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REACTOR SECTION, RADIATION MONITORING

REPORT FOR MONTH OF DECEMBER, 1954

By: P. C. Jerman

Date: January 5, 1955

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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 involved a Maintenance Unit employee entering the top of the 105-C reactor without authorization or the required monitoring. The maximum exposure rate encountered was 150 mr/hr due to a drum of contaminated third safety balls located in the zone which gave a dose rate of 125 r/hr at 3 inches. The dose received was estimated at 15 mr.

During the dry coefficient test at the 105-KW reactor, the maximum neutron flux densities observed in the work area were 360 slow neutrons/cm²/second (3 mrem/hr), 450 intermediate neutrons/cm²/second (10 mrem/hr) and 10⁴ fast neutrons/cm²/second (13 mrem/hr). The maximum power level was approximately 2 megawatts.

A daily survey of all 100 Area Transportation Section garages was inaugurated. All vehicles in the garages were surveyed, together with tools and equipment and the grease pit. Garage personnel were also given personal surveys. No evidence of contamination was found.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad at 105-F reactor throughout the month, at 105-H reactor for nine days and at 105-B reactor for four days. The maximum 24-hour doses were 394, 432, and 405 mrad for the 105-B, 105-F, and 105-H reactors, respectively. The increased activity was tolerated with the concurrence of the Radiological Sciences Department. About two million gallons of effluent water were discharged to the river from the 105-C reactor following the rupture of a regular metal slug. The dose rate from the water was 45 mrad/hr. The increased activity was due to fission products.

General Statistics

	<u>NOVEMBER</u>							<u>DECEMBER</u>							1954 to Date	
	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>Total</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>DR</u>	<u>F</u>	<u>H</u>	<u>KW</u>	<u>Total</u>	
Special Work Permits	187	175	83	74	108	110	737	135	149	108	60	70	127	114	763	8930
Routine & Special																
Surveys	580	517	473	343	633	499	3045	435	667	525	338	655	452	204	3278	33610
Retention Basin	210	139	137	167	111	150	914	244	136	157	149	160	152	0	998	12814
Air Monitoring																
Samples	95	41	80	39	134	40	429	49	130	86	41	57	35	2	400	4430
Hand Contamination																
Cases	0	1	0	0	2	0	3	0	3	2	0	1	0	0	6	122
Skin Contamination																
Cases (other than																
hands)	0	1	1	0	2	1	5	1	4	0	0	3	1	0	9	266

Retention Basin Effluent

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

	100-B	100-C	100-D	100-DR	100-F	100-H
Average beta dosage-rate (mrad/hr)	3.6	1.8	2.9	4.4	3.5	5.6
Average gamma dosage-rate (mr/hr)	7.8	2.9	5.6	7.9	10.7	10.0
Average total dosage-rate (mrad/hr)	11.4	4.7	8.5	12.3	14.3	15.6

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Retention Basin Effluent (continued)

	100-B	100-C	100-D	100-DR	100-F	100-H
Average integrated dose in 24 hours	274	103	204	295	341	374
Maximum integrated dose in 24 hours	394	233	317	360	432	405
Maximum integrated dose in 24 hours, 1954	460	391	670	682	521	854

MONITORING ACTIVITIES

100-B Area

105-B Reactor and Associated Buildings

During process tube replacement, exposure rates as high as 3 rads/hr were encountered while vacuuming a tube channel. The end of the vacuum hose was contaminated to 20 rads/hr including 3 r/hr at 5 inches and swabs to 20 rads/hr including 200 mr/hr at 8 inches. The charge elevator was contaminated to a maximum level of 100 mrad/hr at surface and was cleaned to a level of 6 mrad/hr.

The downcomer was inspected at a maximum exposure rate of 600 mrad/hr including 100 mr/hr. The bed of a pick-up truck was found contaminated to a maximum level of 20,000 c/m on a routine survey. The contamination was removed promptly.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad for four days. The maximum was 394 mrad.

