

UNITED STATES GOVERNMENT

Memorandum

TO : L. R. Rogers, Assistant Director for
Nuclear Materials Safety
Division of Licensing and Regulation

DATE: OCT 17 1960

FROM : Ellyson G. Outten, Acting Assistant Director for
Materials *Ellyson Outten*
Division of Compliance

SUBJECT: ENGELHARD INDUSTRIES, ATTLEBORO, MASSACHUSETTS; LICENSE
NOS. C-4941 AND SNM-185, 10 CFR 40 AND 70 - OVEREXPOSURES
(UNFOUNDED) 70-139

CO: EGO

On July 12, 1960, we notified Mr. Page of L&R that subject licensee had reported to the NY Compliance Division that employees (b)(6) had received film badge exposures of 15 rems and 23 rems of beta radiation, respectively. EX 6

There is attached a copy of an investigation report from the NY Compliance Division and dated October 5, 1960, as well as the cover memorandum of October 10, 1960, concerning these exposures. Based on the information gathered during the investigation, we concur with the NY Compliance Division that these were not valid overexposures, for the following reasons:

1. The two employees' helpers, who were exposed for the same period of time as the melter whom each assisted, received film badge exposures of 80 mrem beta and 130 mrem beta, respectively.
2. The film badges were exposed from the front side although each employee routinely wears his badge with the front side facing his body.
3. The workload engaged in by the employees had increased by less than a factor of two over normal workloads, during which latter time maximum dose rates of 400 mrad/hr are reportedly encountered.

We concur with the NY Compliance Division that the licensee be cited for the two items of noncompliance noted during the investigation and specified in the report thereof. We also concur with the recommendation of NY that L&R correspond with

(continued)

Information in this record was deleted
in accordance with the Freedom of Information
Act, exemptions 2 and 6
FOIA- 2008-0314

H/28
CRJ

L. R. Rogers

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the licensee for the purpose of impressing on the firm the need for a rigid control of film badges and adequate survey instrumentation.

We are of the opinion that no further inquiry is required.

Attachment:

Copy memo fm R. W. Kirkman
to L. D. Low dtd 10/10/60
w/attach invest rpt dtd
7/19/60

Lawrence D. Low, Director
Division of Compliance, Headquarters

OCT 10 1960

Robert W. Kirkman, Director
Compliance Division, NYOO

TRANSMITTAL OF TYPE "B" INCIDENT INVESTIGATION REPORT -
ENGELHARD INDUSTRIES, INC.

SYMBOL: CMP:PRN

Transmitted herewith is the following investigation report
of what was initially considered to be a type "B" incident
at:

ENGELHARD INDUSTRIES, INC.
D. E. Makepeace Division
Attleboro, Massachusetts

License Nos. C-4941
SNM-185

The following items of noncompliance were noted during the
course of the investigation:

20.201(b) "Surveys"

- in that surveys are not made routinely to
determine the radiation dose rates encountered
by employees during melt operations. (See page
4 of investigation details.)

20.401(c) "Records of surveys, radiation monitoring and disposal"

- in that records of radiation surveys and evaluations
of exposure times are not maintained. (See page 4 of
investigation details.)

It is our opinion that (b)(6)

(b)(6) high film badge results for the period of June 13,
1960 through June 24, 1960 were most probably exposures to the
badges only. We base this opinion on the fact that (1) the
only work performed by (b)(6) (b)(6) was routine melting
operations involving uranium (enriched 25.0% U-235), uranium
(enriched 93% U-235), and depleted uranium, (2) the work load

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during this period had increased by less than a factor of two, (3) the helpers radiation exposures during this period were less than 150 mrem although the work was a two man operation and the radiation exposure was jointly shared by each melter and his helper, and (4) the film badges were exposed with their front side facing the source of radiation although they were routinely worn with the front side of the badge facing the body of the employee.

It is our belief that the radiation exposure to the film badges resulted from their inadvertently being left on material having a high radiation dose rate or deliberately exposed by person or persons unknown.

