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RADIONUCLIDE LEVELS
IN AIR FILTER SAMPLES
FROM THE PUREX PROCESS BUILDING

J. E. Fager
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and
R. J. Brouns

December 15, 1967

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By

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Radiological Sciences Section
Environmental and Radiological Sciences Department

December 15, 1967

50

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RADIONUCLIDE LEVELS IN AIR FILTER SAMPLES
FROM THE PUREX PROCESS BUILDING

In the past few years the sensitivity of nondestructive methods for measuring radionuclide concentrations by gamma spectrometry have been greatly improved by the development of low background multiparameter detectors. These detectors consist of pairs of large (e.g., 5-inch by 6-inch) NaI(Tl) scintillators and have light pipes to shield the detectors from the multiplier phototubes. These assemblies are surrounded by a plastic anticoincidence guard and 4-inches of Pb shielding. The anticoincidence guard reduces the background by about five over the unguarded system. Lower backgrounds permit longer counting periods and lower detection limits. Such systems are being used routinely in the low level radiochemistry laboratories of the Pacific Northwest Laboratory, a division of Battelle Memorial Institute, for direct nondestruction gamma spectrometry analysis.

Multiparameter gamma spectrometry can be used advantageously when sample sizes are

limited or when sensitivity is limited because of interfering gamma spectra in complex mixtures. One possible application is in the analysis of air filter samples. If filter samples of rather small volumes of air can be analyzed, it will be easier to measure changes of concentration of radioactive contaminants in air over short periods of time. The measurements described in this report were made to demonstrate the applicability of gamma-gamma coincidence spectrometry to the analysis of common air monitoring filter samples taken in potentially contaminated spaces.

A set of routine air filter samples from the Purex process building (202A) was obtained from Isochem, Inc. personnel*. They were selected from the sets of normal daily and weekly filter collections throughout the building on HV type 4-inch by 8-inch filter papers. The sample descriptions are given in Table I. The samples were sealed in

*The samples were obtained with the assistance of Don Brown, Wayne Killand and George Gurwell of Isochem.

polyethylene bags as soon as they were received at the 300 Area laboratory on 12-29-66. Millipore filter samples taken elsewhere at Hanford and at background locations (Spokane, Washington, and Barrow, Alaska) during the same period were also counted. All of the filters were analyzed by multiparameter gamma spectrometry between either a pair of 11-inch by 6-inch or a pair 6-inch by 5-inch NaI(Tl) crystals with 4-inch-thick NaI light pipes. The 6-inch by 5-inch crystals were operated in anti-coincidence with a large plastic annulus which surrounds the detectors. The HV type filters were counted between 3/8-inch plastic absorbers to reduce the beta activity to the NaI(Tl) crystals. Counting times ranged from 100 minutes to 2000 minutes, depending on the activity of the filter. Four samples were counted simultaneously using a 4-input multiplexed 4096 channel analyzer. The PAK computer programs were used for data handling and analyses. The calculations were done by the GEM Program, a computer program designed to handle multi-component, decaying gamma spectra.

One or more of the common fission products were detected in all samples at levels from one to several orders of magnitude above air sample background levels for the same period of time, although the levels were far lower than the MPC limits. The highest concentrations were found in exhaust plenum and stack samples and in certain "hot" zones of the building. Activation products characteristically found in reactor effluent and Columbia River samples were also detected in a few samples. Filter samples taken outside in the 200E and 200W Areas; in the 300 Area; at Spokane, Washington; and Barrow, Alaska, were analyzed in the same manner for comparison. The results show that about 10^4 standard cubic feet is usually sufficient for measurement of several radionuclides in Purex building samples. Such a sample size could readily be collected in periods as short as two hours, permitting measurement of short term changes in contamination levels.

The data are tabulated as atoms per cubic foot of air sampled in Table II. In that table, a negative sign is used as the symbol for "less than". An "0" means the analysis was not attempted. The "less than" values were estimated for those cases in which

the concentration estimate by the least squares computer program was accompanied by a standard deviation estimate of more than 50 percent, relative. The magnitudes of the "less than" values are indicative of the limits of detection for each nuclide. These limits are strongly influenced by the presence of interfering nuclides in the sample as well as by the sample size. For example, ^{95}Zr - ^{95}Nb spectra interfered with the measurement of ^{137}Cs , but ^{106}Ru and ^{134}Cs can be determined by their unique gamma-gamma coincidence spectra.