All of the 41 air samples taken indicated activity densities of less than the maximum permissible limits for the isotopes involved or the respiratory protection worn.

105-C Reactor and Associated Buildings

The one slug failure which occurred during the month involved a regular uranium piece. A one liter sample of header water gave a dose rate of 260 mr/hr at 2 inches through a glass bottle. A dose rate of 160 mrad/hr including 60 mr/hr was measured at floor level over the storage basin pick-up chutes due to the activity of the water discharged to the basin after the tube was uncapped. A maximum dose rate of 45 mrad/hr for the effluent water entering the Columbia River was noted. The retention basin drain to the emergency crib was opened as soon as the activity of the outlet water increased. The volume of water released to the river at the increased activity was estimated at two million gallons.

The outage for replacement of rear pigtails continued through December 7. Exposure rates for this work were low and good contamination control was exercised.

A Maintenance Unit employee, working under a Special Work Permit on the No. 1 experimental level, made an unauthorized entry to the top of the reactor in search for welding equipment. A drum of contaminated third safety balls giving a dose rate of 125 r/hr at 2 inches was on the top of the reactor. The maximum exposure rate received by the welder was 150 mr/hr. It was estimated that he was on the top of the reactor for five minutes. A Class I radiation incident investigation was conducted and reported separately. The third safety balls had previously been removed from a hopper at a maximum exposure rate of 1.5 r/hr. They were subsequently shipped to the 105-F reactor for cleaning. The maximum dose rates observed after the drum was loaded on a truck were 500 mr/hr at the edge of the bed and 10 mr/hr in the cab.

Reactor Section, Radiation Monitoring Sub-Section

105-C Reactor and Associated Buildings (continued)

Graphite blocks were removed from the "D" experimental hole at a maximum exposure rate of 5 r/hr. A spot of contamination giving a dose rate of 5 mr/hr at 2 inches was found on the black-top paving near the east door of the 181-C river pump house. The source was contaminated swallows nests, which condition was reported previously. The contamination was isolated. A routine survey of the riggers' loft in the 1722-B building revealed a pair of shoes contaminated to 2,000 c/m on the uppers. The shoes were taken to the 105-C building. Follow-up failed to reveal the source of the contamination.

All of the 89 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

During the discharge of special tubes, the maximum dose rate observed on tipoffs was 35 rads/hr including 300 mr/hr at 2 inches. Leak testing and repair of nozzle and Van-Stone leaks were performed in the discharge area at average exposure rates of 100 to 150 mrad/hr, depending upon the location of the work. The maximum dose rate observed on perforated dummies, removed from the rear nozzles during leak testing, was 3.5 rads/hr at surface including 100 mr/hr at 2 inches. The maximum exposure rate in the discharge area for tube replacement work was 500 mrad/hr while removing a last section of tube from the pushing mandrel. Graphite samples were discharged from "B" experimental hole twice during the month. The maximum exposure rate received was 1 rad/hr to the hands while swabbing the retrieving pole. The maximum dose rate on any one sample was 450 mr/hr at 8 feet.

A perf retriever was used on the charge face to seat a poison column toward the rear. Upon removal of the retriever, upstream dummies were withdrawn into the front nozzle, resulting in an exposure rate of 5 r/hr to personnel at a distance of 2 feet. A Radiation Monitor Journeyman monitoring the job showed a pencil reading 130 mr. His film badge was processed and read 165 mr. The employee's total estimated exposure for the badge period was 179 mrem.

About one foot of water was observed on the floor of the gas tunnel, presumably resulting from process tube leaks. The step plug in the outer instrument room was removed during reactor operation, a pump was lowered into the tunnel, and the water was pumped into the storage basin. This work was done with a maximum exposure of 110 mrad/hr during positioning of the pump.

During an outage, a hole was cut in the downcomer roof in preparation for the installation of a larger vent line. After startup, dose rates up to 3.3 rads/hr were found over this hole, due to escaping effluent vapor. The effluent line junction box near the 103-D building was recaulked at a maximum exposure rate of 600 mrad/hr in an attempt to seal it. Previously leaks in the box were responsible for high effluent vapor activity within the 105-D badge house. After recaulking, only minor leaks were present. The hole in the downcomer roof may also have helped in alleviating this condition by reducing the pressure in the system.

