

**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.

<p>(a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.)</p> <p><b>General Steel Industries 1417 State Street Granite City, Illinois</b></p>	<p>(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)</p> <p style="text-align: center;"><b>Same</b></p>
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<p>DEPARTMENT TO USE BYPRODUCT MATERIAL</p> <p><b>Metallurgy Department</b></p>	<p>3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)</p> <p style="text-align: center;"><b>Application for renewal of license No. 12-8271-1 expiration date April 30, 1963</b></p>
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<p>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.)</p> <p><b>Mr. Robert Ripley (See attached)</b></p>	<p>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.)</p> <p style="text-align: center;"><b>Mr. Robert Ripley with assistance from a consulting physicist from Nuclear Consultants Corporation</b></p>
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<p>(a) BYPRODUCT MATERIAL. (Elements and mass number of each.)</p> <p style="text-align: center;"><b>CO-60</b></p>	<p>(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLCURIES 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.)</p> <p><b>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.</b></p>
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**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.**

A/37

## EMERGENCY NO. 2 POCKET DOSIMETER READS OFF SCALE

## I. THE RADIOGRAPHER SHALL:

- A. Do not extrapolate.
- B. Send film badge for immediate processing, interpretation, and reply by telephone to the Radiation Safety Officer.
- C. Recharge dosimeter. Check it after 15 minutes. Repeat this step. If it reads off scale both times, it is probably faulty.
- D. Develop casting exposure films, see if they have the correct density with no distortion. Any misalignment of source or source tube that could result in overexposure would not give a satisfactory radiograph.
- E. Check survey instrument. If survey instrument and radiographs prove to be all right and dosimeter indicates a faulty discharge, assume dosimeter to be faulty.
- F. Call R. W. Ripley or alternate listed below and notify him of these results for his evaluation before making any other exposures.
- G. Record results and remove chamber from active file for repairs or discard.

## II. THE RADIATION SAFETY OFFICER SHALL:

- A. Contact Landauer or the film processing agency immediately.
- B. If film badge report substantiates dosimeter reading, the radiographer will be sent to the corporation doctor with a full report.
- C. A. E. C. will be notified in conformance with Title 10, Part 30, Paragraph 20.403 by the Radiation Safety Officer.
- D. State Board of Health and GSI Safety Department shall be notified.

Telephone Numbers  
(Call in order listed)

- |    |                  |                                   |                                 |
|----|------------------|-----------------------------------|---------------------------------|
| 1. | Robert W. Ripley | 910 Echo Dr., Collinsville, Ill.  | 344-0049<br>Ext. 214, A. C. 252 |
| 2. | John Abbott      | 2795 Sorrell Dr., Florissant, Mo. | 831-0126<br>Ext. 282 or 286     |
| 3. | Phil Wells       | 315 Kingdom St., Bethalto, Ill.   | 377-6113<br>Ext. 342, A. C. 445 |
| 4. | G. N. Little     | 1612 Garfield, G. C., Ill.        | 877-2723<br>Ext. 244, A. C. 342 |

-1 5/11/72 JMS 26827

0982

GENERAL STEEL INDUSTRIES, INC.

CASTINGS DIVISION

1417 State Street  
Granite City, Illinois 62040  
618 • 452-2120

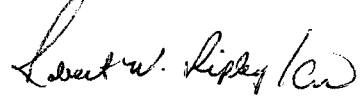
April 11, 1972

Mr. Nathan Bassin  
Materials Branch  
Division of Materials Licensing  
United States Atomic Energy Commission  
Washington, D. C. 20545

Dear Sir:

We wish to acknowledge receipt of your letter of April 5, 1972 in reference to the application for renewal of License No. 12-08271-01. We are preparing a reply to your comments and suggestions and hope to submit them in duplicate at an early date.

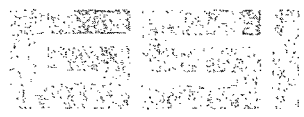
Sincerely,



Robert W. Ripley  
Radiation Safety Officer

RWR:crr

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SENT TO COMPLIANCE



0457

GENERAL STEEL INDUSTRIES, INC.

CASTINGS DIVISION

1417 State Street  
Granite City, Illinois 62040  
618 • 452-2120

February 17, 1972

Mr. Nathan Bassin  
Materials Branch  
Division of Materials Licensing  
United States Atomic Energy Commission  
Washington, D.C. 20545

Dear Sir:

In the referenced letter we stated that February 15 was our projected completion date for submitting the revision of A.E.C. license #12-8271-1. The revised application has been completely rewritten and is now in the final editing stage. It has taken a little longer to complete than we originally anticipated; however, the final copy will be in the mail by the end of the month.

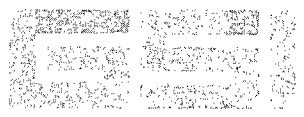
We sincerely regret the delay but feel that the quality of the finished product will justify the few additional days taken.

Sincerely,

*Robert W. Ripley*  
Robert W. Ripley  
Radiation Safety Officer

RWR:crr

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*pull*  
0179

GENERAL STEEL INDUSTRIES, INC.

CASTINGS DIVISION

RICHARD L. LICH  
President

1417 State Street  
Granite City, Illinois 62040  
618 • 452-2120

January 18, 1972

Mr. Nathan Bassin  
Materials Branch  
Division of Materials Licensing  
United States Atomic Energy Commission  
Washington, D. C. 20545

Dear Sir:

In reply to your letter of January 11, 1972, we wish to make the following comments.

