

Title 10 - Energy

CHAPTER I - NUCLEAR REGULATORY COMMISSION

PART 34 - LICENSES FOR RADIOGRAPHY AND RADIOGRAPHY SAFETY
REQUIREMENTS FOR RADIOGRAPHIC OPERATIONS

Amendments of Radiography Regulations

AGENCY: U.S. Nuclear Regulatory Commission.

ACTION: Final rule.

SUMMARY: The Nuclear Regulatory Commission is publishing as effective rules several changes in its regulations on industrial radiography. The rule changes were originally published for public comment on March 27, 1978, and have been revised after consideration of the comments received. These amendments require several procedural changes intended to improve radiography safety. The changes are also intended to formalize as regulations current licensing practices. The amendments apply to industrial radiography operations using radioactive isotope sources licensed by the Nuclear Regulatory Commission.

EFFECTIVE DATE: (6 months from publication date).

NOTE: The Nuclear Regulatory Commission has submitted this rule to the Comptroller General for such reviews as may be appropriate under the Federal Reports Act, as amended, 44 U.S.C. 3512. The date on

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which the reporting requirement of this rule becomes effective, unless advised to the contrary, accordingly reflects inclusion of the 45-day period which that statute allows for such review (44 U.S.C. 3512(c)(2)).

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION: On March 27, 1978, the Nuclear Regulatory Commission published for public comment amendments to Part 34 of its regulations (43 Federal Register 12715). Forty-nine public comments were received. In response to these comments, some of the proposed amendments have been deleted or substantially reworded. The individual amendments are discussed by section below.

§ 34.2

New definitions for "source changer," now used in § 34.22 and § 34.28 and "permanent radiographic installation," now used in § 34.29, are given.

§ 34.11(d)

The proposed amendment specified that internal inspections would be required at intervals not to exceed three months. The predominant comment was that this frequency was too restrictive. The NRC believes the proposed frequency is appropriate in view of the importance of management audits of radiographer performance.

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The NRC has consistently observed that a strong management commitment to safety is necessary if radiographic operations are to be conducted safely. Frequent checks of the performance of radiographers are a necessary part of that commitment. The effective rule therefore retains the proposed frequency for internal inspections.

§ 34.22

The proposed amendment specified securing (not necessarily locking) the sealed source in its shielded position in crankout radiographic exposure devices each time the source is returned to that position. Some commenters questioned the effectiveness of such a requirement. Other commenters thought the requirement should not be limited to crankout devices only. On consideration, the NRC believes the small effort to secure the source is worthwhile since this prevents the source from moving out of its shielded position if the device or the crank is moved. The NRC also has extended the requirement to devices other than crankout devices since the safety considerations with such devices are similar to those for crankout devices.

§ 34.28

The proposed amendment specified that radiographic exposure devices, storage containers, and source changers be maintained at intervals not to exceed three months. The main comment was that this schedule was too restrictive. The NRC agrees that more flexibility in scheduling can be permitted with little or no loss in

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effectiveness of the regulation. In response the schedule is changed to "at intervals not to exceed three months or prior to the first use thereafter." This allows somewhat more flexibility for equipment which may be used only infrequently.

§ 34.29

The proposed amendment specified the requirement of audible and visible alarms on entrances to permanent radiographic installations. Commenters did not object particularly to having the alarm. However, commenters objected strongly to requiring that the alarm alert another individual besides the individual attempting entry. The NRC agrees that warning another individual is not necessary for radiography sources if other means of limiting access of unauthorized personnel are provided. The rule has been rewritten so that a second person besides the radiographer is not required if the licensee chooses to limit access of unauthorized personnel into the high radiation area by locking or maintaining direct surveillance as required by § 20.203(c)(2)(iii) or (4) and § 34.41. Note that personnel access may be controlled by direct surveillance under § 20.203(c)(4) since a permanent radiographic installation does not mean that there is a permanent high radiation area (i.e., 30 days or more).

Some commenters objected to not allowing an automatic source retraction device to substitute for the alarm. As written in effective form, the new § 34.29 allows an automatic source retraction device to substitute for the alarm system. If the installation has a source

retraction device meeting the requirements of § 20.203(c)(2)(i), § 34.29 does not apply.

Other commenters objected to not allowing locked entrances to the installation as a substitute for the alarm. The NRC does not agree with this comment. Many overexposures have occurred when a radiographer unlocked the door to an installation and approached an exposed source without using a survey meter. Therefore, permanent installations must have an alarm even if locking of all entrances is planned. It should be noted that the alarm system required in § 34.29 is aimed more at protecting the radiographer himself than at unauthorized personnel. For this reason, the requirements in § 20.203(c) and § 34.41 on preventing such access by unauthorized personnel remain completely unchanged.

§ 34.31

The amendment proposed to require written and field examinations for both radiographers and radiographers' assistants. The comment was made that oral examinations should be adequate for radiographers' assistants. In view of the high degree of supervision required for an assistant in the new § 34.44, the final rule has been changed to permit oral testing of assistants. The final rule also requires that copies of written tests and the dates of oral and field examinations be retained for three years.

§ 34.33

The NRC proposed to amend § 34.33 to require annual accuracy checks on pocket dosimeters, with a +30% accuracy criterion. The

NRC also proposed to state that after an individual's pocket dosimeter had gone off-scale, the individual would be prohibited from further radiographic operations until the magnitude of the exposure had been evaluated.

Commenters said the accuracy check has little purpose and would not reduce radiation exposures. The NRC now believes that since the pocket dosimeters are being manufactured to the stringent requirements of American National Standard N13.5-1972, "Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma Radiation," that the proposed regulation is not necessary, particularly since defects in the dosimeters are generally either in a safe direction or else render the dosimeter completely unusable.

Commenters strongly objected to requiring that an individual with an off-scale dosimeter be removed from work since such action would be very costly and since dropping causes most dosimeters to go off-scale. The NRC has decided to delete this proposed requirement since it would do little to improve worker safety because the worker would not be restricted from work until after the exposure had already occurred. In addition, it would be quite burdensome. Licensees should note, however, that under § 20.201, "Surveys," they are required to make evaluations of the radiation hazards incident to the use of a radioactive source. Thus it is required that the licensee evaluate the situation to determine the cause of the off-scale dosimeter before allowing the worker to resume work in a restricted area. If an over-exposure has occurred, the important thing is to correct the hazard to prevent a repeat of the incident.

