Evaluation of Uranium Processing Days for Joslyn Manufacturing: SCA-TR-SP2015-0050, Rev. 0

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Independent evaluation of uranium processing days

- Appendix J to TBD-6000 lists the dates uranium billets were rolled into fuel rods
- Separately listed are the dates uranium rods were machined, using centerless grinding (CLG) to reduce the rods' diameters
- Separate evaluations of rolling and machining days were needed to assess intakes of uranium dust, since CLG generated much more uranium dust
- Since NIOSH concluded it could not estimate internal doses at Joslyn with sufficient accuracy prior to August 1, 1948, there was no need to separate the rolling and machining operations that occurred prior to that date

Evaluation of uranium processing days, January–June1943 from Site Research Database (SRDB)

- Chipman (1943) cited the rolling of three ingots on March 13, 1943
- Chipman and Greninger (1943) described rolling of six billets on June 29, 1943
- DeBlois (1946, Part 2) stated Joslyn used 32.3 tons uranium to produce 23.5 tons of rods—completed on June 25, 1943
- Later documents indicate Joslyn could roll 3–10 tons of uranium per day
  - Early productivity assumed to be at the low end of the scale due to lack of experience
  - SC&A assumes that Joslyn spent 11 days rolling 32.3 tons of uranium cited by DeBlois (1946, Part 2) prior to June 25, plus 1 day on June 29

Further evaluation of uranium processing days in 1943

- University of Chicago (U of C) issued subcontract to Joslyn for CLG on uranium fuel rods and tubes at $12.00/h (August 15, 1943)
  - Greninger and Van Echo (1943a) described CLG of uranium rods at Joslyn
    - Duration between 1 and 17 days
  - Greninger and Van Echo (1943b) described CLG of 14 extruded uranium rods (September 7, 1943)
    - Using time-saving procedures, rods were ground in 8 hours, suggesting previous grinding could have taken longer
    - Claimant-favorable assumption: First grinding took 2 days; experience gained allowed Joslyn to perform second operation more quickly
  - Simmons (1944a) reported 17 processing days
    - 16 days of CLG plus preparation for shipping on December 15
    - Analysis assumes a single worker could have worked continuously for 17 days
    - Note: Workers at General Steel Industries reported 65 hours/week during peak activities

Table 1. Uranium processing days at Joslyn, 1943

Dates	Quantity	Workdays
Before June 25	12 tons	11
June 29	6 billets	1
Before September 1	N/A	2
Before September 7	N/A	1
November 29–September 7	N/A	17
Total workdays	N/A	32

Evaluation of uranium processing days under U of C subcontract: 1/1/1944–6/30/1946

- Five agreements after initial U of C contract
- Each agreement listed cumulative cost ceiling
- Given rate of $12/h, SC&A estimated maximum hours during each contract period
- SC&A estimated the number of workdays based on the assumed length of the workday for the given time period
  - Prior to 1951, workday was assumed to be 9.6 hours long
  - These five agreements and the estimated maximum number of uranium machining days in each period are summarized in table 2

Table 2. Agreements modifying Joslyn's subcontract with the University of Chicago

Agreement no.	Date from	Date to	Cost limit (cumulative)	Workdays [a]
1	1/1/44	6/30/44	$5,000	
2	1/1/44	6/30/44	$10,000	87
3	7/1/44	12/31/44	$20,000	87
4	1/1/45	6/30/45	$30,000	87
5	7/1/45	6/30/46	$35,000	43

[a] Estimated on the basis of $12/h, 9.6 h/d

Documented uranium processing days in 1944, exclusive of U of C contract

- Fuqua (1944) reported rollings on May 8–9
- Simmons (1944b) reported rolling and grinding on June 1–5
- Simmons (1944c) reported rolling on June 19–20
- Joslyn rolled uranium rods for duPont on May 9–11, June 2, and June 22–24 (duPont, 1945)
- King (1945) reported rollings on December 11–12 and December 20–28 under the duPont contract
- The specifically documented uranium workdays in 1944, excluding machining performed under the U of C subcontract, are summarized in table 3

Table 3. Documented uranium processing days in 1944, excluding machining under U of C subcontract

Dates	Workdays
May 8–11	4
June 1–8	5
June 19–24	6
October 2–November 30	61
December 11–12, 20–28	11
Total documented	87

Evaluation of uranium processing days: 1945

- Koenig (1945) reported an order for 12 tons of rolled rods from District Office
  - 25 of an order of 220 threaded rods to be shipped by Joslyn by week March 5
  - Bassett and Belmore (1945) reported order was completed on May 16
  - Elapsed time = 11 weeks: entire order of 220 rods could have taken 62 workdays
- Joslyn supplied 222 rods to NRX Reactor at Chalk River, Ontario, in 1945
  - Order took ≈63 days to complete
  - Two orders could have been one and the same
    - 220 rods vs 222 (slight discrepancy)
    - Diameter =1.360 in. for both orders
- SC&A estimates a total of 63 days of uranium exposure in 1945

Evaluation of uranium processing days: 1946

- Uranium workdays during 1946 are estimated on the basis of uranium metal shipments to and from Joslyn
- Beeler (1947) referred to the production of 15 tons of rods by Joslyn for Great Britain
- Other documented shipments from Joslyn during the latter part of that year:
  - 4,407 lb (shipping weight) of rods shipped to Hanford in October and 11 tons of rods shipped to Hanford during November, for a total production of 28.2 tons
  - Production of 12 tons of rods in 1945, estimated to require 62 days
  - Given that rate, ≈146 workdays required to produce 28.2 tons of rods in 1946
  - SC&A makes the claimant-favorable assumption that production started on September 3 and that the final rods for Great Britain were shipped on December 31, a span of 17 weeks plus 1 weekday
  - Assuming a worker worked 5 days/week, there would thus have been 86 uranium workdays during 1946

