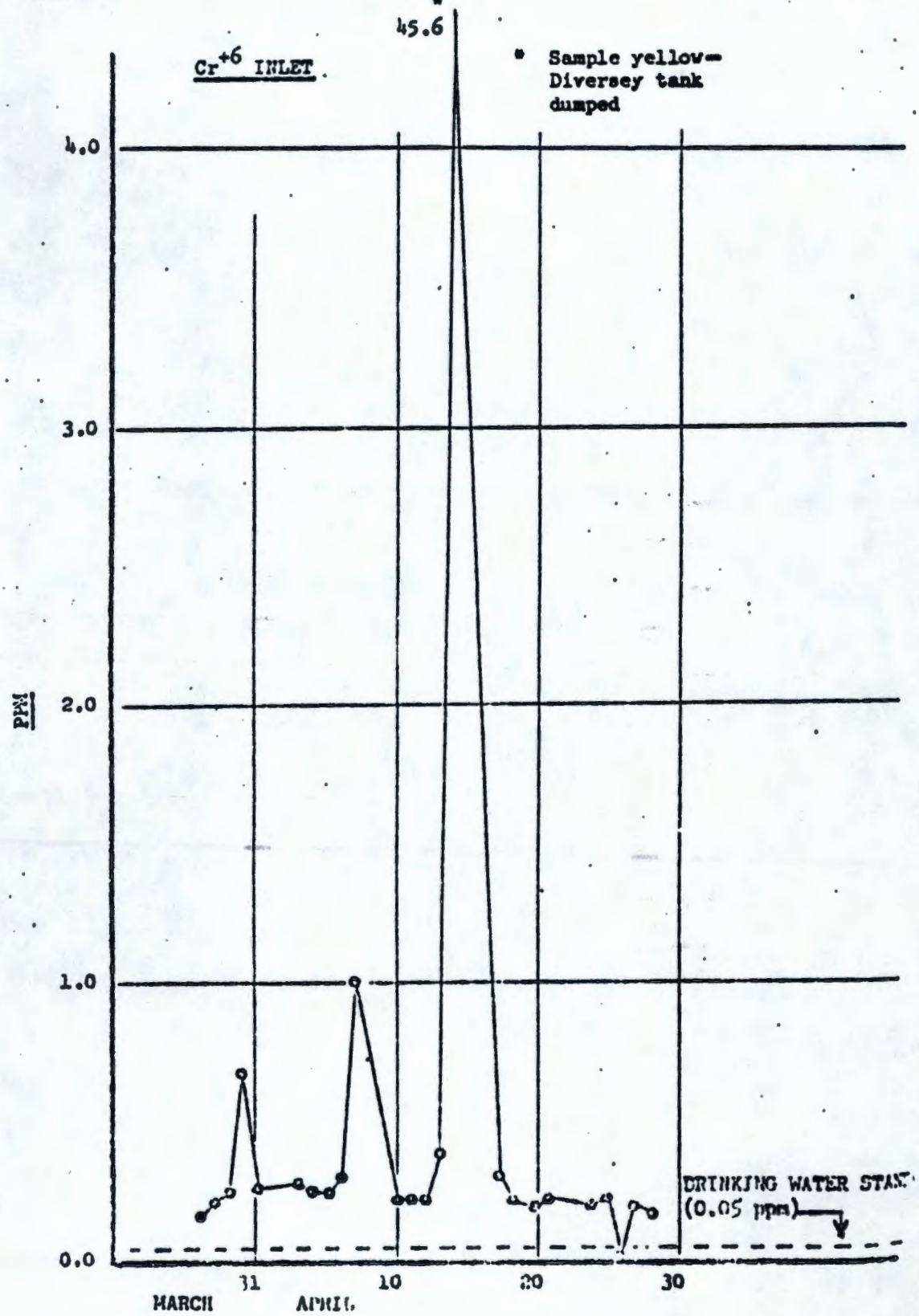
9212583 0329

TABLE VI

Bank Seepage Analyses (ppm)