1. The "Inspection and Maintenance Program" was submitted on October 22, 1971, to the Regional Director of the Division of Compliance in Glen Ellyn, Illinois. It was submitted to them in reply to their letter of September 30, 1971, on items of non-conformance discovered by Mr. Oparka's audit of September 13 and 14, 1971. Two weeks later, during a telephone conversation with the Glen Ellyn Office, our Radiation Safety Officer was told that the Inspection and Maintenance Program looked good except for one change, which was immediately agreed upon. Our Radiation Safety Officer, Mr. Robert Ripley, was given the impression that the program was tentatively approved but final approval must wait until it was forwarded to Washington by the Glen Ellyn Office. For this reason, reference was made to it in our reply to you on December 2, 1971.

Attached is a copy of the program, with the change suggested by the Glen Ellyn Office "penciled" in. It will also be an integral part of the new license application we are updating at the present time.

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**SENT TO COMPLIANCE**

GSI DIVISIONS and SUBSIDIARY: Castings - St. Louis Car - National Roll - Ludlow-Saylor Wire Cloth  
Flex-O-Lite - Standard Pipeprotection - Simplicity Engineering Company

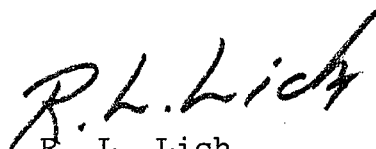
January 18, 1972  
Page 2

2. The operating and emergency procedures forwarded to you on December 2 were from the present license application which was written several years ago. Items such as the reference to 10CFR31, together with the 1970 rewrite and updating of "A.E.C. Licensing Guide", are some of the reasons we are presently updating our license application. We will submit this updated version in mid-February as previously stated.

3. Our training program will be part of our updated license application and the A.E.C. Licensing Guide will be followed. Our new license application will go into detail on training of radiographers, designation of duties, education, instruction and on the job training of a radiographer. The assistant radiographer classification will be covered in this section.

We feel that first priority should be given to the completion of our new license application. It will incorporate all the latest changes, procedures, and training programs. Our target date for submitting this is still February 15.

Yours very truly,

  
R. L. Lich

RWR/lke

Attach.

0173  
R. L. L.

Additions to G. S. I. operating procedure to conform to A. E. C.  
December 13, 1970 Amendment to Title 10, Part 34:

The purpose of this procedure is to provide for periodic inspection and maintenance of the radiographic exposure device and area safeguards applicable to this amendment. The procedure is divided into 3 parts to conform to the daily, tri-monthly, and semi-yearly requirements applicable to the G. S. I., Inc. radiographic installation.

- I. The following operations will be performed by the radiographers once each day that the exposure device is used:
- A. The initial radiation survey will be made as required by G. S. I. Standard operating procedure and so noted in the utilization log.
  - B. The exposure device will be visually inspected for any damage that may impair its use or shielding integrity and so noted under Item 1 of Daily Check Form.
  - C. The device will be checked to determine if the source is properly placed inside the shield. This will be determined by the level of radiation. ~~An increase above the allowable limits as specified in Title 10, Part 34, Paragraph 34.21~~ will be evidence of an improperly placed source. This will be noted under Item 2 of the Daily Check Form.  
*An increase above 50mR*
  - D. The locking mechanism will be checked by unlocking and locking of the exposure device. The operating condition will be noted in Item 3 of the Daily Check Form.
  - E. The first production exposure will then be made following G. S. I. standard operating procedure. The following will be noted: Changes in operating characteristics of the exposure device, operation of source position indication, and the operation of the crank mechanism. These items will be checked off as their condition under Items 4, 5, and 6 respectively of the Daily Check Form.
  - F. In the event of a malfunction, noted on the Daily Check Form in conformance with I, A through E, the following steps will be taken:
    - 1. The supervisor or safety officer will be notified immediately.
    - 2. The supervisor or safety officer will evaluate and correct the problem.
    - 3. Any action taken will be recorded on the Daily Check Form.

4. If the above malfunctions are minor and do not involve a radiation hazard as defined under Title 10, Part 34, Paragraph 34.21 or Table 10, Part 20, Paragraph 20.403, use of the exposure device will continue if possible while corrections are being instituted. Corrective action will be initiated within 24 hours.
5. In the event of a major malfunction which may result in unsafe conditions or a radiation hazard, the G.S.I. emergency procedure, #1, will be put into effect immediately.
6. All action taken will be recorded in the Daily Check Form.
7. All entries in the Daily Check Form will be initiated by the individual making the entry.

II. The following operations as listed on the Quarterly Check Form will be performed at 3 month intervals. In each instance, the manual provided by the manufacturer of the exposure device will be used as a guide to perform these operations:

- A. Examine source and drive cable for wear and/or damage.
- B. Examine source and drive cable tube for wear and/or damage.
- C. Examine the source & drive cable tube connectors for wear and/or damage.
- D. Inspect the inside of the source tube for rust, dirt, or sludge build up.
- E. Inspect all mating components for wear, damage and proper connections.
- F. The cable drive gear box will be inspected for damage, wear, and lubricants. The condition of all required labels will be checked.
- G. All of the above inspections will be noted in the respective area in the Quarterly Check Form.
- H. The checks may be performed by a radiographer or a supervisor or the safety officer. All notations in the Quarterly Check Form will be signed.
- I. The above are preventive maintenance steps to ascertain deterioration of the radiation exposure device through regular production use, before it can create a radiation hazard or unsafe condition. Indications of deterioration noted on the Quarterly Check Forms will dictate the following steps:
  1. Supervisor will be notified by individual performing the check.



