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CLINTON ENGINEER WORKS

CARBIDE AND CARBON CHEMICALS CORPORATION

Works Laboratory

PRODUCTION REPORT OF THE INDUSTRIAL HYGIENE SECTION

OCTOBER AND NOVEMBER, 1947

N. H. Ketcham

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Report No. K-112 - Part I
File No.
Date of issue December 15, 1947

Title: PRODUCTION REPORT OF THE INDUSTRIAL HYGIENE SECTION OCTOBER AND NOVEMBER, 1947

Author: N. H. Ketcham

CLINTON ENGINEER WORKS

CARBIDE AND CARBON CHEMICALS CORPORATION

Works Laboratory

ABSTRACT

Summarized analytical data obtained by the Industrial Hygiene Section during the months of October and November, 1947 is given.

WATER SURVEY PROGRAM

October and November, 1947

A total of 213 water samples were taken. The results are shown in Table I, attached.

All fluoride analyses of the Clinch River effluent from K-25 and of the drinking water in the K-25 and K-27 areas gave analyses indicating a fluoride content of no physiological significance.

Uranium analyses of sufficient sensitivity to assure detection of uranyl salts in parts per billion quantities were successfully made. Statistical control studies of the analytical method and the stability of such dilute uranium solutions in glass containers is currently in progress and when completed should be of interest to others concerned with this problem. Analytical data to date indicate that with the possible exception of Poplar Creek, immediately influent to K-25, the waterways and the K-25 and K-27 drinking water have no measurable uranium content. Slight uranium contamination of Poplar Creek immediately above an inlet northeast of K-25 Building K-303-8 appears to confirm information that back-flow in the creek may exist at times.

Descriptive identification of most of the drainage systems sampled include identification of the main source of the water. Care should be used in interpreting the results, as in some cases it is known that the water originates in more than one building or that the water from a given building goes into two or more disposal lines. For purposes of simplification, only the main source is identified.

Table I

Water Survey Program

October and November 1947

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
13 D	Clinch River, effluent from K-25	10- 2-47	0	---	-
		10- 9-47	0	0.2	Less than 0.5
		10-10-47	0	0.1	1
		10-13-47	0	0.4	Less than 0.5
		10-14-47	0	0.1	1
		10-15-47	2	0.1	Less than 0.5
		10-16-47	0	No analysis	1
		10-17-47	0	No analysis	2
		10-20-47	0	0.5	2
		10-21-47	0	0.5	1
		10-22-47	0	Less than 0.2	1
		10-23-47	0	Less than 0.2	1
		10-24-47	0	0.2	1
		10-27-47	0	Less than 0.2	Less than 0.5
		10-28-47	0	Less than 0.2	Less than 0.5
		10-29-47	0	Less than 0.2	1
		10-30-47	0	Less than 0.2	2
		10-31-47	0	Less than 0.2	1
		11- 3-47	0	Less than 0.2	2
		11- 4-47	0	Less than 0.2	1
		11- 5-47	0	Less than 0.2	Less than 0.5
		11- 6-47	0	Less than 0.2	1
		11- 7-47	0	0.2	1
		11-10-47	0	0.3	1
		11-11-47	0	Less than 0.2	3
		11-12-47	0	Less than 0.2	2
		11-13-47	0	Less than 0.2	1
		11-14-47	0	Less than 0.2	2
		11-17-47	0	Less than 0.2	1

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
13 D	Clinch River, effluent from K-25	11-18-47	0	Less than 0.2	1
		11-19-47	0	Less than 0.2	2
		11-20-47	0	Less than 0.2	1
		11-21-47	0	Less than 0.2	1
		11-24-47	0	Less than 0.2	1
		11-25-47	0	Less than 0.2	2
		11-26-47	0	Less than 0.2	1
		11-28-47	0	Less than 0.2	1
24 D	Effluent water from K-25 Water Purification Plant	10-2-47	0	---	-
		10-9-47	0	---	Less than 0.5
		10-10-47	0	---	Less than 0.5
		10-13-47	0	---	Less than 0.5
		10-14-47	0	---	1
		10-15-47	0	---	1
		10-16-47	0	---	1
		10-17-47	0	---	1
		10-20-47	0	---	2
		10-21-47	0	---	1
		10-22-47	0	---	0.5
		10-23-47	0	---	0.5
		10-24-47	0	---	1
		10-27-47	0	---	1
		10-28-47	0	---	Less than 0.5
		10-29-47	0	---	1
		10-30-47	0	---	1
		10-31-47	0	---	1
		11- 3-47	0	---	1
		11- 4-47	0	---	4
		11- 5-47	0	---	1
		11- 6-47	0	---	3
		11- 7-47	0	---	1
		11-10-47	0	---	1
		11-11-47	0	---	1
		11-12-47	0	---	1
		11-13-47	0	---	2

