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REACTOR SECTION, RADIATION MONITORING

REPORT FOR MONTH OF APRIL, 1955

By: P. C. Jerman

Date: May 4, 1955

Classification Canceled (Change to
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By Authority of

DS Lewis 6/19/92
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Reactor Section, Radiation Monitoring Sub-Section

SUMMARY

There were no Class II and one Class I radiation incidents. The Class I incident occurred at 100-DR Area and involved a Maintenance Unit employee receiving an uncontrolled exposure when he impulsively jumped over a shallow trench used for the disposal of horizontal rods and thimbles. The maximum exposure rate involved was 20 r/hr.

The DR Reactor was shutdown on April 16, for a two weeks outage primarily for replacing the horizontal safety rods. The rod work was performed by the Minor Construction forces without incident.

The KE Reactor commenced operating on April 17, and attained a power level of 1000 MW on April 25. Several minor radiation hazards mainly due to shielding inadequacies were observed which were readily corrected. The KE Reactor 84 inch effluent discharge line to the river failed on April 25. The line apparently broke loose from its underwater moorings and was ripped open in several places. The responsibility for radiation monitoring for inspection and repair of the line which was carried out by the Engineering Department, rested with the Radiological Sciences Department.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad at the B and H Reactors throughout the month, at the C Reactor for 11 days, at the D Reactor for 17 days, at the DR Reactor for 15 days, and at the F Reactor for 19 days. The maximum 24-hour doses were 823, 938, 475, 545, 662, and 1429 mrad, respectively. The increased activity experienced by all the reactors was due primarily to decreased water purity caused by the start of spring run-offs. The extremely high activity experienced at the F Reactor was due to additional circumstances: 1) the relatively high power level and the relatively low water flow rate; 2) the acid feed used in the treatment of one-half the water increased the solubility of manganese. The increased activity was tolerated with the concurrence of the Radiological Sciences Department.

General Statistics

	<u>MARCH</u>									<u>APRIL</u>									1955 Total Date
	B	C	D	DR	F	H	KE	KW	TOTAL	B	C	D	DR	F	H	KE	KW	TOTAL	
Special Work																			
Permits	121	159	102	58	62	94	53	200	849	78	145	71	140	103	110	124	101	872	3425
Routine & Special Surveys	575	525	585	385	593	570	111	404	3748	520	553	498	418	586	473	177	1081	4306	14893
Retention Basin	179	158	126	126	126	175	0	144	1034	167	245	164	109	128	157	49	135	1154	4263
Air Monitoring Samples	61	51	72	42	61	29	0	11	327	66	99	70	81	91	33	0	57	497	1632
Hand Contamination cases	0	1	2	1	0	1	0	0	5	0	0	1	0	0	0	0	1	2	27
Skin Contamination cases (other than hands)	0	3	0	0	0	2	0	0	5	2	3	4	0	9	2	0	10	30	85
Contaminated Injuries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Retention Basin Effluent

The activity of the water leaving the retention basin was as follows:

	100-B	100-C	100-D	100-DE	100-F	100-H	100-HE	100-KV
Average beta dosage-rate (mrads/hr)	6.9	4.5	4.2	4.0	7.3	8.0	1.2	1.4
Average gamma dosage-rate (mr/hr)	11.8	7.6	10.2	9.6	17.4	16.6	2.4	2.5
Average total dose-rate (mrads/hr)	18.7	12.1	14.4	13.6	24.7	24.6	3.6	3.9
Average integrated dose in 24 hours	449	290	346	326	593	590	68	94
Maximum integrated dose in 24 hours	823	475	545	662	1459	938	242	228
Maximum integrated dose in 24 hours, 1955	823	638	588	662	1459	938	242	228

MONITORING ACTIVITIES

100-B Area

105-B Reactor and Associated Buildings

The reactor was shutdown because of obstructions in the cushion chamber. Timbers contaminated to a maximum level of 20 rad/hr at surface including 1.5 r/hr at two inches were removed from the cushion chamber at a maximum exposure rate of 300 mrad/hr. Process tube leak testing was performed at a maximum exposure rate of 180 mr/hr, with dose rates from retrieved downstream dummy pieces being as high as 1.8 rad/hr at surface including 250 mr/hr at two inches. Reclaimed poison pieces were moved from the 0' far level to the charge elevator at a maximum exposure rate of 1 r/hr and were charged at an exposure rate of 25 mr/hr. Horizontal control rods were inspected at a maximum exposure rate of 1 r/hr.

