

**U. S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE**

12-8271-1 AMENDMENT NO. 1

(E64)

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 30, Licensing of Byproduct Material, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, own, possess, transfer and import byproduct material listed below; and to use such byproduct material for the purpose(s) and at the place(s) designated below. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission now or hereafter in effect and to any conditions specified below.

Licensee		In response to application dated February 15, 1963,	
<p>1. Name General Steel Industries</p> <p>2. Address 1417 State Street Granite City, Illinois</p>	<p>3. License number 12-8271-1 is amended in its entirety to read as follows:</p> <p>4. Expiration date May 31, 1964</p> <p>5. Reference No.</p>		
<p>6. Byproduct material (element and mass number)</p> <p>A. Cobalt 60</p>	<p>7. Chemical and/or physical form</p> <p>A. Sealed Source (Budd Company Model 41706)</p>	<p>8. Maximum amount of radioactivity which licensee may possess at any one time</p> <p>A. No single source to exceed one (1) curie.</p>	

9. Authorized use

- A. **To be used in Budd Company Model 110AB exposure device for the performance of industrial radiography.**

CONDITIONS

- 10. Unless otherwise specified, the authorized place of use is the licensee's address stated in Item 2 above.
- 11. **The licensee shall comply with the provisions of Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation" and Part 31, "Radiation Safety Requirements for Radiographic Operations." In lieu of the control device requirements of Section 20.203(c)(2) of 10 CFR 20, the entrance to the high radiation area must be under continuous surveillance of a radiographer or radiographer's assistant and/or locked, so as to make the area inaccessible at all times when a radiation level exists therein which could cause an individual to receive a dose in excess of 100 millirem in one hour.**

Except as specifically provided otherwise by this license, the licensee shall possess and use byproduct material described in Items 6, 7, and 8 of this license in accordance with statements, representations and procedures contained in application dated February 15, 1963, and in related documents and amendments as follows:

- A. **Letters from Gordon Mc Millin dated February 14, March 15, and April 9, 1963, and enclosures thereto.**

(See Page 2)

A/10

U. S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE
Supplementary Sheet

License Number 12-8271-1
(E64)
Amendment No. 1

Continued from Page 1

CONDITIONS

- 13. The licensee is authorized to receive, possess and use sealed sources of Cobalt 60 where the radioactivity exceeds the maximum amount of radioactivity specified in Item 8 of this license provided:
 - A. Such possession does not exceed the quantity per source specified in Item 8 by more than 10% for Cobalt 60; and
 - B. Records of the licensee show that no more than the maximum amount of radioactivity per source specified in Item 8 of the license was ordered from the supplier or transferor of the byproduct material.

For the U. S. Atomic Energy Commission

Date APR 22 1963

E. G. M... / W. O. Miller / Giddens

DUPLICATED
FOR DIV. OF COMPLIANCE

Original Signed by
William O. Miller
Division of Licensing and Regulation
Washington 25, D. C.



GENERAL STEEL INDUSTRIES, INC.

GRANITE CITY, ILL.

February 14, 1963

Mr. James Mason, Chief
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Mason:

Enclosed is our application for the renewal of United States Atomic Energy Commission Byproduct Material License #12-8271-1 comprising form 313 and 313B.

In addition you will find a request for additional radiographers on attachment 313 - 4, 8 and 9.

Recently your Mr. Price, after an inspection by an A. E. C. inspector, requested a survey of the roof area above the sources. This has been included as a portion of our application for license along with a letter from Dr. Konneker of Nuclear Consultants Corporation explaining the circumstances of the survey.

Also included is a proposed radiographers training program which we would like to institute due to fluctuation in personnel.

For your reference we have also included a copy of the original license application.

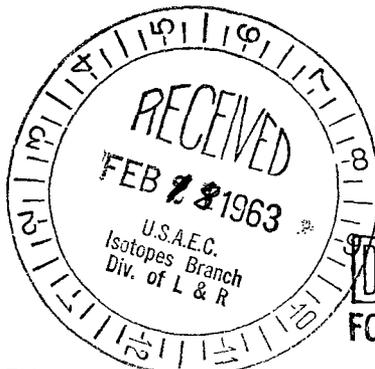
We are also requesting that you send to Mr. R. W. Ripley at this address, a dozen copies of Title 10, Parts 20, 30 and 31 for distribution to the interested parties, and a dozen copies of forms A. E. C. 313 and 313B for use in our next application for renewal.

NOTE

Would you please take this application under advisement and notify us of your decision.

Yours very truly,

Gordon McMillin
Gordon McMillin
Vice President & General Manager



DUPLICATED FOR DIV. OF COMPLIANCE

ACKNOWLEDGED

WED/vs
Encl.

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ATOMIC ENERGY COMMISSION
APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U. S. Atomic Energy Commission, Washington 25, D. C. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.) General Steel Industries 1417 State Street Granite City, Illinois	(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).) Same
2. DEPARTMENT TO USE BYPRODUCT MATERIAL Metallurgy Department	3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.) Application for renewal of license No. 12-8271-1 expiration date April 30, 1963
4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.) Mr. Robert Ripley (See attached)	5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.) Mr. Robert Ripley with assistance from a consulting physicist from Nuclear Consultants Corporation
6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) CO-60	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.) Metallic source of Cobalt in a sealed source. The sealed source was obtained from the Budd Company, their source capsule assembly No. 300-041706(B). There are two such sources mounted in the Budd Company's Model 110A Unitron Radiographic cameras, each source will be less than 1 curie each.
7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.) This material (CO-60) is in the form of a sealed source to be used only within a specially constructed room in the plant for radiographic inspections of large steel castings. The source capsule assembly number is the Budd Company Model 300-041706(B) and is used in a rollout type camera, the Budd Company's Model 110A Unitron Radiographic equipment.	