Plot Plant Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
24 D	Effluent water from K-25 Water Purification Plant	11-14-47	0	---	2
		11-17-47	0	---	1
		11-18-47	0	---	1
		11-19-47	0	---	1
		11-20-47	0	---	1
		11-21-47	0	---	2
		11-24-47	0	---	1
		11-25-47	0	---	2
		11-26-47	0	---	2
		11-28-47	0	---	1 alpha 2 beta
Y-12 Potable Water	Bldg. 9212, Wing A	*	4	---	9
	Bldg. 9206, N.W.Corridor	*	0	---	Less than 0.5
	Bldg. 9212, Wing B	*	0	---	Less than 0.5
	Bldg. 9212, Wing B	*	2	---	1
	Bldg. 9212, ---	*	0	---	1
	Bldg. 9212, Wing C	*	0	---	1
	Bldg. 9212, Wing D	*	0	---	1
	Bldg. 9212, Wing D	*	2	---	4
	Bldg. 9206, S.Cent. Corridor	*	0	---	1
	Bldg. 9202, S.Cent. Corridor	*	2	---	1
	Bldg. 9204-3, K-23 Mech. Serv. Area		0	---	1
	Bldg. N-37, Chem. Process Area	*	0	---	0.5
	Bldg. 9203-3, K-23 Chem. Recovery Area	*	120	---	10
	Bldg. 9203-3, Refining Service Area	*	0	---	1
	Bldg. 9733-1, N. Corridor	*	2	---	1
	Bldg. 9733-1, S. Corridor	*	0	---	1
	Bldg. 9733-2, S. Corridor	*	0	---	1
	Bldg. 9733-4, Basement Corridor		0	---	2
	Bldg. 9733-2, N. Corridor	*	0	---	1
	Bldg. 9733-4, N. Corridor	*	0	---	2
	Bldg. 9733-3, N. Corridor	*	0	---	1
	Bldg. 9733-3, N. Corridor	*	0	---	Less than 0.5

* Sampling Date was not given.

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
Y-12 Potable Water	Bldg. 9731, F-2	*	0	---	1
	Bldg. 9735, S. Corridor	*	0	---	1
	Bldg. 9739, Central Corridor	*	0	---	1
	Bldg. 9766, ---	*	0	---	Less than 0.5
	Bldg. 9204-3, Chem. Recovery Area	*	0	---	2
	Bldg. 9204-3, Chem. Recovery Area	*	0	---	2
	Bldg. 9204-3, Chem. Recovery Area	*	0	---	2
	Bldg. 9204-3, Chem. Recovery Area	*	0	---	1
	* Sampling Date was not given				
12 W	Clinch River, influent to K-25				
		10-15-47	0	0.2	1
		10-20-47	0	0.2	1
		10-28-47	0	Less than 0.2	1
		11- 3-47	0	Less than 0.2	2
		11-11-47	0	Less than 0.2	2
		11-17-47	0	Less than 0.2	1
		11-24-47	0	Less than 0.2	2
16 W	K-25 and K-27 Drinking Water				
	Process Utilities Lab.	10- 1-47	0	---	-
	Bldg. K-1004-D, Room 011	10-16-47	0	0.4	Less than 0.5
	Bldg. K-402-7	10-22-47	0	Less than 0.2	1
	Bldg. K-302-3	10-28-47	0	Less than 0.2	1
	Bldg. K-1001, Wing C	11- 3-47	0	Less than 0.2	1
	Bldg. K-631	11-11-47	0	Less than 0.2	Less than 0.5
	Grounds Equipment Storehouse	11-17-47	0	Less than 0.2	Less than 0.5
	Bldg. K-131	11-24-47	0	Less than 0.2	Less than 0.5

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Con c. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
10 W	Clinch River, below S-50 Sewer outfall	10-16-47	0	0.4	1
		10-20-47	0	Less than 0.2	1
		10-28-47	2	Less than 0. 2	1
		11-3-47	0	Less than 0.2	1
		11-11-47	2	Less than 0. 2	1
		11-18-47	0	Less than 0. 2	1
		11-24-47	0	Less than 0. 2	2
21 W	S-50 Sewer Outfall	10-1-47	0	----	-
		10-17-47	4000	0.8	-
		10-20-47	0	Less than 0. 2	-
		10-28-47	80	0.2	-
		11-3-47	800	0.3	-
		11-11-47	150	0.4	-
		11-18-47	600	0.3	-
		11-24-47	200	0.4	-
14 W	Influent to Sewage Disposal Plant	10-1-47	16	-----	-
		10-15-47	8	-----	-
		10-22-47	120	-----	-
		10-29-47	0	-----	-
		11-3-47	2	-----	-
		11-11-47	2	-----	-
		11-17-47	2	-----	-
		11-24-47	0	-----	-
15 W	Effluent from Sewage Disposal Plant	10-1-47	12	-----	-
		10-15-47	8	-----	-
		10-22-47	2	-----	-
		10-29-47	2	-----	-
		11-3-47	2	-----	-
		11-11-47	0	-----	-
		11-17-47	0	-----	-
		11-24-47	0	-----	-