Water was found on the floor of the -9' level near giving a dose rate of 400 mrad/hr including 100 mr/hr at three inches, apparently the result of a water leak in a horizontal control rod. With the reactor operating, an inspection was made of the inner rod room from the front labyrinth to determine the source of the leak. The maximum exposure rate for this work included 100 mr/hr gamma, 1000 fast neutrons/cm²/sec (125 mrem/hr), 4800 intermediate neutrons/cm²/sec (100 mrem/hr), and 5125 slow neutrons/cm²/sec (41 mrem/hr) for a total of 366 mrem/hr.

A production cask car was received from 100-D Area with a cask containing 32 cored pieces, two of which were ruptured. The outside of the cask was found to be contaminated to a level of 20 rad/hr including 100 mr/hr at 2 inches. Smears of the deck of the car showed up to 20 mrad/hr after one washing. The cask was returned to the well car, the deck was papered, and the car was returned to 100-D Area. No further spread of contamination was found. Forty-four vehicles were surveyed. Two cases of tire contamination of 600 c/m and one case of a floor mat contaminated to 2500 c/m were found. The contamination was reduced to below detectable levels.

The 24-hour dose of the effluent water discharged to the Columbia river exceeded 360 mrad throughout the month. The maximum was 823 mrad.

Sixty-six air samples were taken. One discharge area sample showed an activity density of 5.9×10^{-9} uc/cc with a recount taken one hour later showing no decay. All others showed activity densities of less than the maximum permissible limits for the isotopes involved.

105-C Reactor and Associated Buildings

There were twelve slug failures. The maximum exposure rates encountered during the removal of ruptured slugs was 2 r/hr while setting up equipment for a quickie discharge and 5 r/hr

Reactor Section, Radiation Monitoring Sub-Section

105-C Reactor and Associated Buildings (continued)

during removal and replacement of a rear gunbarrel. The maximum pigtail dose rate was 50 r/hr at 1 inch. Process tubes were removed at a maximum exposure rate of 300 mrad/hr including 20 mr/hr. Maintenance work was performed at the experimental levels and in the inner rod room on octant monitoring chambers at a maximum exposure rate of 1.2 rad/hr including 300 mr/hr. An attempt was made to repair the slide valve on the ball trough in the third safety ball room at a maximum exposure rate of 1.5 r/hr. Gas leak testing was performed in the third safety ball tunnel at a maximum exposure rate of 2 r/hr.

An exposure rate of 10 rad/hr including 35 mr/hr to the hands, was experienced for a few seconds by an electrician while relamping an underwater light. Cans of perforated aluminum dummies were moved from the 20' level far to the wash pad at a maximum exposure rate of 100 mr/hr. The maximum dose rates were 15 rad/hr over the top of an open can and 1 r/hr through the side.

Wash pad floor contamination in the vicinity of the acid tank was reduced from 14 rad/hr surface including 200 mr/hr to nominal levels. Transfer area floor contamination of 3 rad/hr was also reduced to nominal levels by steam cleaning. The storage area water level was lowered approximately five feet to facilitate completion of the installation of equipment for the metal examination facility. The contamination on the exposed basin walls contributed to exposure rates up to 550 mrad/hr including 50 mr/hr for work below the level of the storage area floor. Contamination levels as high as 60,000 c/m were found on 105-C building air supply filters. Spot surveys of the 190-C building air supply filters indicated levels in the order of 2000 c/m.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad for eleven days. The maximum was 475 mrad.

All of the 75 air samples taken showed activity densities of less than the maximum permissible limits for the isotopes involved or the respiratory protection worn.

100-D Area

105-D Reactor and Associated Buildings

There were two slug failures. The maximum rear pigtail dose rate was 100 rad/hr at 1 inch. The maximum exposure rate encountered during removal of the ruptured slugs was 5 rad/hr. Solid aluminum pieces used in discharging one tube were flushed onto the catwalks and caused gross spread of contamination with spots on the 0' and 10' levels giving dose rates up to 150 rad/hr at 1 inch. After extensive decontamination efforts, the maximum levels were reduced to 7 rad/hr at 1 inch. Following discharge of all slugs from the other tube, a dose rate of 400 r/hr was found on the crossheader. This was believed to have been caused by ruptured slug debris lodging inside the header. It was eventually flushed out. The tube was replaced at a maximum exposure rate of 3 r/hr.

