HW-44066

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REACTOR SECTION, RADIATION MONITORING

REPORT FOR MONTH OF JUNE, 1956

By: P. C. Jerman

Date: July 3, 1956

RESPONSIBILITY

The assigned responsibilities of the Radiation Monitoring Sub-Section were not changed during the month of June.

II. ACHIEVEMENT

A. Operating Experience

1. Statistics

	B	C	D	DR	F	H	KE	KW	June Total	May Total	April Total	1956 to Date
Special Work Permits	71	91	105	102	65	86	94	57	671	738	729	4,743
Routine & Special Surveys	552	603	669	374	839	758	444	225	4464	5278	4929	29,744
Air Samples	83	54	85	33	234	100	32	34	655	649	493	3,967
Hand Contamination Cases	0	0	1	1	2	0	0	0	4	13	8	72
Skin Contamination Cases	3	3	0	3	2	2	0	0	13	27	18	177
Contaminated Injuries	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Surveys	110	5	18	39	32	132	40	57	433	344	420	1,928
Vehicles Contaminated	3	0	10	1	4	5	0	1	24	12	24	115
No. of Cases of Personnel Clothing Contamination	1	1	8	3	8	7	0	0	28	36	37	221
No. of Cases of Contamination Spread Outside Radiation Zones	0	1	2	1	8	3	0	1	16	17	31	171
No. of Employees for whom dose rates $\geq$ 3 rads/hr were established	0	0	0	0	1	2	5	0	8	7	18	131
No. of hours Training Others	20	20	60	0	10	26	10	25	171	104	73	531
Exposure received by Radiation Monitoring Personnel	2411	4984	4261	1738	6059	4276	1181	867	25777	26333	32805	188,710
Reactor Effluent Data												
No. of Effluent Calculations	123	118	115	137	110	103	173	106				
Ave. Beta dose rate (mrads/hr)	4.5	4.7	2.1	4.3	1.9	2.7	3.5	3.1				
Ave. Gamma dose rate (mr/hr)	14.2	10.6	6.9	18.5	9.2	9.2	11.8	13.0				
Ave. Total dose rate (mrads/hr)	18.7	15.3	9.0	22.8	11.1	11.9	15.3	16.1				
Ave. Integrated dose in 24 hrs.	452	365	235	539	268	286	350	386				
Maximum Integrated dose in 24 hours	650	507	336	613	613	533	488	528				
Maximum Integrated dose in 24 hours 1956	650	507	544	613	921	796	488	585				
No. of days operated in excess of 360 mrads/day	24	22	0	29	14	15	20	21	130	138	131	615

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1. Statistics (continued)

Unit	Estimated Exposure	Radiation Zone Entries	Handcounts Recorded
Operations			
B	7050	830	1113
C	9800	855	1150
D	11092	882	2875
DR	7025	716	947
F	13739	858	1245
H	7310	557	731
KE	6787	987	1309
KW	5903	952	1202
Suppl.	39297	1670	1886
June Total	108003	8307	12458
Reactor Area Maintenance			
B-C	10585	900	648
D-DR	10949	762	416
F	6006	404	400
H	7139	406	331
K	8065	1283	1178
June Total	42744	3755	2973
Proj. & Spec. Reactor Maint.			
A Shift	16847	418	60
B Shift	23166	516	72
C Shift	16731	373	55
D Shift	14582	341	21
Other	9769	611	308
June Total	81095	2259	516
Process	2442	460	622
Power	48	16	393
Proj. & Pers. Development	367	83	103
Radiation Monitoring	25777	1996	2402
Reactor Section Totals			
June	260,476	16,876	19,467
May	253,368	17,433	17,689
1956 to date	1,715,390	104,950	119,306
Engineering	9,015	622	758
Others	960	267	313
Visitors			1198[1]
June Totals	270,451	17,765	21,736

1 - 1065 handcounts recorded at 100-H main gatehouse.