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
6 W	K-131 Drainage into Poplar Creek	10- 2-47	30	---	-
		10-17-47	40	---	-
		10-21-47	16	---	-
		10-28-47	16	---	-
		11- 3-47	16	---	-
		11-11-47	2	---	-
		11-17-47	4	---	-
		11-25-47	4	---	-
11 W	Poplar Creek, influent to K-25	10- 6-47	1	---	-
		10-15-47	0	0.3	1
		10-21-47	4	Less than 0.2	1
		10-28-47	2	Less than 0.2	1
		11- 3-47	2	Less than 0.2	2
		11-11-47	2	0.2	3
		11-17-47	0	Less than 0.2	2
		11-24-47	0	Less than 0.2	Less than 0.5
17 W	Recirculating Water K-25	10- 2-47	0	---	-
	Recirculating Water K-25	10-15-47	0	---	1
	Recirculating Water K-27	10-23-47	0	---	2
	Recirculating Water K-25	10-28-47	0	---	Less than 0.5
	Recirculating Water K-27	11- 3-47	0	---	4
	Recirculating Water K-25	11-11-47	0	---	2
	Recirculating Water K-27	11-17-47	0	---	1
	Recirculating Water K-25	11-24-47	0	---	1
22 W	Poplar Creek, before junction with Clinch River	10- 6-47	0	---	-
		10-15-47	0	---	2
		10-21-47	0	Less than 0.2	2
		10-28-47	0	Less than 0.2	1
		11- 3-47	0	Less than 0.2	2
		11-11-47	0	Less than 0.2	1
		11-17-47	0	Less than 0.2	1
		11-25-47	0	Less than 0.2	1

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
1 W	Poplar Creek inlet, N.E. of K-303-8	10-1-47	12	---	-
		10-15-47	4	---	-
		10-21-47	8	---	-
		10-28-47	4	---	-
		11-3-47	4	---	-
		11-11-47	12	---	-
		11-17-47	0	---	-
		11-24-47	0	---	-
20 W	Cafeteria Cooking Water	10-6-47	0	---	-
		11-11-47	0	Less than 0.2	2
		11-17-47	0	Less than 0.2	1
		11-24-47	0	Less than 0.2	Less than 0.5
2 M	Drainage from pond S.W. of Garage Area into Poplar Creek	10-1-47	4	---	-
		11-12-47	2	---	-
3 M	Drainage from Process Bldgs. into Poplar Creek	10-2-47	0	---	-
		11-12-47	2	---	-
4 M	Drainage from Process Bldgs. into Poplar Creek	10-2-47	0	---	-
		11-12-47	2	---	-
5 M	Drainage from Process Bldgs. into Poplar Creek	10-2-47	0	---	-
		11-12-47	0	---	-
19 M	Powerhouse water intake	10-3-47	0	---	-
		11-12-47	0	---	-
18 M	Powerhouse water discharge	10-3-47	0	---	-
		11-12-47	0	---	-
8 M	Drainage from "hot scrap yard" into Poplar Creek	10-2-47	0	---	-
		11-12-47	0	---	-

Plot Plan Reference No.	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per Min. per 100 ml.
9 M	Clinch River, west of Jones Scrap Yard	10- 2-47	0	---	-
		11-12-47	0	---	-
25 M	Clinch River, $1\frac{1}{2}$ miles above Elza Gate	11-24-47	0		
				Less than 0.2	1
27 M	Drainage from Labs A, B, C, and D	11-28-47	40	---	7
23 M	Ground water adjacent to K-1239 sludge pit	11-28-47	0	---	-

URINE ANALYSES

October and November, 1947

The results of the special chemical urine analyses are summarized in Table II, attached. The results marked with an asterisk have been reviewed with the Division Head or his designated alternate. Corrective action has been or is being taken, as circumstances require.

The need for obtaining alpha activity measurements on urine samples of certain selected personnel was recognized in connection with both the Health Physics and Industrial Hygiene Programs, and lead to investigations of suitable procedures by the Works Laboratory. A very promising procedure was developed and, starting in December it is planned that a limited number of urine samples from the Dispensary will be alpha counted on an experimental basis. Routine alpha counting of urine samples of selected personnel is anticipated as being possible early in 1948. When enriched material is present, uranium analyses of greater sensitivity than currently obtained by chemical analysis will be possible. When only normal material is present, the chemical analysis is more sensitive than the counting method.

Anticipation of the need for urine analyses for beryllium has resulted in investigations by the Research Laboratory of possible suitable spectrographic procedures. Preliminary data are encouraging, and it is hoped to have a suitable sensitive and accurate urine analysis procedure in the near future.

The following uranium analyses were obtained on tissue samples of a fish from Clinch River at K-25

Tissue	Analysis
Gills	Less than 0.05 micrograms uranium per gram sample
Bone	Less than 0.05 micrograms uranium per gram sample
Fat	Less than 0.05 micrograms uranium per gram sample
Heart	Less than 0.05 micrograms uranium per gram sample
Muscle	Less than 0.05 micrograms uranium per gram sample

Table II

Urine Analyses

October and November, 1947

Contaminant	Total Number of Samples	Number of Analyses of 0.00 mg U / liter	Number of Analyses of Greater than 0.00 mg U / liter
Uranium	359	537	2*
	Total Number of Samples	**Number of Analyses of 0.0 mg Hg / liter**	**Number of Analyses of 0.1 - 0.3 mg Hg / liter**
Mercury	136	98	38*
	Total Number of Samples	**Number of Analyses of less than 0.2 - 1.2 mg F^- / liter**	
Fluorides	31	31	

AIR ANALYSES

October and November, 1947

The results of analyses of air samples are summarized in Table III, attached. Results marked with an asterisk indicate that steps are being or have been taken to assure corrective action as necessary.

Not included in the Table III tabulation, is a series of air analyses run during electric welding, using an argon atmosphere, in an attempt to identify an abnormally irritating constituent in the welding smoke. Traces of phosgene were found in the smoke, but efforts to locate the source of the phosgene or the phosgene-forming chlorinated hydrocarbon were unsuccessful. The condition has not recurred; hence further investigation has not been possible.

