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OCT 16 1986

MEMORANDUM FOR: John D. Evans, Director  
Planning and Program Analysis Staff

FROM: Richard E. Cunningham, Director  
Division of Fuel Cycle and Material Safety

SUBJECT: NRC SENIOR MANAGEMENT MEETING (NMSS #86-960)

Below is a list of questions posed in your October 9, 1986, memorandum along with the Division of Fuel Cycle and Material Safety's responses:

Question 1      How many requirements did NMSS impose upon licensees during the past year (FY-86)?

Answer:              New conditions are imposed upon Fuel Cycle licensees almost every time a license is amended. Enclosed are three examples with the appropriate sections high lighted (Enclosures 1 thru 3).

In addition, we circulated a letter dated July 17, 1986 (Enclosure 4), along with NUREG-1198, the Lessons Learned Group (LLG) Report of the Sequoyah Release to thirty-one licensees. The LLG Report contained 10 recommendations that affect 12 licensed facilities and 14 recommendations that affect 31 facilities. The other LLG recommendations stand to impact licensees in the future. Although no new requirements arose during FY-86, licensees were urged to give early consideration to the LLG recommendations.

Question 2              How many of the requirements have been implemented by the licensees?

Question 3              For how many of the items has implementation been verified by NRC?

Answer 2 and 3:        For specific license conditions, our assurance of license compliance is derived in the following ways:

- We communicate with the Regional inspectors notifying them of the new conditions we intend to impose so that the inspectors can verify compliance.
- We emphasize the new conditions verbally and in writing with licensees before issuing the license amendments.

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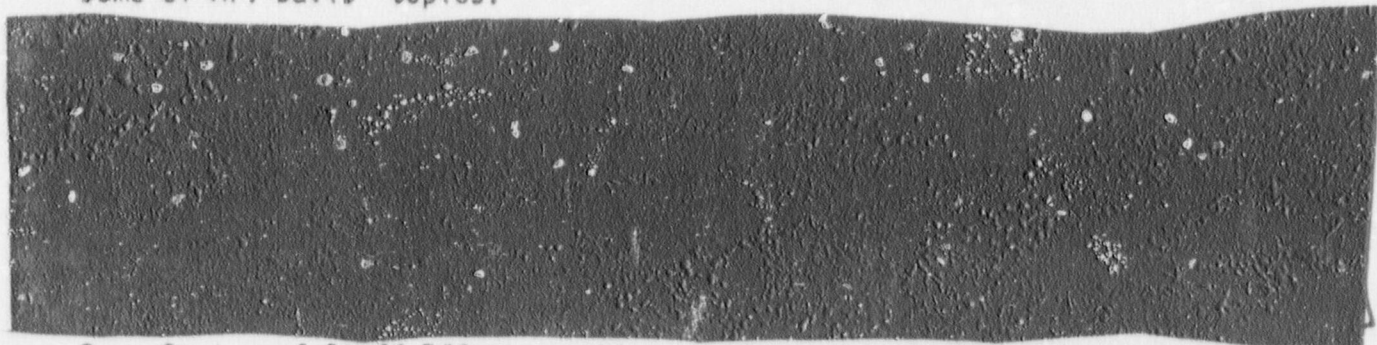
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- We document the new conditions, both in the license itself and/or in the accompanying Safety Evaluation Reports.

With respect to the LLG recommendations, we do not yet know what actions are being taken by licensees as a result of our urging them to consider the LLG recommendations. However, special team inspections are being conducted at the 12 licensed fuel facilities to review their status with respect to the applicable LLG recommendations and other operational safety areas. These have been completed for four facilities during FY-86. (Inspection reports are available for Sequoyah and Allied, but are not yet available for UNC Naval Products or C. E. Windsor.)

On a closely related subject, Mr. Davis sent a memorandum to Mr. Mausshardt dated October 10, 1986. We think we should provide certain information on some of Mr. Davis' topics.



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## 2. Status of Staff Efforts on Licensee Reporting Issue

The incident involving the recovered gauge formerly licensed with CE Glass has prompted the following NRC actions:

- a. IE developed a manual chapter (which is nearly ready in final form). It specifies that all licensees should be contacted annually (on a resource available basis) by telephone if they are not inspected. In these calls, the Regional staff would check the status of the programs by administering a short telephone questionnaire. If problems are identified, inspections would be scheduled.
- b. NMSS staff (FCML) is still coordinating with RES and IE regarding initiation of rulemaking to require licensees to report periodically the status of their programs to NRC and/or respond to the questionnaires.

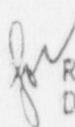
## 3. Tracking of License Implementation of NMSS Requirements

- How is it done now? See answers 2 and 3 above.

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- Population of these items and our knowledge of status of completion - see Enclosure 6.
- Plans and status of doing this on computer - Already underway, for details see previous responses: NMSS #86-765 and NMSS #86-786 (Enclosure 7).

Original signed by  
Ralph M. Wilde

 Richard E. Cunningham, Director  
Division of Fuel Cycle and  
Material Safety

cc: Mr. Davis  
Mr. Mausshardt

Enclosures: As stated

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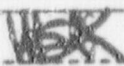
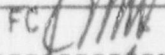
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AEOD/N601

REPORT ON 1985 NONREACTOR EVENTS AND  
FIVE-YEAR ASSESSMENT FOR 1981-1985

by the

Nonreactor Assessment Staff  
Office for Analysis and Evaluation  
of Operational Data

Prepared by:  
Kathleen M. Black

This report characterizes the Nonreactor Event Report (NRER) database maintained by the Office for Analysis and Evaluation of Operational Data. This report does not contain detailed analyses of individual events, but focuses on an attempt to identify potential and actual problem areas, and address the status of NRC activities in those areas.

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## REPORT ON 1985 NONREACTOR EVENTS AND FIVE-YEAR ASSESSMENT FOR 1981-1985

### 1. INTRODUCTION

The responsibilities of the Office for Analysis and Evaluation of Operational Data (AEOD) include the maintenance of data bases for the storage and retrieval of operational experience data and the systematic review of operational safety data. The Nonreactor Assessment Staff (NAS) prepares periodic reviews of current nonreactor data reports to provide an overview of these reports. This report contains a review of the 1985 nonreactor events, as well as an assessment of the events reported in the five-year period from 1981-1985.

### 2. THE NONREACTOR EVENT REPORT DATABASE

The AEOD Nonreactor Event Report (NRER) database contains information on licensed nuclear materials and fuel cycle operational events and on personnel radiation exposure events. The NRER database management system\* provides for input, storage, retrieval, and computer-assisted analyses of operational event data, and may be used to identify trends in operational safety events which may signal a need for remedial actions by the NRC and/or licensees.

AEOD generally does not incorporate information on transportation events into the NRER database since the Department of Energy funds a transportation incident file at Sandia. Their report on Radioactive Material (RAM) Transportation Accident/Incident Analysis (SAND-85-1016) contains information about this database, and summarizes data for the period 1971-1985.

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\*The NRER database utilizes the System 1022 database management system which operates on the Oak Ridge National Laboratory (ORNL) DEC System-10 computer.

In the past, the NRC's Office of State Programs (SP) collected reports of events at Agreement State licensees and published semiannual reviews of these events. The OSP publication was suspended after the review of 1984 events. Agreement States cooperate with the NRC in reporting Abnormal Occurrence events and OSP is in communication with Agreement States concerning significant events. Beginning in 1985, AEOD began a more extensive effort to enter into the database information forwarded by OSP on significant events at Agreement State licensees.

### 3. REVIEW OF 1985 NONREACTOR EVENTS

#### 3.1 Categorization of Events

The NRER database includes 170 records of events that occurred during 1985. Information on these events was contained in reports submitted by nonreactor licensees to the Regional Offices or in other documents, primarily inspection reports. Table 1 provides information on the types of licensees for which information was entered into the database. The database does not include information from certain fuel cycle licensee reports, such as those related to routine effluent releases, nor does it include information from reports of medical misadministrations.\*

Table 2 provides information on how the event information was categorized and entered into the database. An NRER database item may be associated with more than one category of event. For example, a report from a radiography licensee concerning a personnel radiation exposure would be counted in the total number of radiation exposure events as well as in the total number of events involving radiography. The 170 nonreactor licensee reports were cataloged as 318 entries in nine different areas. Note that, because some reports are associated with more than one event category, the total number of events exceeds the total number of reports.

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\*The results of AEOD studies of medical misadministrations are published elsewhere.