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TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	See attached		Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
See attached				

10. RADIATION DETECTION INSTRUMENTS. (Use supplemental sheets if necessary.)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)
NRD Model CS-40A	2	beta gamma	0-5 0-50 0-500 0-5000 0-50000 mr/hr	30 mg/cm²	Monitoring and Surveying

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE **Every three months or after each repair by a physicist from Nuclear Consultants, CO-60 and Ra-226 Bureau of Standards sources are used for calibration.**

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.) **Bi-Weekly film badge service is supplied by Nuclear Consultants Corp., and each person is supplied with a 0-200 mr pocket dosimeter manufactured by the Victoreen Instrument Company.**

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No **See attached**

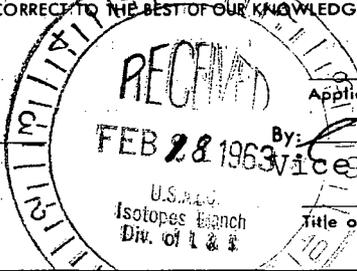
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. **See attached**

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. **The Budd Company**

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Date February 15, 1963



Applicant named in Item 1

By: [Signature]
Vice President & General Manager

Title of certifying official

WARNING.—18 U. S. C., Section 1001, Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT B—SEALED SOURCES

If application is for byproduct material to be used in or manufactured as a "sealed source" complete this supplement and attach to the application for byproduct material license. Applicant for use of sealed source should complete Section I. An applicant desiring to manufacture a sealed source should complete Section II. If information has been submitted previously and there are no changes in the sealed source and/or device design or other changes in information submitted previously, details requested below may be omitted provided reference is made on line below to the application or other document on which this information appears:

SECTION I—USE (See instructions)

1. IF SEALED SOURCE OR DEVICE CONTAINING SEALED SOURCE IS MANUFACTURED COMMERCIALY, GIVE FOLLOWING INFORMATION:

- A. Manufacturer or supplier of sealed source and/or device The Budd Company, Phoenixville, Pa.
- B. Make and model number of sealed source and/or device Capsule Assembly 300-011706 (B) Unitron 110A
- C. Person who will hold legal title to sealed source General Steel Industries, Inc., Granite City, Ill.

2. (a) NAME OF PERSON WHO WILL PERFORM NECESSARY PERIODIC LEAKAGE TESTS (6-month intervals for beta-gamma; 3-month period for alpha emitters. See instructions)

Physicists from Nuclear Consultants Corp. St. Louis, Mo.

- (b) IF ABOVE PERSON IS NOT THE SUPPLIER, MANUFACTURER, NOR A COMMERCIAL LABORATORY ROUTINELY OFFERING SUCH SERVICES, GIVE BRIEF STATEMENT OF EXPERIENCE OR TRAINING OF SUCH PERSON IN TECHNIQUES TO BE EMPLOYED; A STATEMENT OF LEAK TESTING PROCEDURES INCLUDING EVIDENCE OF ITS EFFICACY AND INSTRUMENTATION TO BE USED:

Nuclear Consultants Corporation is a laboratory routinely offering this service under A.E.C. Licenses #24-4206-1 (J62)

3. ARRANGEMENTS WHICH WILL PREVAIL FOR PERFORMING INITIAL RADIATION SURVEY (if appropriate), SERVICING MAINTENANCE, REPAIR, CONTROL, AND DISPOSAL, ETC., OF THE SOURCE:

Radiation physicist from Nuclear Consultants Corporation will make a complete radiation survey of the facilities upon the completion of the installation. A copy of this final report will be forwarded to the U.S. A.E.C. as well as the State Health Department. The Budd Company will arrange for servicing, maintenance, repair and disposal (and replacement) of the source. See attached for further detail.

SECTION II—MANUFACTURE

4. IF SEALED SOURCE TO BE MANUFACTURED OR FABRICATED BY THE APPLICANT IS DESIGNED TO TRANSMIT ONLY GAMMA RAYS AND CONTAINS IN ELEMENTAL FORM (but not powders) COBALT 60, IRIIDIUM 192, GOLD 198, TANTALUM 182, OR THULIUM 170, GIVE FOLLOWING INFORMATION AND DISREGARD QUESTIONS 5 THROUGH 12 ON THIS SUPPLEMENT:

- (a) Quantity of byproduct material per source and model number
- (b) Leak testing procedure to be employed:
- (c) Attach annotated engineering drawing of source container and holder, if any:
- (d) Describe label to be affixed to source container and/or source holder (or attach copy. See instructions):

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APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT B--SEALED SOURCES

ALL SEALED SOURCES OTHER THAN THOSE DEFINED IN ITEM 4

5. QUANTITY OF BYPRODUCT MATERIAL PER SOURCE AND MODEL OR DRAWING NUMBER

6. MEANS BY WHICH BYPRODUCT MATERIAL WILL BE DEPOSITED IN SOURCE CONTAINER:

7. ATTACH ANNOTATED ENGINEERING DRAWING OF SOURCE CONTAINER AND HOLDER, IF ANY:

8. TYPE OF SEAL TO BE USED TO PRECLUDE LEAKAGE OF RADIOACTIVITY TO EXTERIOR OF SOURCE:

9. IF SOURCE HOLDER IS TO BE USED WILL CONTAINER BE PERMANENTLY OR SEMIPERMANENTLY MOUNTED THEREIN?

10. DESCRIBE LABEL TO BE AFFIXED TO CONTAINER AND/OR SOURCE HOLDER (Or attach copy. See instructions):

11. EVIDENCE OF STABILITY OF SOURCE CONTAINER MATERIAL TO IRRADIATION FROM BYPRODUCT MATERIAL THEREIN (Omit if such stability is obvious):

12. LEAK TESTING PROCEDURE TO BE EMPLOYED INCLUDING EVIDENCE OF ITS EFFICACY AND INSTRUMENTATION TO BE USED:

DEVICES CONTAINING SEALED SOURCE

(Give following information if sealed source is to be mounted in a device)