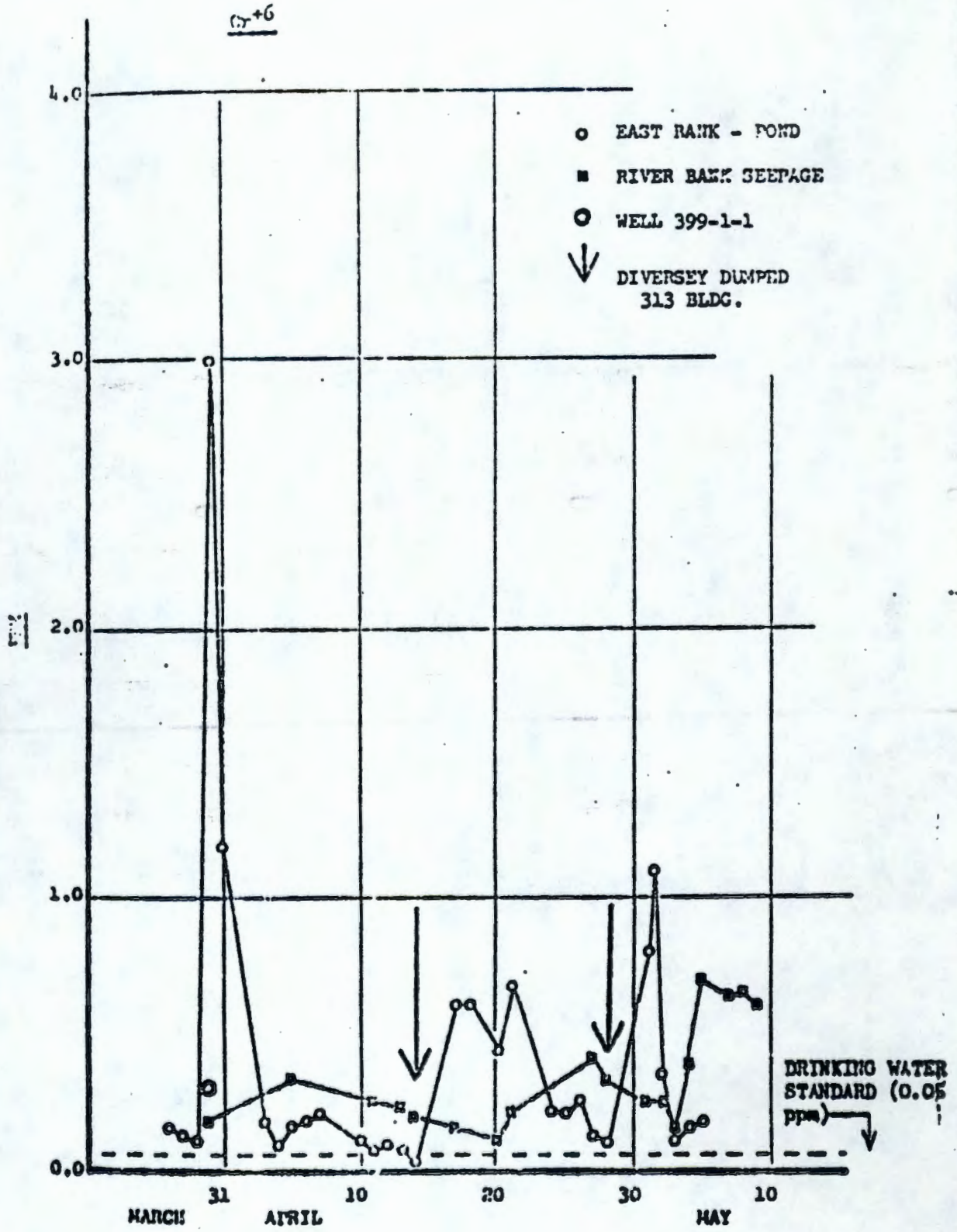
Date	U	NO_3	Cr^{+6}	F
MARCH				
30	.39	115	.17	-
APRIL				
5	.40	136	.33	-
11	.42	125	.25	-
13	.38	161	.22	-
14	.37	99	.19	-
17	.04	100	.16	-
20	.42	181	.11	-
21	.50	122	.21	-
27	.30	132	.40	-
28	.40	123	.33	-
MAY				
1	.30		.30	4.7
2			.29	4.7
3			.14	4.0
4			.38	4.8
5			.70	3.6
7			.62	10.0
8			.64	4.5
9			.60	4.7
AVERAGE	.36	129	.34	5.1

FIGURE 5


45.6
Cr^{+6} INLET
* Sample yellow-
Diversey tank
dumped
4.0
3.0
2.0
1.0
0.0
PPM
DRINKING WATER STAN
(0.05 ppm)
31
10
20
30
MARCH
APRIL