TABLE 1

TYPES OF LICENSEES THAT SUBMITTED REPORTS DURING 1985

<u>LICENSE TYPE</u>	<u>NUMBER OF REPORTS RECEIVED*</u>
ACADEMIC	1
MEDICAL	50
COMMERCIAL/INDUSTRIAL MEASURING SYSTEMS	38
WELL LOGGING (23)	
OTHER MEASURING SYSTEMS (15)	
MANUFACTURING AND DISTRIBUTION (EXCLUDING MEDICAL)	17
INDUSTRIAL RADIOGRAPHY	17
SINGLE LOCATION (IN PLANT) (2)	
MULTIPLE LOCATIONS (FIELD) (15)	
IRRADIATOR	3
R&D	9
SOURCE MATERIALS**	1
MILLS (1)	
UF6 FACILITIES (0)	
OTHER (0)	
SPECIAL NUCLEAR MATERIAL (INCLUDING PLUTONIUM)	5
AGREEMENT STATE	16
OTHER***	<u>13</u>
TOTAL	170

\*MEDICAL MISADMINISTRATION REPORTS ARE NOT INCLUDED.

\*\*ROUTINE ENVIRONMENTAL EFFLUENT RELEASE REPORTS, E.G., REPORTS REQUIRED BY 40.65 AND 70.59 WERE NOT INCLUDED IN THE TOTALS FOR SOURCE AND SPECIAL NUCLEAR MATERIALS LICENSEES.

\*\*\*NUMBER INCLUDES REPORTS RECEIVED FOR WHICH NO PROGRAM CODE WAS AVAILABLE.

TABLE 2  
CATEGORIZATION OF NONREACTOR EVENT REPORTS

<u>CATEGORY*</u>	<u>NUMBER OF REPORTS ASSOCIATED</u>
PRIMARY CATEGORIES:	
PERSONNEL RADIATION EXPOSURES	34
LOST, ABANDONED, AND STOLEN MATERIAL	54
LEAKING SOURCES	29
RELEASE OF MATERIAL	8
CONSUMER PRODUCTS	5
SECONDARY CATEGORIES:	
FUEL CYCLE (E.G., MILLS, UF <sup>6</sup> FACILITIES, SPECIAL NUCLEAR MATERIAL)	6
INDUSTRIAL RADIOGRAPHY	17
MANUFACTURING AND DISTRIBUTION (INCLUDING MEDICAL)	36
COMMERCIAL/INDUSTRIAL MEASURING SYSTEMS (EXCLUDING WELL LOGGING)	15
OTHER**	<u>115</u>
TOTAL	319

\*AN NRER DATABASE ITEM MAY BE ASSOCIATED WITH MORE THAN ONE CATEGORY OF EVENT FOR EXAMPLE, A REPORT FROM A RADIOGRAPHY LICENSEE CONCERNING A PERSONNEL RADIATION EXPOSURE WOULD BE COUNTED IN THE TOTAL NUMBER OF RADIATION EXPOSURE EVENTS AS WELL AS IN THE TOTAL NUMBER OF EVENTS INVOLVING RADIOGRAPHY.

\*\*OTHER INCLUDES CATEGORIES SUCH AS MEDICAL, TRANSPORTATION, MISCELLANEOUS, ETC.

Certain categories in Table 2 are primary categories; that is, they contain events from all types of licensees. These primary categories are: exposures; lost, abandoned, or stolen material; leaking sources; releases of material; and consumer products. With few exceptions, most events are assigned to only one of the categories.

The secondary categories in Table 2 are designed to capture events by the type of licensee involved in the event. Many of the events assigned to these categories are also assigned to primary event categories. Secondary categories generally serve as a measure of the frequency with which certain types of licensees make reports to the NRC.

### 3.1.1 Radiation Exposure Events

The criteria that define overexposures are defined in 10 CFR 20.205 (a)(1). The limits are:

#### Restricted areas:

whole body	1-1/4 rem/calendar quarter, or 3 rem/calendar quarter, if the individual's prior occupational exposure is obtained in writing, and the accumulated exposure does not exceed 5 (N-18), where N is the individual's age
extremity	18-3/4 rem/calendar quarter
skin	7-1/2 rem/calendar quarter
inhalation	40 MPC hours/week for 13 weeks, MPC (maximum permissible concentration) is given in 10 CFR Appendix B, Table I, Col 1)
minors	10% of above limits

#### Unrestricted areas:

individuals	0.5 rem/year, subject to rate limitations
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The NRER database contains information from 34 reports of events that occurred during 1985 in which there was the potential for, or an actual radiation overexposure. Of these 34 events, 21 involved actual radiation overexposure. Information on the 34 overexposure reports is provided in Table 3. The types of licensees associated with the actual overexposures reported during 1985 were as follows:

<u>Licensee Type</u>	<u>Number of Overexposure Events</u>	<u>Total Number of Individuals Exposed</u>
Medical/Academic	7	7
Radiography	9	12
Commercial/Industrial	<u>5</u>	<u>14</u>
Total	21	33

Overexposures at Medical or Academic Licensees - The seven reported events at medical and academic licensees included: three whole body exposure reports, with exposures of 1.75, 2.06, and 3.9 rem/quarter; three skin exposures of 8, 23.73 and 32 rem/quarter; and an extremity exposure of 20.29 rem/quarter. All of these reports came from different licensees.

The extremity exposure of 20.29 rem was attributed to exposure from use of a fluoroscopy device, and was reportable because the individual also worked with radioactive materials. The 32 rem skin exposure resulted when an experimenter was contaminated from spray when a vial was being opened; the 23 rem skin exposure resulted from a contamination accident at a hospital; and the 3.9 rem whole body dose, although counted as an actual exposure by the licensee, could not be explained. The other three overexposures represented comparatively small overexposures.

None of the overexposures at medical or academic licensees was large.

TABLE 3

PERSONNEL RADIATION EXPOSURE, 1985

LICENSEE	LICENSE NUMBER*	LOCATION	EVENT DATE	NO EXP	TYPE EXPOSURE	OTHER ACTIVITY**
3M CO	220005706	ST PAUL	MN 10/01/1985	1	EXTREMITY	MAD
BASIN INDUSTRIAL X-RAY INC	AS	MIDLAND	TX 11/09/1985	1	WHOLE BODY	RAD
BASIN TESTING LAB	AS	WILLISTON	ND 3/30/1985	2	WHOLE BODY	RAD
BELOIT MEMORIAL HOSPITAL	481128102	BELOIT	WI 4/01/1985	1	WHOLE BODY	MD1
BRAND EXAMINATION SERVICES	061715601	FREDERICK	MD 2/07/1985	1	WHOLE BODY	RAD
CALUMET TESTING SERVICES	131634701	BURNS HARBOR	IN 6/14/1985	1	EXTREMITY	RAD
CONSOLIDATED X-RAY	420845602	DALLAS	TX 3/01/1985	1	WHOLE BODY	RAD
DAYTON X-RAY CO	340694301	DAYTON	OH 3/30/1985	0	WHOLE BODY	RAD
E I DUPONT	290088601	DEEPWATER	NJ 10/08/1985	0	BADGE	GAU
E I DUPONT	200032009	NC BILLERICA	MA 11/18/1985	1	EXTREMITY	MAD
EXAM CO	351619101	LABARGE	WY 9/26/1985	2	WHOLE BODY	RAD
HOUSTON INSPECTION LAB	352336201	TULSA	OK 8/01/1985	0	BADGE	RAD
ICI AMERICAS INC	451483701	HOPEWELL	VA 2/01/1985	1	WHOLE BODY	GAU
JIM BRIDGER COAL STATION	GL	CRYSTAL	WY 10/18/1985	10***	WHOLE BODY	GAU
JOSE T MEDINA MD	521493101	CRYSTAL	PR 5/01/1985	1	WHOLE BODY	MD1
KAY RAY INC	121118401	ARLINGTON HTS	IL 5/13/1985	1	EXTREMITY	MAD
LUCY LEE HOSPITAL	241665202	POPLAR BLUFF	MO 6/07/1985	1	WHOLE BODY	MD1
MCDOWELL & ASSOC.	211872401	FERNDAL	MI 5/10/1985	0	BADGE	GAU
NANTICOKE MEMORIAL HOSP	071761801	SEAFORD	DE 6/28/1985	0	OTHER	MD1
NANTICOKE MEMORIAL HOSP	071761801	SEAFORD	DE 3/14/1985	0	OTHER	MD1
NUCLEAR PHARMACY INC	202122701		6/21/85	0	EXTREMITY	MD1
PITTSBURGH TESTING LAB	370027625	NEWELL	WV 4/04/1985	0	EXTREMITY	RAD
PRINCETON UNIVERSITY	290518524	PRINCETON	NJ 5/07/1985	1	SKIN	MSC
PULLMAN POWER PRODUCTS CORP.	370804201	WAYNESBORO	GA 10/06/1985	1	WHOLE BODY	RTR RAD
RIO ALGOM CORPORATION		MOAB	UT 5/12/1985	0	INTERNAL	FCI
SOUTHWEST X-RAY	032135401	LITTLE ROCK	AR 6/01/1985	0	WHOLE BODY	RAD
ST BARNABAS MEDICAL CENT	290160803	LIVINGSTON	NJ 1/25/1985	0	BADGE	MD1
ST BARNABAS MEDICAL CENTER	290160803	LIVINGSTON	NJ 1/30/1985	1	SKIN	MD1
TRANS-EASTERN INSPECTION IN	371485501	WASHINGTON	PA 10/08/1985	1	WHOLE BODY	RAD
VALLEY HOSPITAL	290384501	RIDGEWOOD	NJ 2/01/1985	1	EXTREMITY	MD1
VETERANS ADMINISTRATION	40091604	SEPULVEDA	CA 6/14/1985	1	SKIN	MD1
WASHINGTON HOSPITAL CENTER	80360401	WASHINGTON	DC 4/01/1985	0	BADGE	MD1
WESTERN STRESS CO	492349001	EVANSTON	WY 8/01/1985	2	WHOLE BODY	RAD
WORLD TECHNICAL SERVICES	AS	HOUSTON	TX 2/11/1985	2	WHOLE BODY	RAD