13. ATTACH ANNOTATED ENGINEERING DRAWING OF DEVICE INCLUDING MODEL NUMBER AND DETAILS OF MOUNTING OF CONTAINER OR SOURCE HOLDER IN THE DEVICE:

14. DESCRIBE CONSTRUCTION AND OPERATION OF THE POSITIONING MECHANISM FOR BRINGING SOURCE INTO "ON" AND "OFF" POSITIONS:

15. DESCRIBE CONSTRUCTION AND OPERATION OF READILY VISIBLE INDICATOR OF DEVICE INDICATING "ON" AND "OFF" POSITIONS OF SOURCE:

16. DESCRIBE DESIGN FEATURES WHICH SERVE TO MINIMIZE RADIATION HAZARD FROM THE DIRECT BEAM AND SECONDARY RADIATION (Including type and amount of shielding as well as limited accessibility inherent in installations where use is contemplated)

17. DESCRIBE LABEL TO BE AFFIXED TO DEVICE (Or attach copy. See instructions):

18. RADIATION PROFILE OF A PROTOTYPE DEVICE IS ATTACHED. (Circle your answer).

YES

NO

February 1, 1963

For the background of General Steel Industries experience with radiation see original licence application attachment A.E.C. 313 4. 8. 9. (attached).

We request permission to add the name of Mr. Raymond Duke to the list of licensed radiographers due to the retirement of William Greer. Mr. Duke has attended a lecture course given by W. Konneker, Ph.D. of Nuclear Consultants of St. Louis, Mo. in compliance with Title 10 Atomic Energy Part 31 utilizing as a guide the outline in Appendix A.

where is outline

Mr. Duke has 4 weeks experience as an assistant radiographer, both in the use of Co-60 and the 24 M.E.V. Betatron. He has revealed a remarkable competency in the operation of the two Budd Co. Unitrons (250 mc Co-60 each) and all radiation protection devices applicable to our license.

An evaluation of his operating efficiency by Mr. W. E. Davis and Mr. R. W. Ripley indicates that he fully qualifies as a radiographer within the scope of the G. S. I. license and A. E. C. regulations.

NOTE

We further request the addition of Mr. Leroy Dell to our license as an approved Radiographer. Mr. Dell has attended the lecture course mentioned above and has been judged by Messrs. Ripley and Davis as competent in the operation of all our radiographic and monitoring devices. He is a foreman, assisting Mr. Ripley in supervision of the Chemical & Testing Laboratory, and as a foreman should have access to and knowledge of our procedure. Although fully capable of being a "radiographer", he will not do any actual work as a radiographer. He has had several months experience with the Betatron and radium prior to our purchase of the Budd Co. Unitrons and Co-60.

In addition, we request the addition of the following as approved radiographers:

1. George Doreghazi
2. Walter Vunovic
3. Earl Hall

NOT qualified

These three men have attended the above mentioned lecture course given by Dr. Konneker. At the present time, they are general and routine chemists in the quality control laboratories. Due to anticipated retirements and increased radiographic work load fluctuations during the 1963 license year these men, if approved, would be integrated within our present radiographic group. They will receive on the job training as outlined in the attached training program submitted for A. E. C. approval.

Not good enough!

and appropriate until they do

At the present time our training program is in the process of being formalized and submitted to the A. E. C. With the exception of the textbook now being prepared, Dr. Konneker's lecture course, and applicable A. E. C. rules and regulations, it is the same basic course that has been so successful

What comes?

at G. S. I. for the past 15 to 20 years. This success is measured by the radiation exposure records. During these years the respective A. E. C. published recommendations and exposure dosage limits were followed. No one has exceeded these limits.

January 29, 1963

Memorandum to Mr. F. R. Barclay (2)
Works Manager
Granite City Plant

Attached is the result of a radiation survey of the roof area over the #6 building x-ray cage. Mr. Leroy Hotts, Supervisor of the Mechanical Repair Department, has estimated 2h man hours as the maximum accumulated time in this area for any one year. This is an infinitesimally small occupancy factor for our operation, (500 millirem of cobalt 60)

Nevertheless, by copy of this letter, the Mechanical Repair Department is requested to obtain clearance from Mr. W. E. Davis or Mr. R. W. Ripley before anyone is allowed to work in this area.


Robert W. Ripley
Radiation Protection

RWR/aw
Atchd.

cc: WED HLB-6 MEL file (no attach.)

9842 Manchester Road
1717 Victory Boulevard
17907 Detroit Avenue

St. Louis 19, Missouri
Glendale 1, California
Cleveland 7, Ohio

314-WOODLAND 2-2162
213-CHAPMAN 5-3965
218-LAKWOOD 1-2222

Reply To: St. Louis, Missouri
January 25, 1963

Mr. William E. Davis
Plant Metallurgist
General Steel Industries
1417 State Street
Granite City, Illinois

Dear Mr. Davis:

Enclosed you will find a cross sectional drawing of your foundry building #6 in the area of your radiographic room.

As you will recall, last Saturday (January 19, 1963) during my visit to your plant I made a complete radiation survey of the area immediately above the radiographic room to determine, by measurement, the actual radiation fields present when your Co-60 radiographic sources are in use.

I had previously made calculations of these fields for you, however, during your last A.E.C. inspection the question was raised as to the actual measurements of these fields. Since it was a bad, snowy day I declined the invitation to crawl around on top of the roof to make actual measurements! I did, however, personally climb into the crane cab and on top of this cab where there is a catwalk which spans the complete building immediately above the radiographic room.

These measurements were made with an NRD Model CS-40 ionization type survey meter. This meter had been calibrated in our laboratories using a Bureau of Standards calibrated Co-60 standard.