§ 34.41

The existing wording of this section will not be changed. The proposed wording would have eliminated locking of doors as a substitute for direct surveillance to prevent unauthorized personnel from entering high radiation areas. The comment was made that locking is a very practical means of limiting access by unauthorized personnel in many instances such as shipbuilding. The NRC agrees that locking can be more effective than direct surveillance in preventing unauthorized entry into a high radiation area. In many cases, such as areas that have multiple entry points, a momentary lapse of attention could allow someone to walk into the high radiation area unnoticed. Locks are a mechanical means not dependent on the constant attention of the radiographer. Therefore, the NRC will permit locking as an acceptable alternative. The section therefore will not be changed.

§ 34.43

The proposed amendment of this section explicitly stated that the radiation survey to determine that a sealed source has returned to its shielded position after a radiographic exposure must include a survey of the source guide tube. Commenters said that such action is impractical in some situations, for example, when the cable runs through a shielded wall as in a permanent installation, through conduits between different areas, or when the device or guide tube is suspended on scaffolding. The NRC recognizes that sometimes the entire guide tube

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may not be accessible and that there are other survey techniques to demonstrate adequately that the source has returned to its shielded position.

The requirement to survey the guide tube does not mean that inaccessible portions must be surveyed. For example, if the guide tube runs through a thick concrete wall at a shielded facility, one need only survey to the wall. There would be no need to pull the guide tube out of the wall to make the survey. If the guide tube runs through a cable tray in a submarine under construction, it is only necessary to survey to the point where the guide tube enters the wall. If the guide tube is suspended on a scaffold, it is not necessary to climb up to the guide tube. The survey can be made from the ground.

A requirement to survey the entire circumference of the radiographic exposure device remains. This requirement means that the survey instrument should completely circle the device, especially the front of the device. It does not mean that the bottom of the device need be surveyed.

The proposed amendment of this section would also have added a specific requirement for surveying the perimeter of the restricted area. Numerous commenters said that the proposed wording was too inflexible for many situations, too vague, and potentially hazardous. The NRC has accepted this view. The requirement to survey restricted area boundarys will remain within the more general requirements of § 20.201, "Surveys." The proposed change is deleted.

§ 34.44

The proposed amendment defined in § 34.2 the supervision that a radiographer must give a radiographer's assistant. This proposed change met with stronger opposition than any other of the proposed changes. Many commenters expressed their belief that radiographers' assistants should be allowed to conduct routine surveys such as those of restricted area and radiation area boundaries without being watched by a radiographer. The NRC agrees that an assistant radiographer can quickly be trained to use a survey meter competently and can safely perform many of the less critical surveys, such as a survey of the boundary of the restricted area. The NRC also recognizes that prohibiting an assistant from independently performing such surveys would greatly decrease the usefulness of the assistant and place a large economic burden on licensees. Therefore, the amendment has been reworded so that the only survey during which the radiographer must watch the assistant is the survey to determine that the sealed source has returned to its shielded position after use. The radiographer should be watching the assistant to the extent that he is able to see that the assistant is carrying out his assigned functions in accordance with the instruction he has received. The requirements are being placed in a new § 34.44. It is more appropriate to include these requirements in a new section rather than with the definitions in § 34.2 as was proposed.

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Appendix A

No commenters objected to a proposed requirement that radiographers be instructed in case histories of radiography accidents. A recent NRC report, NUREG-0495, "Public Meeting on Radiation Safety for Industrial Radiographers," discusses such case histories.

Anyone wishing more detail on the development of these amendments may obtain an "Analysis of Public Comments on Proposed Amendments of 10 CFR Part 34" or a "Value/Impact Statement on Amendments of 10 CFR Part 34" by writing to Dr. Stephen A. McGuire, Occupational Health Standards Branch, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 within twelve months of this notice, or writing the NRC's Public Document Room thereafter.

In addition, a complete set of the public comments is available for inspection in the Public Document Room.

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and Sections 552 and 553 of Title 5 of the United States Code, the following amendments of Title 10, Chapter I, Code of Federal Regulations, Part 34 are published as a document subject to codification.

1. New paragraphs (g) and (h) are added to read as follows:

§ 34.2 Definitions.

* * * * *

(g) "Source changer" means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those also used for transporting and storage of sealed sources;

(h) "Permanent radiographic installation" means a shielded installation or structure designed or intended for radiography and in which radiography is regularly performed.

2. Paragraph (d) of § 34.11 is amended to read as follows:

§ 34.11 Issuance of specific licenses for use of sealed sources in radiography.

* * * * *

(d) The applicant will have an internal inspection system adequate to assure that Commission regulations, Commission license provisions, and the applicant's operating and emergency procedures are followed by radiographers and radiographers' assistants; the inspection system shall include the performance of internal inspections at intervals not to exceed three months and the retention of records of such inspections for two years;

3. Section 34.22 is amended to read as follows:

§ 34.22 Locking of radiographic exposure devices, storage containers, and source changers.

(a) Each radiographic exposure device shall have a lock or outer locked container designed to prevent unauthorized or accidental

removal of the sealed source from its shielded position. The exposure device or its container shall be kept locked when not under the direct surveillance of a radiographer or a radiographer's assistant or as otherwise may be authorized in § 34.41. In addition, during radiographic operations the sealed source assembly shall be secured in the shielded position each time the source is returned to that position.

(b) Each sealed source storage container and source changer shall have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers shall be kept locked when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.

4. Section 34.28 is amended to read as follows:

§ 34.28 Inspection and maintenance of radiographic exposure devices, storage containers, and source changers.

(a) The licensee shall check for obvious defects in radiographic exposure devices, storage containers, and source changers prior to use each day the equipment is used.

(b) The licensee shall conduct a program for inspection and maintenance of radiographic exposure devices, storage containers, and source changers at intervals not to exceed three months or prior to the first use thereafter to assure proper functioning of components important to safety. Records of these inspections and maintenance shall be kept for two years.

5. A new § 34.29 is added to read as follows:

§ 34.29 Permanent radiographic installations.

(a) Permanent radiographic installations having high radiation area entrance controls of the types described in § 20.203(c)(2)(ii), (2)(iii), or (4) shall also meet the following special requirement.