2. Monitoring Activities

Radiation Incidents

There were no radiation incidents recorded for the month. Twenty-eight Lapses of Radiation Control occurred and were recorded. The frequency of these lapses of radiation control by facility and responsible Sub-Section is outlined below:

	B	C	D	DR	F	H	KE	KW	Total
Operations	1	0	3	4	2	0	0	3	13
Reactor Areas Maintenance	1	1	0	0	0	1	0	0	3
Projects & Special Reactor Maint.	1	0	1	0	4	1	0	0	7
Process	0	0	0	0	2	0	0	0	2
Radiation Monitoring	0	0	0	1	1	0	0	0	2
Resp. Not Established	0	0	3	0	0	1	0	0	4
Total	3	1	7	5	9	3	0	3	28*

*In three of the Lapses of Radiation Control recorded above, two Sub-Sections jointly shared the responsibility, therefore the total figure is three less than the sum of the sub-totals.

Thirty-five percent of the recorded lapses of radiation control involved the spread of contamination outside established radiation zones and thirty-two percent involved contamination of personal clothing. The remainder resulted from violations of administrative procedures as established for timekeeping, exposure control, monitoring and protective clothing.

External Exposure Control

There were eleven slug failures during the month requiring a total of 168.6 hours of discharge time for removal. Five occurred at C, 3 at D, 1 at KE, 2 at KW and none at DR, F, H, and B reactors. Dose rates to 300 r/hr at 2 inches were observed on pigtails of process tubes which contained ruptured slugs. Dose rates to personnel to 4 r/hr were encountered during rupture removal operations. It was necessary to transfer metal from process tube #1674 at D reactor into the adjacent tube to facilitate removal of a ruptured slug. Maximum dose rates to personnel making the transfer by means of the twin cask method was 450 mr/hr.

A total of 307 process tubes were removed during the month which includes 219 at F reactor, 47 at H and 41 at B reactor. Three hundred twenty-four channels were retubed and returned to production which included 236 at F reactor, 49 at H and 39 at B reactor.

The dose rates associated with tube removal operations were not significantly reduced during the month but improved techniques, more efficient utilization

Monitoring Activities (continued)

of manpower and experience gained from previous outages has continued to bring about a reduction in exposure per tube replaced. During the month this figure has varied from a high of 242 mrads/tube at B reactor where difficulty was encountered removing five stuck splitters and 126 mrads/tube at F reactor during a measured part of the 219 tube removal outage. The average exposure used per tube for the month is estimated at 170 mrads.

The tube extracting device was used in the discharge area during the F reactor 216 tube replacement outage. Dose rates of 500 mrads/hr were encountered by personnel starting to feed the tube onto the spindle which wraps it. Dose rates of 60 mrads/hr were measured on the end of the elevator for personnel operating the device as compared to 15 to 40 mrads/hr for operating a guillotine. On several occasions when a tube jammed in the roller, dose rates up to 8 rads/hr including 4 r/hr were measured at 14 inches from the roller. Personnel received dose rates to 500 mr/hr at 15 feet to remove tubing jammed on the spindle. Personnel observing the operation of the machine at 3 feet encountered dose rates of 5 r/hr. Recommendations for revisions of the tube extracting device have been made which should improve its operation as well as provide better control over the spread of contamination to the machine itself, the elevator floor and the nozzles below as has been experienced in the past. The machine has been removed from service until the revisions can be accomplished.

During the B reactor tube removal outage, a maximum dose rate of 2 r/hr was encountered to insert a mandril into a channel containing a broken section of tube. Dose rates up to 25 rads/hr at surface including 500 mr/hr at 2 inches were measured on a tube splitter. Decontamination efforts were successful in reducing contamination levels to allow remote removal of the splitter at dose rates of 200 mr/hr.

At KE reactor, vertical safety rod #22 which had remained in the reactor during operation for a period of time up to twenty-five days in May was removed from service in preparation for transfer to the thimble cave at a later date. Radiation levels from this rod required the establishement of additional radiation zones in the building. The decay scheme observed during the month indicated that Iron-59 and Chromium-51 are the main contributors of the gamma activity. At the beginning of the month a dose rate of 3 r/hr at 20 feet was observed on the rod. By month end this dose rate had decreased to 2 r/hr. A maximum dose rate to personnel of 10 r/hr was encountered on top of the reactor during adjustment of the regulating valve for the compressed air supply to the vertical safety rods. Routine activities in the work area were carried out at an average dose rate of 45 mr/hr, this gamma activity emanating from the irradiated rod during the time it was tied out of service.