For the convenience of the reader, the data for the five principal fission products are given in Table III in picocuries per cubic meter of air sampled. Where a blank occurs in that table, the nuclide was either not detected or the precision of the measurement was such that only a limit of detection was estimated.

The tables of data include results from a few sets of millipore filter samples collected during the period that the Purex building samples were collected. They consist of samples collected

near the UO_3 and Redox buildings, near the Purex plant stack, at the 329 Building in the 300 Area, near Spokane, Washington, and at the Arctic Research Station near Barrow, Alaska. They are included to permit comparisons of the results from both inside and outside the Purex processing plant with background.

Discussion of Results

The five fission products most prominent on the HV filters were ^{95}Zr , ^{106}Ru , ^{125}Sb , ^{137}Cs , and ^{144}Ce . In general, the levels were an order of magnitude or more higher than background air filters at that time. The values observed inside the Purex building were also higher than observed outside near the Purex stack, but the fission product levels near the 200E and 200W Area plants were also much higher than background. Fallout, therefore, was not a major fraction of the observed fission products found either inside or near the Purex plant. However, even the highest concentrations observed were more than a factor of 10 below the standard occupational MPC limits for these fission products.

Within the Purex building, the marked differences between some areas is probably expected from the nature of the operations. The stack and exhaust plenum samples were among the highest in all isotopes. ^{137}Cs is less variable between "hot and cold" areas in the building than the shorter-lived nuclides, ^{95}Zr , ^{106}Ru , ^{125}Sb , and ^{144}Ce . We have not attempted to estimate average or "typical" levels for each area because the day-to-day variability within a given area was quite high.

Other Nuclides Observed

Some radionuclides detected in the samples were too low and variable to establish any consistent patterns. ^{103}Ru was measurable only in samples 9226 (S-26), 9228 (S-26), and 9250 (P-9). The $^{103}\text{Ru}/^{106}\text{Ru}$ ratio on 9250 indicated a cooling time of about 140 days. ^{134}Cs was measurable in most exhaust samples, the CMP-3 samples and a few others. The median $^{134}\text{Cs}/^{137}\text{Cs}$ atom ratio was 0.0033. ^{141}Ce was detected in several samples. In one case, a $^{141}\text{Ce}/^{144}\text{Ce}$ ratio was obtained. It indicated a cooling time of about 150 days.

The HV filters were not counted until the first part of February, or about 60 days after the sample date. Therefore, one would not expect to detect nuclides with half lives shorter than 10 to 15 days. This helps explain the absence of ^{131}I and $^{140}\text{La-Ba}$ estimates. In addition, the filters would be expected to have a poor collection efficiency for gaseous iodine. Several nonfission product radionuclides were detected at levels above backgrounds in some of these samples. Of particular interest was the detection of ^{54}Mn (in samples 9210, 9215, 9232, 9250, and 9251), of ^{60}Co (in samples 9253, 9255, 9260, 9262, and 9263), and of ^{51}Cr (in samples 9226, 9228, 9250, 9251, 9252, and 9253, and 9257). The first two are measurable in large volume air samples of fallout but at concentrations much lower than indicated by the Purex samples. ^{51}Cr is found only in reactor effluent. All three of these isotopes are activation products present in large amounts in the Columbia River. Their presence in the Purex building may be due to the use of process water originating from the river downstream of at least one reactor.

The data presented here show that filter samples of about 10^4 cubic

feet of air are generally sufficient for measurement of ^{95}Zr and ^{137}Cs concentrations in air anywhere in the Purex building, and samples of 5×10^4 cubic feet are sufficient for some additional fission products. Samples of these sizes can be collected in short periods of time using readily available high velocity air sampling equipment. This, therefore, would permit measurement of concentration changes over short periods of time. Such measurements might be useful

in determining the effects of certain process operations on airborne contamination levels, or the rate of transport of activity between building zones without the necessity of compromising the present degree of contamination control in the building. The counting of such low level samples often requires up to 2000 minutes on expensive multiparameter analysis equipment and the cost of the analytical work would probably be justified only for a development effort.