(b) Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation to which this section applies shall have both visible and audible warning signals to warn of the presence of radiation. The visible signal shall be actuated by radiation whenever the source is exposed. The audible signal shall be actuated when an attempt is made to enter the installation while the source is exposed.

(c) The alarm system shall be tested at intervals not to exceed three months or prior to the first use thereafter of the source in the installation. Records of the tests shall be kept for two years.

6. Section 34.31 is amended to read as follows:

§ 34.31 Training.

(a) The licensee shall not permit any individual to act as a radiographer until such individual:

(1) Has been instructed in the subjects outlined in Appendix A of this part;

(2) Has received copies of and instruction in NRC regulations contained in this part and in the applicable sections of Parts 19 and

20 of this chapter, NRC license(s) under which the radiographer will perform radiography, and the licensee's operating and emergency procedures;

(3) Has demonstrated competence to use the licensee's radiographic exposure devices, sealed sources, related handling tools, and survey instruments; and

(4) Has demonstrated understanding of the instructions in this paragraph (a) by successful completion of a written test and a field examination on the subjects covered.

(b) The licensee shall not permit any individual to act as a radiographer's assistant until such individual:

(1) Has received copies of and instruction in the licensee's operating and emergency procedures;

(2) Has demonstrated competence to use, under the personal supervision of the radiographer, the radiographic exposure devices, sealed sources, related handling tools, and radiation survey instruments that the assistant will use; and

(3) Has demonstrated understanding of the instructions in this paragraph (b) by successfully completing a written or oral test and a field examination on the subjects covered.

(c) Records of the above training, including copies of written tests and dates of oral tests and field examinations, shall be maintained for three years.

7. Section 34.43 is amended to read as follows:

§ 34.43 Radiation surveys.

(a) At least one calibrated and operable radiation survey instrument shall be available at the location of radiographic operations whenever radiographic operations are being performed.

(b) A survey with a radiation survey instrument shall be made after each radiographic exposure to determine that the sealed source has been returned to its shielded position. The entire circumference of the radiographic exposure device shall be surveyed. If the radiographic exposure device has a source guide tube, the survey shall include the guide tube.

(c) A record of the survey required in paragraph (b) shall be maintained for two years when the survey is the last survey prior to locking the radiographic exposure device and ending direct surveillance of the operation.

8. A new § 34.44 is added to read as follows:

§ 34.44 Supervision of radiographers' assistants.

Whenever a radiographer's assistant uses radiographic exposure devices, uses sealed sources or related source handling tools, or conducts radiation surveys required by § 34.43(b) to determine that the sealed source has returned to the shielded position after an exposure, he shall be under the personal supervision of a radiographer. The personal supervision shall include (1) the radiographer's personal presence at the site where the sealed sources are being used, (2) the ability of the radiographer to give immediate

assistance if required, and (3) the radiographer's watching the assistant's performance of the operations referred to in this section.

9. Appendix A is amended to read as follows:

APPENDIX A

I. FUNDAMENTALS OF RADIATION SAFETY

- A. Characteristics of gamma radiation
- B. Units of radiation dose (mrem) and quantity of radioactivity (curie)
- C. Hazards of exposure to radiation
- D. Levels of radiation from licensed material
- E. Methods of controlling radiation dose
 - 1. Working Time
 - 2. Working distances
 - 3. Shielding

II. RADIATION DETECTION INSTRUMENTATION TO BE USED

- A. Use of radiation survey instruments
 - 1. Operation
 - 2. Calibration
 - 3. Limitations
- B. Survey techniques
- C. Use of personnel monitoring equipment
 - 1. Film badges and thermoluminescence dosimeters
 - 2. Pocket dosimeters

III. RADIOGRAPHIC EQUIPMENT TO BE USED

- A. Remote handling equipment
- B. Radiographic exposure devices
- C. Storage containers

IV. INSPECTION AND MAINTENANCE PERFORMED BY THE RADIOGRAPHERS

V. CASE HISTORIES OF RADIOGRAPHY ACCIDENTS

10. The second sentence of the citation of authority is amended to read as follows:

AUTHORITY:***For the purposes of Sec. 223, 68 Stat.958 as amended; 42 U.S.C 2273 §§ 34.11(d), 34.25(c), 34.26, 34.27, 34.28(b), 34.29(c), 34.31(c), 34.33(b), and 34.43(c) issued under Sec. 161o., 68 Stat. 950, as amended, 42 U.S.C. 2201(o).

(Sec. 81, 161, Pub. L. 83-703, 69 Stat. 935, 948; Sec. 201, Pub. L. 93-438, 88 Stat. 1242 (42 U.S.C. 2201, 5341).)

Dated at Washington, D.C. this __ day of _____, 1979.

For the Nuclear Regulatory Commission.

Samuel J. Chilk
Secretary of the Commission

ENCLOSURE B

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DRAFT PUBLIC ANNOUNCEMENT
NRC AMENDS REGULATIONS ON RADIOGRAPHY

The Nuclear Regulatory Commission is changing its regulations to help improve radiography safety and to make the regulations on radiography more compatible with current licensing practices.

The regulations apply to radiography using radioactive sources licensed by the NRC; they do not affect the medical or industrial uses of X-rays, which are regulated by the various States.

The changes, which are to Part 34 of the Commission's regulations, are:

(1) A radiographer must be physically present at the radiography site and watching when a radiographer's assistant performs source manipulation or conducts radiation surveys to show that the source has been returned to its shielded position in the radiographic exposure device.

(2) Internal inspections of a radiographer's regulatory performance must be conducted quarterly by the licensee.

(3) The radioactive source in a radiographic exposure device must be secured in its shielded position each time the source is returned to that position. Radiation surveys to ensure that the radioactive source has returned to its shielded position must include a survey of the entire circumference of the device and a survey of the source guide tube if the device has a guide tube.

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(4) Radiographic exposure devices must be checked for obvious damage each day before use and must be comprehensively inspected and maintained each quarter.

(5) Permanent radiographic installations must in most cases have alarms so that anyone entering the radiographic room will be warned if the entry is being attempted while the source is exposed.

(6) The training requirements state that a written and a field examination must be given to test radiographers' understanding of the training, that either a written or an oral test and a field examination must be given to radiographers' assistants and that records of the training must be maintained for three years.

(7) The list of subjects for training radiographers is expanded to include study of past radiography accidents.