2. The condition will be evaluated by the supervisor or Safety Officer. 0179
3. Any condition that requires corrective action will be reported to the G.S.I. Mechanical Repair Supervisor within 24 hrs.
4. All action taken will be noted on the Quarterly Check Form and signed by radiographer, supervisor or Safety Officer.

III. The following operations will be performed at 6 month intervals as noted on the Six Month Check Form. These checks will be made by mechanical repair department crafts in the presence of a radiographer, his supervisor, or the Radiation Safety Officer.

- A. Door interlocks on small door used by personnel and the large door used to bring in castings will be inspected and their condition noted in Item 1 of the Six Month Check Form.
- B. In the presence of a radiographer, his supervisor, or the Radiation Safety Officer, an inspection will be made to ascertain if all visible and audible warning devices are functioning properly. Conditions will be noted in the Six Month Check Form, in Item 2.
- C. This inspection will not include a calibration of radiation level monitoring equipment. This equipment is calibrated and documented as outlined elsewhere in the approved G.S.I. license application.
- D. All operations will be recorded in the Six Month Check Form and signed by the inspector.
- E. Any malfunction of area safeguards will be reported immediately to the Radiation Safety Officer. Corrective action will begin immediately.
- F. All action taken will be recorded in the Six Month Check Form and signed off by the Supervisor or Radiation Safety Officer.

IV. It is especially noted here that Items 1, II, and III are all additional steps to be taken to conform to the 1970 amendments to Title 10. In no way are they to be interpreted to rescind or supercede any other section of the G.S.I. license.

The radiographer will continue to maintain his usual daily vigilance at all times.

V. Three forms are attached to and become a part of this procedure:

1. Daily Check Form
2. Quarterly Check Form
3. Six Month Check Form

VI. If as a result of these inspection and maintenance procedures the Co source is exposed creating a radiation hazard, emergency operation procedure #1 will be placed in effect immediately. 60

## DAILY CHECK FORM

Operation to be Performed Week of _____ 19____	Mon.	Tue.	Wed.	Thur.	Fr.	Sat.	
1. Damage to the exp. device which may impair its operation.							
2. Proper position of source inside the shield.							
3. Operation of locking mechanism.							
4. Changes in operating characteristics.							
5. Operation of source position indicator.							
6. Operation of the crank mechanism.							

Action taken on above noted malfunctions:

## QUARTERLY CHECK FORM

Operation to be Performed	Feb. 15 19 ____	Mar. 15 19 ____	Aug. 15 19 ____	Nov. 15 19 ____
1. Source and drive cable wear or damage.				
2. Source and drive cable tube wear or damage.				
3. Source and drive cable tube connectors wear or damage.				
4. Rust, dirt, or sludge build up in the source tube.				
5. Mating components connections.				
6. Cable drive gear box damage or wear and proper labeling.				

Action taken on above noted malfunctions:

SIX MONTH CHECK FORM

0170

Operation to be Performed	Nov. 15 19 _____	May 15 19 _____
I. Door Interlocks A. Small door  B. Large door          II. Visual warning devices A. Small door red lights B. Big door       "   " C. Radiation monitor red lights D. Exterior, Bldg.   "   " E.       "       "   warning signs          III. Audible warning devices A. Radiation monitor horn		

Action to be taken on above noted malfunctions:

GENERAL STEEL INDUSTRIES, INC.

CASTINGS DIVISION

1417 State Street  
Granite City, Illinois 62040  
618 • 452-2120

December 2, 1971

Mr. Nathan Bassin  
Materials Branch  
Division of Materials Licensing  
Atomic Energy Commission  
Washington, D. C. 20545

Dear Sir:

This refers to your letter of November 17, 1971 wherein it is requested we submit our operating and emergency procedures which include our inspection and maintenance program. It was additionally requested we submit detailed information concerning training of personnel such as the name of the person conducting the training program, scope, extent and topics covered in training program, scope and extent of on the job training and copies of examinations given to personnel to determine their level of competence.

In compliance with this request, we offer the following for information purposes:

1. We have previously submitted to you our Inspection and Maintenance program which is presently verbally approved. We are now also submitting our Operating and Emergency procedures under Enclosure I, which are currently a part of our license entitled:

Application for Renewal  
1969  
AEC License #12-8271-1  
Radiography with Co60  
General Steel Industries, Inc.

**GENERAL**



2. The person who conducted the personnel training programs was Mr. Robert W. Ripley.
3. The scope, extent and topics covered in the training program is as follows:
  - (a) All persons participating in the recent training program were required to have a minimum of one year operating experience as Radiographer with the 24MEV, Allis-Chalmers Betatron.
  - (b) The people selected for recent training had also been previously trained and were considered qualified as Isotope Radiographers.
  - (c) In order to develop the true level of acquaintance with isotope radiography and A. E. C. requirements, the people were given a preliminary test (Enclosure II) without instruction or training. The results of this testing was then used to guide our training effort as well as A. E. C. and License Application specific requirements.
  - (d) The above testing was followed by 8.0 hours of classroom instruction over a period of three weeks and an estimated 12 hours of off the job study based on the text written and prepared by General Steel Industries, Inc. (Enclosure III)

We feel this testing and the training program covers all required elements of operating and safety requirements.