Table III

Air Analyses

October and November, 1947

Contaminant	Total Number of Samples	Number of Samples Containing 0.00 mg U / cu meter	
Uranium	26	26	
	Total Number of Samples	Number of Samples Containing Less Than 0.1 mg Hg / cu meter	Number of Samples Containing 0.1 mg Hg / cu meter, or Greater
Mercury	129	114	15*
	Total Number of Samples	Number of Samples Containing Less than 100 ppm	Number of Samples Containing 100 ppm or Greater
Trichloroethylene	47	38	9*
	Total Number of Samples	Number of Samples Containing Less Than 1 ppm	Number of Samples Containing 1 ppm or Greater
Fluorides (as HF or F_2)	5	4	1*
	Total Number of Samples	Number of Samples in Which No Combustibles Detected	Number of Samples in Which Combustibles Detected, but not in Explosive Concentrations
Combustibles	15	11	4*

Contaminant	Total Number of Samples	
Dust	42	These samples were analyzed gravimetrically and counted, to assist the Process Engineering Department in a special study.

	Total Number of Samples	Number of Samples Containing Less Than 10 ppm
Nitrous Fumes	4	4

	Total Number of Samples	Number of Samples Containing Less Than 0.1 mg Cd / cu meter	Number of Samples Containing 0.1 mg Cd / cu meter or Greater
Cadmium	3	2	1*

	Total Number of Samples	Number of Samples Indicating No Appreciable Oxygen Deficiency
Oxygen Deficiency	1	1

TESTS OF THE EFFICIENCY OF THE U.S. ARMY COMBAT MASK M5-11-7, B-2 WHITLERITE CANISTER, AS PROTECTION AGAINST THE HYDROLYSIS PRODUCTS OF UF6

Repeated fifteen minute exposure tests of twenty M5-11-7 Combat Mask B-2 Whitlerite Canisters to the hydrolysis products of uranium hexafluoride, in a 50% relative humidity atmosphere, were continued, with no evidence of "failure" from excessive passage of UF_6, UO_2F_2 of HF through the canisters. Due to evidence of plugging of all of the canisters, these particular tests were discontinued November 26th. Flow resistance tests of fifteen of the canisters at a flow rate of 85 liters of air per minute, following the last exposure, showed they exceeded 3 inches water pressure specified by the Bureau of Mines as the maximum permissible. The final pressure drop across these canisters at 85 liters per minute flow varied from 4 inches of water to 35 inches of water.

Table A summarizes the relationship of the total exposures of the canisters to date, and the final 85 liters per minute air flow resistance. Since the canisters were given normal tool crib handling between tests, resulting in freeing particles of UO_2F_2 caught on the filter surface, correlation between total exposure and air flow resistance is not to be expected.

The HF concentrations passing through the canisters during the total of 175 cumulative tests varied from 0.0 ppm to 2.6 ppm, except for one canister, which passed a single HF concentration of 4.7 ppm, followed by subsequent concentrations of less than 0.3 ppm. This single inconsistent result, although unexplained, is not considered significant.

From a total of 175 uranium analyses of the effluent atmospheres, only six analyses, representing five canisters, were greater than 0.02 milligrams uranium per cubic meter. These five concentrations varied from 0.03 to 1.4 milligrams uranium per cubic meter. Three of these canisters showed passage of less than 0.02 milligrams uranium per cubic meter on subsequent tests. Two of the canisters gave effluent gas analyses of 0.07 and 0.28 milligrams uranium per cubic meter respectively, on the last test. The six analyses of greater than 0.02 milligrams uranium per cubic meter probably resulted from contamination of the sample.

Complete data and more detailed discussion of the series of canister tests will be included in a report to be issued upon completion of the work. It appears reasonable to conclude from the present data, however, that this canister gives very acceptable personnel protection against the hydrolysis products of UF_2 in the concentration range studied.

TABLE A

Canister Number	Number of 15 Minute Exposures 32 liters / min. Flow Rate	Total Volume of Air Passed Cubic Meters	Ave. Uranium Concentration in Influent Atmosphere mg. U / cu meter	Total mg. Uranium Passed Into Canister	Pressure Drop Across Canister Flor Rate 85 liters per minute Inches of Water	
					Before Exposure	After Exposure
1	9	4.32	65	280	2.5	8
2	9	4.32	41	180	3.0	35
3	9	4.32	28	120	2.8	15
4	9	4.32	12	54	2.8	9
5	9	4.32	37	160	2.5	22
6	9	4.32	46	200	3.0	33
7	9	4.32	67	290	3.0	12
8	9	4.32	53	240	2.8	5
9	9	4.32	54	240	2.8	12
10	9	4.32	55	240	3.0	35
11	9	4.32	120	530	3.0	17
12	9	4.32	140	590	2.8	12
13	9	4.32	120	540	3.0	6
14	9	4.32	120	530	2.5	14
15	9	4.32	120	530	2.8	4
16	8	3.84	210	820	2.8	-
17	8	3.84	160	610	2.8	-
18	8	3.84	160	600	2.5	-
19	8	3.84	190	710	2.8	-
20	8	3.84	190	740	2.5	-

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CARBIDE AND CARBON CHEMICALS CORPORATION

K-25 PLANT

OAK RIDGE, TENNESSEE

Medical Department

INDUSTRIAL HYGIENE LABORATORY ANALYSES

DECEMBER, 1947

By N. H. Ketcham

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Appendix (Item 3) to Report of Health Physics Activities for December, 1947.