Two measurements were made - one with both sources placed inside of large casting as you would normally use them and the second set of readings were made with both sources laying unshielded on the floor of the radiographic room.

Table one shows the measurements actually taken. From this it can be seen that the crane operator is quite safe even when both sources are completely exposed. The field immediately above the sources on the catwalk reaches a maximum of 7 mr./hr. when both sources are completely exposed. This does not present a problem since you already have a company

Mr. William E. Davis
General Steel Industries

page 2 cont.

policy established that no-one is allowed on the catwalk without first checking with your office. No-one should, of course, be allowed on this catwalk when the sources are in use.

The other question posed by the inspector was the possible radiation fields on the roof. As I stated earlier, I did not physically go to the roof for measurements, however, I'm sure we have ample data to calculate the fields in the positions indicated on the roof. I have selected all points where it would be possible for maintenance men to be required to work. Table II gives the calculated values for these various positions.

As can be seen from this table, the highest field is that in the ridge area immediately above the exposed sources at position I. This represents a field of 0.85 mr./hr - well below the 2 mr./hr. for unrestricted areas and would mean a person would have to remain at this position about 120 hours per week in order to exceed the 100 mr. per week limit. A most unlikely situation!

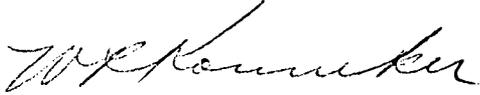
I would, however, recommend you extend your company policy of requiring all maintenance men to clear through your office before going onto the catwalk of the crane to include going onto the roof also. In this manner you can be certain no workmen will be in these areas when the sources are exposed.

I further recommend you make this report a part of your permanent records and submit a copy to both the state and federal A.E.C. inspection agencies in answer to any questions they may have concerning the radiation fields and control of areas above your radiographic facilities.

Should you have any further questions, please call on me at your convenience.

Sincerely,

NUCLEAR CONSULTANTS CORPORATION


W. R. Konneker, Ph.D.
Certified Health Physicist

WRK:im
cc:WRK

enclosures

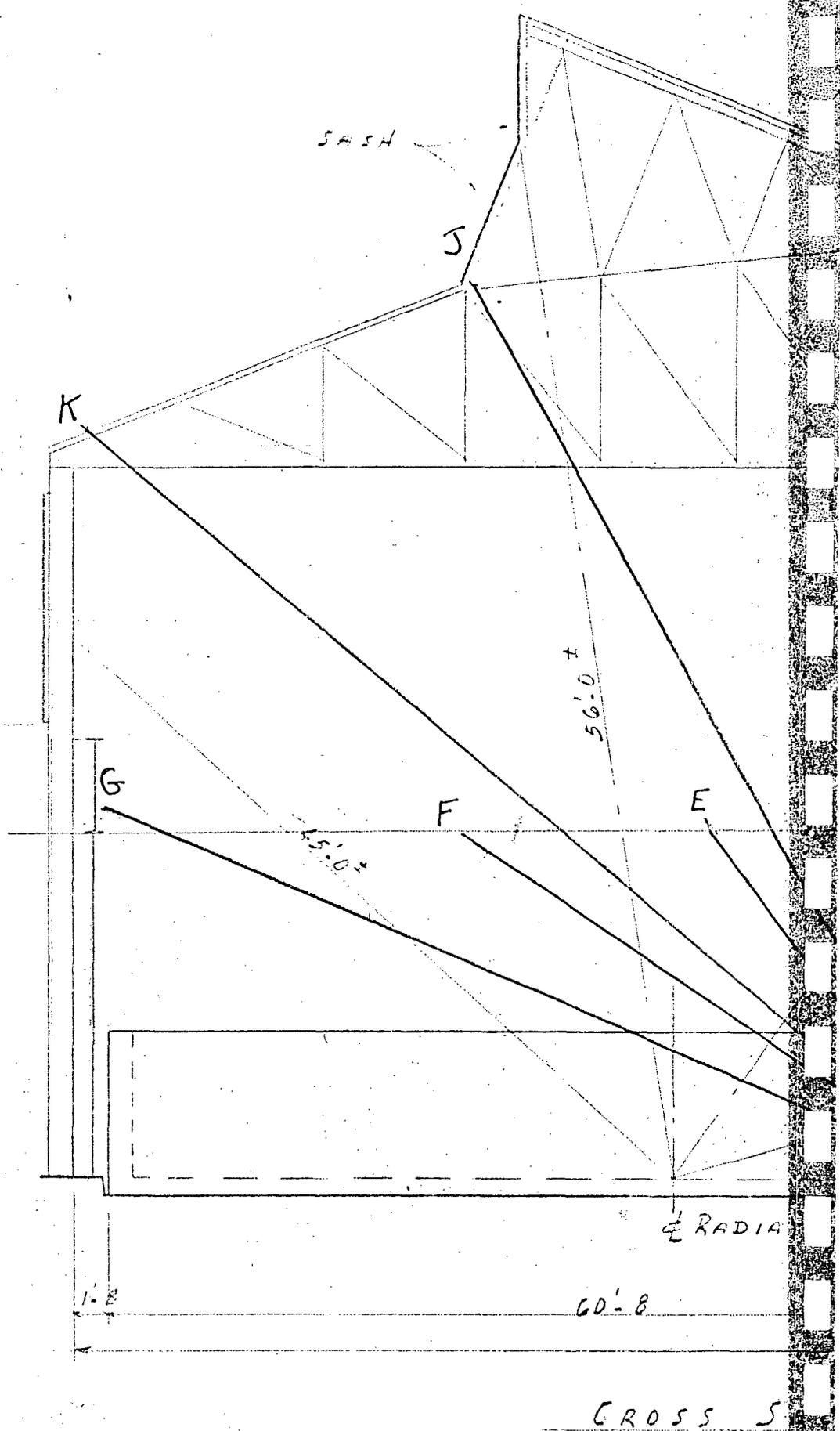
TABLE I

	<u>sources in casting</u>	<u>sources on floor</u>
A. Seat of the crane operator	0.5 mr./hr.	1 mr./hr.
B. Catwalk on top of crane	1 mr./hr.	1 1/2 mr./hr.
C. Catwalk immediately above wall	1 mr./hr.	3 mr./hr.
D. Catwalk immediately above sources	3 1/2 mr./hr.	7 mr./hr.
E. Catwalk about half-way between sources and operator's position	1 1/2 mr./hr.	2 1/2 mr./hr.
F. Catwalk immediately above operator's position	1 mr./hr.	1 1/2 mr./hr.
G. Catwalk immediately above end wall of room	0.5 mr./hr.	1 mr./hr.