The amendments will be effective on _____ (6 months following publication in the Federal Register on _____). They were published in the Federal Register in proposed form on March 27, 1978, for public comment. Among the changes made as a result of the comments received were: (1) the proposed requirements were changed to allow an assistant radiographer to conduct surveys of restricted area boundaries independently--without supervision by the radiographer--and (2) proposed specific requirements regarding the survey of restricted area boundaries were deleted, although the more general survey requirements in Part 20 of the regulations will continue to apply.

ENCLOSURE C

626 069

ANALYSIS OF PUBLIC COMMENTS ON PROPOSED AMENDMENTS
OF 10 CFR PART 34

(43 Federal Register 12715, March 27, 1978)

Forty-nine public comments on the proposed amendments of Part 34 were received. This is a large number of comments for an amendment which affects only industrial radiography. The comments were generally detailed and well thought out. Comments were received from all segments of the radiography industry, with larger radiography companies particularly well represented.

A list of the commenters is at the end of the analysis. In the discussion the comments are referred to by their number in that list.

§ 34.2(d)

"(d) 'Personal supervision' of a radiographer's assistant by a radiographer means supervision in which the radiographer is physically present at the site where sealed sources are being used and watching the assistant when the assistant uses radiographic exposure devices, sealed sources or related source handling tools, or radiation survey instruments in radiography."

Public Comments:

The proposed definition of the "personal supervision" a radiographer must give an assistant radiographer received a fairly large number of opposing comments.

Commenters thought an assistant radiographer should be able to conduct surveys of restricted area and radiation area boundaries without being watched by the radiographer (3, 4, 12, 14, 16, 17, 24, 25, 30, 48). They said reading a survey instrument is simple enough that it can be learned very quickly, and surveying a 2 mR or a 5 mR in an hour boundary is not particularly hazardous. It was pointed out that with the proposed wording an assistant radiographer could still place film by himself, but he would now be prohibited from using a survey meter while doing so (3). The proposed rule would be a hardship for jobs like shipbuilding or ship maintenance where assistants survey boundaries and maintain surveillance out of the sight of the radiographer (14, 17, 24, 48).

Commenters also thought that the proposed definition was too restrictive in that it did not allow the radiographer to take the training, experience, and competence of the assistant radiographer into account (3, 4, 14, 23, 30, 48). Some assistant radiographers remain assistants for many years (3, 14).

Some comments suggested the wording saying "physically present" instead of "watching" (2, 12, 16, 45).

Staff Recommendation:

The staff agrees that an assistant should be able to survey restricted area and radiation area boundaries without being watched. The wording should be changed to allow radiographers' assistants to perform surveys without being watched, except for the surveys required in § 34.43(b) to determine that the sealed source has returned to its shielded position after each exposure.

It is rare for radiographers' assistants to remain assistants for many years, and when this occurs, it is usually related to some particular employment policy used by the employer to classify employees. It is not because it takes that long to become a radiographer.

The change is being made by adding a new § 34.44 because this is really a requirement, not merely a definition.

§ 34.2(h)

"(h) "Permanent radiographic installation" means a shielded installation or structure in which radiography is regularly performed."

Public Comments:

What is "permanent"? (23)

Staff Recommendation:

The existing wording seems adequate. No change is recommended.

§ 34.11(d)

"(d) The applicant will have an adequate internal inspection system to assure that Commission regulations, Commission license provisions, and the applicant's operating and emergency procedures are followed by radiographers and radiographer's assistants; the inspection system shall include the performance of internal inspections at intervals not to exceed three months and the retention of records of such inspections for two years."

Public Comments:

In general, commenters objected to the proposed wording for being too restrictive and difficult to fit to the operation of specific companies

(21, 22, 23, 25, 28, 31, 44). Commenters said audit frequency should be in the administrative procedures (21). "Quarterly does not fit our operation since type and volume of work fluctuate considerably"(22). "As RSO I perform a visual audit every place I go on a 365 day a year basis and take corrective action immediately; quarterly audits look good on paper and are worth about as much"(23). "Our present audit program is every 3 months and we have found it too restrictive for effective control; an effective audit program must contain random unannounced audits"(28). This commenter recommended audits "each calendar quarter." Another commenter said, "The frequency of management inspections should allow for the nature and the amount of radiography being performed at a given site, the findings of previous inspections at the site, the number of radiographers at the site, the experience and past performance records of the individual radiographers involved, and the anticipated duration of work at the site"(31).

Other commenters thought the internal inspections should be on the radiographers but not assistants since assistants have so little responsibility (25, 43).

The proposed rule was thought to be unclear with respect to whether each radiographer had to be inspected (2, 42).

Staff Recommendation:

The staff does not agree that the regulation as proposed may allow too little flexibility in scheduling because of the importance of these management audits. The staff has consistently noted that a strong management commitment to safety is a critical factor in obtaining safe working conditions.

Operations in which the management actively fosters a safe workplace operate safely. Operations in which management pays little attention to safety consistently show high accident rates. The quarterly frequency for the internal inspections is considered appropriate based on years of observation.

The staff does not agree that a daily unrecorded inspection is really adequate. There is no way to judge how thorough or careful it was, or even that it was done at all. The rule does not state that each radiographer must necessarily be inspected each quarter.

§ 34.22

"(a) Each radiographic exposure device shall have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The exposure device or its container shall be locked each day when its use is terminated and shall remain locked until its use is resumed. In addition, during radiographic operations using crankout type radiographic exposure devices the sealed source shall be secured in its shielded position each time the source is returned to that position by locking the exposure device or the crankout control or by other suitable means.

"(b) Each sealed source storage container and source changer shall have a lock or other locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers shall be kept locked when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant."

Public Comments:

Some commenters thought the rule on securing the source would detract from proper use of the survey meter and could in some cases result in overexposures (4, 43, 47). Others said the regulation would be unenforceable and ineffective and should be rewritten and emphasis placed on training (4, 21, 26, 32, 43, 44). One person said that sometimes the job can be done faster and just as safely without locking (23). One comment pointed out that many devices can be locked with the source in the exposed position; only one type of device prevents removal of the source, and it has been criticized because it is inconvenient and unsafe in certain applications (43).

Some commenters thought that securing the source should apply to all devices, including pipeliners (2, 3, 34, 42, 45). One comment said the rule should be clarified to indicate that a key is not needed to secure the device (6).