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Author: N. H. Ketcham

CARBIDE AND CARBON CHEMICALS CORPORATION

K-25 Plant

Medical Department

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A B S T R A C T

Tabular summaries of the industrial hygiene air sampling activities, and the special chemical and physical urinalyses performed during the month of December, 1947, are attached. Brief comment is included with respect to the portions of the data indicative of possibly significant chemical atmospheric contamination. Specific comment with regard to the clinical findings on personnel working in the areas associated with the air or urine analysis data, or involved in particular accidents, is not included, as such information is on record as a part of the established Medical Department reports.

The air samples reported herein were taken by the Works Laboratory, and the air and urine analyses performed by the Works and Research Laboratory staffs, for which grateful acknowledgement is made.

APPROVAL FOR RELEASE

Document: # K-112/PT2 ; Date 1/19/48 ;

Title/Subject INDUSTRIAL HYGIENE LABORATORY ANALYSES, DECEMBER 1947

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K-25 Classification & Information Control Officer — Date 2/1/93

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TABLE I

INDUSTRIAL HYGIENE AIR SAMPLING

DECEMBER, 1947

Air Samples for Uranium Analyses

Total number of samples	13
Number of samples containing 0.00 mg.U/cubic meter	11
Number of samples containing greater than 0.15 mg. U/cubic meter	2*

* Both of these samples were taken in room 21, Building K-1004-D approximately 30 minutes after a UF_6 leak had occurred on December 30, 1947.

Air Samples for Mercury Analyses

Total number of samples	59
Number of samples containing less than 0.1 mg. Hg./ cubic meter	49
Number of samples containing 0.1 mg. Hg/ cubic meter, or greater	10*

* Five of these samples were taken on December 2, 1947 in room 63, K-1004-A. A mercury spill had occurred the preceding day. Clean up efforts were being made. One of these analyses represented atmosphere in a mercury storage area, room 72, K-1004-A. Four were obtained in room 215N, K-1401.

Air Samples for Trichlorethylene Analyses

Total number of samples	30
Number of samples containing less than 200 ppm	24
Number of samples containing 200 ppm or greater	6*

* These analyses were obtained at working positions around the K-1401 Building Cleaning Area degreasing tank and Pump Shop degreaser. Exposure time of any one man is limited and intermittent, hence the data is not considered indicative of any significant exposure.

Air Samples for Dust Counts

Total number of samples	6
Number of samples containing less than 5 MPPCF	5
Number of samples containing greater than 5 MPPCF	1*

* For experimental purposes, this sample was taken in the K-1069 Sand Blasting Shop, immediately following a blasting operation. Protective equipment is worn by personnel doing sand blasting.

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Air Samples for Nitrous Fume Analyses

Total number of samples	7
Number of samples containing less than 10 PPM	3
Number of samples containing 10 PPM or greater	4*

* These analyses were made in the K-1303 Building while operation of a nitric acid decontamination process was in progress. A report of this instance has been issued by the Safety and Inspection Division. Recognition of the possible hazard by the operations personnel, prompt evaluation of the extent of contamination of the atmosphere by the air analyses, and immediate medical treatment of the exposed personnel, very likely avoided what might readily have been a serious accident.

Air Samples for Ammonia Analyses

Total number of samples	2
Number of samples containing less than 10 PPM	2

Air Samples for Phosgene Analyses

Total number of samples	346*
Number of samples in which no phosgene found	346

* 343 of these represent atmosphere samples from inside chlorine type storage cylinders, one shipment of which was received containing residual phosgene in a few cylinders.

Air Samples for Hydrogen Sulfide Analyses

Total number of samples	2
Number of samples containing 0.0% H_2S	2

Air Samples for Cadmium Analyses

Total number of samples	2
Number of samples containing less than 0.1 mg. Cd./cubic meter	2

Air Samples for Hydrogen Chloride Analyses

Total number of samples	1
Number of samples containing less than 10 PPM	1

Air Samples for Beryllium Analyses

Total number of samples	2
Number of samples containing 0.00 mg. Be./cubic meter	2

Discussion:

It is to be noted that air analyses for beryllium are included, for the first time, as one of the services which are available to the plant.

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Six air analyses for mercury, not included in the above tabulation, were made to study the mercury vapor concentrations in the exhausts of vacuum cleaners used to clean up mercury spills. A mercury analysis on the dust scraped from one of these vacuum cleaners was also performed. This information is being assembled by the Safety and Inspection Division.

A water-soluble fluoride analysis made on a leak detector probe confirmed a preliminary diagnosis of a hydrogen fluoride burn.

The following analyses were made at the site of the F-01 Building at the request of the Atomic Energy Commission. The results are not included in the above data tabulation.

