Memorandum

To: Josie Beach, Chair, Subcommittee for Procedure Reviews, ABRWH

From: Mark Rolfes, M.S., NIOSH DCAS Health Physicist

Subject: NIOSH DCAS response to SC&A review of DCAS-PER-073 "Birdsboro Steel and Foundry Company" Finding 1

Date: September 2, 2022

The history of AEC operations at Birdsboro Steel and Foundry are given below from Battelle-TBD-6000 Appendix B [NIOSH 2015, pp. 2-3]:

> *During the week of 11/15/1951, Birdsboro shipped 346 pounds of uranium metal to Lake Ontario Ordinance Works (LOOW). It is not known when Birdsboro received this metal, but the shipment was described as 8 pieces of billets (AEC 1951, Malone 1951).*
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> *Birdsboro developed a basic rolling mill design based on information obtained from the AEC, AEC contractors and laboratories. Because of many unanswered questions the AEC established an experimental rolling program to gather data (Polson and Schiltz). The basic design was discussed and agreed to in a meeting on 2/7/1951 (Reichard 1951). A summary of uranium metal rolling associated with the Fernald operations lists four dates where uranium metal was rolled prior to the meeting (AEC 1951a). Three of these were at Simonds Saw and Steel which were apparently conducted for evaluation by DuPont. The fourth was at Allegheny-Ludlum with the added purpose to provide Birdsboro with data for the rolling mill design. The data appear to be primarily temperature data and observations. All four of these rollings consisted of rolling 5-inch diameter ingots into finished rods.*
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> *On April 16th and 17th of 1951, another rolling at Simonds Saw and Steel occurred. On the 16th, the ingots were again rolled into finished rods but on the 17th, the ingots were rolled into billets (interim product) that were to be finish rolled at Bethlehem Steel. This rolling campaign was also designated experimental rolling #1 per a meeting that occurred on April 6, 1951. Since this rolling was the first in the summary to create billets and is referred to as experimental rolling #1, the 346 pounds of uranium billets pieces likely come from this rolling or a later one. This site profile will take the favorable assumption that the uranium came from this rolling and was received by Birdsboro on 4/17/1951. The metal was shipped from Birdsboro on 11/15/1951.*

Additionally, 5 wafers cut from rods finished at Bethlehem Steel were shipped to Birdsboro on 2/1/1952 (Smith 1952). The wafers totaled 11.5 pounds.[1] *No information was found as to when the pieces were shipped out of Birdsboro. Therefore, this estimate will assume the wafers were at Birdsboro from 2/1/1952 until 12/31/1952 (the end of the covered period).*

Pieces of billets and rods from various rollings were sent to different locations for analysis and inspections. It is not known why Birdsboro received these pieces, but it is assumed they were for metallurgical analysis. From experimental rolling reports, there appears to be interest in a number of parameters, but the grain size and orientation are parameters likely to be analyzed in a metallurgical laboratory (Bach 1952, Bach 1952a, Kattner 1952, Polson and Schiltz, Riches 1955, Sanderson 1952). Evaluation of the grain size and orientation would likely include cutting, grinding and polishing the surface for observation by an optical microscope (Bach 1952). The abrasive sample preparation work (cutting and grinding) could be easily accomplished in one work shift for 5 to 8 pieces of metal. While it is possible not all were processed in the same day, this site profile will take the favorable assumption that it took one full workday to cut the pieces from each shipment and that this was done the day they arrived at Birdsboro. It is further assumed that the remaining metallurgical analyses were not dusty operations but did require the handling of the uranium pieces. It is assumed that the pieces were handled for a full work week (including the cutting) then stored until shipped off-site. Also, for 1951 and 1952, TBD-6000 assumes the standard workday is 8.8 hours, resulting in a 44-hour work week.

[1] The 5 wafers, each 1-2 inches in size came from rods that were rolled at Lackawanna on January 26, 1952. Wafer AA weighed 1.9 pounds, wafer AB weighed 2.1 lbs., wafer A weighed 2.4 lbs., wafer B weighed 2.6 lbs., and wafer "not rolled" weighed 2.5 lbs. (Smith, 1952).