Considerable maintenance work and piping replacement was performed in the gas purification drier rooms during the month. The maximum exposure rate for this work was 200 mrad/hr. A sample of the silica gel from a tower was obtained at a maximum exposure rate of 300 mrad/hr. The dose rate from the one pint sample was 125 mrad/hr at surface. The sample was sent to the Radiological Sciences Department for analysis. Both gas sampling pumps in the inner instrument room were found to be leaking. Gas concentrations in the corridor approached fresh air mask limits when reactor gas purity was low. Repair work is in progress at month end.

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Reactor Section, Radiation Monitoring Sub-Section

105-D Reactor and Associated Buildings (continued)

Daily surveys of Road Maintenance personnel revealed several cases of clothing contamination. One pair of plant issue coveralls was found contaminated to 500 c/m. An employee's personal jacket was found with a spot of contamination on a sleeve reading 40,000 c/m, which when autoradiographed showed a surface dose rate of 100 mrad/hr. The maximum possible dose to the man's arm was 525 mrad. A subsequent check of the jacket revealed another spot of 3,000 c/m. The employee had been operating a road grader in the vicinity of the 200 areas. It had been decontaminated just prior to use. However, when the grader was subsequently surveyed it was found to be contaminated with particles reading from 1000 to 80,000 c/m. A thorough survey was made of the Road Maintenance facilities at White Bluffs. No contamination was found.

A total of 88 air samples was taken. The maximum activity density was 1.2×10^{-7} uc/cc due to effluent vapor in No. 8 fan cell. All discharge area samples showed less than 5×10^{-9} uc/cc.

105-DR Reactor and Associated Buildings

There was one slug failure. A routine survey of all rear face pigtails, made at start of an outage, revealed a dose rate of 500 mr/hr on one pigtail. This was approximately two and one half times the general background. The tube was discharged and a ruptured "J" metal piece was found. Perforated aluminum dummies were removed from tubes in the discharge area at a maximum exposure rate of 3 rads/hr. Perfs recovered and placed in 20 gallon cans gave a maximum dose rate of 750 mr/hr at 2 inches from the outside of the cans. During discharge operations an irradiated slug lodged on a cocked tip-off, but was removed remotely with no exposure to personnel. A horizontal safety rod and thimble were removed at a maximum exposure rate of 3 r/hr. A new type half-rod was installed at a maximum exposure rate of 2 r/hr.

During reactor operation, samples were placed in the test wells on top of the reactor at a maximum exposure rate of 3 rems/hr and recovered after irradiation at the same exposure rate. A ruptured "J" metal piece was drilled to obtain a gas sample. All work was performed under water and no free gas was detected during the operation. The maximum dose rate on the sample container was 1 r/hr. The average exposure rate for the work was 25 mr/hr. The aspirator vent line from the slug weighing device in the technical viewing pit became plugged and water was back flashed out the open end of the vent pipe. An area on the ground outside the building was contaminated up to a maximum of 40 mrad/hr at surface. The affected area was immediately roped off and decontamination started.

A total of 62 non-regulated vehicles in 100-D area were surveyed with no contamination detected.

All of the 41 air samples taken during the month showed activity densities less than the maximum permissible limits for the isotopes involved or the respiratory protection worn.

100-F-H Areas

105-F Reactor and Associated Buildings

Exposure rates encountered in the discharge area during leak testing were generally between 100 and 125 mrad/hr, which was the background level at the tube caps. Decontamination in the inner rod room reduced the maximum level from 15 rads/hr to 300 mrad/hr at 3 inches and reduced the background to 5 mrad/hr. Samples of various materials were placed in the "E" experimental hole to test their reaction to irradiation. Exposure rates were as high as 1.5 rads/hr.