TABLE II

All based on both sources completely exposed using closest measured point and the inverse square law. No additional shielding assumed.

L.	Area between two buildings 68' from sources (use measured field at C for calculation).	0.4 mr./hr.
H.	Platform inside building used to work on window controls 60' from sources (used measured field at C for calculation).	0.52 mr./hr.
I.	Ridge area on top of roof 52' from sources (used measured field at D for calculation).	0.85 mr./hr.
J.	A second platform inside building used to work on window controls 56' from sources (used measured field at E for calculation).	0.45
K.	Edge of building 62 feet from sources (used measured field at F for calculation).	0.4 mr./hr.



CROSS S

N. 100.0' FIN. BLDG.

100.0'

37.8'

100.0'

11.0'

69.64'

58.10'

A

B

C

D

26.14'

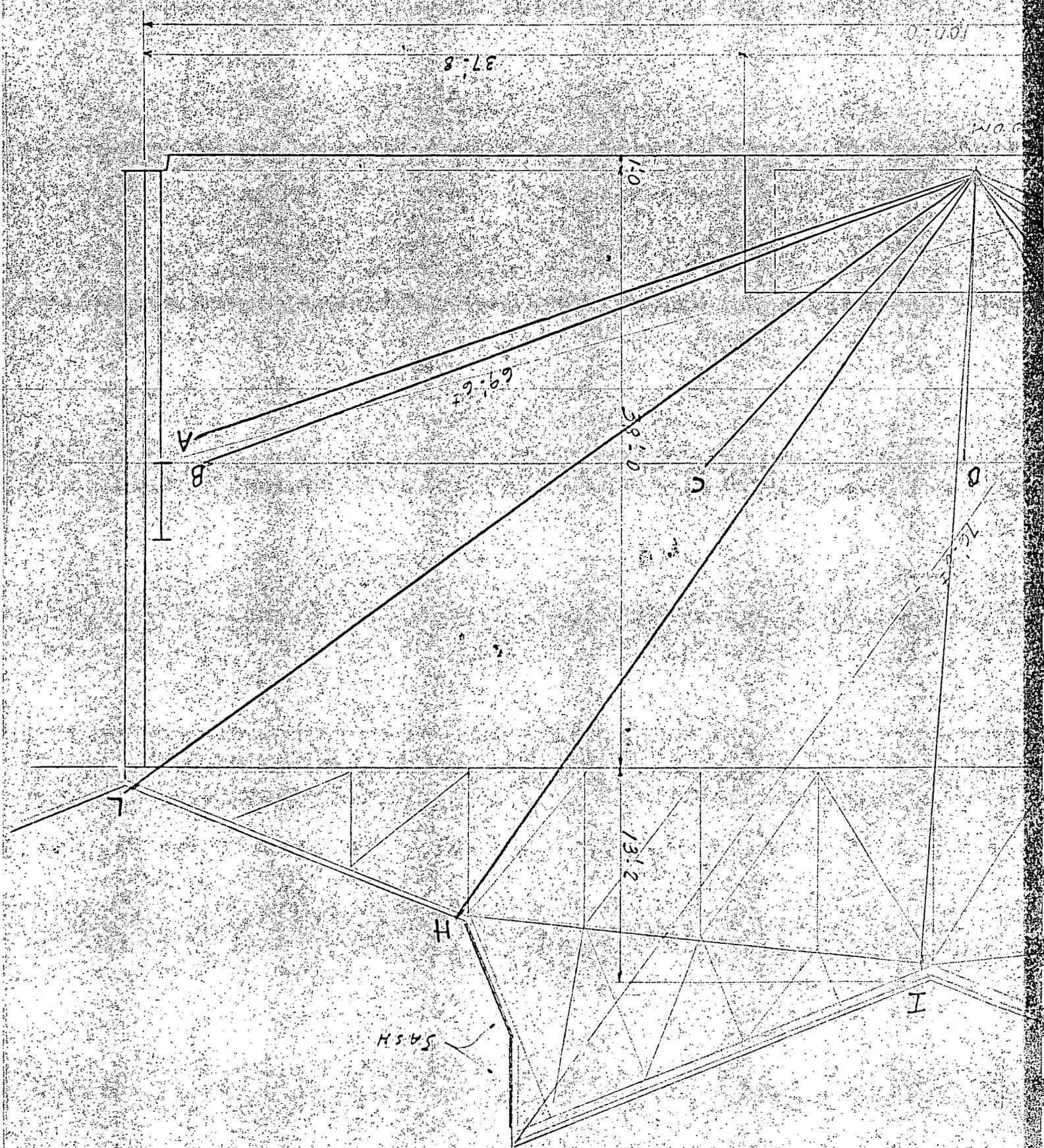
13.12'

H

I

SASH

L



February 1, 1963

For the background of General Steel Industries experience with radiation see original licence application attachment A.E.C. 313 4. 8. 9. (attached).