UNCLASSIFIED

FIGURE 6



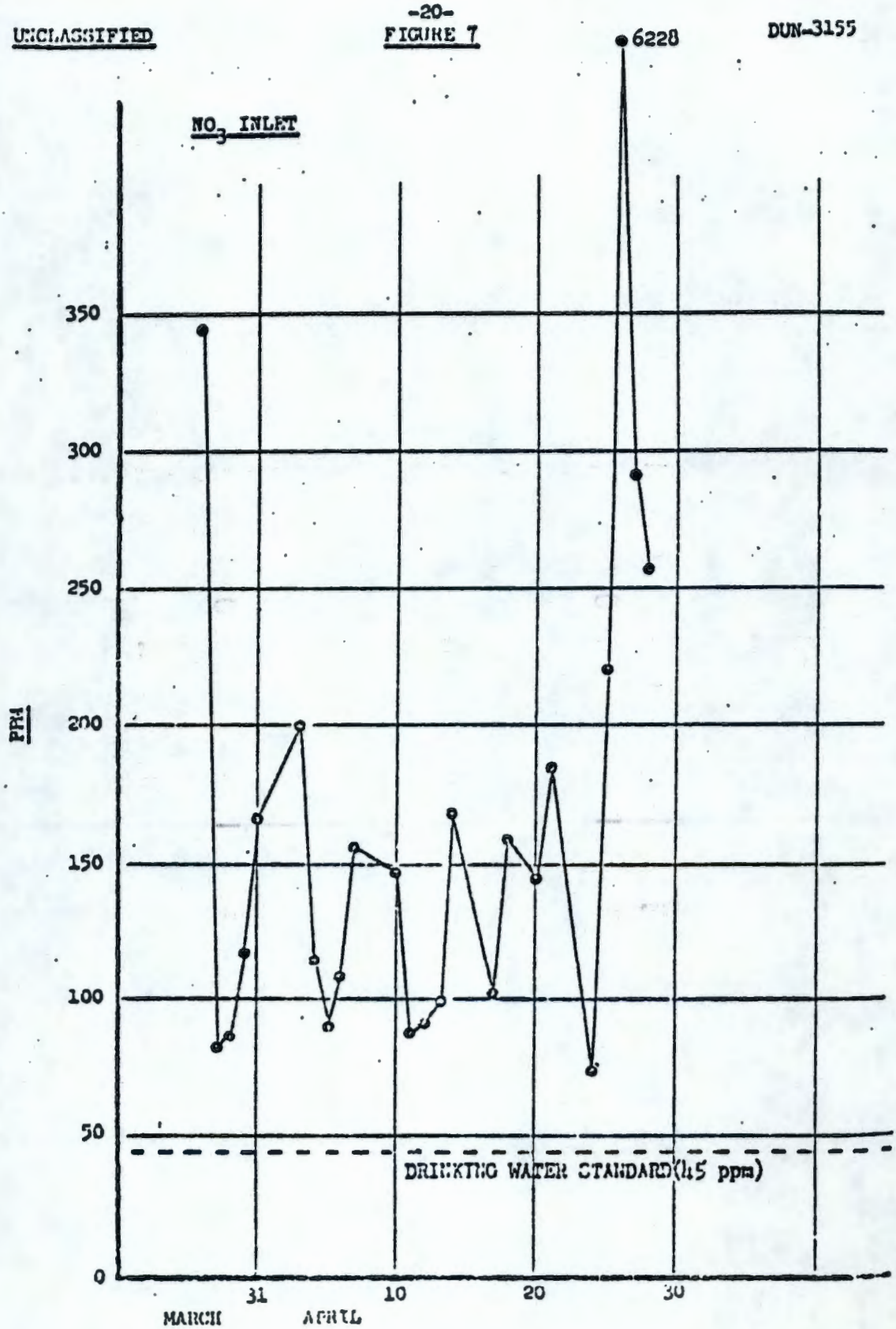
UNCLASSIFIED

9 2 1 2 5 8 3 0 3 3 2

UNCLASSIFIED

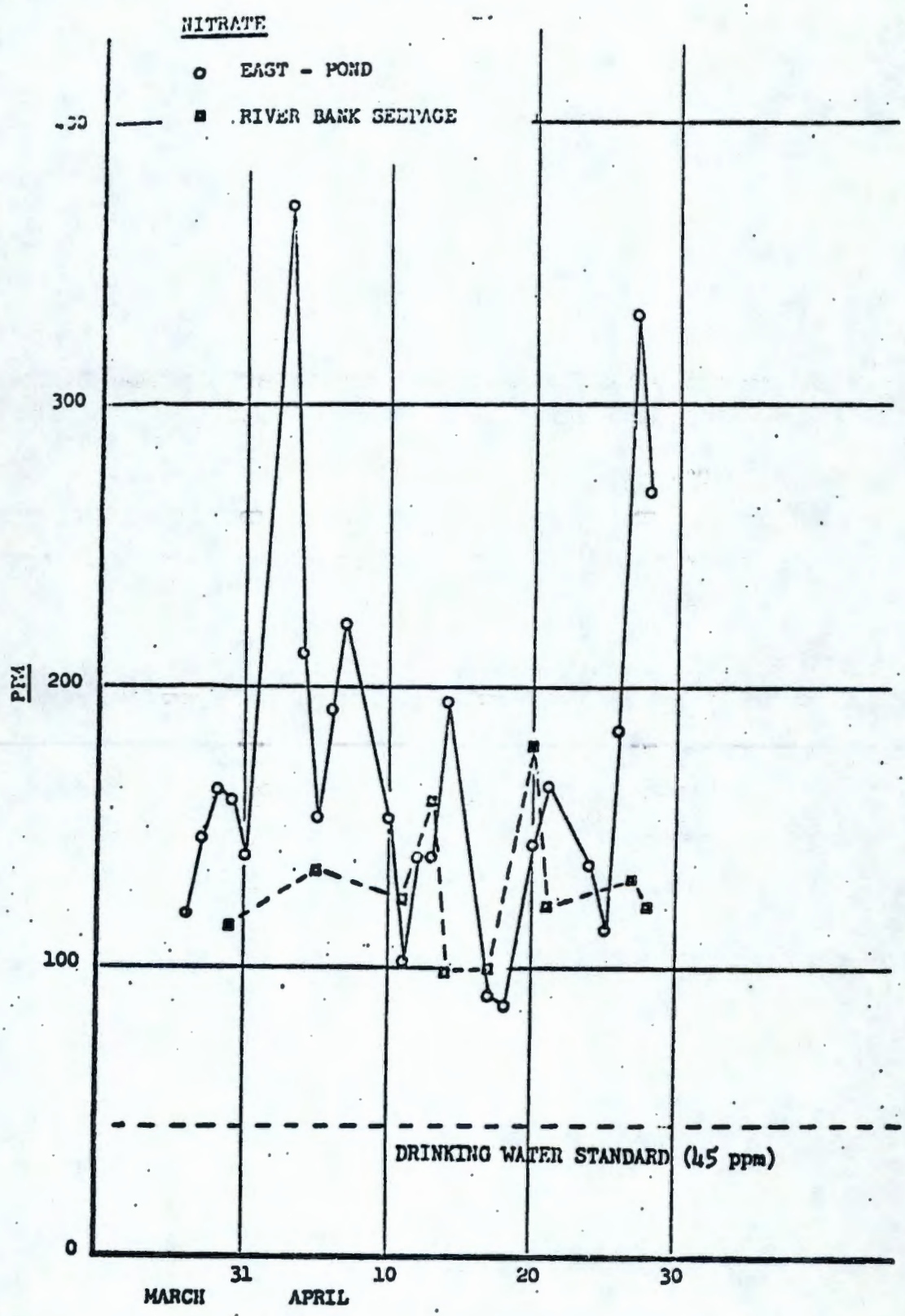
FIGURE 7

DUN-3155



UNCLASSIFIED

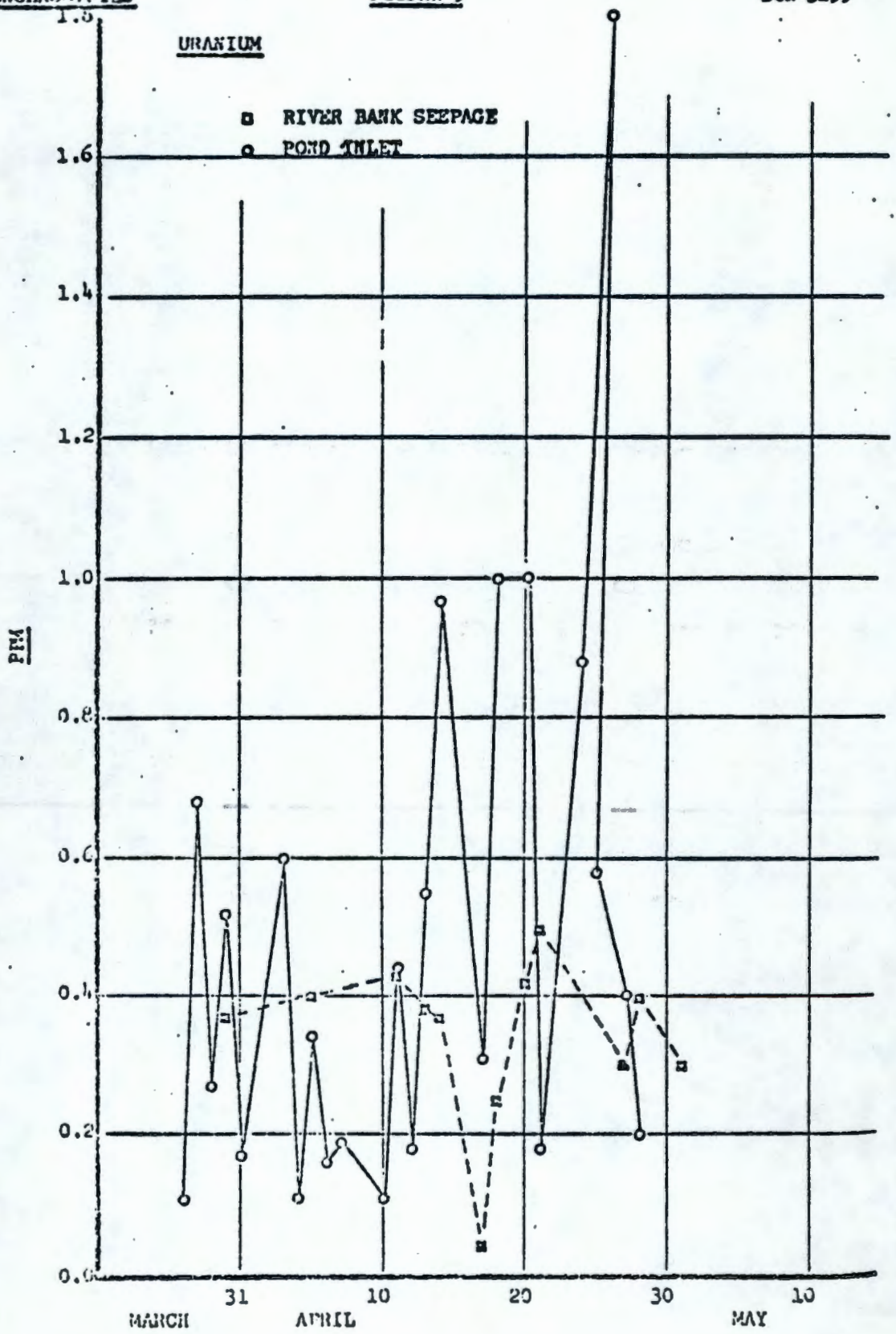