Air samples for fluoride analyses	8
Air samples for uranium analyses	8
Cement samples for uranium analyses	8
Cement samples for alpha activity	8
Wipe tests for fluoride	8
Wipe tests for uranium	8

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TABLE II

SPECIAL CHEMICAL AND PHYSICAL URINE ANALYSES

DECEMBER, 1947

Uranium Analyses

Total number of samples	195
Number of samples containing 0.00 mg. U/liter	194
Number of samples containing greater than 0.00 mg. U/liter	1*

* Action to assure no further exposure of this patient has been taken.

Mercury Analyses

Total number of samples	49
Number of samples containing 0.0 mg. Hg./liter	43
Number of samples containing 0.1 and 0.2 mg. Hg./liter	6*

* Corrective action has been and is being taken by the supervisors concerned with follow up by the Safety and Inspection Division.

Fluoride Analyses

Total number of samples	6
Number of samples containing 0.3 to 0.6 mg. F/liter	6

Alpha Count

Total number of samples	5
Number of samples below "tolerance"	4
Number of samples above "tolerance"	1*

* Action to assure no further exposure of this patient has been taken. The "tolerance" level for alpha activity in the urine specimens is based upon the best present knowledge. As larger numbers of specimens are counted in the future, correlation with other clinical findings may be possible and will be included in the established Medical Department reports.

Discussion:

Arrangements are in progress in cooperation with the Radiation Hazards Department, Health Physics Section, for increasing the number of selected personnel upon whom urinary alpha counting will be performed at periodic intervals. Representative personnel from plant areas where enriched material is regularly handled are to be included in this study.

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Starting in January, 1948, inclusion of urine analyses for beryllium in the medical examination of personnel working with beryllium compounds will be possible. However, at present, it is not anticipated that any appreciable volume of beryllium compounds will be handled in the K-25 or K-27 Plants.

Appendix (Part 1)
to Report of Health
Physics Activities
for December, 1947

Water Survey Program

December, 1947

Plot Plan Reference Number	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts Per min. per 100 ml.	Beta Counts per min. per 100 ml.
23 D	Clinch River, Effluent from K-25	12- 1-47	0	Less than 0.2	Less than 0.5	
		12- 2-47	0	Less than 0.2	1	
		12- 3-47	0	Less than 0.2	Less than 0.5	
		12- 4-47	0	Less than 0.2	1	
		12- 5-47	0	Less than 0.2	1	
		12- 8-47	0	Less than 0.2	1	
		12- 9-47	0	Less than 0.2	1	
		12-10-47	0	Less than 0.2	1	
		12-11-47	0	Less than 0.2	2	
		12-12-47	0	Less than 0.2	0.5 ± 0.7	
		12-15-47	0	Less than 0.2	0.3 ± 0.8	
		12-16-47	0	Less than 0.2	0.2 ± 0.8	
		12-17-47	0	Less than 0.2	0.6 ± 0.7	
		12-18-47	0	Less than 0.2	1.4 ± 0.9	
		12-19-47	0	Less than 0.2	1.5 ± 0.6	
		12-22-47	0	Less than 0.2	1.3 ± 0.9	
		12-23-47	0	Less than 0.2	0.5 ± 0.7	
		12-24-47	0	Less than 0.2	1.3 ± 0.7	
		12-26-47	0	Less than 0.2	0.5 ± 0.7	
		12-29-47	0	Less than 0.2	0.4 ± 0.7	
		12-30-47	0	Less than 0.2	0.4 ± 0.7	
		12-31-47	0	Less than 0.2	0.2 ± 0.6	
24 D	Effluent Water from K-25 Water Purification Plant	12- 1-47	0	-	Less than 0.5	0
		12- 2-47	0	-	1	0
		12- 3-47	0	-	1	
		12- 4-47	0	-	Less than 0.5	
		12- 5-47	0	-	1	0
		12- 8-47	0	-	1	0.26
		12- 9-47	0	-	1	1.47
		12-10-47	0	-	1	0.84
		12-11-47	0	-	2	1.18

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Plot Plan Reference Number	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per min. per 100 ml.	Beta Counts Per min. per 100 ml.
24 D	Effluent Water from K-25 Water Purification Plant	12-12-47	0	-	2	
		12-15-47	0	-	1	
		12-16-47	0	-	Less than 0.5	1.05
		12-17-47	0	-	0.9 ± 0.5	0
		12-18-47	0	-	0.4 ± 0.7	0
		12-19-47	0	-	1.3 ± 0.9	1.25
		12-22-47	0	-	1.6 ± 0.9	0
		12-23-47	0	-	0.6 ± 0.7	0
		12-24-47	0	-	1.6 ± 0.8	0
		12-26-47	0	-	0.3 ± 0.6	0
		12-29-47	0	-	0.3 ± 0.7	0
		12-30-47	0	-	1.0 ± 0.7	0
		12-31-47	0	-	0.2 ± 0.6	
Y-12 Potable Water	Bldg. 9212, Wing A	*	0	-	1	
	Bldg. 9212, S. Main Corridor	*	0	-	1	
	Bldg. 9212, N. Main Corridor	*	0	-	Less than 0.5	
	Bldg. 9735, N. Corridor	*	0	-	Less than 0.5	
	Bldg. 9203, S. Main Corridor	*	0	-	1	
	Bldg. 9711-5	*	0	-	1	
	Bldg. 9712	*	0	-	Less than 0.5	
	Bldg. 9737	*	0	-	Less than 0.5	
	No Location	*	0	-	0.4 ± 0.8	
	Bldg. 9720-2	*	0	-	0.3 ± 0.7	
	Bldg. 9723-4	*	0	-	1.2 ± 0.7	
	Clear Well #1	*	0	-	1.1 ± 0.7	
	Clear Well #2	*	0	-	0.7 ± 0.7	