4. Scope and extent of on the job training is as follows:
  - (a) As described above, persons participating in the recent training program were required to have a minimum of one year operating experience as Radiographer, with the 24MEV, Allis-Chalmers Betatron and were considered as qualified Isotope Radiographers having previously trained and having previously operated the exposure devices for a period of not less than one year.
  - (b) In the future, on the job training will consist of a Trainee Radiographer working with a qualified radiographer for a period of two weeks, after having been trained and tested in accordance with License Application and given a copy of the operating and emergency procedures. A prerequisite for becoming a Trainee Radiographer is one year operating experience as Radiographer with the 24MEV, Allis-Chalmers Betatron or other high energy source.

Mr. Nathan Bossin  
December 2, 1971  
Page 3

5. Copies of tests given to personnel to determine the level of competency of individuals recently trained is contained in Enclosure IV along with a typical set of acceptable answers.

We are presently in the process of rewriting our License Application which we expect to submit for approval by February 15, 1972. In view of the number of revisions made to our program and management controls, we feel that rewriting and resubmittal of our License Application is now necessary.

As a matter of information, we intend, as a part of License Application revision, to exclude the occupation of Radiographer's Assistant. In our operations, the individual who assists the Radiographer performs only dark room duties and helps the Radiographer in setting up cassettes on the casting being shot. He does not, however, at any time use the exposure meter, operate exposure devices, nor act as a Radiographer's Assistant as defined by A. E. C. regulations.

We will appreciate your early review and comment on the material provided. This request is made to enable us to submit our Revised License Application by the indicated target date.

Sincerely,



R. L. Lich

/crr

Enclosures

ENCLOSURE I

3377

6. (e) OPERATING AND EMERGENCY PROCEDURES



## Operating Procedure for Use Of Cobalt 60 Radiographic Source In The Betatron Room

All radiographers must wear film badges and <sup>Dos.</sup> ~~pocket~~ chambers provided whenever working around penetrating radiation, whether it be from the Betatrons or the Co 60 sources.

1. Unlock the door to the Control Room from the outside, enter and immediately lock the door. In the event another radiographer must enter the Control Room while it is locked, he will have to knock on the door.
2. Using the NRD Model CS 40A or the Victoreen Model 592B survey meter, make an entrance survey of exposure device (Radionic Panoramic Camera Model P60-100-A) making certain no source is exposed.
3. Make the necessary entries in the utilization and survey log.
4. Always place the casting as far south as the handling crane will permit, approximately 54' from the north wall. The casting will be as close as is practicable to the east wall. Set up the exposure film and fix the position of the source tube. Make certain the source tube is firmly fixed in the position required and that any angle in the tube is not too sharp to prevent movement of the source within the tube. The Co 60 camera will be set approximately 3' from the east wall and 32' from the north wall. The control crank unit will be inside the control room.
5. Turn on red warning lights. These lights are strategically located at the entrance door to work area and at the double leaf door. Lights may easily be observed by any personnel passing by the area adjacent to the exposure room.
6. Unlock the Radionic's camera device.
7. Have casting and camera located so that control cable may be operated from inside the control room. Observe the source position indicator.
8. Make the necessary entries in utilization and survey log.
9. Radiographer returns to the Control Room outside the radiation area to time and wait for the exposure to be completed. At no time should he enter the exposure area (forward of the 10'0" thick sand filled wall) when the source is exposed.

Operating Procedure for Use of Cobalt 60 Radiographic Source in  
the Betatron Room (Continued)

10. After the exposure is completed, retract the source into the camera by means of the control cable from inside the control room.
11. Make an operational survey of the entire area, taking special note of source tube and camera device.
12. Lock camera device. This should be done even though a second exposure is to be performed within the next few minutes.
13. Make necessary entries in the utilization and survey log. (See attached)
14. Turn off warning lights.
15. Steps No. 3 to No. 14 inclusive may be repeated several times before going to lunch or the end of the shift. Darkroom and offices are located in the processing area behind the 10' 0" thick sand filled wall.
16. Before leaving the room, whether to go to lunch or darkroom or at the end of the shift, a final survey of source holder and source tube will be made and noted in the log. Be sure to sign the log.
17. Leave exposure room and lock door from the outside. Never leave room, even for a few minutes, without locking from the outside.
18. A final dosimeter reading will be made and recorded at the end of each shift. Film badges as noted above will be worn throughout the eight hour shift, regardless of work being performed.
19. See Emergency Procedure for proper action in case of an emergency. In case of emergency, follow those procedures and call Mr. H. B. Norris at once. His telephone number shall be known to all radiographers, and is always on file in the company guard house, which is open 24 hours a day, 7 days a week.

General Steel Industries, Inc.  
Operation Procedure for Use of Cobalt 60 Radiographic Sources

All "Radiographers" (as defined in Title 10, Part 31), 24-MEV Betatron, shall:

1. Read and understand Parts 20 and 31 of Title 10 of the Code of Federal Regulations.
2. Read and become well acquainted with the Instruction Manual for the Budd roll-out camera device and the Radionic Panoramic camera.
3. Read and retain a copy of these Operating Procedures and the attached Emergency Operating Procedures.
4. Receive instructions in the operation of the exposure device and receive actual experience in its operation.
5. Receive instructions and procedures from Mr. H. B. Norris.
6. Receive instructions in health physics, monitoring and personnel monitoring and dosimetry from a physicist from Nuclear Consultants Corporation, or other source including GSI personnel.