We request permission to add the name of Mr. Raymond Duke to the list of licensed radiographers due to the retirement of William Greer. Mr. Duke has attended a lecture course given by W. Konneker, Ph.D. of Nuclear Consultants of St. Louis, Mo. in compliance with Title 10 Atomic Energy Part 31 utilizing as a guide the outline in Appendix A.

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Mr. Duke has 4 weeks experience as an assistant radiographer, both in the use of Co-60 and the 24 M.E.V. Betatron. He has revealed a remarkable competency in the operation of the two Budd Co. Unitrons (250 mc Co-60 each) and all radiation protection devices applicable to our license.

An evaluation of his operating efficiency by Mr. W. E. Davis and Mr. R. W. Ripley indicates that he fully qualifies as a radiographer within the scope of the G. S. I. license and A. E. C. regulations.

NOTE

We further request the addition of Mr. Leroy Dell to our license as an approved Radiographer. Mr. Dell has attended the lecture course mentioned above and has been judged by Messrs. Ripley and Davis as competent in the operation of all our radiographic and monitoring devices. He is a foreman, assisting Mr. Ripley in supervision of the Chemical & Testing Laboratory, and as a foreman should have access to and knowledge of our procedure. Although fully capable of being a "radiographer", he will not do any actual work as a radiographer. He has had several months experience with the Betatron and radium prior to our purchase of the Budd Co. Unitrons and Co-60.

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- what comment

at G. S. I. for the past 15 to 20 years. This success is measured by the radiation exposure records. During these years the respective A. E. C. published recommendations and exposure dosage limits were followed. No one has exceeded these limits.

January 29, 1963

Memorandum to Mr. F. E. Bradley (2)
Work Order
Granite City Plant

Attached is the result of a radiation survey of the roof area over the #5 building 1-27-63. Mr. Harry Davis, supervisor of the Mechanical Repair Department, has estimated the man hours of the workers occupying the area in this area for one year. This is an estimated yearly work compancy factor for our operations (500 million of man-hrs).

Enclosed, by copy of this letter, the Mechanical Repair Department is requested to obtain clearance from Mr. W. L. Davis or Mr. F. E. Bradley before work is allowed to start in this area.

Robert E. Bradley
Robert E. Bradley
Radiation Protection

RE/aw
RWB

cc: 100 1-27-63 file (no attach.)

Consultants on Radioisotopes for the Medical Profession

9842 Manchester Road
1717 Victory Boulevard
17907 Detroit Avenue

St. Louis 19, Missouri
Glendale 1, California
Cleveland 7, Ohio

314—WOODLAND 2-2162
213—CHAPMAN 5-3965
216—LAKWOOD 1-2222

Reply To: St. Louis, Missouri
January 25, 1963

Mr. William E. Davis
Plant Metallurgist
General Steel Industries
1417 State Street
Granite City, Illinois

Dear Mr. Davis:

Enclosed you will find a cross sectional drawing of your foundry building #6 in the area of your radiographic room.

As you will recall, last Saturday (January 19, 1963) during my visit to your plant I made a complete radiation survey of the area immediately above the radiographic room to determine, by measurement, the actual radiation fields present when your Co-60 radiographic sources are in use.

I had previously made calculations of these fields for you, however, during your last A.E.C. inspection the question was raised as to the actual measurements of these fields. Since it was a bad, snowy day I declined the invitation to crawl around on top of the roof to make actual measurements! I did, however, personally climb into the crane cab and on top of this cab where there is a catwalk which spans the complete building immediately above the radiographic room.

These measurements were made with an NRD Model CS-40 ionization type survey meter. This meter had been calibrated in our laboratories using a Bureau of Standards calibrated Co-60 standard.

Two measurements were made - one with both sources placed inside of large casting as you would normally use them and the second set of readings were made with both sources laying unshielded on the floor of the radiographic room.

Table one shows the measurements actually taken. From this it can be seen that the crane operator is quite safe even when both sources are completely exposed. The field immediately above the sources on the catwalk reaches a maximum of 7 mr./hr. when both sources are completely exposed. This does not present a problem since you already have a company

Mr. William E. Davis
General Steel Industries

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policy established that no-one is allowed on the catwalk without first checking with your office. No-one should, of course, be allowed on this catwalk when the sources are in use.

The other question posed by the inspector was the possible radiation fields on the roof. As I stated earlier, I did not physically go to the roof for measurements, however, I'm sure we have ample data to calculate the fields in the positions indicated on the roof. I have selected all points where it would be possible for maintenance men to be required to work. Table II gives the calculated values for these various positions.

As can be seen from this table, the highest field is that in the ridge area immediately above the exposed sources at position 1. This represents a field of 0.85 mr./hr - well below the 2 mr./hr. for unrestricted areas and would mean a person would have to remain at this position about 120 hours per week in order to exceed the 100 mr. per week limit. A most unlikely situation!

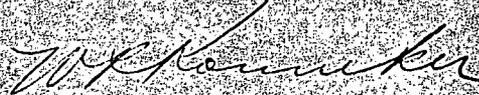
I would, however, recommend you extend your company policy of requiring all maintenance men to clear through your office before going onto the catwalk of the crane to include going onto the roof also. In this manner you can be certain no workmen will be in these areas when the sources are exposed.

I further recommend you make this report a part of your permanent records and submit a copy to both the state and federal A.E.C. inspection agencies in answer to any questions they may have concerning the radiation fields and control of areas above your radiographic facilities.

Should you have any further questions, please call on me at your convenience.

Sincerely,

NUCLEAR CONSULTANTS CORPORATION


W. R. Konneker, Ph.D.
Certified Health Physicist

enclosures

WRK:im
cc:WRK

TABLE I

	<u>sources in casting</u>	<u>sources on floor</u>
A. Seat of the crane operator	0.5 mr./hr.	1 mr./hr.
B. Catwalk on top of crane	1 mr./hr.	1 1/2 mr./hr.
C. Catwalk immediately above wall	1 mr./hr.	3 mr./hr.
D. Catwalk immediately above sources	3 1/2 mr./hr.	7 mr./hr.
E. Catwalk about half-way between sources and operator's position	1 1/2 mr./hr.	2 1/2 mr./hr.
F. Catwalk immediately above operator's position	1 mr./hr.	1 1/2 mr./hr.
G. Catwalk immediately above end wall of room	0.5 mr./hr.	1 mr./hr.