\*AS AGREEMENT STATE LICENSEE  
GL GENERAL LICENSEE

\*\*ACTIVITY TO WHICH EXPOSURE WAS ATTRIBUTED  
FCI MILLING  
GAU GAUGE USE  
MAD MANUFACTURING AND DISTRIBUTION  
MD1 MEDICAL  
MSC MISCELLANEOUS  
RAD RADIOGRAPHY

\*\*\*NO ESTIMATE OF OVEREXPOSURE AVAILABLE.

Overexposures at Radiography Licensees - The nine overexposure events at radiography licensees included one extremity overexposure and eight whole body overexposures. The doses involved in these events were:

extremity exposure	98-288 rem to small part of palm
whole body exposures	1.275 rem
	2.510 rem
	3.26 rem and 4.5 rem (2 individuals)
	8 rem
	15.59 rem
	8-31 rem and 8 rem (2 individuals)
	34 rem and 8 rem (2 individuals)
	128 rem

Four of the nine radiography events resulted in small overexposures. In the remaining five, the overexposures ranged from moderate (5-25 rem whole body; <375 rem extremity) to large (>25 rem whole body).

The individual who received 128 rem whole body in the overexposure event at Basin Industrial Testing, Midland, TX, also showed evidence of high extremity dose (blister on hand). The Texas Department of Health, Bureau of Radiation Control, has characterized the activities of this licensee as showing a "pattern of violations [that] ultimately lead to an employee being seriously injured by overexposure to radiation."

The radiography events were reported by different licensees. However, eight of the nine events, and all of the events in which there were large overexposures occurred during radiography at remote sites (i.e., not fixed sites). See Section 3.2 below for a discussion of Abnormal Occurrences.

Overexposures at Commercial/Industrial Licensees - The five overexposures at commercial or industrial licensees consisted of: two extremity exposures (19.1 and 19.41 rem/quarter); an overexposure of 1.76 rem whole body; and an event resulting in a skin exposure (thumb) of 93 rem. Ten workers worked for 70 hours near an



unshielded 500 mCi Cs-137 source in an event at the Jim Bridger Coal Station, a general licensee.

The overexposures at these licensees were marginally above the regulatory limits. No data, however, are available on the estimated exposures.

In general, with the exception of the overexposures at radiography licensees, most of the overexposures reported during 1985 were small. Of the nine reported overexposures of radiographers, three resulted in whole body overexposures to individuals in excess of 20 rem, with one event resulting in serious injury from radiation.

### 3.1.2 Lost, Abandoned, and Stolen Material

Licensees are required to report the loss or theft of licensed material that has occurred in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas (10 CFR 20.402(a)(1)). The proposed Part 20 specifies activity limits below which written reports need not be made. Irretrievable well-logging sources must be reported pursuant to 10 CFR 30.55 and 70.60.

Fifty-four events occurred during 1985 that involved lost, abandoned, or stolen licensed material. These events are summarized in Table 4. These events consist of 32 reports of lost or stolen material, plus 22 reports of abandoned, irretrievable well-logging sources. None of the 54 events resulted in a known radiation overexposure.\*

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\*An event, not involving U.S. licensed radioactive material, occurred in Morocco. A lost or stolen radiography source is reported to have caused gross overexposure of several members of the public.

TABLE 4

(Part 1)

LOST OR STOLEN SOURCES, 1985

ISO- TOPE	LOCATION	LICENSEE	LICENSE NUMBER	EVENT DATE	DISPOSITION
AM241	LITTLE ROCK	AR MCCLELLAN ENGINEERS INC	31724301	7/15/1985	UNKNOWN
AM241	MUNDELEIN	IL JOHN MATHES & ASSOC.	121876001	8/06/1985	FOUND
AM241	PLYMOUTH	IN DELMONTE CORP	GL	8/01/1985	FOUND
AM241	GRAND ISLE	LA SCHLUMBERGER	420009003	10/18/1985	FOUND (LOST '79)
AM241	TROY	MI TESTING ENGINEERS & CONSULT	211866801	11/16/1985	UNKNOWN
AM241	NEENAH	WI AMERICAN CAN CO	GL	2/28/1985	UNKNOWN
AM241	CASPER	WY CENTENNIAL ENGINEERING, INC	491971101	6/27/1985	FOUND
CO57	CINCINNATI	OH OTTO C EPP MEM HOSPITAL	341886801	7/15/1985	UNKNOWN
CO60	FT MCCLELLAN	AL DEPT OF ARMY	10286105	1/25/1985	FOUND
CS137	OPELIKA	AL UNIROYAL TIRE CO	AS	5/01/1985	UNKNOWN
CS137	ST LOUIS	MO MCDONNELL DOUGLAS	240226103	9/26/1985	UNKNOWN
CS137	DAYTON	OH BOWSER-MORNER TESTING LAB	341739001	9/10/1985	UNKNOWN
CS137	GRAHAM	TX SCHLUMBERGER	AS	2/13/1985	FOUND
H3	FARMINGTON	CT UNIV OF CONN	61302202	1/22/1985	UNKNOWN
H3	CHAPEL HILL	NC UNIV OF NORTH CAROLINA	AS	7/22/1985	UNKNOWN
I125	ARLINGTON HTS	IL AMERSHAM CORP	121283601	2/20/1985	FOUND
I125	ALTOONA	PA MERCY HOSPITAL	370338702	3/18/1985	UNKNOWN
I125	PITTSBURGH	PA MONTEFIORE HOSPITAL	370086510	4/12/1985	COMM. WASTE DISP.
I131	NEW BRUNSWICK	NJ E R SQUIBB & SONS INC	290013904	9/18/1985	UNKNOWN
I131	JOHNSTOWN	PA CONEMAUGH VALLEY HOSPITAL	370187301	8/28/1985	COMM. WASTE DISP.
IR192	SAN DIEGO	CA VETERANS ADMIN MED CTR	41503061	5/01/1985	UNKNOWN
KR85	BRUSSELS	ACCURAY CORP	340025506	1/03/1985	FOUND
KR85	FT S HOUSTON	TX DEPT OF ARMY	290102211	1/07/1985	UNKNOWN
PM147	LITTLE CREEK	VA DEPT OF NAVY	80597002	8/17/1985	OTHER*
PO210	WAHPETON	ND 3M CO	AS/GL	7/29/1985	UNKNOWN
PU239	LEXINGTON	KY DEPT OF ARMY		6/17/1985	UNKNOWN
SNM	ALLIANCE	OH BABCOCK & WILCOX	340304303	4/02/1985	COMM. WASTE DISP.
SR90	CHUGACH	AK DEPT OF ARMY	422353901	9/23/1985	OTHER**
7C99M	GRAND RAPIDS	MI SYNCOR INTERNATIONAL CORP	211921901	4/10/1985	***
U235	SAN DIEGO	CA G A TECHNOLOGIES INC		6/30/1985	UNKNOWN
XE133	LONG BRANCH	NJ MONMOUTH MEDICAL CTR	290811303	9/01/1985	COMM. WASTE DISP.
Y	BOSTON	MA BETH ISRAEL HOSP	200074218	9/27/1985	COMM. WASTE DISP.