At C reactor during maintenance work on the ball third safety system, dose rates from 500 mr/hr to 2 r/hr were encountered in making repairs and inspections in the ball third safety room due to gamma activity from irradiated balls. On the top of the unit, stored irradiated balls necessitated personnel to work in gamma fields up to 2 r/hr to take cold unit motion readings. Dose rates of 120 mr/hr were encountered on the winch level during vertical safety rod drop out tests due to irradiated balls in a clogged ball transfer line.

Employees received approximately 1000 mrads of estimated exposure on the wash

Monitoring Activities (continued)

pad while washing and separating 1000 pounds of balls that were removed from the system.

At H reactor, fuel elements were discharged from the KAPL-120 facility on the No. 1 experimental level at average dose rates to personnel of 100 mr/hr. On one occasion, a dose rate of 5 r/hr was encountered for a brief period by personnel manipulating the movement of fuel elements from the facility into a cask when two elements came out together instead of one as intended. The elements were moved back into the facility and later removed one at a time without further difficulty. The average dose rate to personnel for extended maintenance and revision of the KAPL-120 facility was 100 mrem/hr during unit operation.

At F reactor the "D" hole test facility on the experimental level was removed from the reactor during the tube outage and removed to the burial ground without incident other than mechanical problems. Dose rates of 50 to 250 mr/hr were encountered during the removal of the facility from the building. A dose rate of 100 mr/hr was measured in the truck cab used to transport it to the burial ground.

Burial of removed process tubing was continued at F reactor using the special cask loaded in the transfer area pit. The exposure to personnel doing this operation has dropped from 5 to 0.66 mr/tube for the entire burial operation.

Contamination Control Experience

One case of skin contamination resulting from tube removal work on the B reactor charge elevator resisted cleaning efforts. The initial contamination level on the employee's right forearm was measured at 4000 c/m. Repeated use of cleaning reagents for decontaminating the skin area may have contributed to skin irritation which necessitated suspension of cleaning efforts when the affected area was reduced to 800 c/m. The employee was released and later checked by Industrial Medicine. A recheck when the employee returned to work showed no detectable contamination. All other cases of personnel skin contamination were readily cleaned to less than detectable limits.

Routine surveys of plant vehicles disclosed 20 that were contaminated, for the most part during transporting of contaminated material and equipment. In all cases, the contamination on the vehicles was removed. Vehicles routinely used for movement of contaminated materials continue to be closely controlled.

The contamination of protective clothing of employees during tube removal operations continued to be a problem. The outer coveralls of a maintenance employee became contaminated to 3.5 rads/hr including 30 mr/hr while removing a vacuum hose from a tube channel during broaching operations on the F reactor charge face. The contamination was detected immediately and no over exposure occurred. Handling of the vacuum hoses also contributed to wide spread contamination of the work area, up to 80,000 c/m on two occasions, necessitating temporary work stoppage for purposes of housekeeping and decontamination of the affected area.

The use of the tube extracting device in the F reactor discharge area caused considerable spread of contamination to the discharge elevator floor, and to nozzles and caps below the work location. It was measured at 10 rads/hr including 300 mr/hr at six inches on one occasion. This contamination was

Monitoring Activities (continued)

reduced to a nominal level by flushing with water. Plans are under way to revise the device by addition of a trough which is expected to control contamination spread from the tube extracting operation.

Contamination levels up to 85 mrads/hr at surface were found on the main road from 105-F building to the burial ground at 100-F following burial of process tubing in the tube burial cask. A spill of contaminated water and sludge from the cask was believed to have occurred when the transporting vehicle turned a corner. The cask had not been adequately drained in the transfer area after loading. Contamination level of the roadway was reduced by hosing the affected areas.

Contamination levels have built up on the top of the 105-H reactor to a maximum of 10 rads/hr at surface. This is due to water leakage from a vacuum filter box. Water entered the filter box when a broach was cleaned on the discharge elevator without turning off the connected vacuum systems.

The areas surrounding the 105-H reactor high tanks and the 105-H central viewer were established as temporary radiation zones when swallows building nests at these locations continued to drop contaminated mud, spots of which were measured at 75 mrads/hr at surface, in the vicinity of the nesting locations. Source of the mud was the 107 crib. Recommendations have been made that the interior bank of the crib be lined with gravel or cinders to prevent reoccurrence of this in the future.