An attempt made to remove #2 horizontal control rod thimble resulted in pulling the thimble apart. The maximum exposure rate for this work was 2 rad/hr including 800 mr/hr. The #5 horizontal control rod tip was removed and buried by Minor Construction forces at a maximum exposure rate of 200 mr/hr. Repairs were made of "B" rod at a maximum exposure rate of 1 r/hr. The shielding placed in front of the #2 rod channel after removal of the tip was not properly aligned. As a result, the radiation level at the east labyrinth door was as follows after startup of the reactor: 50 mr/hr, gamma; no detectable fast neutrons, 2500 intermediate neutrons/cm²/second (52 mrem/hr); 6500 slow neutrons/cm²/second (54 mrem/hr).

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105-D Reactor and Associated Buildings (continued)

During the removal of a special graphite stringer column from a process tube, a dose rate of 3 r/hr at 4 inches was observed after 3 feet of the wire was withdrawn from front of tube. A dose rate of 10 rad/hr including 100 mr/hr at 2 inches was measured on the push pole used. The maximum exposure rate encountered was 500 mrad/hr. Timbers and steel plates were removed from the cushion corridor chamber at an exposure rate of 500 mrad/hr including 300 mr/hr. During this work there was 8 inches of water on the cushion chamber floor.

The 24-hour dose of the effluent water discharged into the Columbia River exceeded 360 mrad for 17 days. The maximum was 545 mrad.

A total of 70 air samples were taken. The maximum activity density was 1.5×10^{-8} uc/cc from an air sample taken in the discharge area during decontamination activities.

105-DR Reactor and Associated Buildings

The reactor was shutdown on April 16, 1955, for a two week outage primarily for the replacement of the horizontal rods by Minor Construction forces. The rods and thimbles were removed from the reactor at an average radiation exposure rate of 10 mr/hr and a maximum of 3 r/hr. During removal of the first two rods and thimbles some difficulty was experienced in sealing the cans. This was caused by the presence of graphite blocks in the cans. As a result, some contamination was spread to the ground below the outside rod racks. The maximum spot was 25 mrad/hr at surface. Otherwise, control of radiation exposure and contamination was excellent.

The "B" experimental hole was discharged at a maximum exposure rate of 1.2 rad/hr and at an average exposure rate of 200 mrad/hr. The "B" experimental hole Gatling gun was then removed and buried at a maximum exposure rate of 2 r/hr. Thermopiles were removed from the four far side octant monitoring holes and buried. The maximum exposure rate for this work was 3 rad/hr. The "A" and "E" experimental hole thimbles were removed by Minor Construction forces at a maximum exposure rate of 1.5 r/hr.

A Maintenance Unit employee jumped over a shallow rod and thimble burial trench through an unknown radiation field. Subsequent surveys established the maximum exposure rate at 20 r/hr. A Class I radiation incident investigation was conducted and reported separately. During removal of irradiated gold foil samples from the test wells on top of the reactor an employee of the Pile Technology Section handled a sample in his bare hand without consulting the Radiation Monitor in attendance. He received an exposure of 60 mrad to the hand. This was investigated and recorded as a Class I radiation incident by the Radiological Sciences Department. A J. A. Jones Company employee and a Maintenance Unit employee entered radiation zones and performed work without wearing pocket dosimeters and film badges. Each case was recorded as a Class I incident by the Radiological Sciences Department.

Entry was made into the near downcomer on several occasions to repair a pressure sensing line. The average exposure rates for this work ranged from 130 to 150 mrad/hr. Exposure rates for repair of the 107 west retention basin floor varied from 20 to 100 mrad/hr.

A gasoline truck assigned to Road Maintenance Unit was found contaminated up to 225 mrad/hr on the right front spring. It was sent to 200 West Area for decontamination.

The 24-hour dose of the effluent water discharged into the Columbia River exceeded 360 mrad for 15 days during the month. The maximum was 662 mrad.

Reactor Section, Radiation Monitoring Sub-Section

105-ER Reactor and Associated Buildings (continued)

A total of 81 air samples were taken. The maximum activity density in the discharge area was 2.4×10^{-9} uc/cc. The maximum activity density due to effluent vapors was 3.2×10^{-8} uc/cc in the transfer area.

100-F-H Areas

105-F Reactor and Associated Buildings

Several tubes were removed from the reactor using the cable operated tube splitter at a maximum exposure rate of 300 mrad/hr including 100 mr/hr. Contamination on the cable drum was found to be as high as 5 rad/hr at surface including 200 mr/hr at 2 inches. Tubes were removed to the front of the reactor at maximum exposure rates of 150 mr/hr while manipulating tubes into pipe sections and 250 mr/hr when the pipe sections were capped. On one occasion, electrical conduit was used in place of pipe. As it was being dragged to the burial ground, the coupling at the center failed and the conduit became removed from the tube. Contamination was thereby deposited on the roadway between the location where this occurred and the burial ground. The maximum surface dose rate was 300 mrad/hr. One channel in which a tube splitter became stuck was borescoped at a maximum exposure rate of 750 mrad/hr. Efforts to dislodge it were unsuccessful.

