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Route List

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DATE 5-13-49

SUBJECT Rough Draft-Health Problems Associated
with Investigation of Off-Plant Uranium
Rolling

To File

FROM F.E. Adley

COPY No. 1-A

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F.E. Adley *per* MAY 14 1954

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May 13, 1949

HEALTH PROBLEMS ASSOCIATED WITH INVESTIGATION OF OFF-PLANT URANIUM ROLLING

The following is a report of a trip to the Simonds Saw & Steel Company, Lockport, New York, on May 3, 1949. The purpose of the visit was to observe the various operations involved in the rolling of uranium rods at this plant. Those present in the visiting group from Hanford were: Mr. E.P. Lee, Mr. J.B. McMahon, Mr. V.W. Wood, Mr. R.E. Stanford, Mr. D.P. Schively and Mr. F.E. Adley, the last two being concerned with the health problems associated with the rolling operations. The group was guided and informed almost entirely by AEC representatives from the Buffalo and New York Operations Offices and no official contact was made with the company representatives.

Process

The rolling mill is located in one of several spacious buildings which conduct various types of stamping and rolling operations. The building in which uranium rolling is conducted is a large steel and masonry structure with a dirt floor. The location of the uranium rolling equipment is at one end of the building on a steel plate platform about 2 feet above the floor level, and is layed out as indicated in Figure I. The equipment which is used for uranium rolling was formerly utilized for steel rolling and is still used occasionally for this purpose.

Billets, which are shipped to the company by rail car, are transferred by overhead cranes to a section near the furnaces where they are stacked until needed. The billets are removed by hand from these storage piles and placed on weighing scales after which they are placed upon a narrow gage cart which is pushed to the furnaces. Furnace charging is accomplished by means of a long handled gripping device suspended from a monorail conveyor which is also used for unloading and transferring heated billets to the rolls.

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There are two gas-fired furnaces used for billet heating; the smaller having 3 sections and the larger 6. Each furnace is vented by a stack to the outdoors. Billets are left in the furnaces until they reach a temperature of 1000°F at which time they are removed by the monorail conveyor and taken to the roughing rolls.

The heated billet is fed into the rolls by two operators; one who has a lifting bar and another who guides the billet by means of long-handled tongs. A similar team is on the opposite side of the rolls to receive the billet as it emerges and transfer it to the next smaller section in the rolls. The metal is passed back and forth in this manner and temporarily set aside on a rack to await the second complete roughing pass. On the last pass of the rod through the roughing rolls it leaves from the back side and is dragged about 35' across the platform by long-handled tongs to a sheering machine which cuts it in two. The two pieces are then dragged back and placed on a low frame rack between the roughing and finishing rolls where they remain until needed for final rolling.

The finishing rolls and the operating procedure is similar to that employed in roughing. The rods are passed back and forth until the desired final diameter is attained after which the rods are dragged about 25' to a low frame stand upon which they are placed while waiting for the quenching and scaling operation.

While the rods are on the frame stand an operator marks each rod by a hard metal die stamp after which the rods are placed by pairs in the quenching and scaling machine. This operation consists of an enclosed water spray through which the rods are passed slowly. The entrance and exit parts of the enclosure are equipped with ordinary straw brooms which are intended to remove some of the oxide coating as the rods are rolled back and forth through the enclosure.

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The rods are then picked up manually by two men and placed on a nearby scale where they are weighed and placed aside. When several rods have been weighed a chain is slung around them and they are picked up by an overhead crane which deposits them in a storage section for subsequent shipment from the plant.

Sources of Contamination

Uranium metal when exposed to the air oxidizes readily. This factor is important from a contamination standpoint since the metal is handled extensively. In view of this problem it is essential to consider every handling operation at least as a potential source of atmospheric and equipment contamination.

It was observed that this condition existed at each operation or station involved in the rolling of uranium. Since it is felt that each step between the initial and final weighing operations contributed a certain amount to the contamination problem they have been listed in Table I on Page 5.

From Table I it can be seen that there are several sources of contamination, both from loose oxide and fumes. There are several control measures being used which will be discussed later although the contributing sources of contamination are so numerous that the overall effect of these measures is not completely satisfactory.

Contamination of the plant floor and equipment with oxide in the vicinity of the rolling process is very evident, which, in conjunction with poor housekeeping is definitely a source of general atmospheric contamination which amplifies the contamination problem indicated in Table I.

An additional point of consideration is the gaseous exhaust from the furnaces. No data were available to evaluate this as a possible source of outside contamination.