TABLE IHV Type Air Samples From Purex
Process Building

<u>Sample Number</u>			<u>Description</u>	
9210	-	9218	N-1	N-Cell, hood room (Pu ion exchange process)
9219	-	9225	Q-4	Hot maintenance room
9226	-	9232	S-26	Room sample near hot waste sampling station
9233	-	9239	E-7-4	Stack sample at 50-ft level
9240	-	9246	E-7-3A	Stack exhaust in plenum downstream of fiberglass filter bed.
9247	-	9248	Pg-8	Pipe and operating gallery
9249			L-1	Office area
9250	-	9252	P-9	PR room (plutonium product loading room)
9253	-	9254	U-1	Acid and laboratory waste recovery cell*
9255	-	9257	HCR	Head end process control room
9258	-	9260	S-56	Sample gallery, exhaust end
9261	-	9263	CMP-3	East crane maintenance platform*

*Normally a mask area

Table II AIF FILTERS

				ATOMS PER CUBIC FOOT AT COLLECTION				MINUS MEANS LESS THAN							
STG	LOCATION	DATE	DU-FT.	CR-51	MN-54	CO-50	ZR-95	RU-103	RU-106	SB-125	CS-134	CS-137	CE-141	CE-144	
9210	N-1	N-Cell	120366	7,1+03	-1,5+04	1,6+03	-1,5+03	3,9+03	-1,8+03	-7,7+03	-5,3+03	-8,1+01	8,3+04	-2,8+03	-1,0+00
9211	N-1	N-Cell	120466	7,2+03	-1,4+04	-1,6+03	-1,5+02	4,3+03	-1,7+03	-7,0+03	-1,3+04	-1,5+02	-1,2+05	-4,1+03	-7,4+04
9212	N-1	N-Cell	120566	7,2+03	-9,4+03	-1,5+03	-1,2+03	-1,3+03	-5,7+02	-8,4+03	0,	-1,4+03	-8,8+04	-3,1+03	-5,8+04
9213	N-1	N-Cell	112766	1,4+04	-7,5+03	-1,7+03	-3,2+02	2,0+03	-3,9+02	-5,8+03	-1,9+04	-3,3+02	5,9+04	-2,0+03	-5,1+04
9214	N-1	N-Cell	112766	1,9+03	-2,9+04	-1,2+02	-2,9+03	-5,5+03	-6,2+03	-2,1+04	-2,6+04	-5,8+03	6,4+05	-1,7+04	-3,2+05
9215	N-1	N-Cell	112866	5,6+03	-2,4+04	2,7+03	-2,5+03	2,7+04	-2,9+03	-1,1+04	-2,3+04	-2,0+03	6,1+05	-5,6+03	-5,1+04
9216	N-1	N-Cell	112966	7,4+03	-2,1+04	-7,5+02	-5,5+02	1,2+03	-1,4+03	-6,9+03	-1,1+04	-1,2+03	1,3+05	-4,6+03	-3,0+04
9217	N-1	N-Cell	113066	5,6+03	-1,5+04	-1,7+03	-1,1+03	1,0+03	-2,8+03	-6,4+03	-8,8+03	-1,4+03	-1,1+05	-3,8+03	-4,4+04
9218	N-1	N-Cell	120266	7,2+03	-2,1+03	0,	-1,1+03	2,4+03	-5,3+01	-8,4+03	0,	-2,5+03	-8,3+04	-4,8+03	0,
9219	Q-4	Q-Cell	112766	1,4+04	-1,6+03	0,	-1,3+02	1,2+03	-4,4+02	-5,4+03	0,	-1,6+03	-8,4+04	-2,6+03	-1,5+04
9220	Q-4	Q-Cell	112866	7,4+03	-3,5+03	-5,7+02	-1,8+03	9,6+03	-3,0+02	-1,0+04	0,	-1,4+03	2,3+05	-7,5+03	0,
9221	Q-4	Q-Cell	112966	7,4+03	-2,3+04	-8,8+02	-1,3+03	1,5+03	-1,7+03	-1,1+04	-1,1+04	-2,3+03	9,2+04	-6,0+03	-6,6+04
9222	Q-4	Q-Cell	113066	7,1+03	-2,0+04	-1,4+03	-1,6+03	5,1+03	-2,1+03	7,9+03	-7,1+03	-3,0+03	-1,5+05	-6,7+03	-7,0+04
9223	Q-4	Q-Cell	120166	7,2+03	-1,6+04	-1,1+03	-4,3+02	-6,5+02	-1,4+03	-1,1+04	-4,4+03	-1,2+03	-1,2+05	-7,0+03	-5,5+04