Graphite samples were discharged and removed from their "birdcage" containers at a maximum exposure rate of 2.5 rad/hr including 500 mr/hr at 3 feet. A Maintenance Unit employee received an estimated dose of 88 mrad to his arm when water splashed onto his coverall sleeve during process tube leak testing. This occurred as he replaced a rear tube cap to prevent dummies from washing out. The dose rate from the contamination on the coverall sleeve was 1.1 rad/hr at surface.

A gas leak at the front of a process tube contributed to a dose rate of 800 mrad/hr. By placing a boot over the bellows of the tube, the dose rate was reduced to 75 mrad/hr. Small beams were observed in front of four process tubes. The maximum radiation level was 77 mrem/hr from tube #2468 as follows: 12 mr/hr, gamma; 180 fast neutrons/cm²/second (23 mrem/hr); 2000 intermediate neutrons/cm²/second (42 mrem/hr).

Two leaks developed in the effluent line just south of the 103 building. Trenches were dug at a maximum exposure rate of 200 mrad/hr including 150 mr/hr to contain the contaminated water. The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad for 19 days. The maximum was 1459 mrad. The effluent activity was higher than for other reactors due to 1) the relatively high power level and the relatively low water flow rate; and 2) the acid feed used in the treatment of one-half the water for the reactor increases the solubility of manganese.

Ninety-one air samples were taken. A filter used to take an air sample in the discharge area during the discharge of special samples gave a surface dose rate of 5 rad/hr. No personnel were exposed to this air. All other samples showed activity densities less than maximum permissible limits for the isotopes involved or the respiratory protection being worn.

105-H Reactor and Associated Buildings

The discharge area was decontaminated, using steam with Diversey 514. The maximum exposure rate for the work was 500 mrad/hr. The contamination level was reduced by about 20 percent. Two tubes were removed and replaced. Loosening of the tubes before replacement was done with a new type impact tool which rotates the tube in the channel, thus freeing it before removal is attempted. The tool showed a maximum dose rate of 800 mrad/hr at surface after use.

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Reactor Section, Radiation Monitoring Sub-Section

105-H Reactor and Associated Buildings (continued)

About 30 square feet of concrete floor in front of the "A" experimental hole on the No. 1 experimental level which was contaminated up to 8 rad/hr at surface was chipped out and refilled by Minor Construction forces. On the No. 2 experimental level, three samples were irradiated in the "Y" experimental hole facility. The maximum exposure rate was 250 mrad/hr while placing one sample in a cask after irradiation. Considerable neutron leakage was discovered around the "E" experimental hole step plug after it was replaced during a shutdown. Readings included 100 mr/hr gamma; 8000 slow neutrons/cm²/second (66 mrem/hr), and 8000 intermediate neutrons/cm²/second (166 mrem/hr). Additional shielding reduced the dose rate to 27 mrem/hr including 20 mr/hr. All of the shielding was not replaced around "X" experimental hole after sample discharge. Surveys after startup revealed a beam 3 to 4 inches above the step plug. Readings included 280 mr/hr gamma; 250 slow neutrons/cm²/second (2 mrem/hr); 740 intermediate/cm²/second (15 mrem/hr); and 230 fast neutrons/cm²/second (29 mrem/hr). The beam was shielded to 32 mrem/hr including 25 mr/hr gamma.

A horizontal safety rod was removed from the reactor during operation. The rod was pulled through the sandwich wall until the rear of the rod tip appeared. The dose rate detected at the hose reels was 2.3 rem/hr as follows: 300 mr/hr gamma; 5000 fast neutrons/cm²/second (625 mrem/hr), 35,000 intermediate neutrons/cm²/second (729 mrem/hr), 75,000 slow neutrons/cm²/second (625 mrem/hr). The rod was cut at the sandwich wall and the tip was pushed back into the inner rod room with nominal exposure to personnel. With the sandwich wall gate closed and with a paraffin shield installed at the gate, the dose rate was reduced to less than 1 mrem/hr. Upon entry to the inner rod room during shutdown a maximum contamination level of 100 rad/hr at surface was observed in the vicinity of the opening to the rod channel. This was reduced to 5 rad/hr at surface.