Evaluation of uranium processing days: 1947

- Smith (1947) reported 10 tons of uranium billets received by Joslyn on July 28, 1947
- The billets were rolled into rods on August 5–6
  - Cleanup completed August 7
  - Shipment scheduled for August 8
- SC&A estimates the uranium was handled for 6 days during July 28–August 8
- It is plausible and claimant favorable to assume 6 days of external exposure during this operation
  - Billets were presumably stored in a warehouse under armed guard July 29–August 3
  - Little potential for exposure during this time
- This is the only uranium operation during 1947 for which SC&A found any records in the SRDB, nor is there any information that Joslyn had a contract with AEC or one of its contractors during that year

Evaluation of uranium processing days: 1948

- Under Contract AT-30-1-GEN 281 (1948), Joslyn was to roll 170 tons of uranium, starting on March 1 and ending no later than April 30
  - According to “Hanford Works Monthly Report: March, 1948” rolling began February 28
  - Supplemental Agreements Nos.1–3 successively extended period of performance to June 30
  - Supplemental Agreement No. 4 extended period of performance from July 2 to no later than July 31
  - Macherey (1948) requested Joslyn to roll 7 billets in early August: most likely done in one day
- Uranium was handled at Joslyn from February 28 to June 30 and again from July 2 to July 31, a period that spans 22 weeks, for a total of 110 weekdays
- Adding 1 day in August results in 111 workdays
  - Total includes 110 days during SEC period, when NIOSH performs only partial dose reconstructions based on external exposure, as well as 1 day of rolling in the post-SEC period, when both external and internal doses are reconstructed

Evaluation of uranium processing days: 1949

- Garrow (1959) reported fabrication of 244 uranium rods at Joslyn in 1949 for the NRX reactor
- 275 billets were rolled into rods on May 26–27
- Klevin (1952, Appendix B) presented job analysis sheets for processing uranium rods at Joslyn based on site visit in January 1952
- Limiting operation is CLG
- Operation staffed by one man per shift
  - 18 rods processed per shift
  - 2 shifts per day
  - Grinding 275 rods required ≈8 days
  - Allow 1 day for other processes mentioned by Garrow (1959)
  - Estimate 9 days of uranium handling at Joslyn
  - Single worker could have been exposed during this whole time

Evaluation of uranium processing days: 1950

- Belmore (1950) asked Joslyn for a quote on 305 fuel rods for the National Research Council (NRC) of Canada.
  - SC&A estimates rolling and finishing 305 rods took 10 days, based on production rate in 1949.
- Rods produced from 185–200 lb billets (84–91 kg). If rod ≈75% mass of billet, total mass of rods ≈18,000 kg.
- Based on the mass, SC&A estimates their production took 3 days.
- Stroke (1950) observed rolling of uranium rods for NRC on August 10 and 11, and other experimental rollings.
  - SC&A estimates these rollings occupied at least 3 days.
- SC&A estimates there were 16 days of machining and rolling during 1950.

Evaluation of uranium processing days: 1951

- "Hanford Works Monthly Report for July 1951" mentioned orientation studies on 4 rods rolled at Joslyn
  - No other mention of such rolling during 1951, prior to time of report
  - SC&A makes the claimant-favorable assumption that the rods were produced in 1951
  - SC&A assumes production included machining as well as rolling
- National Lead Company of Ohio conducted a uranium dust survey during machining operations at Joslyn on October 24 (AEC, 1951)
- SC&A assigned 2 days of exposure to uranium machining during 1951
  - Absent other documentation, there is no basis for assigning additional uranium exposure days in 1951

Evaluation of uranium processing days: 1952

- Klevin (1952) reported uranium air dust concentrations during operations at Joslyn
  - 9 sample sheets are dated January 8, 16, and 18: uranium processed during 3 days
- On January 23, Malone (1952) requested shipment of three rods to Joslyn
  - Assume rods machined after that date, for one more day of machining in 1952
- Dunlap (1952) reported planned experiments on fuel rods of three sizes that required:
  - Medart straightening followed by CLG at Joslyn
  - Drawing to smaller diameter, more Medart straightening, CLG (presumably at Joslyn)
  - Medart straightening, cutting, and deburring
  - Processed at Joslyn on 3 separate days
- SC&A assigned 3 additional days of machining, for a total of 7 days of machining in 1952

Table 4. SC&A and NIOSH uranium workdays

Year	Total workdays	SC&A machining [a]	SC&A rolling	SC&A inactive	NIOSH machining [a]	NIOSH rolling	NIOSH inactive
1943	214	32		182	18		190
1944	252	201		51	43		207
1945	250	63		187	54		196
1946	250	86		164	33		217
1947	250	6		244	12		238
Jan–Jul 1948	146	110		36	75		71
Aug–Dec 1948	104		1	103	0	10	94
1949	250	7	2	241	0	2	248
1950	250	10	6	234	3	8	239
1951	250	2		248	1	1	248
1952	250	7		243	1	3	246

[a] Sum of machining and rolling days during SEC period (March 1, 1943–July 31, 1948)

Questions?

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