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Operation	Source of Contamination	Type of Contamination
Weighing	Loose oxide coating	Oxide
Transfer of billets from furnace to rolls	Heavy loose oxide coating	Oxide
Rough Rolling	Oxide coating and burning of uranium	Oxide and fume
Dragging of rods from roughing rolls to shears	Oxide coating and sparking uranium	Oxide and fume
Shearing	Oxide coating and burning uranium	Oxide and fume
Dragging rods from shear across platform	Oxide coating and burning uranium	Oxide and fume
Final rolling	Loose oxide coating	Oxide
Dragging rods from rolls to scaling	Loose oxide coating	Oxide
Stamping	Loose oxide coating	Oxide
Scaling	Loose oxide coating	Oxide

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Control of Air Contamination

Several control measures have been applied to the uranium rod rolling operation in an effort to reduce the health hazard associated with this process. These measures were adopted in steps and the effects of each were evaluated by air sampling, the results of which are discussed in the next section.

Ventilation in the form of canopy hoods has been installed at each of the rolls. The capacity of each system was understood to be slightly above 15,000 cfm. The range of effect of this type of ventilation, however, is limited and little or no control is realized a few feet from the rolls. At the present time the air is exhausted from the two hoods by propeller-type fans and discharged above roof level. No form of air cleaning is used with these systems, although it is planned to install a partial recycling, cyclone air cleaner in the effluent air stream to improve this condition. It was estimated that 1.5 # of V per hour is being exhausted to the outside during operation.

A small ventilated enclosing hood of undetermined capacity was used at the scaling operation to confine and remove steam and oxide generated by quench water inside the hood as the rods passed through. From observation it appeared that little contamination escaped from the hood although oxide continuously spilled off of the exposed portion of the rods outside the hood. This ventilating system also discharged directly outdoors with no form of air cleaning.

Another measure adopted to reduce contamination spread was a Spencer central plant vacuum cleaning system. A long, flexible extension hose was provided for each side of the rolls, each extension intake having slotted opening of about 8" x $\frac{1}{2}$ ". Vacuum cleaner pick-up of visible contamination on the metal floor was performed after the rolling of each "heat". This procedure prevents extensive oxide from accumulating in

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in the vicinity of the rolls but did not include other floor areas such as that adjacent to the quenching operation.

Four floor gratings have been installed, one grating on either side of each roll. These gratings are constructed of $3/4$ " angle with the apex up and the legs about $1/8$ " apart at the base. The longitudinal angles are welded to supporting cross members on the under side to leave a free running track for the rods. The purpose of the grates is to reduce local air contamination by preventing disturbance of the oxide which has deposited on the floor during rolling. Additional floor gratings are contemplated.

Air Sampling Procedure

Air samples are taken by means of a $\frac{1}{10}$ HP Wilson vacuum pump, and also a modified paint spray pump, the air being drawn in each instance through a #41 Whatman filter paper with an effective diameter of 1". The sampling rate is about 0.6 cfm for 30 minutes for general air samples and for actual worker's exposures it ranges from a few minutes to about an hour. The filter papers are then placed in small glassine bags, numbered, and returned to New York City for counting. A parallel plate counter is used to determine the alpha disintegration rate. The weight of uranium is then computed using 70 d/m equivalent to 50 micrograms and introducing a filter efficiency of 70%. A concentration of 50 $\mu\text{g}/\text{m}^3$ is taken as the recommended tolerance for uranium in air. This concentration is the same ($50 \mu\text{g}/\text{m}^3 = 5 \times 10^{-5} \mu\text{g}/\text{cc}$) as used at EN.

Table II, following, shows "times tolerance" figures for operators working in the zones shown on the attached sketch. It should be noted that these data, which were obtained by personnel from the New York Operations Office, represent a weighted exposure for the total daily intake of an operator assigned to work primarily in that zone and do not represent the concentration of uranium in the air at that point.

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These values, then, are not directly comparable to the "times tolerance" data as reported at H.W.

TABLE II

EFFECT OF CONTROL MEASURES ON "TIMES TOLERANCE" FACTORS

<u>Zone</u> (As in Fig.I)	<u>Original</u>	<u>Vacuum Cleaner</u>	<u>Hoods</u>	<u>Grates</u>
1	23	13	5	3
2	17	13	4	3
3	155	28	13	7
4	25	10	28	6
5	8	4	1	2
6	9	10	2	3

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PM Samples

A total of thirty-two workers on two shifts are directly involved with the rolling of uranium. Of this group 20 have been selected for routine urinalyses. Samples are collected at the plant at the end of each shift (PM samples) after the workers have washed. At the time of our visit arrangements were being made to collect samples from this group of workers before beginning work (AM samples). It was not possible to obtain any values of the findings as the results were all at the New York Office.

Supplementary urinalyses are also being done in the form of AAN/C ratios (the ratio of amino acid nitrogen to creatinine). This program has been in operation only a short time but it was said that there seems to be a fair correlation between the results of this test and the worker's exposures.

From observation it seemed that a possible significant factor which should be observed in appraising the worker's uranium intake and excretion values was the ingestion of metal. Ample opportunity for this mode of entry occurred when workers ate sandwiches, etc. and smoked at any time on the rolling platform without washing. Another possible contributing factor was noticed when workers went home for lunch without changing their dirty work clothes which are changed on a weekly basis.

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