During the high water period of the Columbia River, the 100-F burning ground pit became filled by flood waters and effluent seepage from 107-F, and overflowed to the edge of the area perimeter road. Contamination up to 2000 c/m was detected and the area was designated as a radiation zone. Since this situation has been a recurring problem, the burning pit was abandoned and a new pit excavated at a higher location where flooding will be avoided.

Airborne Contamination Experience

During tube replacement operations, frequent use of fresh air masks was required on both charge and discharge elevators during the broaching of tube channels. It is believed that this is primarily due to the use of an internal vacuum system for cleaning the channels of graphite prior to insertion of a new tube. Levels of contamination up to 1000 mrads/hr have been measured on the surface of the vacuum hoses when they are withdrawn from the channels being broached. At the F reactor tube replacement outage, a significant decrease of airborne contamination was noted when the tubes were inserted into the broached channels without vacuuming.

During tube removal operations at H reactor, personnel in the discharge area were exposed to above applicable limit airborne activities for a brief duration of time. Before a change could be made from assault to fresh air masks, further air sampling indicated that the air activity had decreased significantly so as to make the change unnecessary. In all other cases, the required respiratory protection was worn when air samples indicated airborne concentrations of radioisotopes above the applicable permissible limit.

Ventilation Balance Unit personnel have completed a comprehensive study of the ventilation conditions in 105-F reactor. Preliminary information of the results of the study indicate that a significant improvement in ventilation conditions

Monitoring Activities (continued)

may be possible if corrective action is taken. A complete report of the study will be forthcoming from the Ventilation Balance group in the near future.

Non-Routine Monitoring

During the construction of the KE reactor, some 200 rear face nozzles were coated with Dow Corning Silicone Resin XR-671 to evaluate the effectiveness of this material as an anti-contamination agent. In order to evaluate the contamination resistance of the material and to provide data relating rupture experience to rear face dose rates, special observations are being made during each outage at the KE and KW reactors. Twenty representative process tubes have been selected, half of which have the special coating, and the beta-gamma dose rates on the nozzles of these tubes are being observed during each reactor outage. These observations will be continued for an indefinite period to provide the required data. To date the contamination buildup has been small and data is therefore inconclusive.

A 0.25 uc particle was removed from the inlet air filter at the 183-C building. A film study made of the particle indicated a maximum dose rate of 4.5 rads/hr. A gamma spectrometer run on the particle was performed by the Radiological Sciences Department and the active isotope was reported to be nearly 100% Ruthenium-106.

Measurements of the dose rates in the C reactor viewers and storage area while discharging during reactor operation show that gamma dose rates up to 20 r/hr are prevalent in the near viewer, up to 2.5 r/hr at the central viewer, and up to 3 r/hr at the rear wall of the storage basin. The attempts to measure neutrons at these locations were not as successful, however, indications are that slow and intermediate neutrons are present in significant amounts at these locations.

Radiation Analysis Experience

The Radiation Monitoring "Manual of Standard Practices" was revised and sections dealing with the "Radiation Monitoring Program" and "Radiation Monitoring Policies and Operating Standards" were issued to all supervisors throughout the Reactor Section who are associated with work performed in radiation zones in order to make them better aware of their responsibilities for radiation hazards control.

A "Radiation Attitude Survey" has been prepared and distributed among Reactor Section non-exempt personnel. Results of the survey will be analyzed in order to gage the effectiveness of Reactor Radiation Protection and present control methods, to determine areas that may need more attention and control, and to better gage the Radiation Monitoring education program.

The Jordan remote area monitoring equipment was returned to the plant and delivered to Radiological Sciences for testing to determine the effectiveness of component changes made by the Jordan Instrument Company. The equipment had been returned to the vendor for modification and repair after its initial test at H reactor.

A Radiation Work Procedure has been written and is now in effect that requires the remote handling and swabbing of push poles when they are withdrawn from the reactor.

Monitoring Activities (continued)

A crude sample of an unlined British Legging was received from the Tingley Rubber Corporation. This model was manufactured to Hanford specifications and may be worn on either foot. The sample passed laundry tests satisfactorily and indications are that the boot is superior to the present type used. Development work is continuing and more samples will be delivered for further trials.