We feel that the lack of rigid control of the film badges contributed to the cause of the incident.

The above items of noncompliance, as well as the need for (1) better control of their film badges and (2) adequate survey instrumentation, were discussed with Mr. C. A. Canham, Plant Manager, and Mr. Norton M. Weiss, Health and Safety Manager, who expressed willingness to correct the items of noncompliance and to provide the necessary film badge controls and instrumentation.

To prevent the recurrence of such an incident, we recommend that a letter be sent to Mr. C. A. Canham, Plant Manager, requiring that film badges be more rigidly controlled and that their employees be impressed with the seriousness of tampering with personnel monitoring devices. In addition, we recommend that the licensee be required to correct the items of noncompliance and to obtain an adequate radiation dose rate instrument.

During the investigation, the investigator found Mr. C. A. Canham and Mr. N. M. Weiss to be cooperative and capable.

No further action is contemplated by this office in regard to this occurrence.

Enclosure:
4 cys.

Mr. Canham, 10/10/60
Mr. Weiss, 10/10/60
Mr. [unclear], 10/10/60
Mr. [unclear], 10/10/60

Licensee: ENGELHARD INDUSTRIES, INC.
D. E. Makepeace Division
Attleboro, Massachusetts

Date of Investigation:

July 19, 1960

License Nos.: C-4941
SNM-185

Type of Investigation:

Class "B"

Expiration Dates: December 31, 1960
September 30, 1962

10 CFR 20, 40 & 70

APPLICABLE

SUMMARY OF FINDINGS

The licensee, Engelhard Industries, Inc., received notification by phone from their film badge processor, Nucleonic Corporation of America, that the body film badges for two of their employees, (b)(6) showed radiation dosages of 23 rems and 15 rems of beta radiation respectively for the period of June 13, 1960 through June 24, 1960. The AEC was immediately notified and the two employees were removed from all work involving radiation exposure pending an investigation.

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(b)(2)High, (b)(6)

Film badges are kept in an open rack by the guard station at the entrance to the Nuclear Department with employees having ready access to them. It was concluded that in all probability the exposures were to the film badges rather than to the personnel.

The following items of noncompliance were noted during the course of the investigation:

- 20.201 (b) "Surveys"
- in that surveys are not made routinely to determine the radiation dose rates encountered by employees during melt operations. (See page 4 of investigation details.)

20.401 (c) "Records of surveys, radiation monitoring and disposal"
- in that records of radiation surveys and evaluations
of exposure times are not maintained. (See page 4 of
investigation details.)

Paul R. Nelson, Inspector

Robert W. Kirkman, Director

October 5, 1960
Date report prepared

Distribution:

Orig. & 3 cys. - Div. of Comp., Hq.
2 cys. - NYOO

ENGELHARD INDUSTRIES, INC.
D. E. Makepeace Division
Attleboro, Massachusetts

Date of Investigation: July 19, 1960

Persons Accompanying Inspector:

Mr. E. M. Comproni, Massachusetts Division of Occupational Hygiene

Persons Contacted:

Mr. C. A. Canham, Plant Manager
Mr. Norton M. Weiss, Health and Safety Manager

(b)(6)

DETAILS

1. Background Information

On July 8, 1960, Mr. Norton M. Weiss, Health & Safety Manager of Engelhard Industries, Inc., informed the Atomic Energy Commission, New York Operations Office, by telephone and telegram that the film badge results which they had just received on July 7, 1960 for two of their employees, (b)(6) had shown beta radiation dosages of 15 rems and 23 rems respectively for the period of June 13, 1960 through June 24, 1960. He explained that the two men were melters on different shifts engaged in the routine melting of uranium enriched with U-235 and depleted uranium. He added that the film badge results for both helpers who work directly with the melters, had shown dosages of only 130 and 80 mrem beta. He concluded by stating that both men had been transferred to non-radiation exposure jobs pending an investigation. EX6

2. License Status

At the time of the incident, the license status for Engelhard Industries, Inc. Division of Makepeace Division, was as follows:

License 20-5216-1 was in effect which allowed possession of 20 mc of C-14, contained in iron, for the manufacture of iron strips.