9224	Q-4	Q-Cell	120266	7,1+03	-2,0+04	-5,8+02	-1,1+03	-1,5+03	-1,4+03	7,9+03	-1,1+04	-2,3+03	-1,0+05	-8,6+03	0,
9225	Q-4	Q-Cell	120366	7,1+03	-1,7+04	-1,4+03	-1,7+03	4,9+03	-1,1+03	9,5+03	-1,6+04	-2,4+03	-1,3+05	-5,6+03	-8,8+04
9226	S-26		112866	1,4+04	2,8+03	-7,3+02	-2,8+03	1,5+04	4,7+02	-5,9+03	7,6+03	-1,4+03	3,7+05	-9,8+02	-2,3+04
9227	S-26		112966	7,2+03	-3,2+03	-1,7+02	-1,2+03	4,4+03	-5,0+02	6,9+03	5,4+03	-1,3+03	3,2+04	-7,1+02	1,8+04
9228	S-26		113066	3,2+03	2,2+03	-3,6+02	-1,0+03	4,1+03	3,6+02	-5,0+03	-5,6+03	-1,8+03	2,2+04	-8,8+02	-2,6+04
9229	S-26		120266	7,3+03	-3,3+03	-8,8+02	-1,1+03	7,5+03	-5,1+02	-4,4+03	9,2+03	1,3+03	-3,6+04	-5,9+02	-2,7+04
9230	S-26		120466	7,3+03	-3,5+03	-8,6+02	-2,0+03	4,1+03	-6,1+02	3,2+03	-3,8+03	-8,8+02	2,2+04	-8,2+02	-1,7+04
9231	S-26		120566	7,1+03	-2,6+03	-4,4+02	-7,6+02	3,1+03	-5,0+02	-2,7+03	-5,5+03	-1,1+03	2,9+04	-7,6+02	3,0+04
9232	S-26		120766	7,2+03	-1,8+03	9,1+02	-1,5+03	1,3+04	-6,6+02	-2,6+03	-7,4+03	-2,1+02	-1,5+04	-6,9+02	-2,1+04
9233	E-7-4		113066	7,2+03	-2,2+06	-1,2+05	-1,4+04	2,7+06	-4,1+05	6,7+06	-7,9+05	2,6+04	8,4+06	-8,0+05	3,1+06
9234	E-7-4		120166	7,2+03	-2,7+06	-9,9+04	-3,4+04	2,0+06	-7,9+05	9,7+06	-1,6+06	5,5+04	1,3+07	-1,7+06	8,8+06
9235	E-7-4		120266	7,2+03	-1,1+06	-8,2+03	-1,1+04	1,6+06	-5,0+05	7,8+06	-6,1+05	3,0+04	6,5+06	-4,5+05	3,3+06
9236	E-7-4		120366	7,2+03	-6,8+05	-2,2+03	-5,2+03	1,1+06	-5,3+05	5,1+06	-8,4+05	1,3+04	3,2+06	-2,4+05	-2,0+06
9237	E-7-4		120466	7,1+03	-5,9+05	-8,6+04	-8,2+03	1,2+06	-2,0+05	2,6+06	-8,3+05	1,2+04	4,9+06	-1,7+05	-1,7+06
9238	E-7-4		112466	2,2+04	-3,2+05	-4,2+04	-3,0+03	4,6+05	-5,8+04	1,4+06	-4,1+05	-6,1+03	-3,4+06	-6,9+04	-6,1+05
9239	E-7-4		112966	7,2+03	-3,3+05	-1,6+04	-2,2+03	1,5+05	-3,6+05	3,9+06	-8,3+05	-9,7+03	-2,1+06	-1,2+05	-1,2+06
9240	E-7-3A		112866	2,2+04	-8,9+04	-1,4+04	-1,3+03	3,2+05	-4,8+04	2,5+06	-1,9+05	2,2+03	1,1+06	1,7+04	-2,3+05
9241	E-7-3A		112966	7,2+03	-1,0+06	-4,1+04	-1,8+04	3,5+05	-2,4+05	9,2+06	-3,4+06	-2,1+04	-6,6+06	-2,2+05	2,1+06
9242	E-7-3A		113066	7,2+03	-2,7+06	-4,4+05	-2,4+04	2,6+06	-2,5+05	6,8+06	-5,8+06	6,6+04	-4,5+07	-7,8+05	5,9+06
9243	E-7-3A		120166	7,2+03	-2,6+06	-2,3+05	-4,2+04	2,7+06	-9,0+05	1,3+07	-7,7+06	1,1+05	-4,7+07	-1,4+06	1,2+07
9244	E-7-3A		120266	7,2+03	-1,9+06	-2,3+05	-2,4+04	2,1+06	-2,2+05	8,3+06	-5,1+06	4,9+04	-2,6+07	-5,6+05	5,6+06
9245	E-7-3A		120366	7,2+03	-9,7+05	-1,4+05	-1,3+04	1,4+06	-2,1+05	4,1+06	-2,6+06	2,7+04	-1,4+07	-2,4+05	-2,2+06