\*LOST IN CHESAPEAKE BAY

\*\*LOST IN EAGLE RIVER GLACIER, CHUGACH STATE PARK, AK

\*\*\*THEFT OF BRIEFCASE CONTAINING RADIOPHARMACEUTICALS; SYRINGES CRIED  
BY TRAFFIC, CONTAMINATING ROAD

TABLE 4

(Part 2)

IRRETRIEVABLE WELL-LOGGING SOURCES, 1985

ISO- TOPE	LOCATION	LICENSEE	LICENSE NUMBER	EVENT DATE
AM241*		DRESSER INDUSTRIES	420296401	2/14/1985
AM241*	OFFSHORE	GEARHART OWEN INDUSTRIES	420645803	10/18/1985
AM241*	OFFSHORE	GEARHART OWEN INDUSTRIES	420645803	2/21/1985
AM241*	OFFSHORE	SCHLUMBERGER	420009003	1/13/1985
AM241*	OFFSHORE	SCHLUMBERGER	420009003	2/19/1985
AM241*	OFFSHORE	SCHLUMBERGER	420009003	3/21/1985
AM241*	OFFSHORE	LA GEARHART OWEN INDUSTRIES	420645803	10/06/1985
AM241*	OFFSHORE	LA SCHLUMBERGER	420009003	7/17/1985
AM241*	CUSTER CTY	OK DRESSER INDUSTRIES	420296401	8/16/1985
AM241*	MCCLAIN CTY	OK GEARHART OWEN INDUSTRIES	420645803	2/26/1985
AM241*	CUSTER CTY	OK GEARHART OWEN INDUSTRIES	420645803	5/18/1985
AM241*	TEXAS CNTY	OK GEARHART OWEN INDUSTRIES	420645803	6/02/1985
AM241*	OFFSHORE	TX DRESSER INDUSTRIES	420296401	3/11/1985
AM241*	OFFSHORE	TX SCHLUMBERGER	420009003	11/12/1985
AM241*	CAMPBELL CTY	WY GEARHART OWEN INDUSTRIES	420645803	1/29/1985
CS137	OFFSHORE	CONOCO INC	420296401	4/27/1985
CS137		SCHLUMBERGER	420009003	6/20/1985
CS137		LA DRESSER INDUSTRIES	420296401	6/26/1985
CS137	OFFSHORE	LA DRESSER INDUSTRIES	420296401	8/03/1985
CS137	PITTSBURG	OK DRESSER INDUSTRIES	420296401	8/07/1985
CS137	CIMMARON CTY-	OK GEARHART OWEN INDUSTRIES	420645803	11/09/1985
CS137	WIRT CTY	WV YOUNG WIRELINE	472535101	5/05/1985

\*IN MOST CASES, A CS137 SOURCE WAS LOST WITH THE AM241 SOURCE.



Of the 32 reports of lost or stolen material, 9 concerned nuclear gauges, one concerned static eliminator bars, and 22 material in other forms. Of the nine missing gauges, five were portable gauges stolen from vehicles or construction trailers; of the five, two were found undamaged. Of the remaining four events involving lost gauges, one involved the loss by the U.S. Navy of a gauge in the Chesapeake Bay; and three, the loss of fixed gauges. In one of the latter events, a generally licensed gauge containing 200 mCi of Am-241, was found at a scrap yard (Delmonte Corp.). In another event, four gauges containing Cs-137 sources licensed by Alabama were reported missing by Uniroyal Tire Co. One was recovered. During an attempt to find the other three gauges an overflight to monitor the area identified Cs-137 contamination at a pipe and foundry company, however, no positive evidence traces the lost gauges to the foundry. No information is available on the third event. The event involving static eliminator bars covered three bars that were generally licensed material.

The remaining 22 events concerned material that was not in the form of a gauge source. Six involved very small amounts of radioactivity. (If the criteria the proposed 10 CFR Part 20 were applied to the six, they would not have been reportable.) In five, the material was found; in four, the material is probably sent to commercial waste disposal; in one, stolen syringes containing radiopharmaceutical doses were run over by a vehicle, resulting in local contamination of a road by technetium-99m; and in one, a helicopter crash resulted in the loss of strontium-90 sources (five sources of 100 mCi each) on the Eagle River glacier in Alaska, where recovery was not possible.

Of the other five events involving lost material, three of the five involved iodine or iridium-192 seeds that were lost by hospitals; one involved the improper disposal over a 30-year period of a very large number of metal bars, each one of which contained a small amount (about 100 uCi) of Cs-137; and in one event, the Department of Army reported that a calibration set containing 23 ug (approximately 1.5 uCi) Pu-239 was lost between Korea and Kentucky.

Abandoned Well-Logging Sources - NRC licensees are required to report the location of abandoned well-logging sources to NRC. The 22 events shown in Table 4 (Part 2) did not result in any known releases.

### 3.1.3 Leaking or Contaminated Sources

Certain licensees are required to leak test sources and to report leaking sources under 10 CFR 34.25; others are required to leak test sources and to report leaking sources as a license condition. In both cases, a removable contamination exceeding the most common test limit for removable contamination (0.005 uCi) is considered evidence of leakage, and must be reported to NRC.

Twenty-nine events of leaking or contaminated sources occurred during 1985. Information from the reports is included in Table 5. None of the events resulted in a radiation overexposure. The isotopic sources found to be leaking or contaminated contained americium, cesium, iodine, or nickel.

About half of the 29 events were reports of small, individual sources found to be leaking or contaminated. Two source leakage events were attributed to damage to the source during use. In an additional 13, there was some evidence of a manufacturing or use problem.

- Five reports, four from Beta Diagnostics, and one from AECL concerned the leakage of I-125 sources used in medical procedures.
- Two events concerned leaking Ir-192 radiography sources shipped from Gamma Industries occurred in 1985. Following one event, Gamma Industries committed to bubble testing all sources.
- Two reports of leak tests of ion chambers containing Am-241 were received from the Air Force. AEOD had performed an engineering evaluation of similar sources found to be leaking in prior years. These sources were installed in missile silos and may have been exposed to corrosive atmospheres. In addition, the specific manufacturing process used to hold the source in

TABLE 5  
REPORTS OF LEAKING SOURCES, 1985

ISO- TOPE	LOCATION	LICENSEE	LICENSE NUMBER	EVENT DATE	MANUFACTURER
AM241	LITTLE ROCK	AR DEPT OF AIR FORCE	151381201	1/08/1985	
AM241	MCCONNELL	KS DEPT OF AIR FORCE	151381201	11/14/1985	
AM241	ST LOUIS	MO WASHINGTON UNIV SCH OF MED	240016711	1/27/1985	AMERSHAM TRC
AM241	MARCUS HOOK	PA SUN CO	370827503	11/13/1985	
AM241	FT WORTH	TX PENG0 INDUSTRIES	421967101	5/01/1985	
CS137		OUACHITA BAPTIST UNIVERSITY	AS	5/14/1985	
CS137		AR AGREEMENT STATE LICENSEE	AS	6/05/1985	
CS137	ARLINGTON HTS	IL KAY RAY	121118401	2/28/1985	
CS137	CHICAGO	IL UNIVERSITY OF ILLINOIS	120008806	1/17/1985	3M
CS137	BELTSVILLE	MD DEPT OF AGRICULTURE	190091506	8/29/1985	
CS137		NC TROXLER ELECTRONIC LAB	AS	9/01/1985	
CS137	STONE CREEK	OH PERFECTION SERVICES INC	341630501	5/01/1985	GULF NUCLEAR CSV-898
FE55	ANDOVER	MA ANALYTIC MARKETING, INC.	201984202	6/06/1985	
H3		CO UNIV OF COLORADO	62080402	10/07/1985	BRANDHURST
I125	KANATA	ON ATOMIC ENERGY OF CANADA LTD	482439501	4/15/1985	
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	4/15/1985	
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	4/24/1985	AECL C-235
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	5/06/1985	
I125	FT ATKINSON	WI NORLAND CORP	481340302	4/16/1985	
IR192		CT STONE & WEBSTER	600560002	2/21/1985	GAMMA IND
IR192	BREMERTON	WA DEPT OF NAVY	460307801	3/06/1985	GAMMA IND
KR85	CINCINNATI	OH OHMART	340063903	4/03/1985	3M 3E40
NI63	AVONDALE	PA HEWLETT PACKARD	370700202	5/23/1985	
NI63	DALLAS	TX DEPT OF HEALTH & HUMAN SERV	420976402	8/22/1985	
NI63	LAS VEGAS	NV U S ENVIRONMENTAL PROT AGEN	70586101	2/14/1985	
PM147	CHICAGO	IL MAGNAFLUX	120062209	4/13/1985	
TL204	CHICAGO	IL MAGNAFLUX	120062209	4/11/1985	
7*	ST PAUL	MN MINNESOTA MINING & MANUFACT	220005706	4/08/1985	
Z	CINCINNATI	OH CHRIST HOSPITAL	340383102	5/31/1985	

\*Z = UNSPECIFIED



place in the ion chamber may have contributed to the failure. The use of the sources is to be phased out by 1987, so that no action by the NRC appears necessary.

