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METAL RECOVERY PLANT RADIATION REPORT

JANUARY-MARCH, 1957

C. D. Hylton

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ORNL-2359

Contract No. W-7405-eng-26

CHEMICAL TECHNOLOGY DIVISION

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1.0 ABSTRACT

During the third quarter of FY 1957, 19 persons worked in the Metal Recovery Plant. The total radiation exposure received by this group was 21.6 rep, an average of 87 mrep/man-week. The exposure per person ranged from 10 to 63 per cent of the permissible (3.0 rep/quarter).

Uranium from tanks W-10 and W-7 of the tank farm and uranyl nitrate solution from Chalk River was processed. The gamma activity level of these feeds was 10^6, 10^7, and 10^5 cts/min/ml respectively. The processing equipment was cleaned and decontaminated prior to processing the Chalk River uranyl nitrate solution.

2.0 PERSONNEL EXPOSURE DATA

There were 17 operating and two maintenance men working the plant who received a total of 21.6 rep, or an average of 87 mrep/man-week. Based on the pocket meters, the total radiation exposure was 18 rep, or an average of 73 mrep/man-week. Individual exposures ranged from 10 to 63 per cent of the quarterly tolerance of 3 rep/man.

There were two periods of above average exposure during the quarter (Fig. 2.1). The first peak of 100 mrep/man-week was caused by decontaminating the W-10 slurry pump after a failure and cleaning precipitated sodium nitrate from the feed evaporator. The second peak of 220 mrep/man-week occurred during decontamination of the process equipment.

Operators and maintenance men received more radiation exposure than the foreman and engineers. This difference is expected since operators routinely perform equipment checks in cell areas, and maintenance men make necessary repairs to process equipment in the cells. During operational difficulties, however, foremen and engineers lend assistance as needed on tanks in highly radioactive areas. The exposure to all groups was lower in the second quarter of FY 1957 than during the first and