FIGURE 8


NITRATE
EAST - POND
RIVER BANK SEEPAGE
300
200
100
0
PPM
DRINKING WATER STANDARD (45 ppm)
31
10
20
30
MARCH
APRIL

UNCLASSIFIED

FIGURE 9

DUN-3155



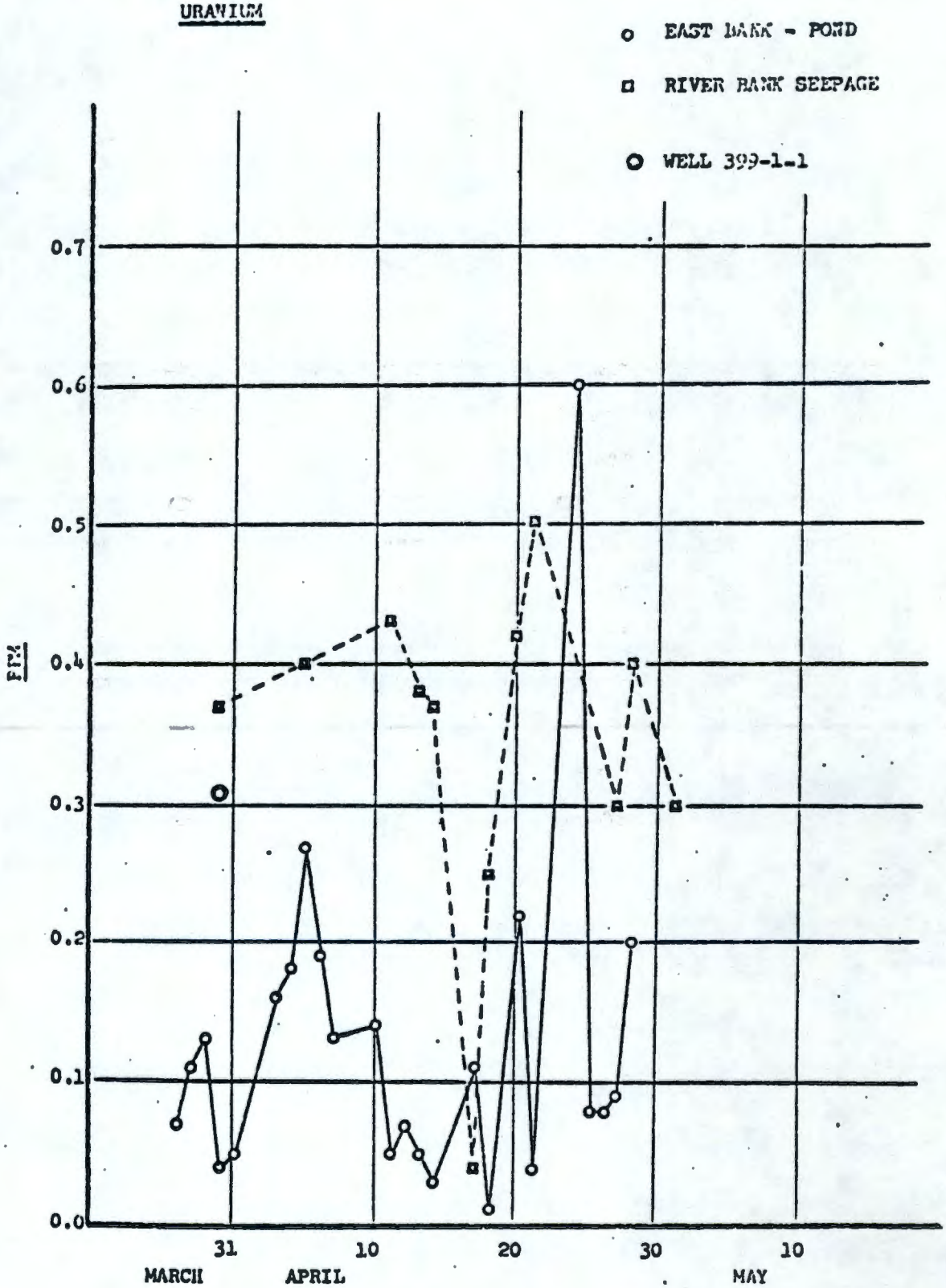
UNCLASSIFIED

UNCLASSIFIED

FIGURE 10

DUR-3155

URANIUM



UNCLASSIFIED

A. LIQUID EFFLUENTS (continued)

amount of uranium does not contribute measurable human exposure and does not constitute a pollution problem.