Staff Recommendation:

Pipeline type devices reportedly have been involved in incidents reported to Louisiana, and they should be included. This requirement, similar to the requirement to survey after each radiographic exposure, is difficult to enforce unless the inspector can observe an actual operation. However, with such observations by an NRC inspector or in an internal company audit, the regulation is enforceable.

It is true that some devices can be locked with the source exposed if the source or source assembly has been disconnected from the drive cable, but this is rare. Since 1971, among 42 radiography overexposure incidents

reported to NRC causing whole body exposures over 5 rem or extremity exposures over 75 rem not a single one involved a source "pill" becoming disconnected from the source assembly and only three involved the source assembly becoming disconnected from the drive cable. Thus the number of situations where securing the source assembly would allow the source to be exposed and cause an overexposure is small. The wording of the regulation has been changed to add "assembly" to show that securing the "assembly" is required, not securing the "pill." Also the words on "locking" were deleted so as not to imply that the "securing" requires a key.

The staff does not believe that the requirement to secure the source assembly will detract from making the survey. The securing takes only a few seconds once the radiographer has approached the exposure device as it must be in order to make the survey.

Note that a change in proposed § 34.43(c) to reduce vagueness requires a similar change in this section. Therefore, locking will be a requirement when "direct surveillance" is ended rather than "each day when its use is terminated."

§ 34.28

"(a) The licensee shall check for obvious defects in radiographic exposure devices, storage containers, and source changers prior to use each day the equipment is used.

"(b) The licensee shall conduct a program for inspection and maintenance of radiographic exposure devices, storage containers, and source changers at intervals not to exceed three months to

assure proper functioning of components important to safety. Records of these inspections and maintenance shall be kept for two years."

Public Comments:

One commenter objected to routine quarterly maintenance saying, "We have done more damage and caused more problems by our maintenance than has been gained. When a problem develops the problem is fixed. What is gained by working on a good smooth working device?" (23).

Some commenters thought the schedule was too restrictive, especially for equipment that might not be used during a quarter (25, 31, 36, 46).

Some thought the inspections should be required for controls and guide tubes as well (32, 43).

Some thought the requirement involved too much record keeping (21, 23).

One comment suggested deletion of the word "obvious" in paragraph (a) (2). Another commenter said that use of defective equipment should be prohibited until it is repaired (43).

Staff Recommendation:

To provide for seldom used equipment reword the scheduling to "at intervals not to exceed three months or prior to the first use thereafter." There should be little chance of doing more harm than good if the maintenance is done in accordance with the manufacturer's recommendations.

§ 34.29

"Each entrance to a permanent radiographic installation shall have visible and audible warning signals. The visible signal shall be actuated by radiation whenever the source is exposed. The audible signal shall be

actuated when an attempt is made to enter the installation while the source is exposed. The audible signal shall warn an individual entering the installation of the hazard and shall make at least one other individual who is familiar with the activity aware of the entry. With respect to permanent radiographic installations, this requirement supersedes the requirements in § 20.203(c)(2). The alarm system shall be tested at intervals not to exceed three months. Records of the tests shall be kept for two years."

Public Comments:

Numerous and diverse comments were received on this amendment, but relatively few of the comments opposed its intent. The comments are numbered below so that they can be compared with the Staff recommendations.

1. One comment objected to the alarm requirement because it would encourage dependence on the alarm instead of the survey meter with less safety as a result; the comment also said alarms fail in a nonsafe manner, whereas a properly trained individual would be more likely to note an inoperable survey meter (2). Another comment said people would become oblivious to the light and buzzer in short order, and that many bad over-exposures have occurred at installations with such interlocks (23).

2. Two comments said that direct surveillance of the entrance should be an acceptable substitute for the alarm (18, 27).

3. Another comment said these alarm systems were complex to design and expensive to install and maintain (21).

4. Several comments opposed requiring that the alarm alert both the individual attempting to enter the installation and at least one other individual, saying that it in effect creates a two man team rule for such installations (5, 24, 25, 26, 46).

5. Some comments stated that their installations had large equipment entrances which are locked from the inside after the equipment is brought in. They said alarms should not be required on these entrances (17, 37).

6. Several comments objected to not allowing automatic retraction devices as described in § 20.203(c)(2)(i) (24,32, 37) or locking to control access as described in § 20.203(c)(2)(iii) (24, 32).

7. One comment objected to the alarm because at his installation the operators crank the sources from inside the vault, but behind a shielded wall, and they would thus be setting off the alarm repeatedly (6).

8. One comment said they now use a short alarm at the start of each exposure to warn anyone accidentally remaining in the vault. The comment said the dual alarms could be confusing (10).

9. One comment said the alarm would cause difficulties for blind people, who are now effectively used for some very low energy radiography where uncovered film is used in a darkened room (10).

10. One comment said it should be acceptable to occasionally use a field device in a permanent installation whose regular source is equipped with an automatic retraction device (37).

11. One comment said that remote outdoor bay areas with no shielding should also have alarms when the areas are permanently established (47).

12. One comment said the test interval of "not to exceed three months" was too restrictive because they prefer to test the first weeks of every quarter, which can be slightly longer than 3 months (31); another comment said the test should not be required if the installation is not used at this frequency (36).

Staff Recommendation:

1. Reduced reliance on the survey meter may be an occasional consequence of the alarm system for permanent installations. Failure to survey would still be a violation of the regulations. There is no intent to substitute proper surveys with the alarm. However, it must be recognized that many radiographers do not perform the required surveys. In a recent questionnaire sent to experienced radiographers by the University of Lowell only about 1/5 of the 37 radiographers replying said they always surveyed, about 3/5 said they usually surveyed, and about 1/5 said they usually surveyed only when they were being watched. The alarm on permanent installations will help the substantial number of radiographers who do not always survey.

2. Direct surveillance is not considered adequate for these situations where an alarm system can be easily and inexpensively installed. Most overexposures involve the radiographer himself who mistakenly enters the installation when the source is exposed.

3. The cost of a gamma alarm is \$720 from Dosimeter Corporation of America or \$900 from Baird Atomic. Installation is not difficult: plugging in the unit and mounting and connecting the detector, alarm, light,

and door switch or photo tube. This is not very expensive nor difficult to install.