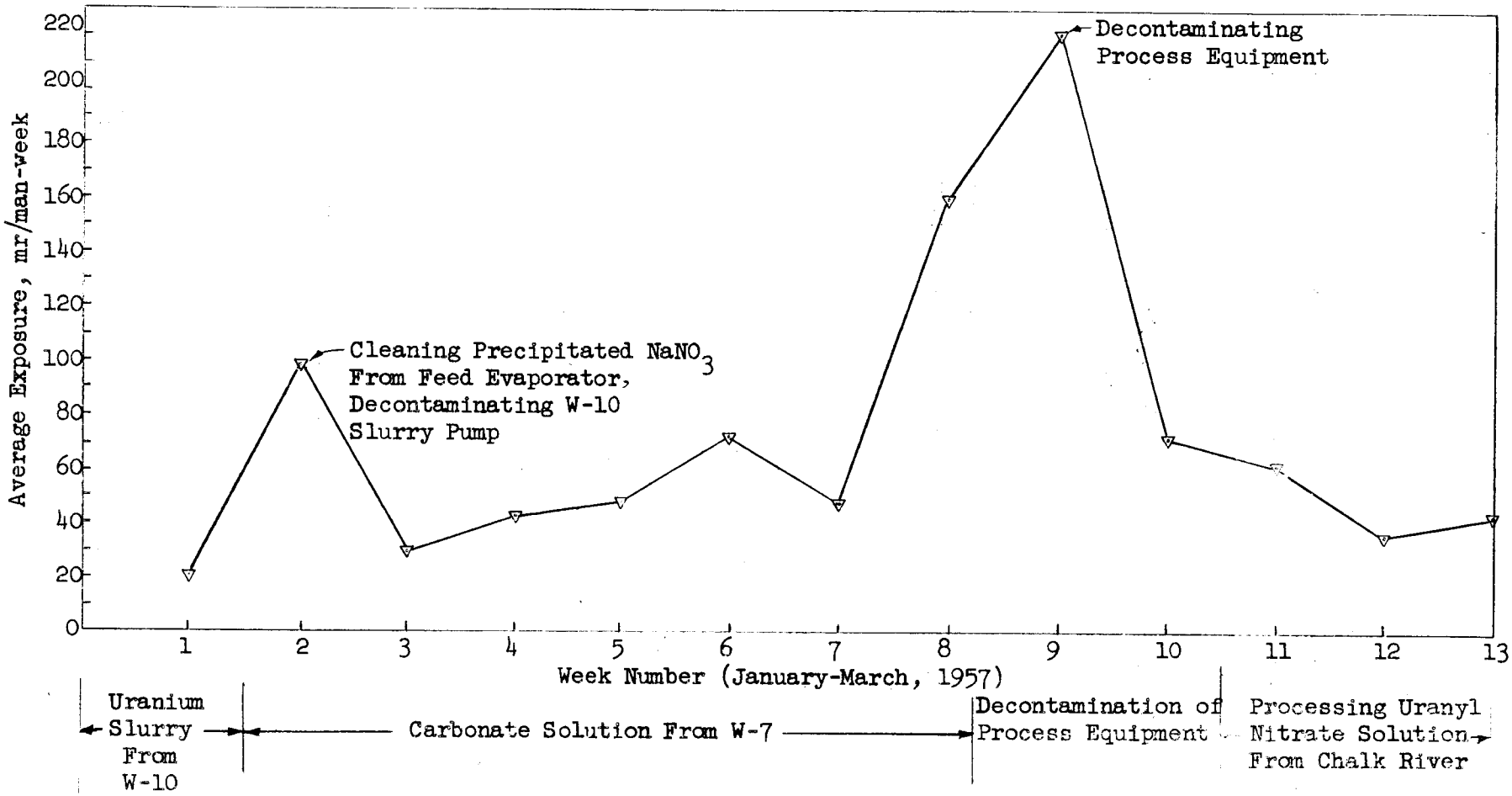

FIG. 2.1. Metal Recovery Personnel Average Exposure.

third quarters. Decontamination of process equipment and operational difficulties in the first and third quarters caused increased exposure, whereas the entire second quarter was spent processing slurry from tank W-10 and there were no significant operational difficulties. Exposure by work groups per quarter is presented graphically in Fig. 2.2.

3.0 PLANT OPERATION

The plant was operated for two weeks processing sodium diuranate slurry (10^6 γ c/m/ml) from tank W-10, six weeks processing uranium carbonate solution (10^7 γ c/m/ml) which was transferred from W-7 to W-10, two weeks decontaminating feed tanks in cell A, and three weeks processing uranyl nitrate solution (10^5 γ c/m/ml) from Chalk River.

Operations which contributed most to the radiation exposure were:

1. Reducing the size of the nozzles on the slurry recirculation system of tank W-10.
2. Decontamination of a spill into the operating area.
3. Cleaning plugged lines on the feed evaporator.
4. Decontaminating the W-10 slurry pump.
5. Decontaminating the process equipment.

There are five 2-in. pipes with 1-in. nozzles which extend to the bottom of tank W-10, through which tank solution is pumped to slurry the uranium sludge. Each pipe was lifted out of the tank and held by a crane while an operator steadied the pipe and the pipefitter reduced the nozzle from 1 in. to 1/2 in. Each pipe read 10 r/hr at 4 in. Approximately 2 minutes' working time was required for each nozzle.

During acidification and volume reduction of the first batch of uranium carbonate solution, a large amount of gas was evolved and excessive foaming resulted. Solution overflowed from the evaporator and passed through instrument lines into the operating area of the plant, entering the main electrical