- Two reports in Table 5 concern the same event. Ohmart discovered two leaking Kr-85 sources manufactured by 3M; the same event was discussed in an Inspection Report of 3M. The cause of the leakage was attributed to failure of a brazed seal; 3M has replaced the brazing process with laser welding. Ohmart committed to recalling all gauges (12) containing the 3M krypton source.
- Perfection Services reported that a large (2 Ci) Cs-137 source was found leaking. The leakage was attributed to a bubble on the inner weld.
- Kay Ray reported that it found that a number of small, 10 uCi Cs-137 sources were leaking. The type of source purchased was going to be changed, in an attempt to eliminate the problem.

The brief overview of the leaking or contaminated source reports presented above shows that generic (or potentially generic) problems that have arisen to date have been corrected by the manufacturer to eliminate or detect the leakage before distribution. Thus, no additional action by the NRC appears to be warranted.

#### 3.1.4 Release of Materials

Eight events occurred in 1985 that involved the release of materials:

- Tr-99m generators were accidentally incinerated in two events. Neither event resulted in contamination outside of the licensee facility.
- Contaminated waste was accidentally incinerated.

- A fire at a facility that possessed material under a general license resulted in the destruction of two Po-210 static eliminator sources and damage to an Am-241 source.
- A fire at an Army base in Korea resulted in contamination of a building and the area around it by Pm-147 microspheres (3 mCi).
- Three laboratories were contaminated when Os-185 and 191 (2 mCi) vaporized.
- A small amount of UF<sub>6</sub> was released when a valve on an empty cylinder was opened. Concentrations of uranium were less than 10 CFR Part 20 limits; calculated exposures at the site boundary were less than 0.5 mRem. (NFS Erwin)
- Cs-137 contamination was found in fly-ash in a steel company baghouse. A gauge containing 200-500 mCi Cs-137 may have been melted with scrap steel. The licensee was unaware of the event until a toxic waste shipment from the mill was found to be contaminated. This event resulted in substantial cleanup costs. (See Section 3.1.5 also.)

No data are available on the extent of contamination resulting from the two events involving fires. The contamination resulting from the other events was limited.

### 3.1.5 Consumer Products

An additional category, "consumer products," was defined for the database in 1985. These reports describe events in which radioactive material was found in, or had a reasonable probability for being introduced into, nonlicensed consumer products. Five reports of this nature were received in 1985:

- A gauge originally owned by Del Monte Corporation was discovered at a scrap yard. No contamination resulted from this event.

- Steel originating in Brazil was found (by Florida) to be contaminated by Co-60. Calculations showed contamination levels of no more than 0.03% of MPC could result if the contaminated steel pipe is used in drinking water systems.
- Toxic waste from a California steel manufacturer was discovered to be contaminated with Cs-137. Investigation showed that fly-ash in the baghouse was also contaminated. It is probable that a gauge containing 200-500 mCi Cs-137 was melted with scrap steel.
- A Cs-137 gauge licensed by Alabama was found at a scrap yard (three others were still missing).
- In an overflight made in an attempt to find the above three missing gauges, low level Cs-137 contamination was discovered at U.S. Pipe and Foundry in Bessemer, AL.

All of the above events concerned the possibility of introducing radioactivity into a steel process. This is a frequent source of contaminating consumer products, but is not the only source. Other consumer products have been known to become contaminated by leaking sources used as process monitors. In two cases, gauges were found before they were melted. In the case of the Co-60 contaminated steel, the contamination level was so low that overexposures would not result from its use. The State of California is conducting an investigation of the Cs-137 gauge melting event. No information is available on the Alabama events from which to assess their significance.

### 3.1.6 Fuel Cycle Facility Event Reports\*

Reports on six events were received from fuel cycle licensees during 1985:

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\*NRER database does not include information from fuel cycle licensee reports of routine effluent releases.



- Two events occurred at NFS Erwin. In the first, the top of an 11-liter cylinder containing concentrated uranium solution blew off, permitting six to eight liters to escape. To avoid the problem in the future, NFS is adding instrumentation to the process that generates the solution. In the second, uranium hexafluoride was released from an "empty" cylinder when a valve was opened. The releases did not exceed regulatory limits, and the calculated exposure at the site boundary was 0.5 mRem.
- One event involved a worker at a uranium mill being exposed to 108 MPC-hours in one week.
- Three events involved waste shipments. Two involved one shipment each from different fuel fabricators, where the shipping drums had holes in them. The other involved a waste shipment from a third licensee which contained partially solidified waste.

None of these events appeared to be significant, given the corrective actions taken, the potential for public health and safety consequences; and the generic concerns.

### 3.1.7 Radiography

Seventeen 1985 events involved radiography. Two (2) of the events occurred at a fixed radiography site and 15 occurred at remote (field) radiography sites. Information on the reported events is included in Table 6.

Thirteen of the reports concerned overexposure or potential overexposure events and have been listed in Table 3. The number of radiography events (17) does not differ substantially from the number of events reported during prior years.

### 3.1.8 Manufacturing and Distribution

Those 1985 events were identified as being associated with manufacturing and distribution from the program code of the licensee. These licensees have no unique reporting requirements for events involving health and safety, unless the requirements are incorporated into a license condition or an order

TABLE 6  
RADIOGRAPHY EVENTS, 1985

ISO- TOPE	LOCATION	LICENSEE	EVENT DATE	TYPE EVENT*
C060	PHILLIPSBERG	NJ INGERSOLL-RAND CO	4/15/1985	TRS
IR192		CT STONE & WEBSTER	2/21/1985	LKS
IR192	WAYNESBORO	GA PULLMAN POWER PRODUCTS CORP	10/06/1985	EXP RTR
IR192	BURNS HARBOR	IN CALUMET TESTING SERVICES	6/14/1985	EXP
IR192	FREDERICK	MD BRAND EXAMINATION SERVICES	2/07/1985	EXP
IR192	WILLISTON	ND BASIN TESTING LAB	3/30/1985	EXP
IR192	TULSA	OK HOUSTON INSPECTION LAB	8/01/1985	**
IR192	WASHINGTON	PA TRANS-EASTERN INSPECTION	10/08/1985	EXP
IR192	MIDLAND	TX BASIN INDUSTRIAL X-RAY INC	11/09/1985	EXP
IR192	BREMERTON	WA DEPT OF NAVY	3/06/1985	LKS
IR192	NEWELL	WV PITTSBURGH TESTING LAB	4/04/1985	EXP
IR192	LABARGE	WY EXAM CO	9/26/1985	EX
IR192	EVANSTON	WY WESTERN STRESS CO	8/01/1985	EXP
Z	LITTLE ROCK	AR SOUTHWEST X-RAY	6/01/1985	*
Z	DAYTON	OH DAYTON X-RAY CO	3/30/1985	*
Z	TULSA	OK UNITED INSPECTION	1/16/1985	MSC
Z	DALLAS	TX CONSOLIDATED X-RAY	3/01/1985	EXP

\*TYPE EVENT:

EXP EXPOSURE  
LKS LEAKING SOURCE  
MSC MISCELLANEOUS  
RTR REACTOR  
TRS TRANSPORTATION

\*\*NO OVEREXPOSURE

Thirty-six events occurring during 1985 involved the manufacturing and distribution of byproduct material. Information from the reports is included in Table 7.

One event in Table 7 was significant from the point of view of presenting a possible threat to public safety. The John C. Haynes Company, holding a manufacturing and distribution license, was the focus of extensive NRC activities in March 1985. Mr. John C. Haynes, doing business as John C. Haynes Company, was arrested by FBI agents for illegal possession and use of radioactive material and for making material false statements to the NRC. Ten to 14 curies of americium were seized. In April, NRC ordered Mr. Haynes to provide access to his laboratory for cleanup and removal of contaminated equipment. NRC and EPA initiated a cleanup of areas of significant contamination in the laboratory and surrounding areas using moneys (up to \$150,000) from the EPA Superfund.

As early as 1981, NRC modified the John C. Haynes Company license to limit activities to storage only, and in 1984, a Show Cause Order was issued requiring Mr. Haynes to submit a decontamination plan for his facility. (He responded that he was financially unable to undertake the cleanup.) A February 1985 allegation that Mr. Haynes possessed significant amounts of americium and was continuing to use radioactive materials led to the March and April interventions by NRC and other Government agencies.