Above instructions will include lectures, actual use of exposure devices and survey instruments, and practical problems, utilizing Appendix A, Part 31, Title 10, CFR, as an outline. A copy of this training program is attached as 6(f).

There will be no transportation of sources or exposure devices to any field location, nor in fact, shall they be moved from the special radiographic room within the plant. All records will be maintained by Mr. H. B. Norris or by the division accountant (inventory) in the division accounting department at the same address.

Only "Radiographers" licensed by the AEC and assigned to this department shall have keys to the radiographic room and to the exposure device. Under NO conditions are you to loan or give your key to anyone, regardless of his position within the company without the direct approval of Mr. Norris. If your keys are lost or misplaced, notify Mr. Norris of this at once.

All "Radiographers" must wear film badges whenever working around radiation whether it be x-ray, betatron or the Co 60 sources.

## Operating Procedure for Use of Cobalt-60 Radiographic Sources (Continued)

They must also wear the pocket chambers provided when working with the Co 60.

A step-by-step procedure which is to be followed by each shift and each man is tabulated below:

1. Unlock the door to the radiographic room from the outside, enter and immediately lock the door from the inside. This is necessary due to the higher than normal noise level in the plant. A loud siren is located over the door with a push button activator on the outside for use in the event another radiographer must enter the room while it is locked from the inside.
2. Place film holder and any other equipment taken into the room in the small viewing room outside the radiation area (but within the radiographic room). Using the NRD Model CS-40A survey meter, make an entrance survey of each exposure device (Budd Company's Model 110A Unitron Radiographic Camera), making certain no sources are exposed.
3. Make the necessary entries in the Utilization and Survey Log. (See attached sample of log.)
4. Set up exposure film and fix position of source tube. Always place source as near center of room and as far from the walls as is practical. Never place source closer than four feet from the wall unless it is inside the casting. Make certain source tube is firmly fixed in position required, and that any angle in tube is not too sharp to prevent easy operation of source within the tube.
5. Turn on red warning lights. These lights are strategically located on the top of the exposure room walls, and over the outside entrance, so that they may easily be observed by any personnel passing by the area adjacent to the exposure room.
6. Unlock Budd Camera devices.
7. Have castings and camera located so that the control cable may be operated from behind one of the 4 inch thick armor plate steel shields separating the radiographic area from the control area. The control cable shall be maintained behind this shielding at all times. The source may now be exposed utilizing the control cable from behind the armor plate shields. Observe the source position indicator.

Operating Procedure for Use of Cobalt 60 Radiographic Sources (Continued)

8. Make necessary entries in Utilization and Survey Log.
9. "Radiographer" retires to small room outside of radiation area to time and wait for exposure to be completed. At no time should he enter the exposure area (forward of the steel shields) when sources are exposed.
10. After exposure is completed, retract source into source holder with control cable from behind armor plate shielding.
11. Make an operational survey of the entire area, taking special note of source tube and camera device.
12. Lock camera device. This should be done even though a second exposure is to be performed within the next few minutes.
13. Make necessary entries into Utilization and Survey Log. (See attached)
14. Turn off warning light.
15. Steps No. 3 to No. 14, inclusive, may be repeated from two to five times before going to lunch, or between trips to the darkroom and film storage area, or the end of the shift. Darkroom and office are over 500 yards from exposure room.
16. Before leaving the room, whether to go to lunch or darkroom or at the end of the shift, a final survey of source holder and source tube will be made and noted in the log. Be sure to sign the log.
17. Leave exposure room and lock door from the outside. Never leave room, even for a few minutes, without locking from the outside.
18. A final dosimeter reading will be made and recorded at the end of each shift. Film badges as noted above will be worn throughout the eight hour shift, regardless of work being performed.
19. See Emergency Procedure for proper action in case of an emergency. In case of emergency follow those procedures and call Mr. Norris at once. His telephone number shall be known to all radiographers and is always on file in the company guard house which is open 24 hours a day, 7 days a week.

## EMERGENCY OPERATING PROCEDURES

A telephone is located in the small room protected from the radiation area but within the locked exposure room. Any deviation from normal operating procedure may be reported to the supervisor in charge of radiography without the necessity of the radiographer leaving the locked exposure room. All men handling the source will be radiographers within the definition of Part 31, Paragraph 31.3.

EMERGENCY NO. 1 SOURCE CANNOT BE RETRACTED INTO THE SOURCE HOLDER OR THE SURVEY INDICATES THAT IT IS NOT WITHIN THE HOLDER WHEN IT SHOULD BE. THE RADIOGRAPHER ON DUTY SHALL:

1. The warning lights will be on in conformance with operating procedure. If the emergency happens at any other time, turn on warning lights.
2. Call H. B. Norris, by auto call or telephone.
3. Unlock door, leave radiation room, and lock door from the outside.
4. Using NRD Model CS 40A survey meter, survey area immediately surrounding radiographic area, and post any area of greater than 5 mr/hr.
5. Maintain vigilance at doorway until Mr. Norris arrives.

### THE RADIATION SAFETY OFFICER SHALL

1. Obtain full story, evaluate, rectify if possible.
2. If necessary, call Nuclear Consultants Corporation or the Budd Company. Exposure room will remain locked and all warning lights will remain on until area is safe. Radiographer will maintain personnel vigilance at exposure room door if gravity of situation warrants.
3. Record will be made of the incident.
4. AEC will be notified, if necessary, in compliance with Title 10, Part 20, Paragraph 20.403.