Reactor Section. Radiation Monitoring Sub-Section

105-F Reactor and Associated Buildings (continued)

The rupture of the effluent line, just below the point where it passes under the railroad spur near 108-F building, was evidenced by steam and water coming up out of the ground. The leak was repaired by Minor Construction forces.

No contamination was found on the 65 vehicles surveyed during the month.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad throughout most of the month. The maximum was 432 mrad.

All activity densities for the 57 air samples taken during the month were below the maximum permissible limit for the isotopes involved or the respiratory protection worn.

105-H Reactor and Associated Buildings

There was one slug failure. The ruptured slug was detected when a dose rate of 25 rads/hr was observed at the rear pigtail of a process tube during a scheduled outage. The charge was removed without difficulty.

The thimble was removed from the No. 14 horizontal rod channel for the installation of a new type rod. Exposure rates encountered were as high as 5 r/hr at 6 feet from the end of the thimble. The rod rack was contaminated up to 10 rads/hr including 1 r/hr at 2 inches as the result of removing the thimble. The floor was contaminated up to 17.5 rads/hr at 1 inch. Graphite tracks, giving a dose rate of 17 rads/hr at 1 inch, were retained in the inner rod room.

The "E" experimental hole step plug was removed and replaced at a maximum exposure rate of 2 r/hr. The "B" experimental hole step plug was removed and a new plug inserted. The maximum exposure rate encountered during this job was 2.5 r/hr. Several test runs were made with the neptunium irradiation equipment on the No. 2 experimental level. No undue exposure rates were encountered even though one capsule contained UO_3 . The maximum dose rate through the 2 inch lead glass window was 170 mr/hr.

Installation of the gamma monitor turret in the near sample room was accomplished at an exposure rate of 75 mrad/hr. The proportional counter tube beneath the reactor at the -9' level was replaced during reactor operation. The average exposure rate was 700 mrem/hr, which included 240 mrem/hr due to neutrons.

Thirty-three vehicles were surveyed. A spot of contamination reading 2000 c/m was found in the bed of a pick-up truck which was easily removed.

The 24-hour dose of the effluent water discharged to the Columbia River exceeded 360 mrad for nine days. The maximum was 405 mrad.

A total of 35 air samples were taken. All were below the maximum permissible level for the isotopes involved or the respiratory protection worn.

100-K Area

105-KW Reactor and Associated Buildings

Dry loading started on December 9, 1954 and continued until dry critical was reached on December 12, 1954. During the dry coefficient test the maximum flux densities observed in the work area were 360 slow neutrons/cm²/second (3 mrem/hr), 480 intermediate neutrons/cm²/second (10 mrem/hr) and 104 fast neutrons/cm²/second (13 mrem/hr). The maximum power level

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Reactor Section, Radiation Monitoring Sub-Section

105-KW Reactor and Associated Buildings (continued)

was approximately 2 megawatts.

Material removed from the reactor, including ion chambers and slugs containing pins and foils, gave dose rates up to 9 rads/hr including 4 r/hr at 2 inches. The maximum exposure rates were 2.5 rads/hr to the hands and 500 mr/hr to the body. Contamination encountered was negligible.

IMPROVEMENT EXPERIENCE

New beta sources in a specially designed holder were received at each of the reactors. The sources allow for a complete check of all ranges of portable instruments to insure that the battery voltage is adequate. If batteries are weak, it is not possible to drive the instrument full scale, a condition which causes erroneous readings in a radiation field.

A°Saxson Meter was tested in the field as a possible replacement for the Ryerson electro-scope in making beta measurements of effluent water activity. The instrument is similar to the Zeuto, but is much more sensitive. It has definite advantages over the Ryerson in that it is much easier to use, is more reliable, and is far easier to maintain.

FORCE SUMMARY

	<u>Start of Month</u>	<u>End of Month</u>	<u>Net Change</u>
Monthly	22	22	0
Weekly	<u>54</u>	<u>57</u>	<u>13</u>
Sub-Section Total	76	79	13

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