#### 3.1.9 Gauges/Measuring Systems

Holders of specific licenses to possess gauges are required to report failures of, or damage to, shielding, on/off mechanisms, or indicators of the gauge, or detection of removable contamination on the gauge. In addition, these licensees must make reports required pursuant to 10 CFR Part 20 (lost, or stolen materials, releases of material, etc.). Gauge licensees that submitted reports of events occurring in 1985 were identified by the program codes of the licensee.



TABLE 7

MANUFACTURING AND DISTRIBUTION EVENTS, 1985

ISO- TOPE	LOCATION	LICENSEE	LICENSE NUMBER	EVENT DATE	TYPE EVENT*
AM241	NEWARK	OH JOHN C HAYNES COMPANY	34157401	4/05/1985	MSC
C14	NO BILLERICA	MA E I DUPONT	200032009	11/16/1985	EXP
CS137	ARLINGTON HTS	IL KAY RAY, INC	121118401	2/28/1985	LKS
CS137	ARLINGTON HTS	IL KAY RAY, INC	121118401	5/13/1985	EXP
CS137	ST PAUL	MN 3M CO	220005706	10/01/1985	EXP
H3		CO UNIV OF COLORADO	062080402	10/07/1985	LKS
I125	ARLINGTON HTS	IL AMERSHAM CORP	121283601	2/20/1985	LAS
I125	KANATA	ON ATOMIC ENERGY OF CAN LTD	482439501	4/15/1985	LKS
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	4/15/1985	LKS
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	4/24/1985	LKS
I125	FT ATKINSON	WI BETA DIAGNOSTICS	482439501	5/06/1985	LKS
I131	NEW BRUNSWICK	NJ E R SQUIBB & SON INC	290013904	9/18/1985	LAS
KR81M	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371846106	1/14/1985	TRS
KR85	BRUSSELS	ACCURAY CORP	340025506	1/03/1985	TRS LAS
KR85	CINCINNATI	OH OHMART	340063903	4/03/1985	LKS
KR85	FT S. HOUSTON	TX DEPT OF ARMY	290102211	1/07/1985	LAS
NI63	AVONDALE	PA HEWLETT PACKARD	370700202	5/23/1985	LKS
PM147	CHICAGO	IL MAGNAFLUX	120062209	4/13/1985	LKS
TC99M	WOBURN	MA NUCLEAR PHARMACY INC	202122701	9/13/1985	MDI
TC99M	GRAND RAPIDS	MI SYNCOR INTERNATIONAL CORP	211921901	4/10/1985	LAS
TC99M	HARRISBURG	PA NUCLEAR PHARMACY INC	371846101	1/07/1985	TRS
TL	LANCASTER	PA NUCLEAR PHARMACY INC	371958601	4/10/1985	MSC
TL201	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371846101	1/25/1985	MSC
TC99M	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371846101	1/07/1985	MSC
TC99M	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371758601	3/21/1985	MSC
TC99M	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371846101	4/03/1985	MDI
TL204	CHICAGO	IL MAGNAFLUX	120062209	4/11/1985	LKS
Y	BOSTON	MA NUCLEAR PHARMACY INC	202122701	5/18/1985	MDI
Y	LEBANON	PA NUCLEAR PHARMACY INC	371958601	1/29/1985	TRS
Z	ARLINGTON HTS	IL KAY RAY INC	121118401	6/01/1985	EXP
Z	WOBURN	MA NUCLEAR PHARMACY INC	290013902	5/03/1985	MSC
Z	BOSTON	MA NUCLEAR PHARMACY INC	202122701	7/02/1985	MSC
Z	BOSTON	MA NUCLEAR PHARMACY INC	202122701	10/07/1985	MSC
Z	BOSTON	MA NUCLEAR PHARMACY INC	202122701	10/18/1985	MSC
Z	ORANGE	NJ NUCLEAR PHARMACY INC	291960801	10/14/1985	MSC
Z	PHILADELPHIA	PA NUCLEAR PHARMACY INC	371846101	6/14/1985	MDI

\*TYPE OF EVENT

EXP EXPOSURE  
 LKS LEAKING SOURCE  
 LAS LOST, ABANDONED, STOLEN MATERIAL  
 MDI MEDICAL  
 MSC MISCELLANEOUS  
 TRS TRANSPORTATION

Fifteen events during 1985 were received from gauge licensees. Information from the reports is included in Table 8. Most of the 15 reports of 1985 gauge events also represent events reviewed in other sections of this report: exposures (3.1.1), lost or stolen sources (3.1.2), leaking sources (3.1.3), and release of materials (3.1.4).

Only one event in the table has not been listed in prior tables--an event (Herbert Rimby, Inc.) in which a portable gauge manufactured by Troxler was run over by a paving roller. Although the gauge was damaged, the source was not (i.e., no radioactive material was released). There were no reports of failure of, or damage to, shielding, on/off mechanisms of gauge indicators during 1985.

### 3.2 Abnormal Occurrences

Abnormal Occurrences (AOs) are unscheduled incidents or events which the Commission determines are significant from the standpoint of public health or safety. They may be individual incidents, recurring events, generic concerns, or a series of incidents involving:

- Moderate exposure to, or release of, radioactive material licensed by or otherwise regulated by the Commission;
- Major degradation of essential safety-related equipment; or
- Major deficiencies in design, construction, use of, or management controls for licensed facilities or material.

In the first three quarters of 1985, there were eight nonreactor events classified as AOs:

- Four events involved overexposures of radiographers or radiographers' assistants;
- One event involved the overexposure of an employee at a manufacturer, Gulf Nuclear;

TABLE 8  
GAUGES/MEASURING SYSTEMS EVENT REPORTS, 1985

ISO- TOPE	LOCATION	LICENSEE	LICENSE NUMBER	EVENT DATE	TYPE EVENT*
AM241	LITTLE ROCK	AR MCCLELLAN ENGINEERS INC	31724301	7/15/1985	LAS
AM241	LITTLE ROCK	AR DEPT OF AIR FORCE	151381201	1/08/1985	LKS
AM241	MCCONNELL	KS DEPT OF AIR FORCE	151381201	11/14/1985	LKS
AM241	TROY	MI TESTING ENGINEERS & CONSULT	211866801	11/16/1985	LAS
AM241	PIKE CTY	PA HERBERT RIMBY, INC	371846301	10/22/1985	MSC
AM241	MARCUS HOOK	PA SUN CO	370827503	11/13/1985	LKS
AM241	CASPER	WY CENTENNIAL ENGINEERING, INC	491971101	6/27/1985	LAS
CS137	MUNDELEIN	IL JOHN MATHES & ASSOC.	121876001	8/06/1985	LAS
CS137	DAYTON	OH BOWSER-MORNER TESTING LAB	341739001	9/10/1985	LAS
NI63	DALLAS	TX DEPT OF HEALTH & HUMAN SERV	420976402	8/22/1985	LKS
PM147		DEPT OF ARMY	120072207	6/21/1985	MSC RLM
PM147	LITTLE CREEK	VA DEPT OF NAVY	80597002	8/17/1985	LAS
Z	FERNDAL	MI MCDOWELL & ASSOC.	211872401	5/10/1985	EXP
Z	BAYAMON	PR JOSE T MEDINA MD	521493101	5/01/1985	EXP
Z	HOPEWELL	VA ICI AMERICAS INC	451483701	2/01/1985	EXP

\*TYPE EVENT

EXP EXPOSURE  
LAS LOST, ABANDONED, STOLEN MATERIAL  
LKS LEAKING SOURCE  
MSC MISCELLANEOUS  
RLM RELEASE OF MATERIAL



- One event involved unlawful possession of radioactive material by John C. Haynes Co.;
- One event involved the breakdown of management controls at Pittsburgh Testing Laboratory, a radiography licensee; and
- One event involved the loss of a large (1.5 Ci Cs-137) well-logging source from a Schlumberger Well Services facility. The source was recovered about two months after it was lost.

Of the eight events, six were reported by the licensees. The AOs at Pittsburgh Testing and John C. Haynes resulted from NRC inspections of the facilities. Because AOs are sometimes found months after they have occurred, two of the 1985 AOs involving radiography overexposures actually occurred during 1984.

The four radiography AOs resulted in estimated exposures of 2000 rem to the palm; 1320 rem to the hand; 8 and 34 rem whole body to two individuals; and 8-31 rad and 15 rad whole body to two individuals.

The majority of nonreactor AOs for 1985, in terms of numbers as well as potential health effects, resulted from radiography operations.

#### 4. FIVE-YEAR ASSESSMENT FOR NONREACTOR EVENTS FROM 1981-1985

##### 4.1 Discussion

AEOD began accumulating information on nonreactor events in 1980, and has a computer retrievable database of nonreactor events that occurred in 1981 and later. An overview of the nonreactor events that occurred over the past five years is presented below.