License C-4941 was in effect which allowed the licensee to receive possession of and title to 60,000 pounds of source material for research and development and fuel element fabrication during the period from December 3, 1957 to December 31, 1960. The licensee had on hand approximately 60,000 pounds of source material which was being used in the manufacture of fuel assemblies.

License SNM-185 amended May 17, 1960 was in effect which allowed possession of 1180 kgs of U-235 as enriched uranium, for the fabrication of reactor fuel elements and related activities. At the time of the incident the licensee possessed approximately 902 kgs of licensed U-235 and 21 kgs of contractual U-235 as enriched uranium in the U-235 isotope which was being used in the fabrication of reactor fuel elements.

3. Investigation Details

A. Film Badge Evaluation

On July 18, 1960, the high film badge results for (b)(6) were discussed by telephone with Mr. J. Celnik, Physicist for the Nucleonic Corporation of America, the licensee's film badge supplier and processor, who stated that both films showed (1) an even beta exposure with no evidence of being near a point source, (2) no evidence of heat or fog, (3) no evidence of any gamma exposure and (4) an irregularity in that it appeared that the open window of the badges had faced away rather than towards the source of the radiation as would be normally expected. He added that inasmuch as this would result in the insensitive film being shielded by the badge plastic, the film results would require a reevaluation. He stated the results as first interpreted could be low by 20 to 30%.]

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On October 3, 1960, Dr. Schloss, President of the Nucleonic Corporation of America, was contacted by telephone with respect to the reevaluation of the film badges. He questioned the fact that the badges had faced away from the source of radiation and after personally examining them, stated that they definitely had not been facing away from the source of radiation when exposed. He explained that he based this decision on the fact that had the film badge been exposed while facing away from the source of beta radiation, a picture of the film badge clip would have resulted. He added that the examination of the film revealed no such picture.

B. Interrogations

Norton M. Weiss
Health & Safety Manager
Engelhard Industries, Inc.
D. E. Makepeace Division

Late in the afternoon of July 7, 1960, Weiss was informed that their film badge processor, Nucleonic Corporation of America, had just reported by telephone an exposure of 15 rem and 23 rem due to beta radiation for the body film badges worn by (b)(6) respectively, during the period of June 13th through June 24th, 1960. Both men were melters in the Nuclear Department with]

(b)(6) was immediately removed from all work involving radiation and (b)(6) was also transferred upon his return to a job which would not expose him to any radiation. Weiss was at home on vacation when he received the message and the following morning, July 8, 1960, he returned to the Engelhard plant and took the following action:]

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(1) The Atomic Energy Commission, NYOO, was notified of the exposures.

(2) The film badges of (b)(6) for the period of June 27th to July 8th, 1960, were picked up and sent in for processing. This was the period immediately following the weeks concerned.]

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- (3) The area where the men had been working, namely the furnaces, tables, crucibles and hoods, revealed no dose rates in excess of 20 mrad/hr.
- (4) (b)(6) were questioned as to whether they could recall anything which was out of the ordinary during the period of high film badge exposure (June 13th through June 24th). Neither man could recall anything unusual.
- (5) A record of the melts made during this period was obtained, but it was found that only routine melts had been performed. (See Exhibit "A"). The work load during the period in question had increased somewhat, but by less than a factor of two. (See Exhibit "B").

Subsequent melts made in the air reduction furnace were monitored, but no dose rate in excess of 1 mr/hr was noted.

On June 28, 1960, routine urine samples had been submitted to Controls For Radiation, Inc., located at Cambridge, Massachusetts for analysis. The results were as follows:

(b)(6)	-	1.6 x 10 ⁻³ ug/ml
	-	1.6 x 10 ⁻³ ug/ml
	-	1.4 x 10 ⁻³ ug/ml
	-	1.2 x 10 ⁻³ ug/ml

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Additional urine samples taken on July 19, 1960 revealed 1.2 x 10⁻³ and 2.3 x 10⁻³ ug/ml for (b)(6) respectively.