4. Upon reconsideration, warning the "other individual" should not be necessary. Normally the person entering will be the radiographer, the assistant, or a plant worker familiar with the purpose of the cell. In fact, among the overexposures at permanent installations between 1971 and 1977, only radiographers, their assistants, or their helpers were involved. (It is possible that some unbadged workers were overexposed and that this was never detected or reported since there were no badges to measure the dose. The lack of this situation ever being reported, however, does suggest that it is rare). It should only be necessary to alert the radiographer, who would be trained to react properly in this situation. The section is revised accordingly.

5. It is reasonable that large equipment entrances that are locked should not require alarms. The rule should be revised to state that "Each entrance... used for personnel access during radiographic operations" should have the alarm.

6. Automatic retraction should be an acceptable substitute for an alarm because it also avoids exposure in the case of accidental entry while the source is exposed. That provision is added. Locking would not seem acceptable for these cases where an alarm can be easily and inexpensively installed. The radiographer could forget to retract the source, unlock the door, and fail to use his survey meter; therefore, locking will not be included as an alternative to the alarm.

7. Proper placement of the alarm trip would eliminate this licensee's problem.

8. The dual alarms should not create confusion. In both cases the alarm means the source is exposed and personnel should respond by getting out of the exposure room.

9. The alarm should not cause difficulties for blind people. It would not be a constant alarm. It would sound only if someone tried to enter the exposure room while the source was exposed.

10. It sounds reasonable to occasionally use a portable field device without an alarm in a permanent installation equipped with automatic retraction of the permanent source. This situation, however, should be treated as a license exception because it is too complicated to deal with in the regulations.

11. It was not intended to require alarms on unshielded installations such as large outdoor bay areas since there are no walls to limit personnel access and channel people past alarm activators. Such radiography should be treated as field radiography.

12. The comment is reasonable. More scheduling flexibility is desirable for facilities used only occasionally. The staff suggests the alarm be tested "at intervals not to exceed three months or prior to its first use thereafter."

§ 34.31

"(a) The licensee shall not permit any person to act as a radiographer until such person:

* * *

"(2) Has received copies of and instruction in NRC regulations contained in this part and in the applicable sections of Parts 19 and 20 of this chapter, NRC license(s) under which the radiographer will perform radiography, and the licensee's operating and emergency procedures;

* * *

"(b) The licensee shall not permit any person to act as a radiographer's assistant until such person:

* * *

"(3) Has demonstrated understanding of the instructions in this paragraph (b) by successfully completing a written and field examination on the subjects covered.

"(c) Records of the above training including copies of the tests shall be maintained for as long as the individual works for the licensee as a radiographer or a radiographer's assistant."

Public Comments:

Some commenters did not want to have to issue radiographers copies of the regulations or the license since keeping their copies up to date can be a burden if there are a large number of employees. They said it is management's responsibility to see the regulations are followed (24, 27).

Some commenters thought it should be acceptable to give an oral examination to assistant radiographers in view of their limited responsibilities (3, 31).

One commenter did not think training records should have to be kept for as long as the individual is an employee (21).

Some commenters thought more specific training requirements should be stated (30, 42, 44).

Staff Recommendation:

Although it can be argued that radiographers can get along without Parts 19, 20, and 34 of the regulations and can rely on the operating and emergency procedures, there is some value to their having copies of the actual wording of the regulations and the commitments the licensee has made to get his license.

In addition, posting of the regulations does not appear to be an adequate substitute for having the regulations on hand. Understanding the regulations requires concentrated and prolonged thought and attention difficult to attain while standing at a bulletin board.

An oral examination with a record of the date should be adequate for an assistant radiographer.

Retaining tests for 3 years would seem adequate since there is periodic retraining and presumably also retesting. That someone knew more than 3 years ago has little relevance.

More specific guidance on training is appropriate for a guide and would be too inflexible for the regulations. The Occupational Health Standards Branch plans to start a guide on this subject within about a year.

§ 34.33(a)

"(a) The licensee shall not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each such individual wears a direct reading

pocket dosimeter and either a film badge or a thermoluminescent dosimeter (TLD). Pocket dosimeters shall have a range from zero to at least 200 milliroentgens and shall be recharged at the start of each shift. Each film badge and TLD shall be assigned to and worn by only one individual."

Public Comments:

It was said that pocket dosimeters hold charge sufficiently well and can be recharged less frequently than at the start of each shift (24, 32). Daily was recommended (24).

One comment suggested that two high range dosimeters (0-5R and 0-100R) should be required (33). Another comment suggested restricting the range to 0-200 mR (32).

Staff Recommendation:

It is preferable for a radiographer's dosimeter to have available the full range for discharge and to have only his own exposure on the dosimeter. Therefore, recharging should be done at the start of shift.

There does not seem to be a real need for additional pocket dosimeters or restricting the range.

§ 34.33(c)

"(c) Pocket dosimeters shall be checked at periods not to exceed one year for correct response to radiation. Acceptable dosimeters shall read within plus or minus 30 percent of the true radiation exposure."

Public Comments:

Many commenters saw little purpose or need to check pocket dosimeters for accuracy (5, 8, 19, 25, 27, 46). Because a film badge or TLD

report becomes available later on, discrepancies would show up. Also, the most common mode of failure is charge leakage which causes the dosimeter to read high. This does not create a safety problem. Dosimeters would be reported as "drifting" or "unable to hold a charge." Accuracy checks would not result in any exposure reduction.

Other commenters thought the tolerance of $\pm 30\%$ was too wide (26, 35). Another commenter thought sufficient notice would be required to establish an acceptable method of testing pocket dosimeters (49).

Staff Recommendation:

Commercially available pocket dosimeters are now manufactured to meet the specifications in American National Standard N13.5-1972, "Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma Radiation." Manufacturers say they went to great effort to meet the standard. This standard contains tough requirements on ruggedness and accuracy. The standard has been adopted by Regulatory Guide 8.4. It would seem sufficient for radiographers to use dosimeters which meet the ANSI standard. Accuracy checks are largely redundant and unlikely to result in any exposure reduction. Comparison with the regular film badge or TLD report already provides a check on accuracy. The proposed amendment should be deleted.

§ 34.33(d)

"(d) If an individual's pocket dosimeter is discharged beyond its range, his film badge or TLD shall be immediately sent for processing.

The individual shall be prohibited from performing radiographic operations until the magnitude of the exposure has been evaluated."