##### 4.2 Nonreactor Database

The reports in the nonreactor database were reviewed to determine whether any trends in the number or type of events were apparent. Table 9 shows informa-

TABLE 9

FREQUENCY OF REPORTS ASSOCIATED WITH PARTICULAR AREAS  
(1981-1985)

<u>ITEM</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
NUMBER OF REPORTS:					
TOTAL	191	217	193	184	170
FUEL CYCLE	20	38	44	19	8
OTHER	171	179	149	165	162
TYPE OF REPORTS:					
EXPOSURE	66	53	42	39	34
ACTUAL	25	21	13	29	24
BADGE	41	32	29	10	10
LOST/STOLEN MATERIAL	18	40	27	39	31
ABANDONED (W/L) SOURCES	1	17	22	26	22
LEAKING SOURCES	15	17	9	15	29
RADIOGRAPHY	24	31	24	18	17
MANUFACTURING & DISTRIBUTION	11	28	13	37	36
GAUGES	24	33	25	24	16

tion on the total number of reports by year, as well as a breakdown by type of report by year.

Total Number of Reports - Although the total number of reports appears to show a downward trend from 217 in 1982 to 170 in 1985, a breakdown of reports by the type of licensee shows this decrease could be due to the number of reports from fuel cycle facilities (mills, SNM licensees) being entered into the system, since there were fewer mills operating in 1985 than in 1981. The number of reports from licensees other than fuel cycle licensees ranged between 149 and 179, with no apparent secular trend.

Exposure Reports - The total number of reports of actual over-exposures (those exceeding regulatory limits) does not show any secular trend. The number of real exposures annually varied from 13 to 29, with an average of 22. Badge exposure or events in which there was no overexposure ranged from 41 to 10, with fewer events being entered into the database in recent years.

Radiography Reports - The number of radiography reports per year was comparatively constant, ranging from 17 to 24, except during 1982 when the number of reports rose to 31.

Other Reports - The numerical distribution of other categories of reports is also given in the table. Lost or stolen material reports varied annually, generally totaling 30 to 40; reports of abandoned well-logging sources also showed some annual variation, ranging from 17 to 26. The low number of abandoned well-logging sources reported in 1981 probably resulted from incomplete records for 1981.

A statistical analysis of the data in Table 9 did not reveal any trend in the number of events with time.



#### 4.3 Abnormal Occurrences

Over the period from 1981 to the third quarter of 1985, there were 37 non-reactor events that were classified as AOs. Table 10 lists information on each of the AOs. It can be seen that exposure events (19) were the most numerous of the events, with most of the exposure events occurring at radiography licensees.

Overexposure Events - As noted above, the largest category of abnormal events at nonreactor licensees over the time period from 1981-1985 was that of overexposure events. A total of ten events occurred at NRC licensees and nine at Agreement State licensees over the five-year period. These events have involved radiographers, other licensees, and members of the public.

NRC Licensee Radiography Overexposures - There were three overexposures to radiography personnel over the five-year time period that were classified as AOs:

- The employee of a consultant hired to assist in the recovery of a disconnected radiography source received an extremity exposure of 650-1100 rem. The direct cause of the overexposure was failure to perform an adequate survey.
- A radiographer received an extremity exposure of 3400 rem from an X-ray unit at a site. (Although NRC does not regulate X-ray equipment, the radiographer worked with NRC licensed material during the quarter and received 3.1 rem whole body from the X-ray device and the licensed material.) The principal causes were failure to install the required radiation alarm and the absence of an interlock on the door to the room containing the X-ray unit and radiography equipment.

TABLE 10

ABNORMAL OCCURRENCES, 1981-1985  
NONREACTOR LICENSEES

<u>YEAR</u>	<u>AONO</u>	<u>LICENSEE NAME</u>	<u>TYPE OF EVENT</u>	<u>TYPE OF LICENSEE</u>
811	8102	AUTOMATION IND	EXP	MAD
813	8105	EVELETH EXPANSION CO	EXP	GAU
813	8106	MUSTANG SERVICES	EXP	RAD
813	AS8102	ANALYTIC INSP	EXP	RAD
823	8206	CONSOLIDATION COAL	RLM	WLO
831	AS8306	AUBURN STEEL CO	CON	GAU
831	AS8301	BROWN UNIV	CTM	ACA
831	AS8302	GEAR-TEX WELL SERV	LAS	WLO
831	AS8303	HUYTECH CORP	LAS	GAU
831	AS8304	DRESSER ATLAS CORP	LAS	WLO
831	AS8305	MAGNAFLUX CORP	LAS	RAD
832	AS8307	BAYOU TESTERS	EXP	RAD
832	AS8308	GEARHART IND	LAS	WLO
832	AS8309	GULF NUCLEAR INC	RLM	MAD
833	8310	AUTOMATION IND	EXP	RAD
833	8308	NUCLEAR METALS INC	EXP	FC1
833	8311	KAY RAY INC	EXP	MAD
833	8309	AM TESTING LABS	MFS	GAU
833	8313	SHELLWELL SERV	RLM	MAD
834	8316	PITTSBURGH TESTING	EXP	RAD
934	AS8310	X-RAY INSPECTION CO	EXP	RAD
841	8404	UNIV CINCINNATI HOSP	EXP	MED
841	AS8401	NDT INC	EXP	RAD
843	8415	VA BRONX	EXP	MED
843	AS8402	RHODE ISLAND HOSP	MD1	MED
843	8413	TWO RADIOPHARMACIES	MD1	MAD
843	8412	NUCLEAR FUEL SERV	SGD	FC3
844	AS8403	ULTRASONICS SPEC	EXP	RAD
844	8419	NUCLEAR FUEL SERV	MSC	FC3
851	AS8501	GULF NUCLEAR INC	EXP	MAD
851	AS8502	QA SPECIAL SERVICES	EXP	RAD
851	AS8503	MAGNAFLUX IND RAD	EXP	RAD
851	AS8503	SCHLUMBERGER	LAS	WLO
851	8504	JOHN C HAYNES CO	LMC	
852	AS8505	WORLD TECH SERV	EXP	RAD
852	8510	PITTSBURGH TESTING	LMC	RAD
853	8517	WESTERN STRESS	EXP	RAD

KEY:

YEAR = DATE OF FIRST TWO DIGITS ARE YEAR, THIRD DIGIT IS QUARTER  
AONO = AO NUMBER

TYPE OF EVENT:

CON CONSUMER PRODUCT  
CTM CONTAMINATION  
EXP EXPOSURE  
LAS LOST, ABANDONED, OR STOLEN MATERIAL  
LMC LOSS OF MANAGEMENT CONTROL  
MED MEDICAL LICENSEE  
MFS MATERIAL FALSE STATEMENT  
MSC MISCELLANEOUS  
RLM RELEASE OF MATERIAL  
SGD SAFEGUARDS

TYPE OF LICENSEE:

ACA ACADEMIC  
FC1 URANIUM MILL  
FC3 FUEL FABRICATION  
GAU GAUGE  
MAD MANUFACTURING AND DISTRIBUTION  
MED MEDICAL  
RAD RADIOGRAPHER  
WLO WELL LOGGING



- A radiographer and his helper received whole body exposures of 8-31 rad and <15 rad, respectively, as the result of a failure to connect a 29 Ci Ir-192 source pigtail to the drive cable. The radiographers did not make a survey when their work was completed. The source pigtail remained in the source guide tube for a day, and was transported in the guide tube from one job site to another. This exposure event was ascribed to management and procedural control difficulties.
  
- A fourth AO event resulted in calculated overexposure in an unrestricted area. A member of the general public may have received a whole body dose that exceeded 0.5 rem in one calendar year. A mounted radiography gauge was being removed from a trailer by an individual who did not have any personnel dosimetry and who did not use survey meters. The source became dislodged and fell into the bottom of the trailer. The trailer was moved by its new owner, and, during the move, the source fell out. The source was recovered three days later. Calculations show that the only probable overexposure was to the new owner of the trailer. He could have received 1.4 rem.

Agreement State Licensees - There were eight overexposures at Agreement State radiography licensees over the five-year period.

- An exposure device broke loose due to barge motion and rolled under some equipment and broke. The Captain of the barge handed the source to the radiographer who received approximately 3000-5000 rad extremity dose. Two members of the barge crew (public) were also overexposed. The State agency cited the radiographer for failing to follow prescribed emergency procedures.