Urinalyses are performed once a year for all employees working in the restricted contaminated area and four times a year for the melters. Blood analyses are performed only when an employee is hired and when he terminates. Following the exposure report however, blood tests and physical examinations were made of the two men. (See Exhibit "C".)

To determine the radiation dose which a film badge would receive in contact with uranium metal, two film badges were placed on pieces of depleted uranium for a period of 8 and 24 hours. The eight hour exposure resulted in a dose of 3 r (beta) and the 24 hour exposure resulted in a dose of 10 r (beta). The depleted uranium was used inasmuch as a GM survey revealed 5 to 15 mrad/hr for the enriched uranium and off scale (greater than 20 mrad/hr) for the depleted uranium.

The actual work performed by the two men during the period of June 13th through June 24th consisted of routine melting operations. The actual melts were as follows:

(b)(6) - 11 melts

- 4 Magnesium - Aluminum melts
- 6 Enriched (93% Uranium - Aluminum melts (12 to 15% Uranium with balance Aluminum)
- 1 Depleted Uranium - Molybdenum melt (97% Uranium with balance Molybdenum)

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(b)(6)

- 18 melts

- 4 Magnesium - Aluminum melts
- 4 Enriched (25.9%) Uranium - Molybdenum melts
- 10 Enriched (93%) Uranium - Aluminum melts
(12-15% Uranium with balance Aluminum)

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The work, consisting of furnace loading, unloading, and crucible cleaning, is a two man affair conducted on each shift by a melter and his helper. All the various operations such as loading the furnaces etc. are performed by both the melter and helper in order to share the radiation exposure.

Biweekly radiation dosages for the melter and his helper are comparable (See Exhibit "D") with the helper's exposures usually being somewhat greater than the melter's. It was noted that none of the biweekly exposures exceeded the permissible weekly dose as set forth in Appendix A of Part 20. Most of the melts during this period were made in the air induction furnace (See Exhibit "A") which results in less radiation exposure to the man than when melts are made in the vacuum induction furnace. This is due to the fact that no actual entry into the furnace is required during the loading and unloading operation as it is for the vacuum furnace. Such entries necessitate closer proximity by the employee to the source of radiation. The handling time is calculated as being less than five minutes per melt with a total of 70 minutes required for making the 18 melts. Cleaning of crucibles having surface dose rates of less than 20 mrad/hr etc. are performed within a hood, but behind a thick plexiglass shield. No detectable beta radiation penetrates this shield. The maximum size of the melts are 13,000 gms. including 3,000 gms. of 93% enriched uranium, 60,000 gms. including 54,000 gms. of 25.67% enriched uranium, and 380 lbs. including 340 lbs. of depleted uranium.

For a period of three months prior to the reported exposure, no radiation dose rate surveys at the furnaces had been made. Originally, surveys were conducted after melts were made, but the dose rates encountered within the vacuum furnace exceeded the range of their GM survey meter. A time study was made of the melt operations coupled with film badge results, and a time limit within the furnace of 10 minutes per day per man was established. Following a reported biweekly dose of 1500 mrem, a chain fall was provided which made it possible to reduce the time limit within the vacuum furnace to two minutes. In addition, a thicker plexiglass window was provided on the hood where crucible cleaning was performed and cleaning of the furnaces was set up on a weekly basis by personnel other than the melters and helpers. It was calculated from film badge results that dose rates as high as 400 mrad/hr are encountered in the vacuum furnace. No records of the dose rate readings, time studies or dose rate evaluations were available. Cleaning of crucibles are performed approximately once a week within a ventilated hood and behind a thick plexiglass shield. A radiation survey is made of the crucibles and only those showing a dose rate of less than 20 mrad/hr are cleaned. These above 20 mrad/hr are held for decay.