Table II (cont'd) AIR FILTERS

BNWL-643

			ATOMS PER CUBIC FOOT AT COLLECTION				MINUS MEANS LESS THAN							
STG	LOCATION	DATE	CU.FT.	CR-51	MN-54	CO-60	ZR-95	RU-103	RU-106	SB-125	CS-134	CS-137	CF-141	CE-144
9246	E-7-3A	120466	7.1+03	-1.3+06	-3.2+05	-1.8+04	1.3+06	-1.4+05	2.0+06	-2.5+06	-4.4+04	-2.7+07	-3.3+05	-2.8+06
9247	PG-8	112966	1.0+05	-3.9+03	-1.3+03	-8.3+02	1.5+04	-6.7+02	3.7+03	-1.2+04	-3.3+02	7.4+04	-3.9+03	-1.8+04
9248	PG-8	120666	5.0+04	-4.8+02	-2.3+02	-3.3+02	1.7+03	-7.5+01	-1.3+03	2.2+03	-2.7+02	-9.2+03	-2.3+02	-3.2+03
9249	L-1	120166	5.0+04	-1.1+03	-2.5+02	-6.5+02	4.0+03	-2.1+02	1.3+03	9.2+03	-3.2+02	1.1+05	-2.3+02	-7.4+03
9250	P-9 PR-Room	112966	5.0+04	2.1+03	3.2+02	-9.3+02	2.5+04	4.0+02	2.1+03	1.2+04	-1.7+02	9.6+04	4.6+02	-1.4+04
9251	P-9 Pr-Room	120666	5.0+04	4.6+02	1.1+02	-1.4+02	1.4+03	-9.8+01	-8.0+02	1.7+03	-2.3+02	7.4+03	-9.0+01	-4.5+03
9252	P-9 PR-Room	121366	5.0+04	5.4+02	-1.7+02	-5.0+02	1.5+03	-7.5+01	-1.2+03	-9.6+02	-1.5+02	5.2+03	-1.3+02	-1.9+03
9253	U-Cell	120166	1.0+05	4.4+03	-1.9+02	5.0+02	1.8+04	0	8.6+04	-1.2+04	7.5+02	3.9+05	2.1+03	7.8+04
9254	U-Cell	120866	5.0+04	-5.9+05	-8.6+04	-2.9+03	-1.6+05	-7.4+04	-1.0+03	-1.4+06	0	-1.2+07	-2.8+05	-3.0+05
9255	HCR	112966	5.0+04	-4.2+03	-1.6+03	4.1+02	3.4+04	-2.8+02	4.2+03	-1.3+04	-2.0+02	1.3+05	2.0+03	0
9256	HCR	120666	5.0+04	-6.5+02	-1.2+02	-2.0+02	2.0+03	-5.5+02	1.3+03	-4.7+03	-7.3+01	1.5+04	5.0+02	-1.2+03
9257	HCR	121366	5.0+04	5.3+02	-1.4+02	-2.5+02	2.5+03	-4.8+02	1.3+03	-3.1+03	-7.4+01	1.2+04	-5.9+02	-9.9+03
9258	S-56	120466	8.8+04	-3.4+03	-8.4+02	-2.7+02	2.1+04	-1.3+02	3.9+03	-9.1+03	9.5+01	9.6+04	1.5+03	-5.2+03
9259	S-56	120666	1.2+04	-2.4+03	-6.1+02	-3.6+02	2.1+03	0	2.6+03	0	-2.6+02	9.2+04	-4.9+03	-1.0+05