The deoxidizer solution from the component cleaning area was identified as the source of the hexavalent chromium noticed in the pond and at the river bank (see Figure 6). After each deoxidizing solution was dumped, a "wave" of Cr^{+6} was generated which reached the river bank some six to seven days later. The concentration rose to a peak of 0.4 ppm and slowly descended approaching the 0.05 ppm limit, but rose again after another deoxidizer tank was dumped. The April 28th, 1967, drain has special significance in this interpretation in that the valve on the process tank was inadvertently left open and a double batch was dumped. Notice that the concentration on the river bank increased significantly (0.7 ppm) after this incident. Although not a significant pollution problem, ways of reducing the source of Cr^{+6} are being investigated. Included are reduction to Cr^{+3} and pumping to 303-F for controlled discharges each day to the sewer. While these concentrations are above the drinking water standard, samples taken by Battelle-Northwest at the Richland Water Plant show an average concentration of 0.008 ppm which is well below the 0.05 ppm limit for drinking water.

Fluctuation of the nitrate content makes any interpretation of the nitrate analyses difficult in regard to seepage rates and major source identification; but, on the average, the bank seepage concentrations (135 ppm) exceed the drinking water standard. Samples taken by Battelle-Northwest indicate a nitrate content less than 1 ppm in Columbia River water at the Richland Water Plant which also is much below the 45 ppm limit for drinking water.

The fluoride analyses indicate that this area should be studied further since two high readings were seen - a 26 ppm concentration in the east bank sample on May 4, 1967, and a resulting 10 ppm concentration in the bank seepage sample of May 7, 1967. Unfortunately, earlier samples were discarded before it was realized that fluoride analyses might be desirable.

Samples from the anodizing spacer cleaning tank were analyzed monthly for radiochemical elements. A typical analysis is shown in Table VII. Previous samples have indicated a maximum alpha activity of 1.0×10^{-5} microcuries per milliliter and a maximum beta activity of 1.9×10^{-4} microcuries per milliliter.

A. LIQUID EFFLUENTS (continued)

While the maximum beta activity exceeds the limit of 5×10^{-5} microcuries per milliliter permitted by RL Manual Appendix 0510, sufficient dilution is realized before the contaminants enter the process pond. Radiochemical analysis of samples taken from the north process pond, well 399-1-1, and Columbia River seepage (Table VIII) have shown a maximum total beta activity of 2.8×10^{-7} microcuries per milliliter. It is assumed that the alpha activity is also in this range with neither activity level constituting a pollution problem.

TABLE VII

Typical Radiochemical Analysis of Anodizing Caustic Solution

Isotope	Activity Level (μc/ml)
Zn^{65}	0.19
Zr-Nb	0.09
Se^{46}	0.27
Fe^{59}	0.03
Co^{60}	0.02
Co^{58}	Trace
Maximum Beta	1.9×10^{-4}
Maximum Alpha	1×10^{-5}

TABLE VIII

Typical Radiochemical Analysis of Well 399-1-1 and Bank Seepage Samples

Isotope	Bank Activity Level (μc/ml)	Well 399-1-1 Activity Level (μc/ml)
Zn^{65}	9.1×10^{-8}	9.1×10^{-8}
Co^{60}	8.8×10^{-8}	8.7×10^{-8}
Cr^{51}	9.1×10^{-7}	1.4×10^{-6}

TABLE VIII (continued)

Isotope	Bank Activity Level (μc/ml)	Well 399-1-1 Activity Level (μc/ml)
Pu^{239}	5.6×10^{-5}	5.7×10^{-5}
Maximum Beta	2.8×10^{-7}	2.1×10^{-7}

A study made by A. B. Johnson (1)* indicated that radioactive activation product buildup is not to be anticipated in the process sewer system because of the periodic releases of the caustic cleaning solution. Samples will continue to be taken in order to assure control of these releases. In addition, Battelle-Northwest is periodically sampling the wells in the vicinity of the ponds in order to assess the magnitude of radiochemical contamination flowing to the river.

Samples have been taken from the leaching trenches and the river, both above and below the trenches, by Battelle-Northwest and analyzed for coliform content and biochemical oxygen demand (BOD). A typical analysis is shown in Table IX. (For a further explanation of coliform and BOD and their relationship to water pollution, see Appendix III.) Based on these analyses, the 300-Area sanitary waste treatment system is judged to be performing an adequate secondary treatment of sanitary wastes.

TABLE IX

Bacteriological Analysis of Leaching Trenches, Wells, and Columbia River

Date	Location	Coliform/100 ml	BOD, mg/l
2/16/67	Leach Trench	60,750	28
	Well 399-1-3	20	0
	Well 399-3-1	120	0
3/14/67	Leach Trench	82,000	4.9
	Well 399-1-3	75	0
	Well 399-3-1	9	0
5/19/67	Leach Trench		
	Herd End	22,500	15.8
	River End	31,000	18.6
	River		
	Upstream	3.5	3.7
	Seepage Area	6	3.0

* The numbers in parentheses ( ) refer to the list of References.

A. LIQUID EFFLUENTS (continued)

Level 1.