Experimental work conducted on the minus 12' level involved deliberate rupturing of unirradiated uranium slugs. On two occasions uranium alpha contamination was discovered in the zone, the maximum being 10,000 d/m. The zone was immediately cleaned up and repapered. There was no spread to non-regulated zones.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad throughout the month. The maximum was 938 mrad.

Of the 33 air samples taken, all were below the maximum permissible limits for the isotopes involved or the respiratory protection worn.

100-K Area

105-KE Reactor and Associated Buildings

The reactor was started up on April 17 and attained a power level of 1000 MW on April 25. Building surveys during the start-up period disclosed several abnormal conditions. The pneumatic sample facility exhaust air filters indicated a maximum activity level of 500 mr/hr at 2 inches. When the air blower speed was increased to circulate air through the loop at a faster rate, the reading dropped to 18 mr/hr at 2 inches. A beam 1/2 inch in diameter giving an uncorrected dose rate of 37 mrem/hr was found at the RT 3A facility on the No. 1 experimental level. Installation of a dummy train did not appreciably reduce the intensity of the beam. External shielding will be provided as soon as possible. A beam from the front face test facility 0074 was reduced from 42 mrem/hr to 6 mr/hr by the introduction of a lead-polyethylene plug into the front nozzle. Unit gas leaks contributing to dose rates of 160 mrad/hr including 12 mr/hr and 175 mrad/hr including 10 mr/hr were found at octant monitoring facility 1L on the No. 1 experimental level, and at the orsat equipment in the gas instrument

Reactor Section, Radiation Monitoring Sub-Section

105-KE Reactor and Associated Buildings (continued)

room, respectively. Both leaks were repaired.

During the numerous outages, octant monitoring chambers were repaired and adjusted at a maximum exposure rate of 2 rad/hr including 3 r/hr at 2 inches from the octant chamber slide tracks.

A routine survey of the gas instrument room revealed that an Alnor portable dewpoint analyzer was giving dose rates of 50 mr/hr at 2 inches (uncorrected) through the fog chamber inside the instrument, and about 7 mr/hr through the back of the case. Investigation revealed that the source of the radiation was a small radium source contained inside the fog chamber. Film surveys revealed dose rates of 530 mr/hr, 15 mr/hr and 61 mr/hr through the fog chamber, the eyepiece and the back of the instrument, respectively. These dose rates coupled with the possibility of radon emission prompted removal of all Alnor portable analyzers from service until the radiation hazard can be evaluated.

On April 4 the 107 crib was inadvertently filled to overflowing and as a result a portion of the crib wall, measuring approximately 30 feet wide by 20 feet deep, was washed out. Direct readings at the site of the washout and samples of water failed to reveal any significant contamination. The wall was repaired. The KE 84 inch effluent discharge line to the river failed on April 25. The line apparently broke loose from its underwater moorings and was ripped open in several places. The responsibility for radiation monitoring and repair of the line rested with the Radiological Sciences Department. A modification of the effluent piping at the 1904 outfall structure was made to permit the KE effluent water to be discharged through the KW line. Effluent tank cycling was stopped and effluent water was permitted to pass through two basins and out the overflow thus maintaining constant flow on the line. As a result, effluent water activity increased by a factor of 2, raising the average from approximately 4.5 mrad/hr to about 9.0 mrad/hr.

105-KW Reactor and Associated Buildings

On April 21 a scram at the KE Reactor resulting from low water pressure caused a scram at the KW Reactor which activated the ball third safety system. Balls were recovered at a maximum exposure rate of 5 rad/hr to the hands. The average exposure rate was about 400 mr/hr. The maximum dose rate encountered was 20 rad/hr including 2 r/hr at 2 inches from spilled balls. Contamination from graphite became a problem and resulted in 8 cases of personnel contamination. Vacuuming and swabbing with solvent prevented spread of contamination beyond the top of the reactor.

Filming of the top of the reactor was completed. There was no evidence of radiation leakage through the biological shielding. Filming of the experimental levels was in progress at month end. Installation of larger pigtails on the upper nozzle connectors of front face test hole facilities 0065 and 0074 eliminated the beam from these tubes reported last month.

A total of 57 air samples was taken. The maximum activity concentration was 2.1×10^{-8} uc/cc on top of the reactor while recovering the third safety balls. All samples were below the maximum permissible limits for the isotopes involved or the respiratory protection worn.

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FORCE SUMMARY

	<u>Start of Month</u>	<u>End of Month</u>	<u>Net Change</u>
Monthly	22	22	0
Weekly	60	60	0
Sub-Section Total	82	82	0

P. C. Jerman

Radiation Monitoring
REACTOR SECTION

PC JERMAN:gb

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