9260	S-56	121366	5.0+04	-1.2+03	0	3.4+02	3.4+03	-6.2+02	2.8+03	-4.2+03	-1.9+02	4.1+04	-1.3+03	-2.4+04
9261	S-56	112966	5.0+04	-1.8+05	-2.0+04	-6.3+03	3.7+05	-6.2+04	6.5+05	-5.3+05	5.2+03	-3.3+06	-1.4+05	1.4+05
9262	CMP-3	120666	5.0+04	-3.5+04	-5.3+03	2.0+03	7.5+04	-2.1+04	3.1+05	-1.4+05	1.6+03	3.8+05	-1.6+04	1.7+05
9263	CMP-3	121366	5.1+04	-3.3+04	-1.2+04	2.7+03	1.4+05	-1.4+04	2.0+05	-1.5+05	3.9+03	1.1+06	-2.6+04	3.9+05
9101	200 Area(UO ₂)	110466	4.6+05	0	6.5+01	1.7+01	5.0+03	8.4+02	1.7+04	-4.7+02	2.1+03	3.9+05	4.6+02	1.8+04
9119	200 Area(Prex)	110866	5.0+05	0	3.1+01	3.0+01	3.1+03	2.0+02	1.1+03	0	7.6+01	3.2+04	3.6+02	3.3+03
9274	300 Area(329)	111566	2.0+06	0	1.6+01	1.9+01	5.4+02	8.2+01	7.1+02	1.0+03	1.0+01	4.5+03	9.3+01	2.4+03
9275	300 Area(329)	111366	2.1+06	0	8.7+00	1.5+02	2.2+02	4.0+01	1.7+02	3.4+02	7.2+00	4.9+03	5.9+01	8.0+02
9276	300 Area(329)	121566	2.1+06	0	4.4+00	7.4+00	7.1+01	1.3+01	1.1+02	2.8+03	3.4+00	2.3+03	-2.0+01	3.4+02
9298	300 Area(329)	010167	4.4+06	0	-9.5+00	3.9+01	4.3+02	3.0+01	1.1+02	-1.5+02	-1.3+01	4.5+03	6.6+01	1.0+03
9158	Barrow, Alas	111866	7.8+06	0	7.2+00	-1.3+01	4.2+01	8.4+00	6.5+01	5.7+01	-8.9+01	3.5+03	1.8+01	3.4+02
9172	Barrow, Alas	120166	7.4+06	0	8.6+00	4.3+00	2.0+02	5.0+01	6.4+01	-5.7+01	0	2.3+03	6.8+01	2.7+02
9202	Barrow, Alas	121566	7.2+06	-8.7+01	5.6+00	2.9+00	8.2+01	3.3+01	4.3+01	-2.1+01	0	1.8+03	3.3+01	-1.6+02
9160	Spokane, Wn	111766	2.0+06	-2.1+01	9.9+00	-1.4+01	1.7+02	7.0+01	8.9+01	2.0+02	-2.1+00	2.2+03	8.1+01	1.1+03
9169	Spokane, Wn	120166	2.0+06	-1.5+01	6.6+00	-6.0+00	8.7+01	4.0+01	5.9+01	9.4+01	-7.6+01	2.0+03	4.4+01	7.6+02
9270	Spokane, Wn	122966	2.0+06	0	7.3+00	-5.9+00	9.3+00	4.5+00	6.7+01	-6.5+01	-2.5+00	2.0+03	-1.4+00	2.7+02
9204	Spokane, Wn	121366	2.0+06	-3.2+01	-8.8+00	-1.5+00	1.9+01	1.2+01	-2.3+01	1.7+02	-1.3+00	1.2+03	1.0+01	-2.3+02