B. Equipment Experience

Nine staplex air samplers were received from the vendor and are in the process of being modified and calibrated for use.

All equipment operated with only routine and preventative maintenance required.

C. Improvement Experience

Relocation of the HM chambers at the pickup chutes in the KW reactor was completed during the month. This relocation, now complete in both reactors, provides HM chamber systems which afford reliable monitoring of the area. The chambers were formerly mounted on the storage area floor and the vibration of the floor during movement of personnel or equipment produced spurious signals to the Beckman amplifier. Chambers are now mounted on rigid I beams and signals to the Beckman amplifiers represent accurate indications of radiation levels that can be relied upon to indicate a radiation condition rather than malfunctioning on part of the instrument.

Significant experience has been obtained with the continuous air monitoring system installed during May at the F reactor to illustrate its usefulness in the monitoring operation. The device, presently being used to continuously monitor the air conditions on the charge face, has been able to detect radioactive gas and effluent vapor during reactor operation as well as air conditions during shutdown operations. The instrument materially assists in reducing monitoring requirements for the location at which it operates.

D. Events Influencing Costs

Overtime requirements during the month have been well below the forecast. For the first eleven weeks of the fourth quarter of FY 1956, 4117 hours of overtime were worked by Radiation Monitoring personnel. The forecast for the quarter was 7750 hours.

Good use was made of five Monitors on loan from Radiological Sciences Department during the Minor Construction strike and overtime was reduced to 5% during that period.

F. Significant Reports Issued

1. Routine

"Reactor Section, Radiation Monitoring Sub-Section Report for May, 1956", dated June 1, 1956, HW-43471, author, P. C. Jerman.

"Reactor Section, Radiation Monitoring Sub-Section, Management Report for June, 1956", Confidential-Undocumented, dated June 22, 1956, author, P. C. Jerman.

III. Organization and Personnel

A. Organization

There were no changes in organization structure or nomenclature during the month.

B. Force Summary

	Start of Month	End of Month	Net Change
Sub-Section Monthly	30	31	+1
Sub-Section Weekly	78	75	-2
Total	108	107	-1

W. G. Westover transferred from Separations, Radiation Monitoring to Reactor, Radiation Monitoring and was assigned as Superintendent, 100-B Radiation Monitoring Unit effective June 1.

The reduction of weekly forces was brought about by one termination and one removal from payroll due to an extended illness.

C. Safety Experience

There were no disabling injuries during the month nor were Sub-Section personnel involved in any serious or near-serious accidents. One medical treatment injury was reported.

D. Radiation Experience

The average rate of accumulation of gamma exposure by monitoring personnel for the first 24 weeks of the year was 46 mr/week/man. This is a significant reduction. Control of exposure accumulation for individuals who are exceeding the average rate is continuing through individual instruction, work location reassignments and consideration of individual monitoring assignments.

E. Personnel Activities

At the end of the month there were no Rotational Training Technical Graduates assigned to the Radiation Monitoring Sub-Section.

L. V. Barker returned from a loan assignment to the Naval Radiological Defense Laboratory after participating in Operation Redwing.

L. A. Carter continued on loan assignment to the Naval Radiological Defense Laboratory and is participating in Operation Redwing.

Supervisor Training Development Programs attendance during the month was as follows

Report Writing - L. M. Ostby, A. W. Fash and L. M. Mitchell.
Job Instruction Training - C. L. Stairet.

R. J. Meyer completed a course in Radiobiology at the G. E. School of Nuclear Engineering.

Several radiation hazard meetings were conducted to present Radiation Hazard Topic No. 48 "The Shipment of Radioactive Materials".

Personnel Activities (continued)

A radiation training program for Operations personnel is being developed. A committee composed of Operations and Radiation Monitoring exempt personnel has been formed for the purpose of developing the program.

Seventeen Monitors and Journeymen completed the second lecture series which ran from February 10, 1956 to May 29, 1956. Eleven others attended only portions of the series. Five Radiation Monitor Trainees and one Journeyman are currently attending the third lecture series for monitoring personnel.

H. E. Book attended the second annual meeting of the Health Physics Society at Ann Arbor, Michigan.