* Sampling Date was not given

12 W	Clinch River influent to K-25	12-1-47	0	Less than 0.2	Less than 0.5	
		12-10-47	0	Less than 0.2	Less than 0.5	
		12-16-47	0	0.3	0.7 ± 0.7	
		12-22-47	0	Less than 0.2	1.0 ± 0.7	
		12-29-47	0	Less than 0.2	0.3 ± 0.7	

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Plot Plan Reference Number	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per min. per 100 ml.	Beta Counts Per min. per 100 ml.
16 W	K-25 and K-27 Drinking Water					
	Garage Area	12-2-47	0	Less than 0.2	2	
	K-27	12-10-47	0	Less than 0.2	2	
	Bldg. K-1024, Rm. 7	12-17-47	0	Less than 0.2	1.1 ± 0.9	
	Bldg. K-1001	12-22-47	0	Less than 0.2	0.3 ± 0.6	
10 W	Clinch River immediately below S-50 Sewer Outfall	12-1-47	0	Less than 0.2	Less than 0.5	
		12-10-47	0	Less than 0.2	2	
		12-16-47	0	Less than 0.2	0.6 ± 0.7	
		12-22-47	0	Less than 0.2	0.2 ± 0.6	
		12-29-47	0	Less than 0.2	0.7 ± 0.7	
21 W	S-50 Sewer Outfall	12-1-47	80	0.2	-	
		12-10-47	80	0.5	-	
		12-16-47	170	Less than 0.2	-	
		12-22-47	40	0.3	-	
		12-29-47	40	0.2	-	
14 W	Influent to Sewage Disposal Plant	12-1-47	1	-	-	
		12-10-47	12	-	-	
		12-16-47	4	-	-	
		12-22-47	1	-	-	
		12-29-47	4	-	-	
15 W	Effluent from Sewage Disposal Plant	12-1-47	0	-	-	
		12-10-47	0	-	-	
		12-16-47	4	-	-	
		12-22-47	0	-	-	
		12-29-47	0	-	-	
6 W	K-131 Drainage into Poplar Creek	12-3-47	8	-	-	
		12-9-47	8	-	-	
		12-19-47	4	-	-	
		12-26-47	6	-	-	

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Plot Plan Reference Number	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per min. per 100 ml.	Beta Counts Per min. per 100 ml.
14 W	Poplar Creek, influent to K-25	12-1-47	0	Less than 0.2	1	
		12-9-47	0	Less than 0.2	1	
		12-16-47	0	Less than 0.2	0.8 ± 0.7	
		12-22-47	0	Less than 0.2	0.7 ± 0.7	
		12-29-47	0	Less than 0.2	1.6 ± 0.8	
17 W	Recirculating Water K-27	12-1-47	0	-	1	
	Recirculating Water K-25	12-10-47	0	-	1	
	Recirculating Water K-27	12-16-47	0	-	Less than 0.5	
	Recirculating Water K-25	12-22-47	0	-	0.9 ± 0.7	
	Recirculating Water K-25	12-29-47	0	-	0.8 ± 0.7	
22 W	Poplar Creek immediately before junction with Clinch River	12-1-47	0	Less than 0.2	1	
		12-9-47	0	Less than 0.2	1	
		12-16-47	0	Less than 0.2	2.5 ± 0.8	
		12-22-47	0	Less than 0.2	2.4 ± 1.0	
		12-29-47	0	Less than 0.2	0.4 ± 0.7	
1 W	Poplar Creek inlet, N.E. of K-303-8	12-1-47	0	-	-	
		12-10-47	12	-	-	
		12-16-47	4	-	-	
		12-22-47	2	-	-	
		12-29-47	2	-	-	
20 W	Cafeteria Cooking Water	12-3-47	0	Less than 0.2	1	
		12-12-47	0	Less than 0.2	1.3 ± 0.9	
		12-17-47	0	Less than 0.2	0.9 ± 0.7	
		12-23-47	0	Less than 0.2	0.2 ± 0.6	
		12-29-47	0	Less than 0.2	0.1 ± 0.6	
2 M	Drainage from Pond S.W. of Garage Area into Poplar Creek	12-2-47	2	-	-	

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Plot Plan Reference Number	Location	Date Sampled	Uranium Conc. p.p.b.	Fluoride Conc. p.p.m.	Activity Alpha Counts per min. per 100 ml.	Beta Counts Per min. per 100 ml.
3 M	Drainage from Process Bldgs. into Poplar Creek	12-4-47	0	-	-	
4 M	Drainage from Process Bldgs. into Poplar Creek	12-3-47	0	-	-	
5 M	Drainage from Process Bldgs. into Poplar Creek	12-3-47	0	-	-	
8 M	Drainage from "hot" scrap yard into Clinch River	12-3-47	0	-	Less than 0.5	
9 M	Clinch River east of Jones Scrap Yard	12-2-47	0	-	-	
18 M	Powerhouse water discharge	12-2-47	0	-	-	
19 M	Powerhouse water intake	12-2-47	0	-	-	
23 M	Ground water adjacent to K-1239 Sludge Pit	12-4-47	0	-	-	
25 M	Clinch River, above Elza Gate	12-5-47	0	Less than 0.2	1	
26 M & 27 M	Drainage from Labs. A, B, C, & D	12-23-47	2	-	2.4 ± 0.8	