TABLE III

Sample Number	Type	Date Filter Removed	Size Cu. ft.	Concentration in pCi/m ³				
				Zr ⁹⁵	Ru ¹⁰⁶	Sb ¹²⁵	Cs ¹³⁷	Ce ¹⁴⁴
9210	N-1, N-Cell	12-3-66	7.1 x 10 ³	0.46			0.06	
9211	N-1, N-Cell	12-4-66	7.2 x 10 ³	0.49				
9212	N-1, N-Cell	12-5-66	7.2 x 10 ³					
9213	N-1, N-Cell	11-27-66	1.4 x 10 ⁴	0.24			0.04	
9214	N-1, N-Cell	11-27-66	1.9 x 10 ³				0.46	
9215	N-1, N-Cell	11-28-66	5.6 x 10 ³	3.2			0.42	
9216	N-1, N-Cell	11-29-66	7.4 x 10 ³	0.14			0.09	
9217	N-1, N-Cell	11-30-66	6.6 x 10 ³	0.12				
9218	N-1, N-Cell	12-2-66	7.2 x 10 ³	0.29				
9219	Q-4, Q-Cell	11-27-66	1.4 x 10 ⁴	0.14				
9220	Q-4, Q-Cell	11-28-66	7.4 x 10 ³	1.13			0.16	
9221	Q-4, Q-Cell	11-29-66	7.4 x 10 ³	0.18			0.064	
9222	Q-4, Q-Cell	11-30-66	7.1 x 10 ³	0.60	0.16			
9223	Q-4, Q-Cell	12-1-66	7.2 x 10 ³					
9224	Q-4, Q-Cell	12-2-66	7.1 x 10 ³		0.16			
9225	Q-4, Q-Cell	12-3-66	7.1 x 10 ³	0.56	0.18			
9226	S-26	11-28-66	1.4 x 10 ⁴	1.84		0.06	0.26	
9227	S-26	11-29-66	7.2 x 10 ³	0.53	0.13	0.04	0.02	0.46
9228	S-26	11-30-66	8.2 x 10 ³	0.50			0.015	
9229	S-26	12-2-66	7.3 x 10 ³	0.88		0.07		
9230	S-26	12-4-66	7.3 x 10 ³	0.50	0.06		0.015	
9231	S-26	12-5-66	7.1 x 10 ³	0.35			0.02	0.81
9232	S-26	12-7-66	7.2 x 10 ³	1.6				
9233	E-7-4	11-30-66	7.2 x 10 ³	310.	130.		6.	84.7
9234	E-7-4	12-1-66	7.2 x 10 ³	236.	190.		8.8	236.
9235	E-7-4	12-2-66	7.2 x 10 ³	194.	151.		4.6	88.
9236	E-7-4	12-3-66	7.2 x 10 ³	127.	99.		2.2	
9237	E-7-4	12-4-66	7.1 x 10 ³	144.	49.		3.4	
9238	E-7-4	11-28-66	2.2 x 10 ⁴	53.	28.			
9239	E-7-4	11-29-66	7.2 x 10 ³	17.	74.			