TABLE II

All based on both sources completely exposed using closest measured point and the inverse square law. No additional shielding assumed.

L. Area between two buildings 68' from sources (use measured field at C for calculation).	0.4 mr./hr.
H. Platform inside building used to work on window controls 60' from sources (used measured field at C for calculation).	0.52 mr./hr.
I. Ridge area on top of roof 52' from sources (used measured field at D for calculation).	0.85 mr./hr.
J. A second platform inside building used to work on window controls 56' from sources (used measured field at E for calculation).	0.45
K. Edge of building 62 feet from sources (used measured field at F for calculation).	0.4 mr./hr.

CONTENTS

INDUSTRIAL RADIOGRAPHER TRAINING PROGRAM

SUBMITTED FOR APPROVAL OF A. E. C.

- PART I** Outline of training program
- PART II** Outline of text to be issued to each radiographer when printed
- PART III** Sample Quiz
- PART IV** Evaluation sheet

PART I

OUTLINE OF TRAINING PROGRAM

Radiation Safety Training Program for Industrial Radiographers at General Steel Industries - Granite City Plant

I. Conducted by

- What is his qualification?*
- | | |
|---------------------|------------------------------------|
| 1. Robert W. Ripley | G. S. I. Health Protection Officer |
| 2. William E. Davis | G. S. I. Plant Metallurgist |
| 3. Dr. W. Konneker | Nuclear Consultants Corp. |

II. Initial Training

- Outline?*
1. Lecture course by Dr. Konneker covering all items listed in Title 10 Part 31 Appendix A.
 2. Issue each man text on radiation physics (see attached outline of text) as soon as it is prepared.
 3. Informal discussions of text among radiographer trainee, radiographers, and Messrs. Davis and Ripley.
 4. Test on textbook content.
 5. Discussion and explanation of any changes or additions to A.E.C. regulation, G.S.I. procedure or equipment.
- How long is course?
Require 1/2 day?
major subjects?*

III. Determination of Trainee Understanding

1. Oral questions and answers at conclusion of lecture.
 2. Trainees take notes.
 3. Daily exchange of information and ideas during work day.
 4. Up to this time February 1, 1963 no formal written tests have been given. Most of the present radiographers have worked with radium, cobalt, and a 24 M.E.V. Betatron for 2 - 15 years. They are competent in manipulation of all equipment and cognizant of health physics. During this period the exposure limits published by the A.E.C. at the applicable time were followed. They were never exceeded and averaged under 25%.
 5. Short quizzes to both trainees and approved radiographers at odd intervals.
 6. After February 1, 1963 short test to be given on lecture content.
- Is this period in days?
Examples?*

IV. On the Job Training

1. Minimum of 4 weeks as assistant radiographers doing all actual operations under the constant supervision of an A.E.C. approved radiographer.
- Example of questions?
Results?*

2. Instruments used are as follows:

- a. Two Budd Co. Unitron Exposure Devices each holding 250 mc of cobalt 60. ✓
 - b. Two CS-40A Musser survey instruments. ✓
 - c. Victoreen minometer and pocket ionization chamber.
 - d. Use of film badges.
 - e. Blood count procedure.
 - f. Maintenance of required records.
- Instrument?* →

V. Procedure for Determining Competency

- 1. Random observation during job training by Mr. R. Ripley. Constant observation by radiographers.
- 2. Each trainee, at the completion of 4 weeks on the job training, will go through the complete work procedure, and simulate each emergency procedure under the observation of Messrs. Ripley or Davis. His competency will be evaluated. (See attached evaluation form). If necessary he will be given an additional two weeks of on the job training or any other corrective information as indicated on his evaluation form. When he is evaluated as competent he will be declared a "radiographer". Record of his evaluation and quizzes will be maintained. ✓

PART II

TEXT OUTLINE

Radiation Safety Training Program for Industrial Radiographers at General Steel Industries - Granite City Plant

I. Fundamentals of Radiation Safety

A. Radiation

1. atomic structure
2. isotope & radiation
3. alpha, beta & gamma
4. interaction with matter
5. x radiation & gamma radiation

B. Glossary

1. terms - Learn them first
2. significance & explanation of

C. Radiation Levels

1. unrestricted area, define, explain dangers in
2. radiation area " " " "
3. high radiation area " " " "

D. Health Hazards from Radiation

1. whole body effects
2. reversibility & irreversibility
3. skin effect
4. reproductive organs - genetics & future generations
5. effect on blood

E. Betatron

1. theory
2. operation of
3. hazards from
4. radiation from
5. comparison with gamma from Co-60
6. safety devices, procedure, & explanation of

F. Methods of Controlling Radiation Dosage

1. time
 - a. equations
 - b. explanation
2. distance
 - a. equations
 - b. explanation
3. shielding
 - a. equations, charts & graphs
 - b. absorption factors
 - c. half value layers

II. Radiation Detection Instruments

A. Radiation Detection Instruments

- 1. Nucor CS-40A survey meter**
 - a. principle of operation
 - b. operation technique
 - c. limitations
 - d. calibration

- 2. Film Badge**
 - a. principle of
 - b. use of
 - c. limitations

- 3. Victoreen Minometer & Pocket Chambers**
 - a. principle of
 - b. use of
 - c. limitations