Film badges in use are stored in a open badge rack at the guards station located outside of the Nuclear Facility. A guard is present at all times from 7:00 a.m. to 5:00 p.m., but during the remaining 24 hours he is making hourly rounds. Inasmuch as (1) each employee removes his own film badge from the rack and returns it when going to lunch or when going

home, and (2) there are approximately 150 film badges on the rack, film badges could be removed from the rack, and mistreated without the guard being aware of it. Film badges are received monthly and changed every two weeks by Hazel Johnson, a technician. Prior to shipping the exposed film badges to the processor she examines them for any physical damage. No check is made for contamination.

EX 6

(b)(6)

EX 6

Richard Industries, Inc.
D. E. Makepeace Division

All four men were interviewed separately and privately and each substantiated the statements made by Weiss as noted previously. None could recall anything of an unusual nature during this period and each stated that the work consisted of only the usual routine melts. Some variation was noted in their estimation as to the length of time spent within the vacuum furnace which ranged from three to ten minutes when making 350 lb. depleted uranium melts. All confirmed the fact that the work of loading and unloading of the furnaces, and transferring the ingot to the hood was performed together by the melter and helper. (b)(6) estimated that the direct handling time was approximately six to nine minutes per melt. Each confirmed that his film badge was always worn within his shirt pocket (back side facing out), that his shirt was never removed while on the job, and at no time had he lost or misplaced his film badge.

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C. Additional Information

A survey by the investigator within the Nuclear Contaminated Section, a restricted area approximately 50' x 100' in size where all work with radioactive materials is conducted revealed the following dose rates:

- (1) 4 to 5 mrad/hr (beta) maximum within the vacuum furnace which reportedly had not been used for 2 to 3 weeks.
- (2) 1 mrad/hr maximum at the air furnace.
- (3) 40 mrad/hr including 2 mr/hr gamma at contact (2" from effective center of instrument) depleted uranium copper clad.
- (4) 80 mrad/hr at contact (2" from effective center of instrument) depleted uranium.
- (5) 1 mrad/hr maximum at crucible cleaning hood.

D. Instruments used by the investigator are as follows:

- 1 - Nuclear Measurements #5571 GM survey meter calibrated 5/11/60.
- 1 - Technical Associates, #670, Juno survey meter calibrated 7/11/60.

Withhold All

EX 6

TABLE 1
cont'd

(b)(6)

8/13 - 8/28

<u>TYPE</u>	<u>DATE</u>	<u>CHANGE WT.</u>	<u>U WT.</u>	<u>ENRICHMENT</u>	<u>FURNACE</u>
V-11	8/14	12,000 gms.	2900 gms.	95%	Air
V-11	8/15	5,000 gms.	550 gms.	95%	Vacuum
V-11	8/17	60,000 gms.	54,000 gms.	25.6%	Vacuum
V-11	8/20	10,000 gms.	600 gms.	93%	Air
V-11	8/21	350 lbs.	340 lbs.	Depl.	Vacuum
V-11	8/22	10,000 gms.	600 gms.	93%	Air
V-11	8/28	350 lbs.	340 lbs.	Depl.	Vacuum

Pages 14 through 22 redacted for the following reasons:

(b)(4) and (b)(6)

Withhold All - Ex 6

(b)(6)



1/1/60
1/15/60
1/29/60
2/12/60
2/26/60
3/12/60
3/26/60
4/9/60
4/23/60

(b)(6)



4/27/60
5/11/60
5/25/60
6/8/60
6/22/60
7/6/60
7/20/60
7/27/60
8/10/60
8/24/60

(b)(6)



8/27/60
9/10/60
9/24/60
10/8/60
10/22/60
11/5/60
11/19/60
12/3/60
12/17/60
12/31/60

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EXHIBITION OF
U.S. ATOMIC ENERGY COMMISSION

1960 OCT 11 AM 10 28

DIVISION OF COMPLIANCE
RECEIVED