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Appendix (Item 2)
to Report of Health
Physics Activities
for December, 1947

Industrial Hygiene Section

N. H. Ketcham

E. B. Olszewski

IH-3 Mask Testing O. B. Young

During the month of December, five M5-11-7 canisters were exposed to the hydrolysis products of uranium hexafluoride. These canisters were exposed continuously until they either plugged or passed uranium. During exposure samples of the influent and effluent atmospheres were taken at thirty-minute intervals. All of these samples were analyzed for uranium and the samples of the effluent atmosphere were also analyzed for fluoride. The pressure drop across the canisters was also recorded at frequent intervals.

Tables 2 through 5 summarize the results obtained on the canisters tested. Each table represents a different canister. The canister represented in Table 3 is the only one which passed uranium, but here hydrogen fluoride was also passed. Since the hydrogen fluoride concentration is approximately 50 times higher than the theoretical, it is evident that the uranium hexafluoride saturator contained either water or free hydrogen fluoride and the last four results obtained in Table 3 should be discarded. The same impurity was also evident in Table 4. Tables 1 and 5 gave results which were expected. From the data obtained in these tests it can be assumed that the M5-11-7 canisters will stop the hydrolysis products of uranium hexafluoride for fairly long periods of time, but they will not stop hydrogen fluoride when it is present in high concentrations.

Results have also been obtained from the analysis of the material in the twenty canisters which were given 15-minute exposures. These results show that all the uranium is retained by the paper filter while the fluoride is distributed throughout the canister.

Tests are being continued and in the very near future tests will be made to find whether the M5-11-7 canister will pass any radiation.

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TABLE I

Exposure Time in Minutes	U Conc. of the Influent Atmosphere mg / cu meter	U Conc. of the Effluent Atmosphere mg / cu meter	Fluoride Conc. Effluent Atmopshere PPM	Pressure Drop in Inches of Water Column
10	65	0.0	0.07	3.00
50	65	0.0	0.02	3.60
90	75	0.0	0.18	4.00
130	67	0.0	0.09	5.00
170	67	0.0	0.11	8.00
210	70	0.0	0.20	11.00
250	67	0.0	0.19	13.00
290	84	0.0	0.05	16.00

TABLE 2

10	4.2	0.0	0.09	2.00
50	14.0	0.0	0.09	2.60
151	41.0	0.0	0.03	2.60

TABLE 3

30	350	0.0	2.48	3.00
70	350	0.0	0.60	3.20
110	164	0.0	0.70	3.80
150	322	0.0	79.2	4.00
190	252	0.0	3744.	4.00
230	322	0.0	2810.	4.00
270	70	1.75	4134.	4.00
310	63	3.5	3922.	4.00

TABLE 4

10	105	0.0	0.88	2.0
60	105	0.0	0.33	2.0
100	105	0.0	0.49	3.00
140	98	0.0	0.35	3.00
180	98	7.0	1.3	3.00
220	4.6	0.0	150.	3.00
260	4.6	0.0	1794.	3.40
300	4.6	0.0	2964.	4.00
340	4.6	0.0	2886.	4.60
380	4.6	0.0	3588.	4.80
420	3.5	0.0	2652.	5.00
460	3.5	0.0	1503.8	6.00
500	3.8	0.0	1840.8	7.00
540	3.5	0.0	1899.3	7.20
580	3.5	0.0	2030.0	9.00
620	3.8	0.0	2083.0	9.20
660	5.2	0.0	2246.4	14.0

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TABLE 5

Exposure Time in Minutes	U Conc. of the Influent Atmosphere mg / cu meter	U Conc. of the Effluent Atmosphere mg / cu meter	Fluoride Conc. Effluent Atmosphere PPM	Pressure Drop in Inches of Water Column
10	3.5	0.0	179.4	3.00
50	3.5	3.5	1.58	3.00
90	3.5	0.0	3.34	3.00
130	1.75	0.0	1.50	3.00
170	14.0	0.0	0.88	3.00
210	1.75	0.0	0.88	3.00
250	1.75	0.0	0.70	3.20
290	3.50	0.0	0.74	3.20
330	1.75	0.0	0.47	3.20
370	0.70	0.0	0.40	3.20
410	3.50	0.0	0.46	3.40
450	0.[illegible]	0.0	0.44	3.40
490	1.75	0.0	0.28	3.40
530	6.0	0.0	0.88	3.40
570	0.7	0.0	0.33	3.40
610	1.4	0.0	0.32	3.40
650	0.7	0.0	0.46	3.40
690	3.5	0.0	0.40	3.40
730	7.0	0.0	0.35	3.40
770	0.7	0.0	0.22	3.40
810	1.4	0.0	0.44	3.40
850	0.35	0.0	0.13	3.60
890	0.70	0.0	0.21	3.60
1010	0.28	0.0	0.18	3.60
1050	0.40	0.0	0.46	3.60
1090	0.35	0.0	0.28	3.60
1130	0.70	0.0	0.26	3.60
1170	15.7	0.0	0.30	3.60