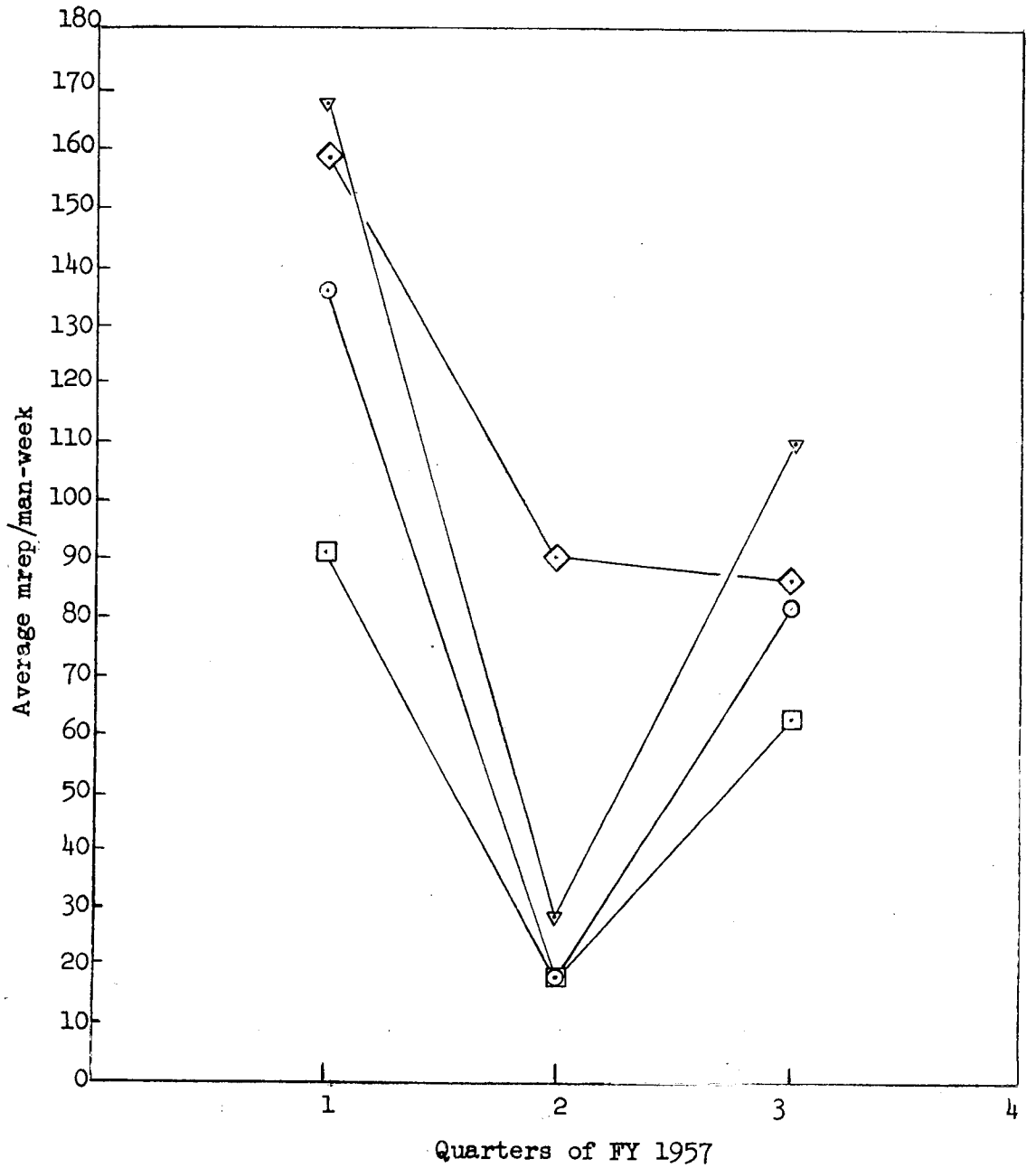

FIG. 2.2. Quarterly Average Exposure by Work Groups.

⊡ Engineers

⊙ Foremen

▽ Operators

◇ Maintenance

control panel. The general radiation level was 100 mr/hr with areas reading up to 750 mr/hr. Inside the power panel, the radiation was 200 mr/hr. The power panel was disassembled and cleaned; steel grating was removed and decontaminated; and a portion of the tile floor was replaced. Except for equipment that was disassembled for decontamination, all contamination was removed by scrubbing and wiping by hand, since flushing with water was not possible.

Excess nitrate concentration (above 2 M) caused sodium nitrate to precipitate in the feed evaporator, plugging the transfer jet and suction line. The jet and suction line were removed, cleaned, and replaced in a field of 600 mr/hr. Open flanges of the jet were greater than 10 r/hr at contact. Precipitate in the evaporator was flushed with water to plant waste.

A bearing failure on the W-10 slurry pump (40 hp) necessitated the removal of the pump from tank W-10. The spare pump (10 hp), which read 500 mr/hr to 10 r/hr at the base, was installed. The suction strainer on the 40-hp pump, partially plugged with solids and a towel, read 10 r/hr at 2 ft. The motor and barrel were 300 mr/hr to 4 r/hr. Using extension wrenches, the pump strainer was removed, then sent to plant decontamination. The pump, however, was removed to the new burial ground, where it was washed with detergent, Versene, and high-pressure water. This treatment reduced the radiation level at the motor and coupling from 4 r/hr to 750 mr/hr, and all loose rust and dirt were removed. The pump was then sent to the plant decontamination facility where the radiation level was reduced to 50 mr/hr. In this field, the pump bearing was replaced; the pump was then installed in W-10.

To clean the feed tanks and solvent extraction system of solids which had accumulated from W-7 solution, the plant was flushed thoroughly with hot caustic solution. After extensive cleaning, it was found that the radiation in the feed tanks was still of the order of 10 r/hr, with the bottom dish of

the evaporator reading greater than 100 r/hr. It was found that a black sticky residue had accumulated and was the main source of the radiation. Batch treatment of caustic and acid failed to remove the residue from the evaporator. The bottom drain was removed, the top center flange of the tank opened, and the residue was flushed out with high-pressure water. This reduced the background radiation in A cell from 2 r/hr at the cell door to 100 mr/hr.