Memorandum

In SCA-TR-2018-PR003, SC&A expressed concern in finding 1 that NIOSH potentially omitted external exposures to Birdsboro Steel and Foundry employees during the covered period from documented radiography sources to include a 24-MV Betatron, a 300 kVp X-ray machine, a 200 milliCurie Cobalt-60 source, and 500 milligrams (500 milliCuries) of radium [SC&A/Saliant 2018].

To investigate this issue, NIOSH DCAS and contractor staff (Oak Ridge Associated Universities Team members) conducted record searches and reviewed 94 existing Birdsboro documents in the site research database (and NIOSH Autonomous Data Warehouse). Additionally, claim records describe the sources listed above in 1959 [Gearhart 1959, 1960a; Conducting radiography, no date] and provide some personnel radiation dosimetry results [Birdsboro 1959] and a safety assessment of the X-ray area in 1960 [Gearhart 1960b]; however, none of the records identified the presence of these sources or X-ray machines during the AEC covered time period in 1951 or 1952. The earliest date in this claimant submission indicated radiation surveys and personnel monitoring from the 1959 to 1960 period, years after the AEC covered work involving uranium metal samples took place.

Based on a review of the available reports provided in the "Claimant Provided Exposure Data" for NIOSH claim [redacted] from 3-19-2007, a copy of the "X-ray Operators Safety Manual" can be found. The manual states [Lutz, no date, p. 3]

> *This manual is issued to comply with requirements of the Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of Radiation Protection and* ***covers major safety precautions associated with equipment located within the Betatron building at Birdsboro Corporation's Armorcast facility****. It is provided as a guide for minimum safety operation of all X-ray equipment and is a supplement to instruction and maintenance manuals of the Allis-Chalmers Betatron and Andrex X-Ray Unit. These manuals should be reviewed for detailed instructions in the safe operation and maintenance of the X-ray equipment.* [emphasis added]

The above excerpt of the X-ray Operators Safety Manual indicates that the Betatron building is at the Birdsboro Corporation's **Armorcast facility**. The purpose of the Armorcast facility was investigated, and a documented decision and order of the National Labor Relations Board was located [National Labor Relations Board, no date, pp. 2-4]. An excerpt from this document is included below:

> *The Petitioner seeks an over-all unit at the Employer's Armorcast Plant. Both the Intervenor and the Employer maintain that the existing multiplant unit is appropriate. In 1944, following a Board election, Birdsboro Steel Foundry and Machine Company, herein called Birdsboro,*

entered into an agreement with the Intervenor covering its plant in Reading and its twoplants and pattern shop in Birdsboro, Pennsylvania. One of these Birdsboro plants, which produced steel castings during World War II, was closed in 1947, and therefore was omitted from the subsequent multiplant agreements between Birdsboro and the Intervenor. This plant was later operated by Penn-Ohio Steel Corporation in the production of ingots.

In 1951 Birdsboro, manufacturing steel castings and steel mill equipment, obtained a defense subcontract for the manufacture of armor castings. For accounting and tax purposes, it created the Employer, a wholly owned subsidiary, herein called Armorcast, and assigned the subcontract to it. Shortly thereafter Birdsboro obtained repossession of the World War II plant from Penn-Ohio Steel Corporation for use by Armorcast. On March 15, 1952, the Intervenor, Birdsboro, and Armorcast entered into a supplemental agreement extending the existing multiplant agreement between Birdsboro and the Intervenor to the employees of Armorcast. At that time preparatory work for the Armorcast operation, including the training of personnel for Armorcast, was being done at Birdsboro's main plant. On April 29 Armorcast operations began, and on July 7, when the current multiplant contract was executed, a total of approximately 335 production and maintenance employees were at Armorcast and 1,200 at Birdsboro. Approximately 50 percent of Armorcast employees was transferred from Birdsboro, including all skilled and supervisory personnel.