Public Comments:

Many comments opposed requiring that a radiographer with a discharged dosimeter be prohibited from further work until his film badge or TLD was processed and his exposure known (1, 5, 12, 14, 16, 21, 25, 35, 38). It was said to be costly and unnecessary to take a man off the job for 2-3 days while the badge is being processed. Many comments though that an exception should be made when the dosimeter was just dropped.

Other commenters thought that the regulation should prohibit any further exposure to radiation, not just exposure in radiography (2, 26).

Staff Recommendation:

To prohibit further work when a dosimeter goes off scale and there is no indication of a radiation exposure would be a costly requirement for licensees and one with little likelihood of being obeyed. If a radiographer is in the middle of a job and his dosimeter is discharged - perhaps after being dropped - it is very unlikely that he will stop the job in the middle. More likely he will ignore the off scale reading and complete the work. The requirement as proposed would encourage disobeying the regulations and thus fail to provide the licensee management with a timely notice of a possible problem. As such the proposed regulation could cause more overexposures than it prevents.

Thus the proposal to prohibit further work should be withdrawn and the wording of this requirement left as is in the regulations presently. However, the statement of considerations will explain that a licensee is

required under § 20.201, "Surveys," to make an evaluation of the radiation hazards incident to the use of the radioactive source. If an actual overexposure has occurred and the licensee has not evaluated and corrected the situation, the licensee would be subject to considerably more severe enforcement action than if the hazard had properly evaluated and corrected.

§ 34.41

"During each radiographic operation not conducted in a permanent radiographic installation, the radiographer or radiographer's assistant shall maintain direct surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in Part 20 of this chapter."

Public Comments:

A comment suggested that locking should be an acceptable alternative to direct surveillance as presently allowed in the regulations (24). In a telephone call made to emphasize their concern, the commenter said that in constructing submarines, for example, it is often possible to positively prevent access by locking doors. If direct surveillance were substituted more personnel exposure would result in addition to extra cost.

Staff Recommendation:

Upon reconsideration of this point, there are good reasons to allow locking to serve as a substitute for direct surveillance to protect against unauthorized entry into a high radiation area. In general, it is more reliable to depend on mechanical devices or engineered safeguards than a human operator's actions. An operator attempting to maintain surveillance

over two or more entrances and simultaneously time the radiographic exposure, fill out his log, etc., can easily allow his attention to lapse for a moment. Someone could enter the high radiation area unseen. A lock has no such lapse of attention. In general, such locking will be more reliable than the operator's surveillance. The alternative of locking is consistent with the NRC's preference for relying on mechanical devices to assure safety instead of relying on proper operator action.

In addition, direct surveillance could be extremely expensive in situations where there are many entrances, which would not be guarded by one or two people. For example, in a submarine the high radiation area could extend over several levels and many corridors. Locking passageways could accomplish as much as a dozen men in preventing unauthorized entry. Similar situations could arise in radiography at nuclear power plants or similar industrial settings.

The staff also noted that the rule as proposed contained a major flaw. Section 34.41 deals with the security necessary to prevent inadvertant entry into a high radiation area by unauthorized personnel. This is quite separate from the question of alarms at permanent facilities; those alarms are aimed primarily at the radiographer himself. The § 34.41 should therefore not be amended.

§ 34.43(b)

"(b) A survey with a radiation detection instrument shall be made after each radiographic exposure to determine that the sealed source has returned to its shielded position in the radiographic exposure device. The

entire circumference of the device shall be surveyed. If the radiographic exposure device has a source guide tube, the survey shall include the guide tube."

Public Comments:

Several commenters opposed the requirement to survey the entire length of the guide tube (3, 4, 19, 21, 23, 24, 49). Surveying the entire length was said to be unnecessary (3, 4) needless (4), bothersome (4) and a waste of time (23). It was said to be ineffectual and would direct attention away from getting the radiographer to survey at all (19). One large company illustrated a survey technique which moved around the camera only, which they considered an excellent way to prove the source location (23). A manufacturer of submarines, who telephoned to elaborate on his comments, said that the requirement caused great difficulties for them because they often run the guide tubes through conduits which were not accessible for surveys or up scaffolding where a survey of the entire guide tube would be time consuming and dangerous (24).

Staff Recommendation:

There are adequate survey techniques to determine that the source has returned to its shielded position which do not include a survey of the entire length of the guide tube. However, a survey of the guide tube can be done quickly and easily and can show the radiographer in a very simple and unambiguous manner whether the source is in the guide tube.

§ 34.43(c)

"(c) When the use of a radiographic exposure device or storage container is to be terminated at the end of a work period, a survey with a radiation detection instrument shall be made of the locked radiography device or storage container to determine that the sealed source is in its shielded position. A record of the surveys required by this paragraph (c) shall be kept for two years."

Public Comments:

One comment said "the end of a work period" is vague (24). Another comment said records of this survey should not be required as there is already excessive paperwork (22).

Staff Recommendation:

The term "end of a work period" is vague. The wording should be changed to follow more closely the logic of the existing Part 34 by basing the requirement on the "direct surveillance" of the operation.

The survey at the end of work before the device is to be put in storage is important enough to require a record.

§ 34.43(d)

"(d) An area survey of the perimeter of the restricted area with a radiation detection instrument shall be made with the source exposed before or during the initial radiographic exposure on each shift and when the source-target configuration for an exposure is substantially different from that of the preceding exposure. These surveys are not required for radiography performed in a permanent radiographic installation."

Public Comments:

The major objection to this change was that for many short exposures of a few minutes or less there would not be enough time for the radiographer to survey the entire perimeter of the restricted area; therefore, the radiographer would have to expose the source before the actual exposure (8, 13, 19, 23, 25, 32, 34, 39, 45, 46). This was said to be an unnecessary exposure of the source which would cause more personnel exposure and result in more opportunity for accidents. It was stated that before the exposure the radiographer will calculate the restricted area boundary. Spot checks of the perimeter are then sufficient to verify the calculation (13). Comments also said that "substantially different" is too vague and that radiographers are fully capable of determining when a resurvey of the perimeter is necessary (13, 23, 32, 40).

One comment said records of these surveys should be required (43).

Staff Recommendation:

The staff recommends deletion of this paragraph. As written, the regulation would cause unnecessary radiation exposure of the radiographer, increase the opportunity for accidents, and be very time consuming and costly with little resulting benefit. The present Part 20 survey requirements are considered to be adequate.