- Two radiographers were overexposed (53 rem and 6 rem). Investigation showed that the exposure device lock plunger would close and lock even though the source was unshielded.
- A Radiation Safety Officer received an extremity exposure of 4000-8000 rad when he picked up a guide tube knowing it contained a stuck source.
- A radiographer and his assistant received both whole body (9 and 63 rem) and extremity exposure (3000 and 5000 rad) when they touched the end of a guidetube that contained a radiography source.
- A radiography trainee received an extremity exposure of between 2500-3000 rad.
- A radiographer received an extremity exposure of possibly 2000 rem.
- A radiographer received an extremity exposure of 1300 rem at a plant.
- Two radiographers received 8 and 30 rem whole body when one of the individuals failed to connect the source.

A Radiography Steering Committee, chaired by the Deputy Director of the NRC's Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, has been working on ways to improve radiographer safety. A subgroup chaired by a representative of NRC's Office of Nuclear Regulatory Research (RES) developed a program for improved radiography equipment design. These design improvements, if mandated by regulations, might have eliminated some of the very high overexposures at radiography licensees.

In addition, a second subgroup of the Committee has been evaluating the characteristics of alarming dosimeters to determine whether or not their use would tend to eliminate overexposures such as those discussed above.

Other Exposure Events - There were seven exposure events that did not involve radiography licensees. These events had few common characteristics, and tended to result in lower exposures than the radiography exposure events.

AOs Involving Release of Materials - Over the five-year period, there were four AOs that involved the release of radioactive materials:

- The rupture during recovery operations, of a sealed americium-241 well-logging source that had become wedged in the well during operations.
- The rupture of a sealed americium-241 well-logging source during attempts to remove the source from a source holder in a workshop.
- The rupture of a sealed americium-241 well-logging source during attempts to remove the outer encapsulation in an Agreement State laboratory.
- Melting of a cobalt-60 source at a steel manufacturing plant in an Agreement State.

Three of the four events involved well-logging sources, and two of these three involved the rupture of a source during attempts to open the source with sharp tools. The fourth event concerns the melting of a source that was unknowingly received as part of a scrap steel shipment used as feed to the steel process.



All of these events resulted in extensive contamination, with the second event above resulting in contamination of offsite areas, and the overexposure of an individual.

Other AO Events - There were 14 other nonreactor events classified as Abnormal Occurrences:

- Six lost or stolen sources
- Three events involving management control or material false statements
- Two events involving molybdenum breakthrough of technetium generators
- Two fuel cycle events
- One event involving contamination of an individual

None of these fifteen events appeared to show any generic problems.

#### 5. AEOD STUDIES OF-NONREACTOR EVENTS FROM 1981-1985

AEOD undertook a number of studies of nonreactor events in 1981-1985. Most of the studies looked at leaking source events because of the possibility of a generic problem with encapsulation of sources. One of the studies, contamination of sources at missile sites, appeared to point to problems stemming from the environment to which the sources were exposed in use or to problems associated with the manufacturing process. Since the use of these sources was being phased out with the particular military program, no action by NRC appeared necessary.

Other studies made over the period included three studies of events at mills, one event at a fuel cycle plant, two events concerning lost sources, and nine studies that could be categorized as miscellaneous.

AEOD undertook one case study during the five-year period: a study of the breaching of well-logging sources. The study was occasioned by five events, three of which were also ACs. In the case study, AEOD made recommendations to RES concerning the proposed 10 CFR Part 39. The response to our recommendations was satisfactory, with the exception of one concerning a requirement that licensees have available a survey instrument capable of reading dose rate levels of at least 100 mr/hr. The current version of the proposed Part 39 requires that survey meters be capable of reading levels up to 50 mr/hr. Although the proposed Part 39 does specify that licensees have access to a survey meter reading to 100 mr/hr, we note that Part 20 contains a requirement that licensees post and control access to high radiation areas, with a high radiation area being defined as an area in which an individual could receive 100 mr in any 1 hour. Our recommendation stems in part from our reading of the regulations.

## 6. FINDINGS

A review of the 1985 nonreactor database showed that the number and type of events that were reported did not differ substantially from those received in other years.

When the events from-1981-1985 were reviewed, the number and categories of events reported (i.e., exposures, lost or stolen materials, etc.) did not vary appreciably from year to year. No secular trend in event occurrence was apparent from a statistical standpoint.

A review of the Abnormal Occurrence reports from 1981 through the third quarter of 1985 indicated that 37 nonreactor events were determined to be Abnormal Occurrences.\* Of these, 19 were overexposure events. Of the 19, 12 were overexposures received in conjunction with radiography operations.

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\*To put this number into perspective there were a total of 97 AOs over the time period: 4 reactor events; 37 nonreactor events; and 12 misadministration events.

A Radiography Steering Committee chaired by NRC's Office of Nuclear Material Safety and Safeguards has been looking at ways to reduce the overexposures to radiographers. Activities include development of proposed equipment standards for radiography devices, as well as evaluation of the use of different kinds of dosimetry. These interoffice and Agreement State Steering Committee activities support the Commission's Strategic Goal 3.2, Reduce Overexposures of Radiographers. To supplement the work already accomplished by the Steering Committee, AEOD has undertaken a study of "source disconnect" or "failure to connect" events. The study will attempt to determine whether there are any additional lessons to be learned from these events.

There have been several events that occurred over the past five years that resulted from the accidental contamination of steel. The most notable of these events was the Mexican steel event of early 1984. These events sensitized the NRC staff to the need to collect information on events in which radioactive material was found in, or had a reasonable probability of being introduced into, consumer products. Five reports of this category occurred in 1985. Continuing collection of the category of reports should permit an analysis and evaluation of their significance.

Careful review and evaluation of nonreactor events is an essential activity that supports the Commission's Strategic Goal 3.4, Ensure that Handling of Radioactivity is Conducted Safely. AEOD will continue its careful review of events reported by NRC licensees, and will work with the NRC's Office of State Programs to assure that significant events in Agreement States are reported and reviewed. Lessons learned will be fed back through Information Notices. Specific problems will be addressed through formal case study reports.



Milo

I called K. Black last  
week; she promised me ~~the~~ a  
listing of the 1985 reports.  
When I get it I'll send it  
to you

M/Car

12-16-88

FOIA-87-402

A/9 (b)

REPORTS ISSUED PRIOR TO 1985 - BY YEAR

1981

<u>Subject</u>	<u>No.</u>
Interim Report on Brown Boveri Betatron Calibration Check Source	N101
Irradiator Incident at an Agreement State Licensee's Facility (Becton-Dickinson, Broken Bow, Nebraska)	N102
Interim Report on the October 1980 Fire at the Sweetwater Uranium Mill	N103
Interim Report on the January 2, 1981 Fire at the Atlas Uranium Mill	N104
Interim Report on Tailings Impoundment Liner Failure at the Sweetwater Uranium Mill	N105
Review of Reports of Leaking Radioactive Sources	N106
Engineering Evaluation of Fire Protection at Nonreactor Facilities	N107
Notes on AEOD Review of Emissions from Tritium Manufacturing and Distribution Licensees	N108

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1982

<u>Subject</u>	<u>No.</u>
Report on Medical Misadministrations for the Period November 10, 1980 - September 30, 1981	N201
Buildup of Uranium-Bearing Sludge in Waste Retention Tanks	N202
Lost Plutonium - 238 Source	N203
Report on Medical Misadministrations for the Year 1981	N204
Preliminary AEOD Review of Iodine-125 Sealed Source Leakage Incidents	N205
Eberline Instrument Corporation - Part 21 Report	N206
AEOD Review of Iodine-125 Sealed Source Leakage Incidents	N207
Potentially Leaking Plutonium-Beryllium Neutron Sources	N208
A Summary of the Nonreactor Event Report Database for 1981	N209
Leaking Hoses on Self Contained Breathing Apparatus (SCBA) Manufactured by MSA	N210



1983

<u>Subject</u>	<u>No.</u>
Nonreactor Event Report Database for the Period January - June 1982	N209A
I125/I131 Effluent Releases by Material Licensees	N301
Mound Laboratory Fabricated PuBe Sources	N302
Americium Contamination Resulting from Rupture of Well-Logging Sources	N303
Nonreactor Event Report Database for the Period July - December 1982	N209B
Americium-241 Sources	N304
Report on Medical Misadministrations for January 1981 - December 1982	N204C
Human Factors Contributions to Accident Sequence Precursor Events	N305
Potentially Leaking Americium-241 Sources Manufactured by Amersham Corporation	N306
Nonreactor Event Report Database for the Period January - June 1983	N307

1984

Subject	<u>No.</u>
Report on Medical Misadministrations for January 1983 through June 1983	N204D
Nonreactor Event Report Database for the Period July - December 1983	N401
Events Involving Undetected Unavailability of the Turbine-Driven AFW Train	N402
Report on Medical Misadministrations for July 1983 - December 1983	N403