The main Birdsboro operation is 500 yards from the Armorcast plant and 9 miles from the Birdsboro machine shop in Reading. The Birdsboro pattern shop adjoins the Armorcast plant and the office building servicing both operations is close by. Although each plant has its own superintendent, Armorcast and Birdsboro have common officers, directors, works manager, purchasing agent, and personnel manager. Separate accounting, personnel, and payroll records are maintained for Armorcast as well as an employment office, though interplant referrals of job applicants are frequent. At present Armorcast produces a "flask" or preliminary casting. Eventually Armorcast will utilize foundry operations and job classifications substantially similar to those at Birdsboro. Because tank castings require a different chemical content and heat treat process than ordinary steel castings, however, Armorcast will also have in its employ Betatron operators and heat treat furnace operators. All patternmaking for Armorcast as well as major repairs to patterns are performed at Birdsboro and there is regular interchange of spare parts

and machine maintenance personnel. Production plans call for part of the processing of tank turrets and hulls at Birdsboro and a regular interplant flow of raw materials and partly processed products. Armorcast employees receive the same vacation, group insurance, profit sharing, and other benefits, and enjoy the same wage schedules and working conditions as Birdsboro employees. Employees transferred from Birdsboro retain seniority on their previous jobs and newly hired Armorcast employees acquire multiplant seniority.

The mere existence of a new plant does not constitute evidence of a self-contained and separate operation such as would warrant a self-determination election on the issue of inclusion in a broader unit. As noted, the operations of the Armorcast plant are essentially integrated with those of the Birdsboro plants, the end products differing only in shape and chemical Content. With minor exceptions, job classifications and functions are the same, as well as hours, wages, and working conditions. Direction of multiplant functions and labor relations policy is centralized in the hands of the same officials, Armorcast employees are drawn from Birdsboro, and there is regular interchange of employees under multiplant seniority. Under Armorcast production plans, further integration of operations will result when Birdsboro partly processes turret and hull castings. Moreover, there is a history of bargaining on a multiplant basis including the Armorcast plant.

In view of the foregoing factors, particularly the integration of plant functions and the history of bargaining on a multiplant basis, we find that Armorcast is an extension of the Birdsboro operations and that, therefore, a unit restricted to the Armorcast plant is not appropriate for the purposes of collective bargaining within the meaning of Section 9 (b) of the Act. Accordingly, we shall dismiss the petition.

From the above excerpt of the NLRB, the Armorcast facility was a physically separate facility located 500 yards from the AEC covered Birdsboro facility and was involved in a defense contract for the production of tank hulls, turret castings, and armor castings for the U.S. Army. Production and inspection of such massive military tank components likely created the need for the Betatron, as indicated in "The Chemical World This Week" in *Chemical and Engineering News* [The Chemical World 1952].

"A History of the Philadelphia District U.S. Army Corps of Engineers 1866 – 1971," [Korean Conflict, p. 146] shows that a contract was awarded to expand the Birdsboro facility for manufacturing the "new" M-48 tanks, and to include a Betatron machine for quality assurance in the casting process. The contract was awarded 3/7/1952 and completed 6/1/1954 as shown below:

> *Developing strategy in Korea emphasized the use of tanks in battle. The new M-48 medium tank required one-piece castings for both the hull and the turret (unlike older models, cast in separate pieces and then joined together). A facility for this express purpose was created by the District at the old Navy steel castings foundry at Birdsboro, Pennsylvania. A cost-plus-fixed-fee type contract was awarded for this project on 7 March 1952. Plans for the $23 million facility required the most advanced furnace design possible, with an extremely high order or quality control in the casting process (including a special Betatron building with massive 24-million-volt X-ray testing facilities). The Main Foundry Extension and Heat Treatment Building were monumental structures 400 feet wide by 575 feet long and 188 feet wide by 907 feet long, respectively.*
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> *A smaller, similar facility was developed at General Steel Castings, Eddystone, Pennsylvania. Work at these facilities was performed at an accelerated rate. When the facilities were two-thirds finished, the end of the Korean Conflict was in sight. The Birdsboro contracts were finally completed on 1 June 1954 at a total contract cost of $23,268,879.37.*

A photograph of the Birdsboro Foundry, east bay looking west, dated January 1954 is shown below [Korean Conflict, p. 147]:

Memorandum

Birdsboro Foundry, the east bay looking west, January 1954.