Appendix A

"V. Case histories of Radiography Accidents"

Public Comments:

No one opposed teaching case histories of radiography accidents that have occurred, but numerous commenters thought the NRC should provide suitable study material.

Staff Recommendation:

No change in the proposed requirement. IE has recently published suitable accident case histories in NUREG-0495.

LIST OF COMMENTERS ON 10 CFR PART 34 AMENDMENTS
PROPOSED MARCH 27, 1978 (43 FR 12715)

1. Frank A. Malek, Jr., Training Department Manager, Gulf Nuclear, Inc., Houston, Texas.
2. Aubrey V. Godwin, Director, Division of Radiological Health, Alabama Department of Public Health.
3. Rex E. Vincent, Radiation Protection Officer, Chicago Bridge and Iron Company, Houston, Texas.
4. P. F. Lumbye, Manager, Product Assurance Department, Atlantic Research Corporation, Gainesville, Virginia.
5. Darrell Pruitt, Radiation Safety Officer, Pryor Foundry, Inc., Pryor, Oklahoma.
6. Bruce J. Sylvester, J. G. Sylvester Associates, Inc., Rockland, Mass.
7. Florentino F. Abrigo, Jr., Radiation Safety Officer, American X-Ray and Inspection, Inc., Farmington Hills, Michigan.
8. Royce G. Burris, Radiation Safety Officer, Kooney X-Ray, Inc., Houston, Texas.
9. William A. Mills, Director, Criteria and Standards Division, Office of Radiation Programs, U.S. Environmental Protection Agency, Wash. D.C.
10. James G. Stearns, Chief, Safety and Environmental Branch, Department of Energy Albuquerque Operations - Rocky Flats Area Office, Colo.
11. Robert W. Mullins, Civilian Operations Officer, Department of the Army, Lone Star Army Ammunition Plant, Texarkana, Texas.
12. Joe D. Hinton, Inspection Group Supervisor, Thiokol/Louisiana Division, Shreveport, Louisiana.
13. John W. Huffman, Radiation Protection Officer, The Hartford Steam Boiler Inspection and Insurance Company, Deep River, Connecticut.
14. David M. Anderson, Manager, Environmental Quality Control, Bethlehem Steel Corp., Bethlehem, Pennsylvania.
15. Thomas L. Junod, Associate Chief, Office of Environmental Health, NASA, Lewis Research Center, Cleveland, Ohio.

16. Walter P. Peeples, Jr., President, Gulf Nuclear, Inc., Houston, Texas.
17. J. A. Tipton, Radiation Safety Officer, Litton/Ingalls Shipbuilding, Pascagoula, Mississippi.
18. Todd Wolmoth, Radiation Safety Officer, CAM Industries, Kent, Washington.
19. Eric T. Clarke, Vice President, Technical Operations, Inc., Boston, Mass.
20. H. Glasser, General Manager, Nuclear Associates, Carle Place, NY.
21. William E. Morgan, Chief, Radiation Health Protection, The Boeing Company, Seattle, Washington.
22. Clifford A. Asvitt, Director, Maintenance Inspection and Control, United Airlines, San Francisco, California, submitted by the Air Transport Association, Washington, D.C.
23. George R. Henke, Radiation Safety Officer, Kaiser Steel, Napa, CA.
24. J. F. Dallinger, Principal Engineer, General Dynamics Electric Boat Division, Groton, Connecticut.
25. Otis C. Gamble, Radiation Safety Officer, Nuclear Energy Services, Inc., Conan Inspection Division, Houston, Texas.
26. R. J. Tuttle, Manager, Radiation and Nuclear Safety, Atomics International Division of Rockwell International, Canoga Park, CA.
27. William O. Parker, Jr., Vice President, Duke Power, Charlotte, NC.
28. Gary R. Elder, Assistant Radiation Protection Officer, Townsend and Bottum, Inc., Ann Arbor, Michigan.
29. Kenneth F. Sinclair, President, Xetex, Inc., Redwood City, California.
30. Timothy C. Mather, Manager, Industrial Relations Department, Motor Vehicle Manufacturers Association, Detroit, Michigan.
31. Bruce Kovacs, Senior Radiographer and Corporate Radiation Safety Officer, Foster Wheeler Energy Corporation, Livingston, NJ.
32. Michael H. Mobley, Radiological Physicist and Johnny C. Graves, Radiological Physicist, Division of Radiological Health, Tennessee Department of Public Health.
33. William J. Friedman, Certified Health Physicist, Health Physics Consultants and Engineering, Sacramento, California.

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34. John J. Munro, III, Technical Director, Tech/Ops, Radiation Products Division, Burlington, Mass.
35. Larry Buzan, Manager, Quality Assurance, Esco Corporation, Portland, Ore.
36. Ronald P. DiPiazza, Manager, NES License Administration, Water Reactor Divisions, Westinghouse Electric Corporation, Pittsburgh, Pennsylvania.
37. A. A. Arcuni, Special Assistant for Nuclear Programs, Department of the Navy, Naval Facilities Engineering Command, Alexandria, VA.
38. David D. Snellings, Jr., Director, Division of Radiological Health, Bureau of Environmental Health Services, Arkansas Dept. of Health.
39. Albert J. Hazle, Director, Radiation and Hazardous Wastes Control Division, Colorado Department of Health.
40. Johnny C. Graves, Radiological Physicist, Division of Radiological Health, Tennessee Department of Public Health.
41. Marshall W. Parrott, Manager, Radiation Control Section, Health Division, Oregon Department of Human Resources.
42. Aubrey V. Godwin, Director, Division of Radiological Health, Alabama Department of Public Health.
43. Martin C. Wukasch, Director, Division of Occupational Health and Radiation Control, Texas Department of Health.
44. Robert D. Funderburg, Supervisor, Radiation Control Section, Idaho Department of Health and Welfare.
45. B. Jim Porter, Administrator, Nuclear Energy Division, State of Louisiana.
46. John P. Lanham, Public Health Physicist, Radiological Health Program, Florida Department of Health and Rehabilitation Services.
47. Nancy P. Kirner, Health Physicist, and R. C. Will, Supervisor, Radiation Control Program, Washington (State) Department of Social and Health Services.
48. J. C. McArthur, Commander, Pearl Harbor Naval Shipyard, Hawaii.
49. R. D. White, Forman-Inspection and NDT, Frontier Airlines, Denver, Colo.

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