EMERGENCY OPERATING PROCEDURE (Continued)

EMERGENCY NO. 2      POCKET DOSIMETER READS OFF SCALE

1. Do not extrapolate.
2. Recharge dosimeter, check it after 15 minutes, repeat this step. If it reads off scale both times, it is probably faulty.
3. Develop casting exposure films, see if they have the correct density with no distortion. Any misalignment of source or source tube that could result in overexposure would not give a satisfactory radiograph.
4. Check survey instrument. If survey instrument and radiographs prove to be all right and dosimeter indicates a faulty discharge, assume dosimeter to be faulty. Use spare dosimeter.
5. Call H. B. Norris and notify him of these results for his evaluation before making any other exposures.
6. If above indicates that the apparent overexposure may have actually occurred, send film badge in for processing with request for an immediate reply by telephone.
7. If film badge report substantiates dosimeter reading, the radiographer will be sent to the corporation doctor with a full report.
8. AEC will be notified in conformance with Title 10, Part 30, Paragraph 20.403.

A. E. C. - Test #1

3377

1. What is the utilization log? *a log of each day's operations & radiation surveys & is required by AEC regulations*
2. At what distances do you survey the exposure device and what levels of radiation are allowed at these distances for the 80 curie source? For the small  $\text{Co}^{60}$  source? *1 meter - 10 mR/hr or 200 mR/hr at the exposure surface  
50 mR/hr at 6 inches*
3. How often must the survey meter be calibrated? *every 6 months maximum*
4. How often must we have a leak test? *every 6 months max*
5. Where are copies of the operating procedure and emergency procedures kept? *in the control room & in R.S.C. office*
6. What are (2) personnel monitoring devices that are required by the A. E. C. for radiographers to wear? *personal chamber or dosimeter & film badge*
7. Radiation levels are measured in terms of microR dosage in terms of hours.
8. What is a curie? *a measurement of the amount of radiation, its a rate of decay or  $3.7 \times 10^{10}$  disintegrations/second*



9. Of the (3) types of radiation, alpha, beta, and gamma, which is the most dangerous? Most penetrating? Which is electromagnetic in nature? Which is particle in nature?

1 each under different conditions

2 gamma

3 gamma

4 alpha & beta

10. What is form A. E. C. -3? *Notice to employees into regional offices*

11. What is form A. E. C. -4? *form on which total dose is accumulated*

12. Where are copies of the G. S. I. licensee application kept? *in control room & in R.S.D. office*

13. If you go into the radiation room on a Monday morning and the source is missing, what would you do? What should the licensee (G. S. I.) do?

1 follow emergency procedure

2 telephone or teletype regional office immediately

3 monthly report within 30 days to Washington office

14. What are the (3) ways of reducing levels of radiation?

*time, distance, shielding*

15. A 10 curie source is used in the center of a 20 foot square room constructed with 24" concrete walls. What is the radiation intensity at the outside surface of the room? (24" concrete - 8 half value layers) (use 14, 400 mr/hr of 1 foot for 1 curie of cobalt.)

$$\frac{14}{1440} \text{ m/hr} = \frac{(10)^{20}}{12^2} = 975 \text{ m/hr (approx)}$$

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{256}$$

$$975 \text{ m/hr} \div 256 = 3.8 \text{ m/hr}$$

## PART II

1. What part of an atom determines its chemical combining properties?  
Its elemental identity? *orbital electrons — protons in nucleus*
2. What does the atomic number signify? *the number of orbital electrons, number of protons,*
3. What does the mass number signify? *the number of neutrons + protons in the nucleus*
4. Write all you can from the expression  ${}^{60}_{28}\text{Co}$ .  
*it's cobalt atomic number 28  
29 electrons mass number 60  
29 protons  
32 neutrons If it is cobalt the atomic number should be 27*
5. Gamma radiation comes from what part of an atom? The beta particle?  
*nucleus — nucleus*
6. Name two forms of interaction of electromagnetic radiation with matter.  
*Compton effect; photo electric effect; ion pair production, Bremsstrahlung effect.*
7. The penetrating power of gamma radiation is determined by its *energy.*
8. One curie of  ${}^{60}\text{Co}$  emits 14,400,000 per hour at 1 feet with an energy of 2.5 M.E.V., at the end of one half life it emits 3,600,000 per hour at 1 feet with an energy of 1.5 M.E.V.
9. How many half lives may our source go through before we have to stop using it? Why? *1, 2, 3, it's a matter of economics*
10. What is reversibility?  
*ability of body cells to rebuild or repair themselves.*

11. What is the first visible body indication of an over exposure to radiation?  
*redness of skin*
12. List in order of their penetrating power: gamma, alpha, and beta radiation.  
*gamma, beta, alpha*
13. What are the three methods of reducing exposure to radiation available to the radiographer?  
*time, distance, shielding*
14. Under what conditions may a radiographer wear another individual's film badge?  
*none*
15. What do the numbers 10X & 1000X on the CS40A survey meter mean? If the scale needle indicates 3 mr/hr, what is the radiation intensity if the selector switch is set on 1X? 100X? 1000X?  
*multiplication factors*  
*3 300 3000*
16. Name and explain (2) weaknesses inherent in the pocket dosimeter? How do you compensate for these?  
*1. easily discharged by accident require frequent measuring & treatment, or you cannot stop the "off scale" readings. 2. be careful; frequent readings - use of beta badge*
17. How many radiation surveys are made during an 8 hour day in the 6 building cage?  
*depends on number of exposures, but there will be a number of it (entrance, & final)*
18. There are three isotopes of hydrogen. How many are radioactive?  
*one*
19. The pocket dosimeters we use detect gamma rays; how good are they for detection of alpha and beta? Why?  
*none, the alpha & beta particles will not penetrate the cover window*
20. <sup>60</sup>Co decays to nickel. It emits 1440000 per g/cm<sup>3</sup> at 1 feet. Its half life is 5.3 years. It emits gamma radiation and beta particles.