Under contract to the Atomic Energy Commission, Birdsboro was to design a rolling mill to roll uranium billets into uranium rods. The experimental rollings took place at Simonds Saw and Steel and Allegheny Ludlum in the April 1951 timeframe. Birdsboro shipped 346 pounds of uranium to Lake Ontario Ordnance Works in November 1951. In February 1952, 11.5 pound of uranium wafers were sent to Birdsboro likely for metallurgical analysis. These small 1-2" samples [Smith 1952] would not have required a 24 MV Betatron for analysis.

On March 7, 1952, Birdsboro / Armorcast was awarded a contract to manufacture one-piece castings for the hull and turrets of the M-48 tank. This required construction of a massive new building with the most advanced furnaces and a special Betatron building to house the 24 MV X-ray testing facility. The Betatron was used for the quality control testing of the steel tank turret castings.

Memorandum

On March 15, 1952, Birdsboro extended their labor agreement to include the Armorcast employees. This 1952 contract specifically notes that Armorcast will have in its employ Betatron operators and heat treat furnace operators.

Based on the weight of the evidence, the Betatron operations at Birdsboro appear to be associated with the Armorcast contract (i.e., quality control for the M-48 tank castings) not associated with the AEC work to design a uranium rolling mill. This work also occurred after the AEC work and in a different facility not associated with the AEC work.

Additional information concerning the two radiography sources (Co-60 and Ra-226) could not be located to pinpoint the date that these sources were first present at Birdsboro Steel. The earliest mention of these sources was not until after the AEC covered period had ended and the sources were specifically used for "conducting radiography of steel castings" [Conducting radiography, no date, p. 2]. A lawsuit filed against Birdsboro Steel by [redacted], on behalf of her deceased husband, [redacted] suggests that these sources were used by [redacted] to radiograph metal castings to check for defects. [redacted] was employed by Birdsboro Steel beginning in 1952, but it was not until 1956 that he began working in the Birdsboro Steel metallurgy department where he was employed as an X-ray technician. No mention of uranium work was made [Narrick 1999, p. 2]:

> *In 1952, Decedent began working for Birdsboro Corporation (Employer), which manufactured metal castings for bridges and submarines. In 1956, Decedent began working in Employer's metallurgy department, a position he held for more than 30 years. Decedent's job required that he take pictures, known as radiographs, of metal castings to check for defects. From 1958 to 1961, the radiograph procedure required the technicians to obtain radiographs by suspending small pieces of live, radioactive cobalt attached to a string, commonly referred to as the "pill," above a metal casting to reveal any defects. This radiograph process exposed Decedent to substantial amounts of radiation.2 At some point during the late 1960's, Decedent began performing his job using an x-ray machine, which substantially reduced but did not eliminate Decedent's radiation exposure.3*

The only mention of radium in this document was on page 11 [Narrick 1999]: "*...due to the decedent's exposure to massive doses of radiation from cobalt, radium, and x-ray equipment during his employment from 1956 through [redacted] when he was laid off.*"

In summary, based on the weight of the evidence, the radiography work at Birdsboro appears to be associated with quality control of steel castings at the Armorcast facility. This facility was not associated with the AEC uranium work and the radiography work was conducted after the AEC uranium work was completed. If future information becomes available to indicate the presence of such radiography sources at the Birdsboro Steel and Foundry Company, NIOSH DCAS staff can revisit this issue. NIOSH DCAS believes that the totality of the information reviewed and presented above provides evidence that this issue should be closed, and that radiation doses potentially received by employees of Birdsboro Steel and Foundry, while under contract to the AEC in 1951-1952 have been reconstructed in a complete and claimant-favorable manner.

REFERENCES

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