OPERATING PROCEDURES

Operating procedures involving the receiving, storage, and distribution of liquid chemicals and their subsequent use in the process are outlined in documents [illegible]-38058-100 REV and [illegible]-38058-200 REV, "Manufacturing Operation Operating Procedures, Fuels Separation Department." These documents provide a comprehensive summary of the procedures and equipment used to control the various production process variables.

Specific sections of these documents are related to the control of liquid effluents and include the following:

a. Receiving, Storage, and Distribution of Liquid Chemicals ([illegible])

Section	Procedure
150	Tank Car and Truck Sampling
151	Receiving, Storage, and Distribution of Nitric Acid
152	Receiving, Storage, and Distribution of Caustic
153	Receiving, Storage, and Distribution of Trichlorethylene
154	Nitrated Caustic Mixing and Distribution
155	Twenty-five Percent Sleeve Caustic Mixing and Distribution
156	Diversey 514 Solution
157	Methanol Tank Car Unloading
158	Altrex Mix and Distribution
159	Caustic Meter Operation

OPERATING PROCEDURES (continued)

b. Use and Discharge of Liquid Wastes

Section	Procedure
	Recovery (HW-38058-100 REV)
130	Stripping Tank Equipment
131	Stripping Operation
132	Treating Tank Equipment
133	Treating Operation
134	Operation of Centrifugal Pumps
136	Spent 50% Caustic Transfer
137	Neutralizing Process Equipment
138	Neutralizing Process Operation
139	Pressure Tank Equipment
140	Pressure Tank Operation
141	Filter Press Equipment
142	Filter Press Operation
	Pickle Machine Operation (HW-38058-200 REV)
225	Pickle Machine Startup
226	Pickle Machine Operation
228	Pickle Machine Equipment
229	Pickle Degreaser Still Startup
230	Pickle Degreaser Still Operation
231	Degreaser Still Equipment

9212583034 1

OPERATING PROCEDURES (continued)

Sleeve Machine Operation
([illegible] REV)

240	Sleeve Cleaning Machine Startup
241	Sleeve Cleaning Machine Operation
242	Sleeve Cleaning Machine Equipment
243	Sleeve Cleaning Machine Solution Makeup

Cap and Can Machine Operation
([illegible] REV)

250	Cap and Can Machine Startup
251	Cap and Can Machine Operation
252	Cap and Can Machine Equipment
253	Cap and Can Cleaning Machine Solution Makeup
254	Cap and Can Machine Safety Protection
256	Cap and Can Degreaser Still Startup
257	Cap and Can Degreaser Still Equipment
258	Methanol Still Startup
259	Methanol Still Operation
260	Methanol Still Equipment

2. Future action to assure continuing compliance with Executive Order 11258 includes:

SAMPLING PROGRAMS

On July 17, 1967, an automatic sampler was located at the 300-Area north process pond to gather a composite sample of aqueous effluents discharged from the 300-Area operations. Chemical and radiochemical analyses will be periodically performed in order to maintain a continuing inventory of

SAMPLING PROGRAMS (continued)

possible pollutants. A description of the sampler and its operating characteristics is shown in Appendix IV.

In addition to the pond samples, periodic grab samples are taken at the wells in the vicinity of the ponds along with bank seepage samples whenever river conditions permit.

Samples will continue to be taken of the anodizing caustic cleaning solution, and the results will be recorded and periodically reported in order to maintain continuing cognizance of this disposal activity.

Battelle-Northwest will continue to sample the leaching trenches and river for BOD and coliform content. These results will be periodically supplied to DUN.

REVIEWS

Periodic reviews of operating procedures and practices involving effluent control will be performed to insure continuing compliance with established release criteria. Quality Control will be responsible for coordinating future replies to effluent control practices.

B. GASEOUS EFFLUENTS

COMBUSTION OF FUELS

In conjunction with the compliance with Executive Order 11282, HEHF was requested to sample the 384 building powerhouse stack in order to measure the emission density of the smoke and the concentration of sulfur dioxide and recommend a detector or alarm system to monitor releases from the combustion units. The results of this sampling program have been reported by HEHF (2). Certain difficulties were encountered in obtaining representative stack gas samples because of the lack of available sample lines and particle size analysis was not made. Air samples were collected from the 150-foot stack and compared with the theoretical emission rate based on power level. At a steam generation level of 25,000 - 27,000 pounds per hour, the theoretical SO_2 concentration by use of fuel consumption is 214 ppm. The sample showed a concentration of 143 ppm.

By the use of curves comprised of ambient air concentrations versus meteorological parameters as related to stack gas sources, and assuming a steam load of 50,000 pounds per hour, a stack emission of 1.7×10^{-3} cubic meters of SO_2 per second

COMBUSTION OF FUELS (continued)

would result. Estimated ground level concentrations extrapolated from meteorological curves would be less than 0.1 ppm at 4,000 meters under stable atmospheric conditions and 5.0 ppm at 60 to 70 meters under unstable atmospheric conditions. Because the boilers that are normally operated during high steam generation (50,000 to 125,000 pounds of steam per hour) were not operating during the study, it appears that the on-site ground concentrations of SO_2 could be of concern. For this reason, supplementary studies will be made during the winter months when high steam generation rates are expected.