1. Define "occupational dose".  
*The quantity of radiation absorbed by the body or any portion thereof excluding medical x-rays or therapy.*
2. What does "radiation" mean?  
*alpha, beta, gamma, x-rays, including  $\alpha$  radiation from the betatron, but not including sonic or radio waves or visible or invisible light.*
3. What is a "restricted area"?  
*Any area access to which is controlled by the licensee for purposes of protection to individuals from exposure to radiation from radioactive material.*
4. What is "Source Material"?  
*Uranium or thorium, combinations thereof in any physical or chemical form.*
5. What is meant by "survey"?  
*A tour through an area with a survey meter to evaluate & determine radiation levels in Raymonds.*
6. Define "rad".  
*a measure of the dose of any ionizing radiation to the body in terms of energy absorbed.*
7. Define "rem".  
*a measure of the dose of any ionizing radiation to the body in terms of biological effect relative to a dose of 1r of x-rays. In our facility rem, rad, & r are the same.*
8. Define "dose".  
*Is the amount of radiation absorbed by the body or parts thereof.*
9. Define "curie".  
*a measure of the amount of radioactive material or a measurement of disintegration per unit of time.*
10. Who is permitted to make interpretations of regulation meanings?  
*a written interpretation by the General Council is required by the Commission.*

11. Communications and reports are made to which office of the AEC?  
*WPAington D.C. or off & filed on AEC-3 forms.*
12. What is the permissible dosage of an individual in a restricted area?  
*1.25 rads / quarter. whole body, or 3 rads / quarter when the 5(N-19) paragraph is used together with an AEC-4 form properly filed and.*
13. What exceptions are there to the stated permissible dosage?  
*due to repeated lowering of maximum permissible dosage, an AEC-4 form may result in a higher dose permitted after 1/1/61. The eyes may be ignored.*
14. What is meant by "accumulated dose"?  
*the total lifetime dosage of an individual*
15. What information is obtained on Form AEC-4?  
*1 radiation record from former employers  
 2 correct age  
 3 total dose to date  
 4 additional dose permitted 5(N-19)*
16. How are airborne radioactive material limits determined?  
*not discussed in lecture or educational classes. The question is thrown in to evaluate extent of extra reading or interest by the individual.*
17. What restrictions are placed on minors regarding radioactive materials?  
*1 no exposure to airborne radiation  
 2 a dose of 10% or less of adult dose in a restricted area*
18. What restrictions are enforced for radiation levels in unrestricted areas?  
*average radiation levels & occupancy factors calculated so no individual receives a dose in excess of .5 rads / yr. if included in license application, otherwise 2 millirads per hour or 100 millirads / 7 day week is maximum.*
19. Concentrations of radioactive materials in effluents are governed in which manner?  
*This question is not specific to any facility, answers are used to determine extent of radiographic extra reading or study.*
20. What are the restrictions in the medical applications of radiation?  
*AEC does not limit or regulate an individual's exposure to medical radiation.*
21. How are bio-assays used in the regulations?  
*see answer to #17*

22. How does a "high radiation area" differ from a "radiation area"?  
*in the level of radiation, other requirements, entrance & surveillance requirements.*
23. Describe a radiation symbol.  
*a yellow background square or rectangular symbol, symbol is a small central circle surrounded with 3 segments of a larger circle, at intervals 60°*
24. What 4 caution signs are designated by the regulations?  
*1 radiation symbol  
2 radiation areas  
3 high radiation area  
4 storage container signs*
25. Is it necessary to label containers of radioactive material in a radiation area?  
*It is not always required by AEC regulations. In our facility it is always required*
26. Is it necessary to post the AEC regulations for licensed establishments?  
*yes*
27. Is it necessary to supply radiation exposure reports to employees in restricted areas?  
*not always, but for our facility, it is required.*
28. What are the two basic instruction areas for personnel as stated by the regulations?  
*1. qualifications, function & instructions of radiation areas  
2. Post regulations & AEC-3*
29. Is any authorization required for disposal of licensed material?  
*yes*
30. Can licensed material be disposed of by releasing it into sanitary sewers?  
*under certain conditions it may.*
31. What is the common method of disposal of licensed material?  
*burial at sea or underground*

32. How shall Form AEC-5 be used?

*a record of incident & exposure to radiation.*

33. What procedure should be followed if licensed material is missing?

*Report to Regional Office by telephone or telegraph immediately; if possible report to Washington within 30 days; follow emergency operating procedure.*

34. Notification of an incident must be made to the AEC in what period of time?

*Follow emergency operating procedure, immediately notify Regional Office by telephone or telegraph or a 24 hr notification period depending on degree of radiation beyond.*

35. What radiation report can be requested by an employee?

*a summary of his individual radiation exposure history.*

36. At termination of employment, what report should be requested by an individual?

*a full report of his or her exposure during while employed at that facility.*

37. Define radiographer.

*one who personally conducts or supervises radiographic operations & is responsible to the licensee for compliance to regulations & license conditions.*