TABLE III (continued)

Sample Number	Type	Date Filter Removed	Size, Cu. ft	Concentration in pCi/m ³				
				Zr ⁹⁵	Ru ¹⁰⁶	Sb ¹²⁵	Cs ¹³⁷	Ce ¹⁴⁴
9240	E-7-3A	11-28-66	2.2 x 10 ⁴	39.	4.9		0.78	
9241	E-7-3A	11-29-66	7.2 x 10 ³	42.	180.			56.
9242	E-7-3A	11-30-66	7.2 x 10 ³	303.	134.			158.
9243	E-7-3A	12-1-66	7.2 x 10 ³	321.	254.			321.
9244	E-7-3A	12-2-66	7.2 x 10 ³	243.	162.			151.
9245	E-7-3A	12-3-66	7.2 x 10 ³	166.	81.			
9246	E-7-3A	12-4-66	7.1 x 10 ³	155.	39.			
9247	PG-8	11-29-66	1.0 x 10 ⁵	1.7	0.07		0.05	
9248	PG-8	12-6-66	5.0 x 10 ⁴	0.2		0.017		
9249	L-1	12-1-66	5.0 x 10 ⁴	0.46	0.02	0.07	0.07	
9250	PR-room	11-29-66	5.0 x 10 ⁴	2.9	0.04	0.09	0.06	
9251	PR-room	12-6-66	5.0 x 10 ⁴	0.17		0.013	0.005	
9252	PR-room	12-13-66	5.0 x 10 ⁴	0.17			0.003	
9253	U-Cell	12-1-66	1.0 x 10 ⁵	2.1	1.7		0.27	2.1
9254	U-Cell	12-8-66	5.0 x 10 ⁴					
9255	HCR	11-29-66	5.0 x 10 ⁴	3.9	0.08		0.09	
9256	HCR	12-6-66	5.0 x 10 ⁴	0.23	0.025		0.01	
9257	HCR	12-13-66	5.0 x 10 ⁴	0.29	0.025		0.008	
9258	S-56	12-4-66	8.8 x 10 ⁴	2.5	0.07		0.07	
9259	S-56	12-6-66	1.2 x 10 ⁴	0.24	0.05		0.06	
9260	S-56	12-13-66	5.0 x 10 ⁴	0.39	0.05		0.03	
9261	CMP-3	11-29-66	5.0 x 10 ⁴	42.3	12.7			39.
9262	CMP-3	12-6-66	5.0 x 10 ⁴	8.8	6.0		0.26	4.6
9263	CMP-3	12-13-66	5.1 x 10 ⁴	16.2	3.9		0.77	10.2
9101	200 Area (UO ₂)	11-4-66	4.6 x 10 ⁵	0.56	0.34		0.27	0.49
9119	200 Area (Pur ³ ex)	11-8-66	5.0 x 10 ⁵	0.35	0.02		0.02	0.09
9249	300 Area	11-15-66	2.0 x 10 ⁶	0.063	0.014	0.008	0.0031	0.063
9275	300 Area	11-30-66	2.1 x 10 ⁶	0.026	0.0032	0.0026	0.0034	0.021
9276	300 Area	12-15-66	2.1 x 10 ⁶	0.0084	0.0020	0.022	0.0016	0.0092
9298	300 Area	1-1-67	2.4 x 10 ⁶	0.049	0.0022		0.0031	0.027

TABLE III (continued)

<u>Sample Number</u>	<u>Type</u>	<u>Date Filter Removed</u>	<u>Size Cu. ft</u>	<u>Concentration in pCi/m³</u>				
				<u>Zr⁹⁵</u>	<u>Ru¹⁰⁶</u>	<u>Sb¹²⁵</u>	<u>Cs¹³⁷</u>	<u>Ce¹⁴⁴</u>
9158	Barrow, Alas.	11-16-66	7.8 x 10 ⁶	0.0049	0.0013	0.0004	0.0025	0.009
9172	Barrow, Alas.	12-1-66	7.4 x 10 ⁶	0.023	0.0013		0.0016	0.007
9202	Barrow, Alas.	12-15-66	7.2 x 10 ⁶	0.0095	0.0008		0.0013	
9160	Spokane, Wash.	11-17-66	2.0 x 10 ⁶	0.019	0.0017	0.0016	0.0015	0.030
9169	Spokane, Wash.	12-1-66	2.0 x 10 ⁶	0.010	0.0012	0.0007	0.0014	0.020
9204	Spokane, Wash.	12-15-66	2.0 x 10 ⁶	0.0022		0.0013	0.0008	
9270	Spokane, Wash.	12-29-66	2.0 x 10 ⁶	0.0011	0.0013		0.0013	0.007

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