B. Survey Techniques

- 1. General**
 - a. background & its significance
 - b. equations

- 2. Our Operation at G.S.I.**
 - a. technique
 - b. documentation & records

III. Radiographic Equipment

A. Budd Co. Exposure Device

- 1. Diagrams**
 - a. explanation
 - b. limitations
 - c. advantages

- 2. Operation of**
 - a. theory
 - b. our procedure

- 3. Storage Container**
 - a. requirements
 - b. qualifications of Budd Co. Device
 - c. A.E.C. requirements

IV. Procedure

A. Regular Operation Procedure

- a. review step by step
- b. explanation of

B. Emergency Operating Procedures

- a. review step by step
- b. explanation of

V. A.E.C. Regulation

A. Title 10 Part 30

- a. review
- b. explain

B. Title 10 Part 31

- a. review
- b. explain

C. Title 10 Part 30

- a. review
- b. explain

VI. Equipment & Operation of in the Radiographic Installation Itself

A. Budd Co. Exposure Device

1. Actual operation of, by each individual until he becomes proficient in its operation.
2. Actual recording of any and all records required by A.E.C. & G.S.I.

B. CS-40A Survey Meter

1. Actual operation of, by each individual until he becomes proficient in its operation.
2. Actual recording of any and all records required by A.E.C. & G.S.I.

C. Pocket Chamber & Minoimeter

1. Actual operation of, by each individual until he becomes proficient in its operation.
2. Actual recording of any and all records required by A.E.C. & G.S.I.

D. Film Badge

1. Actual practice and full explanation of procedure of receiving, use and mailing to Badge Service Company.
2. Explanation of records required by A.E.C. & G.S.I.

VII. All Equations Necessary for Safe Operation Reviewed

VIII. Written Test with emphasis on:

1. Equations & calculations for personnel protection, (shielding time distance)
2. Detection, surveys & personnel monitoring
3. Health Hazards

BIBLIOGRAPHY

*Are these books
given to trainees?*

1. Radiation Health Physics Program Outline
Instruments Division Budd Co.
2. Instruction Manual Model 110A Unitron
Instruments Division Budd Co.
3. Instruction Manual Nucor CS-40A Survey Meter
Nuclear Corp. of America
4. Measurements of Radioactivity
National Bureau of Standards
U. S. Government Printing Office
5. Los Alamos Handbook of Radiation Monitoring
Los Alamos Scientific Laboratory
U. S. Government Printing Office
6. Protection Against Radiation from Radium Cobalt 60 & Cesium 137
National Bureau of Standards
U. S. Government Printing Office
7. Radiological Monitoring Methods & Instruments
National Bureau of Standards
U. S. Government Printing Office
8. Protection Against Radiation from Sealed Gamma Sources
National Bureau of Standards
U. S. Government Printing Office
9. The Tolerance Dose
S. T. Cantrell, M. D.
H. M. Parker
Argonne National Laboratory
10. The Effects of Irradiation on the Blood & Blood Forming Tissues
S. T. Cantrell
L. Jacobson
J. J. Wicksen
Argonne National Laboratory
11. Radioactive Isotopes as Source in Industrial Radiography
Gerald H. Tenney
Los Alamos Scientific Laboratory
12. The Lethal Effects of Radiation
Edward Spaona, Ph.D.
Scientific American
13. General College Chemistry
L. B. Richardson
A. J. Scanlett
Henry Holt & Co.

BIBLIOGRAPHY

14. Background Information on the 25 Million Betatron Volt
Allis Chalmers Mfg. Co.
15. 25 Million Volt Betatron Manual
Allis Chalmers Mfg. Co.
16. The Use of Cobalt 60 for Industrial Radiography
A. Morrison
Physics Division
National Research Council of Canada
17. Radiation Physics & Bomb Phenomenology
U. S. Government Printing Office
18. Concrete as a Protective Barrier for Gamma Rays from Cobalt 60
R. J. Kennedy
H. O. Wyckoff
W. H. Snyder
National Bureau of Standards
U. S. Government Printing Office
19. Title 10 Atomic Energy Part 20 Standards for Protection against Radiation
Code of Federal Regulations
20. Title 10 Atomic Energy Part 30 Licensing of Byproduct Material
Code of Federal Regulations
21. Title 10 Atomic Energy Part 31 Radiation Safety Requirements for
Radiographic Operation
Code of Federal Regulations
22. Electron & Nuclear Physics
J. E. Hoag, Ph.D.
D. Van Westrand Company, Inc.

PART III

SAMPLE TEST

PART IV

RADIOGRAPHERS TRAINING EVALUATION SHEET

RADIOGRAPHERS TRAINING EVALUATION FORM

NAME _____ AGE _____ DATE _____

1. Lecture test grade _____
2. Text book test grade _____
3. Participation during lecture course _____

comments _____

 as observed by _____

4. Proficiency at the end of 4 weeks in operation of:

	<u>good</u>	<u>adequate</u>	<u>poor</u>
A. Budd Co. Unitrons	_____	_____	_____
B. CS-40 A Survey Meter	_____	_____	_____
C. Victoreen Minometer & pocket chamber	_____	_____	_____
D. GSI Operating procedure	_____	_____	_____
E. Simulated Emergency Procedure			
Number 1	_____	_____	_____
Number 2	_____	_____	_____
F. Utilization log	_____	_____	_____
G. Personnel Monitoring records	_____	_____	_____

5. Comments _____

6. Recommendations:

- A. Additional 2 weeks "on the job training" _____
- B. Additional academic knowledge _____
- C. Qualifies as A.E.C. Radiographer _____

SIGNED _____
 TRAINEE

 RADIATION PROTECTION OFFICER

*not an
 AEC
 radiographer*

ORIGINAL APPLICATION FOR LICENSE

NUMBER 12-8271-1, EXPIRATION DATE APRIL 30, 1963

ISSUED APRIL 18, 1962 AND SIGNED BY WILLIAM O. MILLER

FOR REFERENCE ONLY