38. What is accomplished by a "leak test"?

*a check on condition of source; has any of it been scrapped or rub off which contaminates the area?*

39. What three types of training are required for a radiographer?

*original, refresher, periodic or new equipment or procedures are adapted, on the job.*

40. What are the radiation limits adjacent to the radiographer exposure devices?

*80 mrad/yr at 1 meter  
.5 " " 50 mrad/yr at 6 inches*

41. Is it required that exposure devices be locked?

*yes when not in use*

- How often must radiation survey instruments be calibrated?  
*every 3 months, max*
43. How frequently must a source be leak tested?  
*6 month intervals*
44. How frequently must source material be inventoried?  
*quarterly*
45. What is the purpose of the utilization log?  
*a record of each use of a source, who used it, & survey reports made*
46. How frequently must a radiation survey be made?  
*before starting a shift, before each exposure into an exposure area, & after completing a shift or series of exposures.*
47. Is it necessary to have direct surveillance of radiography by a radiographer?  
*yes*
48. What monitoring equipment is required in performing radiography?  
*a survey meter, film badge, pocket dosimeter, & stationary monitoring device*
49. Is it necessary to have written instructions for operating procedures?  
*yes*
50. Is it necessary to refer unusual equipment or operating conditions to the Radiation Safety Officer?  
*yes*



Control No.

~~3127~~

**GENERAL STEEL INDUSTRIES, INC.**

**CASTINGS DIVISION**

RICHARD L. LICH  
President

November 1, 1971

1417 State Street  
Granite City, Illinois 62040  
618 • 452-2120

Mr. Nathan Bassin  
Division of Materials Licensing  
U. S. Atomic Energy Commission  
Washington, D. C. 20545

Dear Mr. Bassin:

Mr. Boyce H. Grier, Regional Director, United States Atomic Energy Commission, Region III, has asked that we provide you with information concerning the training and experience of Mr. Robert W. Ripley, who has recently been appointed Radiation Safety Officer at the Castings Division of General Steel Industries.

You will note from the attached memorandum dated October 22, 1971, to Mr. W. H. Rapp, Director - Quality Assurance at the Castings Division, that Mr. Ripley has the necessary qualifications and background for this assignment.

If, after you have had an opportunity to review his qualifications, you have any questions, please do not hesitate to contact me.

Sincerely,



Richard L. Lich

Attachment

cc: Mr. Boyce H. Grier

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Memorandum to Mr. W. H. Rapp:

I have been asked to state my qualifications for Radiation Safety Officer at General Steel operating under A. E. C. License No. 12-8271-1.

My experience with radiography began in 1949 and continued uninterrupted until 1964.

In 1949, I set up what I believe to be the first artificial isotope installation in this area at "The Key Co." located in East St. Louis, Illinois. This company manufactured high alloy and stainless steel high pressure valve bodies and high pressure, high temperature valve bodies and return bends for oil refining catalytic cracking towers. At that time, I attended a school conducted by Dr. Konniker of Nuclear Consultants, St. Louis, Mo. This course included radiation hazards and health, legal requirements of the A. E. C. and operation of manipulating and monitoring equipment. I believe we used sources of .5 to 2.0 curies. My title was Nondestructive Testing Supervisor and later Assistant Plant Metallurgist. About 1954, Key Co. was purchased by A. C. F. Industries and the operation was transferred to Houston, Texas. I did not wish to relocate so I sought and found employment at General Steel Industries in Granite City. I was employed as Chief Chemist and supervised the chemical and test laboratories and the nondestructive testing group which included two sources of radium (approximately 500-800 milligrams).

In 1960-61, this facility was converted to Co<sup>60</sup>. At that time, I attended a school "Radiation Health Physics" conducted by the Budd Instrument Division of the Budd Company. The school consisted of lab and lectures in safety radiation health physics, title 10, exposure equipment, and survey meter operations. At this time, I was appointed and approved as Radiation Safety Officer for General Steel. During this period, I set up the entire practice, license application, operating procedure, emergency procedure, and training program. The installation and practice was approved by A. E. C. on its first application for license. I also qualified as radiographer supervisor under Mil S-11356D.

During this period of time, I worked with the Civilian Defense Agency, attended two schools on radiation hazards and decontamination as a result of an atomic mishap, and received a card, if my memory serves me right, as a Radiation Decontamination Warden. For several years during this period of time I was one of two Decontamination Officers for this company in the event of atomic mishap or hostile action. These schools were a joint effort of the C. D. A. and Southern Illinois University and held at the Granite City High School as night classes. I attended a more comprehensive school for one year on all aspects of Nondestructive testing at Rolla University, St. Louis campus night school. This was a college credit course.

In 1964, the foundries at Eddystone, Pa. and Granite City were consolidated and necessitated changes in organization. I became Assistant Plant Metallurgist and concentrated my efforts in the metallurgical aspect of foundry operations and in 1970 became Manager of Plant Metallurgy. On September 28, 1971, I was asked to become Manager of Quality Control with direct supervision of the radiographic facility.

During this interim period, I have tried to keep abreast of the A. E. C. program in its entirety as a matter of keen personal interest in one of the most exciting and useful scientific developments of our generation. I sincerely believe my educational background and experience has only improved since my resignation as Safety Officer in 1964.

*R. W. Ripley*  
R. W. Ripley