Studies have shown that a concentration of 0.6 ppm of SO_2 will produce no detectable response in healthy human beings; but in the range between 1 and 5 ppm, most persons will begin to show a detectable response (3). There is no sound evidence that chronic exposure to concentrations below 5 ppm of SO_2, by itself, has any persistently ill effects. Most people can detect 5 ppm, and it produces a distinctive gross physiological response - exposure for one hour causes choking. Most people find 10 ppm quite unpleasant; an exposure for one hour to this concentration produces severe distress.

It appears from the mathematical model used by HEHF that concentrations of greater than 5 ppm could be found at ground level during high generation, and it could be that certain controls will have to be implemented should this turn out to be the case.

Smoke density measurements made with a Mines Safety Appliance Smokescope showed that the density of the smoke was below shade number one on the Ringelmann Scale and, therefore, complies with the standard. Since the smoke density complies with the standard, it is believed that the particle size emission is also below the allowable release level. Measurement of particle size would be very difficult, and HEHF feels that it is no problem.

It is interesting to note that when the size of particles in an exhaust stream approaches the wave length of light, the stack discharge is quite visible in spite of the fact that the actual quantity of particles may be small. Thus, since visibility of an effluent exhaust is a function of the light-reflecting surfaces of the escaping material and since surface area per pound increases inversely with the square of the particle size, it is possible to remove 80 to 90 percent of the material from an exhaust stack without altering its appearance (4).

COMBUSTION OF FUELS (continued)

The recommendation from HEHF as to the type of smoke alarms for monitoring the combustion units is pending until a reply to an inquiry to the Department of Health, Education, and Welfare is received.

DISPOSAL OF REFUSE

Current disposal practices do not conform to the daily limit of 25 pounds of material that can be burned in open pits; but because of the remote location, low population density, refuse being primarily paper, and favorable meteorological conditions, it is believed that this standard is unduly restrictive, and an exemption has been requested by the RL-AEC. In conjunction with the dark-smoke-producing requirement, all subsections within the Production Fuels Section have been informed that should significant quantities of this material be generated, special disposal procedures should be used.

OTHER POLLUTION-PRODUCING PROCESSES

HEHF has sampled the stacks in the 313 and 306 buildings and has issued a report on the concentrations of gaseous effluents (5). The results indicate that scrubber replacements should be considered (see Appendix VIII for diagrams of current scrubber systems).

HEHF is scheduled to procure air monitoring equipment in October, 1967, and will monitor selected locations in the 300 Area to determine if the Production Fuels Section's gaseous effluents are harmful. Until that time, no change in the current mode of operation is contemplated.

RADIOACTIVITY

Previous investigation has shown that the Production Fuels Section does not contribute any gaseous radioactive effluents to the atmosphere that would be considered as harmful or hazardous to the public (6).

VI. RECORDS AND REPORTING

A. LIQUID EFFLUENT SAMPLES

Chemical and radiochemical analyses of the 300-Area process effluents will be reported monthly in the Quality Control Record Report. Significant changes will be discussed along with the planned action of reduction of the concentrations of those contaminants which are considered potential pollution contributors. The analyses will be supplied to those persons responsible for preparing the DUN Annual Report on Pollution Control Practices.

Summaries of the coliform and BOD content of leaching trenches and Columbia River samples will be reported when received from Battelle.

Semiannual radioactive waste disposal reports will be prepared based on the requirements of RL-0510.

B. GASEOUS EFFLUENTS

HEHF will be periodically sampling at different locations in the 300 Area starting in October, 1967. The results of these sampling programs will be documented and distributed to those concerned with this program. A semiannual gaseous effluent analysis of the Production Fuels Section buildings will be made and documented. Based on the results of these analyses, recommended changes will be offered in order to assure continuing compliance. The results of these various sampling programs, likewise, will be supplied to those responsible for conducting the annual DUN report on gaseous effluent control and the semiannual radioactive disposal report.

VII. ACKNOWLEDGMENTS

Appreciation is extended to C. D. Corbit for his review and suggestions and to C. T. Houghan for his effort in supplying the graphs and drawings.

9212583034 6

LIST OF REFERENCES

(1) A. B. Johnson, "Anodizing Process Waste Study," DUN-2431, April 24, 1967

(2) D. E. Anderson, HANFORD ENVIRONMENTAL HEALTH FOUNDATION, "The Release of Atmospheric Pollutants from DUN Facilities - 100 B and C, 100 KE and KW, and 300 Area," June, 1967

(3) AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, "Air Conservation," 1965, Publication No. 80, p. 62

(4) "Machine Design," July 20, 1967, p. 37

(5) W. E. Gill, HANFORD ENVIRONMENTAL HEALTH FOUNDATION, "Gaseous Effluent Survey, 313 Building," June, 1967

(6) C. D. Corbit, "Waste Disposal Inspection Report of Douglas United Nuclear," HAN-94336, April 20, 1966